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DEPARTMENT OF TRANSPORTATION (DOTr)
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PROJECT ON MASTER PLAN STUDY AND INSTITUTIONAL DEVELOPMENT ON URBAN TRANSPORT SYSTEM IN METRO CEBU

FINAL REPORT

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ABBREVIATIONS

ACI	Airport Council International
AFCS	Automatic Fare Collection System
AGT	Automated Guideway Transit
AIP	Annual Investment Program
APEC	Asia-Pacific Economic Cooperation)
APSE	Air Pollution Source Equipment
ART	Aerial Ropeway Transit
ATC	Area Traffic Control
BDG	Bicable Detachable Gondola
BESF	Budget of Expenditures and Sources of Financing
BID	Business Improved District
BOD	Biochemical Oxygen Demand
BOI	Philippine Board of Investments
BOT	Built-Operate-Transfer
BPM	Business Process Management
BPO	Business Process Outsourcing
BRT	Bus Rapid Transit
CBD	Central Business District
CBRT	Cebu City Bus Rapid Transit
CCLEX	Cebu-Cordova Link Expressway
CCPL	Central Cebu Protected Landscape
CCTO	Cebu City Traffic Office
CCTV	Closed-Circuit Television
CDA	Cooperative Development Authority
CDP	Comprehensive Development Plan
CENRO	City Environment & Natural Resources Office
CLM	Municipality of Cordova, Lapu-Lapu City, and Mandaue City
CLUP	Comprehensive Land Use Plan
CML	Cebu City, Mandaue City and Lapu-Lapu City
CMP	Community Mortgage Program
COC	Congressional Oversight Committee

CPA	Cebu Port Authority
CPC	Certificate of Public Convenience
CPDO	City Planning and Development Office
CPT	Cable-Propelled Transit
CPU	Central Processing Unit
CSCR	Cebu South Coastal Road
CTESS	Consolacion Traffic Enforcement and Special Services
CTCOM	Compostela Traffic Commission
CTMS	City Traffic Management System
CTA	Cebu Truckers Association
CT-TODA	City of Talisay – Traffic Operations & Development Authority
DAC	Development Assistance Committee
DBP	Development Bank of Philippines
DENR	Department of Environment and Natural Resources
DENR-EMB	Department of Environment and Natural Resources – Environmental Management Bureau
DILG	Department of the Interior and Local Government
DO	Department Order
DOE	Department of Energy
DOF	Department of Finance
DOH	Department of Health
DOJ	Department of Justice
DOLE DILEEP	Department of Labor and Employment Integrated Livelihood & Emergency Employment Program
DOT	Develop-Operate-Transfer
DOTC	Department of Transportation and Communications
DOTr	Department of Transportation
DPWH	Department of Public Works and Highways
DSWD	Department of Social Welfare and Development
DTI	Department of Trade and Industry
DUs	Dwelling Units
ECA	Environmentally Critical Area
ECC	Environmental Compliance Certificate
ECP	Environmentally Critical Project

EIA	Environmental Impact Assessment
EIRR	Economic Internal Rates of Return
ELA	Executive and Legislative Agenda
ENPV	Economic Net Present Value
EST	Environmental Sustainable Transport
ESC	Environmental and Social Considerations
ETC	Electronic Toll Collection System
FAR	Floor Area Ratio
FIRR	Financial Internal Rate of Return
FPE	Foundation for the Philippine Environment
F/S	Feasibility Study
GDP	Gross Domestic Product
GFIs	Government Financial Institutions
GHG	Greenhouse Gas
GIS	Geographical Information System
GMCAC	GMR-Megawide Cebu Airport Corporation
GPRA	Government Procurement Reform Act
GPS	Global Positioning System
GRDP	Gross Regional Domestic Product
GRT	Gross Register Tonnage
GTE	GT Express
GWEN	Green and Wholesome Environment that Nurtures
G2G	Government-to-Government
HSH Study	The Study of Master Plan on High Standard Highway Network Department
HLURB	Housing and Land Use Regulatory Board
ICC	Investment Coordinating Committee
ICM	Island Central Mactan
ICT	Information and Communications Technology
IEC	Information, Education and Communications
IRR	Implementing rules and Regulations
ITS	Intelligent Transport Systems
JCOC	Joint Congressional Oversight Committee

JMC	Joint Memorandum Circular
JICA	Japan International Cooperation Agency
JPMO	Joint Project Management Office
JV	Joint Venture
KPO	Knowledge Process Outsourcing
LDIP	Local Development Investment Program
LGU	Local Government Unit
LIP	Local Investment Program
LITCOM	Liloan Traffic Commission
LOS	Level of Service
LPTRP	Local Public Transport Route Plan
LRT	Light Rail Transit
LRTA	Light Rail Transit Authority
LRV	New Light rail Vehicles
LTFRB	Land Transportation Franchising & Regulatory Board
LTO	Land Transport Office
LVC	Land Value Capture
MCASGB	Metro Cebu Airshed Governing Board
MCBMB	Mactan-Cebu Bridge Management Board
MCDC	Metro Cebu Development Council
MCDCB	Metro Cebu Development and Coordination Board
MCDA	Mega Cebu Development Authority
MCIA	Mactan Cebu International Airport
MCIAA	Mactan Cebu International Airport Authority
MCLUTS	Metro Cebu Land Use and Transport Study
MCTCC	Metro Cebu Traffic Coordinating Council
MCTEA	Mega Cebu Traffic Enforcers Academy
MCTMCB	Metropolitan Cebu Traffic Management Coordination Board
MDG	Monocable Detachable Gondola
MEPZ	Mactan Economic Processing Zone
MICE	Meetings, Incentives, Conferences/ Conventions, and Events/ Exhibitions
MITCOM	Minglanilla Traffic Commission

MLLW	Mean Lower Low Water
MMDA	Metro Manila Development Authority
MNDC	Metro Naga Development Council
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPSS	Minimum Performance Standards and Specifications
MPTDC	Metro Pacific Tollways Development Corporation
MRT	Mass Rapid Transit
MSEZ	Manufacturing Special Economic Zone
MTPDP	Medium-Term Philippines Development Plan
NAU	Number of Authorized Units
NCCAP	National Climate Change Action Plan
NCICP	New Cebu International Container Port
NEDA 7	National Economic and Development Authority Regional Office 7
NEP	National Expenditure Program
NEVS	National Electric Vehicle Strategy
NFSCC	National Framework Strategy on Climate Change
NPFP	National Physical Framework Plan
NIPAS	National Integrated Protected Areas System
NOC	Notice of Compliance
NONC	Notice of Non-Compliance
NOV	Notices of Violations
O&M	Operating and Maintenance
OD	Origin-Destination
ODA	Official Development Assistance
OECD	Organization for Cooperation and Development
OECF	Overseas Economic Cooperation Fund
OFG	Omnibus Guidelines on the Planning and Identification of Public Road Transportation Services and Franchise Issuance)
OPACC	Office of the Presidential advisor on Climate Change
OTC	Office of Transport Cooperatives
PAPs	Priority Programs, Activities, and Projects
PCU	Passenger Car Unit

PDC	Cebu Provincial Development Council
PDD	Programming and Budgeting Division
PDIP	Provincial Development Investment Program
PDP	Philippines Development Plan
PDPFP	Provincial Development Physical Framework Plan
PEISS	Philippines Environmental Impact Statement System
PENRO	Provincial Environment & Natural Resources Office
PETC	Private Emission Testing Centers
PEZA	Philippine Economic Zone Authority
PhilEXIM	Philippine Export-Import Credit Agency
PIP	Philippine Investment Program
PNS	Philippine National Standard
PPHPD	Passenger Per Hour Per Direction
PPP	Public–Private Partnership
PUB	Public Utility Buses
PUJ	Public Utility Jeepney
PUV	Public Utility Vehicle
PUVMP	PUV Modernization Program
PTFCC	Presidential Task Force on Climate Change
R/D	Record of Discussion
RDC	Regional Development Council
RDP	Regional Development Plan
RDIP	Regional Development Investment Program
RMC	Route Measured Capacity
Roadmap Study	Roadmap Study for Sustainable Urban Development in Metro Cebu
ROW	Right-of-way
RPFP	Regional Physical Framework Plan
RPOD	Research, Program, and Organizational Development
SCATS	Sydney Coordinated Adoptive Traffic System
SEA	Strategic Environmental Assessment
SHFC	Social Housing Finance Corporation
SL	Screen Line

SRP	South Road Property
STEP	Special Terms for Economic Partnership
STIS	Southwest Terminal of the Integrated Transport System
TCC	Traffic Control Center
TDG	Tricable Detachable Gondola
TEAM	Traffic Enforcement Agency of Mandaue
TESDA	Technical Education and Skills Development Authority
TEU	Twenty-foot Equivalent Units
TEZ	Tourism Economic Zone
TIA	Traffic Impact Analysis
TMO	Traffic Management Office
TMP	Traffic Management Plan
TOD	Transit Oriented Development
TRB	Toll Regulatory Board
TRIP	Three-year Rolling Infrastructure Program
TTC	Travel Time Cost
UMRT	Urban Mass Rapid Transit
UP-NCTS	University of the Philippines – National Center for Transportation Studies
VCR	Volume Capacity Ratio
VOC	Vehicle Operating Cost

1 INTRODUCTION

1.1 Project Background

As the second-largest metropolitan area in the Philippines, Metro Cebu has to address its growing traffic concerns. The population of Metro Cebu is expected to increase from 2.55 million in 2010 to 5 million in 2050 due to rapid urbanization. However, only limited transport investments have been made so far, consisting mostly of modifications of the existing infrastructure such as road widening and construction of flyovers in the 2000s.

To ensure sustainable growth of Metro Cebu and its surrounding areas, an efficient transport system providing timely and equitable movement of goods, services, and people is an essential element that must be developed.

From 2013 to 2015, the Japan International Cooperation Agency (JICA) supported the implementation of the "Roadmap Study for Sustainable Urban Development in Metro Cebu" (hereinafter referred to as "the Roadmap Study"), in collaboration with Metro Cebu Development and Coordination Board (MCDCB). The Roadmap Study identified 10 flagship projects that should be implemented by 2020 and 14 anchor programs to be carried out by 2050. Seven sub-roadmaps were also identified and formulated under the study, namely:

(i) Metropolitan Competitiveness Enhancement,

(ii) Urban Structure and Land Use,

(iii) Highway Network and Public Transport,

(iv) Water Supply, Storm Water and Wastewater Management,

(v) Solid Waste Management,

(vi) Smart South Road Property (SRP) Development, and

(vii) Metropolitan Governance.

Based on sub-roadmaps (ii) and (iii), JICA was requested to implement the current project entitled "Project on Master Plan Study and Institutional Development of Urban Transport System in Metro Cebu" (hereafter referred as "the Project") in order to formulate a detailed transport master plan for Metro Cebu. The master plan will include priority projects to be identified and agreed upon by stakeholders, such as local government units (LGUs), for tangible improvements on the traffic condition.

Prior to commencement of the Project, JICA dispatched a Detailed Planning Survey Team in January 2017 to discuss the details of the requested project[1] with the Philippine government. All parties signed the Record of Discussion (R/D) in March 2017, which indicates all the reached agreements regarding the requested project.

[1] The Detailed Planning Survey on the Master Plan Study on Urban Transport System Development in Metro Cebu Project (hereinafter referred to as "the Detailed Planning Survey").

1.2 Project Objectives and Expected Outputs

The following specific objectives aim to improve the traffic condition in Metro Cebu and to contribute to the sustainable development of the metropolitan area:

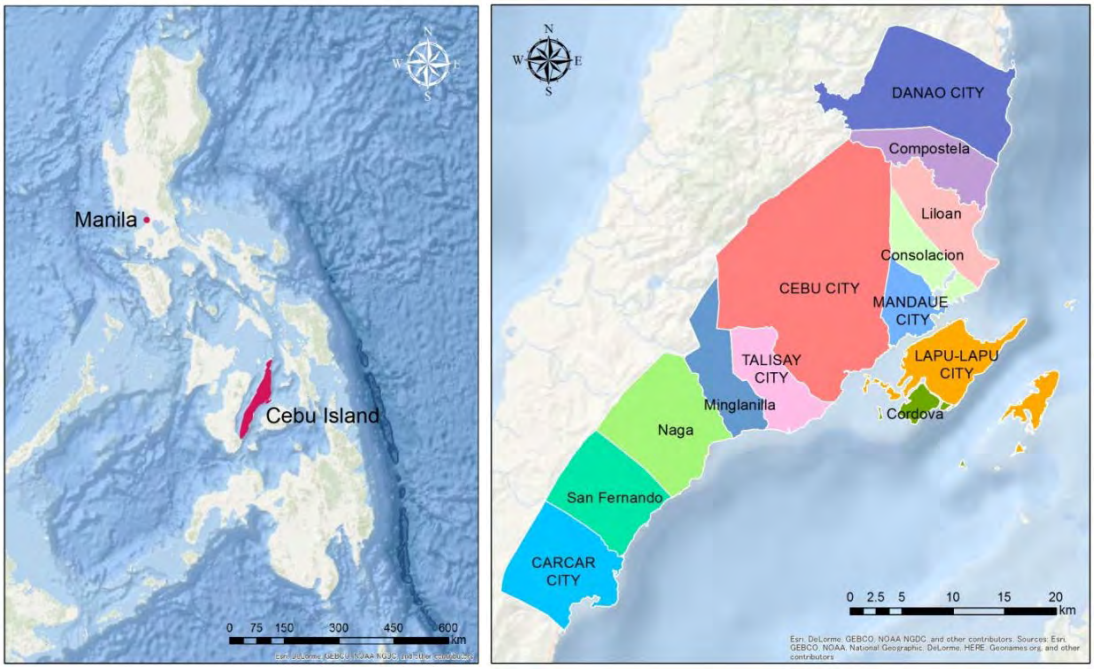
(i) To formulate the Metro Cebu Urban Transport Master Plan for the target year of 2022 (short-term), 2028 and 2040 (medium-term), and 2050 (long-term);

(ii) To identify priority projects and to conduct a pilot project and a pre-feasibility study (Pre-F/S) for some priority projects to be included in the Master Plan; and

(iii) To strengthen the capacity of Metro Cebu agencies responsible for urban transportation such as for planning, implementation, and coordination.

1.3 Study Area

The Project covers Metro Cebu that has an area of about 1,013 km^2 and consists of 13 LGUs, i.e., Cebu City, Danao City, Mandaue City, Lapu-Lapu City, City of Talisay, City of Naga, and City of Carcar; and Municipality of Compostela, Municipality of Liloan, Municipality of Consolacion, Municipality of Cordova, Municipality of Minglanilla, and Municipality of San Fernando. The Project also covers the regional transportation connecting Metro Cebu and its surrounding areas.



Source: JICA Project Team

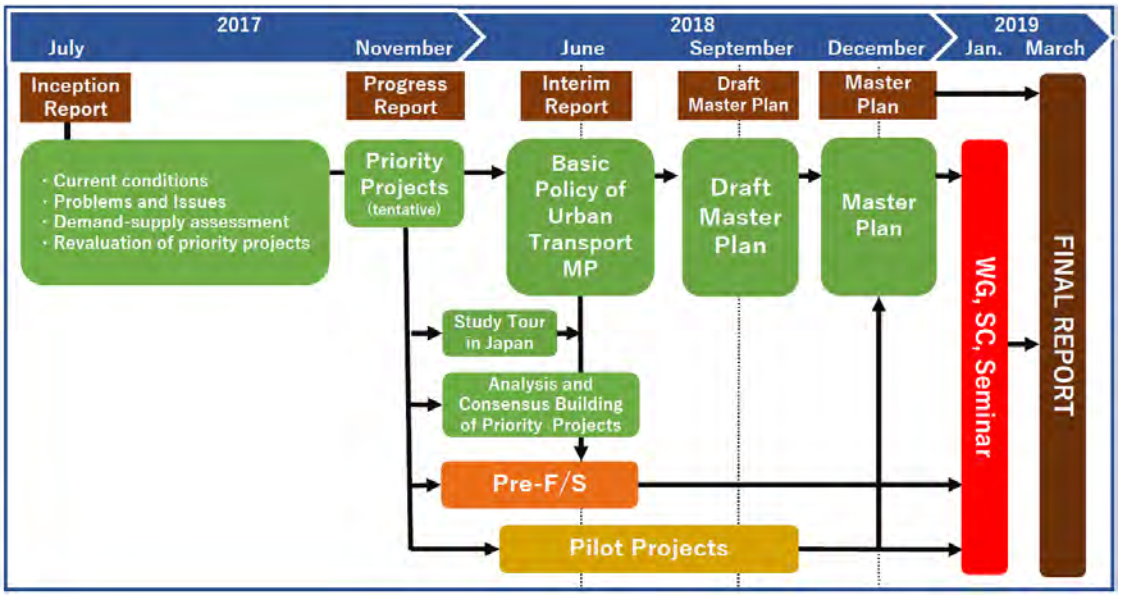
Figure 1.3.1 Location of the Study Area (Metro Cebu)

1.4 Updated Project Framework

The Project commenced at the end of July 2017 and currently scheduled to end in March 2019. Since evaluation for the priority projects and selection of the project for the preliminary study took longer time than the original schedule due to the close coordination among the relevant stakeholders, the overall project schedule was revised accordingly. The following are the updated key milestones planned during the rest of the project period as shown in Figure 1.4.1.

(i) Following the Inception Report, Progress Report, Interim Report, Draft Master Plan and Master Plan have been prepared for the intermediate discussion. There will be one more report (Final Report) submission currently scheduled in March 2019.

(ii) A seminar, Working Group and Steering Committee meetings are planned to be held in January 2019 to share the contents of the master plan among the stakeholders.



Source: JICA Project Team

Figure 1.4.1 Key Milestones of the Project

1.5 Contents of the "Master Plan" Report

The major contents of this "Master Plan" report are summarized as follows:

(1) Existing Urban Planning and Development in Metro Cebu

The existing conditions relevant to urban planning and development in the Study Area including socio-economic situation and planning system in Metro Cebu are described to identify the current urban planning and development issues (Chapter 2).

(2) Existing Conditions of Urban Transport in Metro Cebu

The existing conditions of urban transport such as air, sea, road, bridge as well as public transport and traffic management were described to identify the current urban transport issues. (Chapter 3).

(3) Existing Traffic Demand Analysis

The existing traffic demand was analyzed based on the results of supplemental survey and database of the Roadmap Study. Gap assessment of road-based public transport demand and supply was also carried out based on the data obtained from the public transport terminal survey and the public transport passengers survey (Chapter 4).

(4) Existing Urban Transport Institutions in Metro Cebu

Institutional framework of urban transport development including the roles of relevant agencies and the project evaluation and endorsement process was introduced. Status of the relevant laws and regulations as well as projects and programs were also summarized (Chapter 5).

(5) Basic Policy of Urban Planning in Metro Cebu

Basic policy and strategies of urban development in Metro Cebu were proposed according to the existing Mega Cebu Vision in order to maximize the benefits of the proposed urban transport projects through the integrated urban and transport development. Updated land use plan of 3 LGUs and design guideline were proposed as the case studies to introduce the concrete measures for the implementation of the integrated urban and transport development (Chapter 6).

(6) Basic Policy and Orientations of Urban Transport Development in Metro Cebu

Basic policy and orientations of urban transport development in Metro Cebu were proposed based on the review of the past planning studies including their policy. Targets of urban mobility and accessibility were set to clarify the orientation of the development policy. Development strategies were proposed by phases based on the analysis on the future traffic demand including the demand-supply gap in the transport network. In accordance with these strategies and prepared evaluation criteria, priority projects were selected based on the proposed transport projects by the Roadmap Study (Chapter 7).

(7) Proposed Urban Transport Master Plan and Projects

Urban transport network was introduced including road, UMRT and public transport system. Urban transport management was also studied in terms of both technical and financial aspects. Impacts of the proposed urban transport network were estimated by the indicative figures such as travel time and congestion ratio. Details of the selected priority projects were compiled including economic and financial analysis as well as environmental and social analysis (Chapter 8).

(8) Preliminary Feasibility Study on Mandaue-Lapu Lapu Link Bridge (4th Mactan Bridge) and Mandaue Coastal Road Project

The preliminary feasibility study on 4th Mactan Bridge and Mandaue Coastal Road was conducted to identify the recommended bridge type and location. This project was selected as the focal project for future cooperation between government of Philippine and Japan and currently feasibility study is underway through other study (Chapter 9).

(9) Evaluation of Urban Transport Master Plan

Economic analysis was conducted for the entire proposed urban transport network to confirm its benefits. Financial feasibilities were also confirmed through the comparison of the cost and estimated public funding (budget envelope) (Chapter 10).

(10) Strategic Environmental Assessment and Environmental and Social Considerations

According to the SEA plan, second stakeholders' meetings in 13 LGUs and focus group discussions were conducted for the purposes of a) validation of 1st stakeholders' meeting results, 2) presentation of the Project's initial findings and recommendations (priority projects) and 3) presentation of the direction of the transport infrastructure development in Metro Cebu and hearing opinions on the findings and recommendations on the transport network plan. (Chapter 11)

(11) Alternative Options for Metropolitan Cebu Traffic Management Coordinating Board

Alternative options for Metro Cebu urban transport development authority and council were described based on reviewing sub-roadmap for metropolitan governance in the roadmap study. Also referring to House Bill for Mega Cebu Development Authority and indicative institutional setup for urban transport regulation and management in Traffic Crisis Act of 2017 (Chapter 12).

(12) Pilot Projects

Two pilot projects listed below were conducted in the Project. The main purpose of those pilot projects was to enhance the capacity of local operational organization.

- Local Public Transport Route Plan

  This pilot project was conducted to assist the formulation of the public transport route plan to be prepared by LGUs. In this pilot project, 3 LGUs (Mandaue City, Lapu-Lapu City and Municipality of Cordova) were selected to formulate the plan as a case study. Several traffic surveys and workshops were conducted to collect necessary traffic data and to prepare the optimal route plan based on the obtained data. Relevant LGU officers learned the process of formulation of the plan, prepared the plan and submitted to the national government agency (Land Transportation Franchising & Regulatory Board: LTFRB) for approval (Chapter 13).

- Traffic Signal Control

  This pilot project was conducted to enhance knowledge and skills of the relevant LGU officers for the optimal traffic signal control. In this pilot project, a intersection located at the foot of 1st Mactan Bridge in Lapu-Lapu City was selected as the project site. Several traffic surveys for data collection and analysis were conducted to calculate optimal traffic signal cycle length. Also, one traffic signal was installed to control the traffic flows to 1st Mactan Bridge (Chapter 14).

(13) Capacity Development Activities

As one of the most important aims of the Project, various capacity development activities were conducted. Most of the activities were the seminars and workshops. JICA project team invited the relevant stakeholders to conduct capacity development through technology transfer (Chapter 15). Details of the seminars and workshops including their materials were listed in Appendix 2.

1.6 Summary of Meetings and Seminars

The Project Team attended and held various meetings to identify the roles and functions of stakeholders, gather information, and build capacity of stakeholders with detailed

discussions on their existing conditions and plans/projects. Meetings held by the Project Team are listed in the following tables.

Table 1.6.1 Meetings of Major Agencies and Organizations Attended by the Project Team

Date	Agency/Organization/Meeting
13th December 2017	MCDCB 4th Quarter Meeting
5th January 2018	MCDCB Emergency Meeting on Heavy Congestion in City of Talisay
7th February 2018	Meeting with Department of Public Works and Highways (DPWH) Regional Office 7
16th March 2018	Steering Committee Meeting
20th March 2018	Meeting with DPWH Regional Office 7
12th April 2018	Meeting with Mayor of Lapu-Lapu City for Pilot Project Approval
24th April 2018	Meeting with Mandaue City Government, Planning Office
9th May 2018	Meeting with DPWH (Usec.Cabral and Usec.Sadain)
10th May 2018	Meeting with Department of Transportation (DOTr) (Usec.Reinoso)
11th May 2018	Meeting with National Economic and Development Authority Regional office (NEDA7), DPWH7, Cebu Province, MCDCB
6th July 2018	Working Group Meeting
6th July 2018	Steering Committee Meeting
13th July 2018	Meeting with DPWH Regional Office 7
16th July 2018	Meeting with Cebu City Government, City Administrator
24th September 2018	MCDCB 3rd Quarter Meeting
25th September 2018	Meeting with DPWH Regional Office 7
12th December 2018	MCDCB 4th Quarter Meeting
23rd January 2019	Joint Working Group and Steering Committee Meeting

Source: JICA Project Team

Table 1.6.2 Stakeholder Meetings by the Project Team for the SEA

Date	Agency/Organization/Meeting
27th February 2018	1st Stakeholder Meeting with Municipality of Minglanilla
6th March 2018	1st Stakeholder Meeting with Municipality of Cordova
7th March 2018	1st Stakeholder Meeting with Municipality of Liloan
7th March 2018	1st Stakeholder Meeting with Municipality of Compostela
8th March 2018	1st Stakeholder Meeting with Municipality of San Fernando
13th March 2018	1st Stakeholder Meeting with Lapu-Lapu City
13th March 2018	1st Stakeholder Meeting with Mandaue City
14th March 2018	1st Stakeholder Meeting with Municipality of Consolacion
15th March 2018	1st Stakeholder Meeting with Danao City
21st March 2018	1st Stakeholder Meeting with City of Naga
21st March 2018	1st Stakeholder Meeting with City of Carcar
27th March 2018	1st Stakeholder Meeting with Cebu City
17th April 2018	1st Stakeholder Meeting with City of Talisay
30th April 2018	1st Focus Group Discussion/ Consultative Workshop
10th August 2018	2nd Stakeholder Meeting with Mandaue City
13th August 2018	2nd Stakeholder Meeting with City of Talisay
16th August 2018	2nd Stakeholder Meeting with Cebu City
17th August 2018	2nd Stakeholder Meeting with Municipality of Minglanilla
17th August 2018	2nd Stakeholder Meeting with City of Naga

18th August 2018	2nd Focus Group Discussion with the Youth Sector
20th August 2018	2nd Stakeholder Meeting with Danao City
20th August 2018	2nd Stakeholder Meeting with Municipality of Compostela
24th August 2018	2nd Stakeholder Meeting with Lapu-Lapu City
24th August 2018	2nd Stakeholder Meeting with Municipality of Cordova
29th August 2018	2nd Stakeholder Meeting with Municipality of San Fernando
29th August 2018	2nd Stakeholder Meeting with City of Carcar
30th August 2018	2nd Stakeholder Meeting with Municipality of Liloan
6th September 2018	2nd Stakeholder Meeting with Municipality of Consolacion
10th September 2018	2nd Focus Group Discussion with the Women Sector
10th September 2018	2nd Focus Group Discussion with the Market Vendors Sector
12th September 2018	2nd Focus Group Discussion with Disability Sector
12th October 2018	2nd Focus Group Discussion/ Consultative Workshop

Source: JICA Project Team

Table 1.6.3 Meetings for Information Gathering by the Project Team

Date	Agency/Organization/Meeting
4th December 2017	Meeting with Cebu City Government, Transportation Office
12th December 2017	Meeting with Lapu-Lapu City Government, Planning Office
14th December 2017	Regional Workshop Related with National Transport System Master Plan Study
18th January 2018	Meeting with Technical Education and Skill Development Authority (TESDA)
26th January 2018	Meeting with Lapu-Lapu City Government, Planning Office
29th January 2018	Meeting with Mandaue City Government, Planning Office
31st January 2018	Meeting with Mandaue City College
7th February 2018	Meeting with Municipal Government of Minglanilla, Planning Office
8th February 2018	Meeting with City Government of Naga, Planning Office
13th February 2018	Meeting with Mandaue City Government, Planning Office
14th February 2018	Meeting with Lapu-Lapu City Government, Planning Office
20th February 2018	Meeting with City Government of Talisay, Planning Office/Counselor Management Office
20th February 2018	Meeting with Municipal Government of Minglanilla, Planning Office
20th February 2018	Meeting with Municipal Government of Cordova, Engineering Office
21st February 2018	Meeting with City Government of Carcar, Planning Office
21st February 2018	Meeting with San Fernando, Planning Office
21st February 2018	Meeting with City Government of Naga, Planning Office
21st February 2018	Meeting with Cebu City Government, Planning Office/Counselor Management Office
22nd February 2018	Meeting with Municipal Government of Consolacion, Planning Office
22nd February 2018	Meeting with Municipal Government of Liloan, Planning Office
22nd February 2018	Meeting with Municipal Government of Compostela, Planning Office
22nd February 2018	Meeting with Mandaue City Government, Planning Office
23rd February 2018	Meeting with Mactan Export Processing Zone 1 (MEPZ1)
8th March 2018	Meeting with Lapu-Lapu City Government, City Government Attorney
9th March 2018	Meeting with MEPZ1
30th April 2018	Focus Group Discussion
13th August 2018	Meeting with Lapu-Lapu City Government, Planning Office
13th August 2018	Meeting with Mandaue City Government, Planning Office
13th August 2018	Meeting with Mandaue City Government, Environment Management Office
13th August 2018	Meeting with Province of Cebu, Environment Management Office

Date	Agency/Organization/Meeting
13th August 2018	Meeting with DPWH Region 7
22nd August 2018	Meeting with NEDA Region 7
23rd August 2018	Meeting with Cebu City Government, City Administrator
31st August 2018	Meeting with Lapu-Lapu City Government, City Administrator, Planning Office and Command Center

Source: JICA Project Team

Table 1.6.4 Seminars the Project Team Held for Capacity Development

Date	Agency/Organization/Meeting
15th March 2018	Capacity Development Seminar (1st Session)
19th March 2018	Capacity Development Seminar (2nd Session)
20th March 2018	Capacity Development Seminar (3rd Session)
22nd March 2018	Capacity Development Seminar (4th Session)
12th April 2018	GIS Training Seminar (Basic Course 1st Session)
13th April 2018	GIS Training Seminar (Basic Course 2nd Session)
16th April 2018	Traffic Demand Forecast Seminar
18th April 2018	GIS Training Seminar (Advanced Course 1st Session)
19th April 2018	GIS Training Seminar (Advanced Course 2nd Session)
20th April 2018	GIS Training Seminar (Advanced Course 3rd Session)
18th May 2018	Pre-Seminar on Pilot Projects
7th August 2018	Post-Seminar for Study Tour in Japan
8th August 2018	Urban Management Workshop “Simulation on TOD Transit Oriented Development” (1st Session)
9th August 2018	Urban Management Workshop “Simulation on TOD Transit Oriented Development” (2nd Session)
7th September 2018	Site Observation and Seminar for Traffic Signal Control on Pilot Project
18th September 2018	Workshop for LPTRP on Pilot Project (1st Session)
20 September 2018	Workshop for LPTRP on Pilot Project (2nd Session)
2nd October 2018	Evaluation Meeting and Seminar for Traffic Signal Control on Pilot Project
22nd January 2019	Capacity Development Seminar for Implementation of Master Plan

Source: JICA Project Team

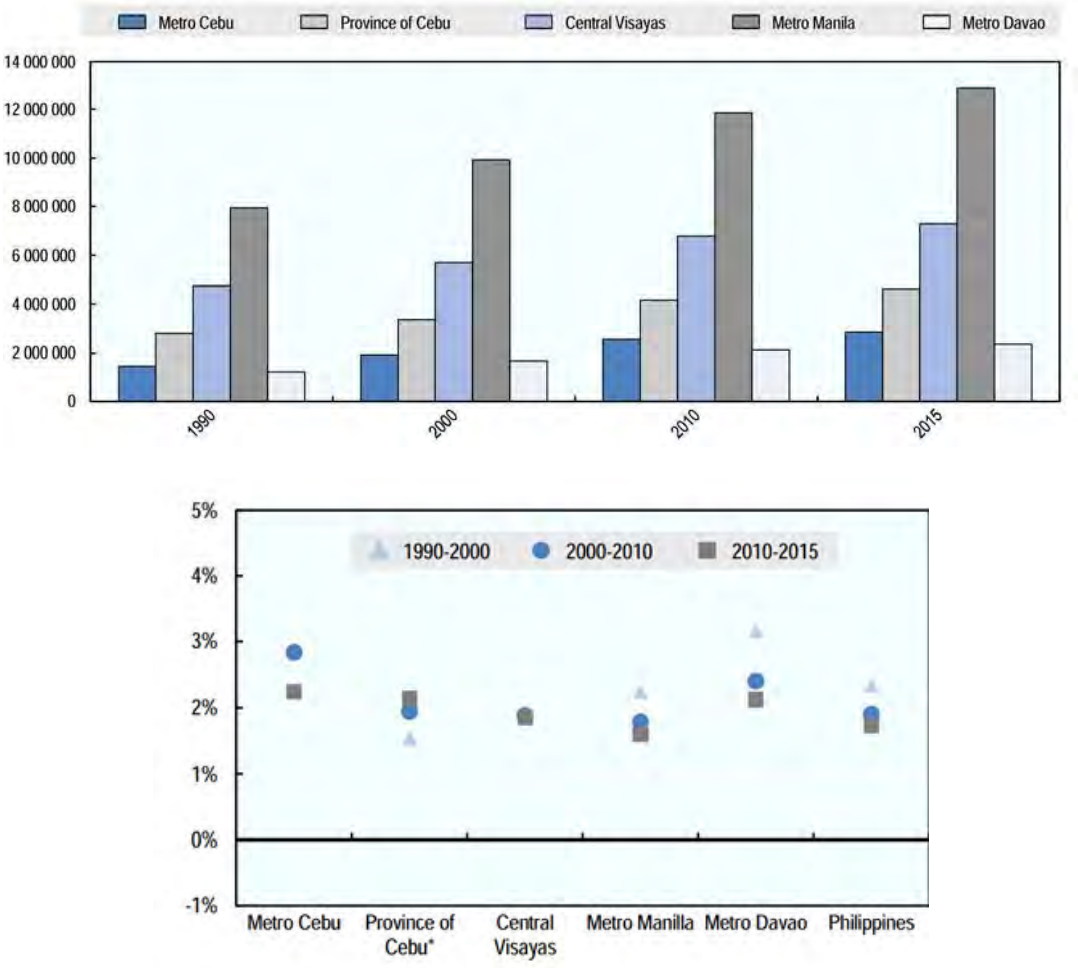
2 EXISTING URBAN PLANNING AND DEVELOPMENT IN METRO CEBU

2.1 Socio-Economic Situation

1) Population of Metro Cebu in the Regional Context

There are three metropolitan areas in the country as defined by NEDA in the current Philippine Development Plan 2017–2022: Metro Manila in Luzon, Metro Cebu in Visayas, and Metro Davao in Mindanao. As of the 2015 national census, the Metro Manila population is 12.9 million, Metro Cebu is 2.8 million, and Metro Davao is 2.5 million. Not only does Metro Cebu rank second in population size, but also in land size at 1,163 square kilometers while Metro Manila is at 636 square kilometers and Davao City at 2,443.

As shown in Figure 2.1.1, while the population of Metro Cebu is quite smaller than Metro Manila, its population growth is higher even compared to the average of Cebu Province and Central Visayas Region. Some Metro Cebu LGUs have the highest population growth in the Philippines as shown in Table 2.1.1. The table also indicates the rapid urban growth rate in the last 20 years.



Source: Green Growth in Cebu, Philippines 2017, OECD; Philippine Statistics Authority 2016.

Figure 2.1.1 Population and Population Growth in the Metropolitan and Relevant Areas

2) Population of Metro Cebu

Metro Cebu is composed of 7 cities and 6 municipalities. With an annual growth rate that has slowed down from 2.9% in the 10-year period 1990–2000 to 2.8% in 2000-2010 and further down to 2.2% in the recent 5-year period of 2010–2015, Metro Cebu still reached a population of 2.8 million. The population distribution by LGUs in the metropolis shows a concentration in the core cities of Cebu, Mandaue, and Lapu-Lapu Cities, which are all just adjacent to each other (see Table 2.1.1). These cities are regarded as highly urbanized independent cities that are independent from the provincial administration and are statistically classified and recorded separately[1].

Table 2.1.1 Population of Metro Cebu by City and Municipality, 1990–2015

City/ Municipality Name	Land Area (hectares)	No. of Brgy.	Population					Annual Growth Rate (%)		
			1990	1995	2000	2010	2015	90–00	00–10	10–15
City of Carcar	11,678	15	70,841	78,726	89,199	107,323	119,664	2.3	1.9	2.2
Cebu City	31,500	80	610,417	662,299	718,821	866,171	922,611	1.6	1.9	1.3
Municipality of Compostela	5,390	17	22,006	26,499	31,446	42,574	47,898	3.6	3.1	2.4
Municipality of Consolacion	14,720	21	41,270	49,205	62,298	106,649	131,528	4.2	5.5	4.3
Municipality of Cordova	1,715	13	22,331	26,613	34,032	50,353	59,712	4.3	4.0	3.5
Danao City	10,730	42	73,358	79,932	98,781	119,252	136,471	3.0	1.9	2.7
Lapu-Lapu City	5,810	30	146,194	173,744	217,019	350,467	408,112	4.0	4.9	3.1
Municipality of Liloan	4,592	14	42,587	50,973	64,970	100,500	118,753	4.3	4.5	3.4
Mandaue City	2,518	27	180,285	194,745	259,728	331,320	362,654	3.7	2.5	1.8
Municipality of Minglanilla	6,560	19	50,875	62,523	77,268	113,178	132,135	4.3	3.9	3.1
City of Naga	10,197	28	60,425	69,010	80,189	101,571	115,750	2.9	2.4	2.6
Municipality of San Fernando	6,939	21	35,051	38,700	48,235	60,970	66,280	3.2	2.4	1.7
Talisay City	3,987	22	97,955	120,292	148,110	200,772	227,645	4.2	3.1	2.5
Metro Cebu	**116,336**	**349**	**1,453,595**	**1,633,261**	**1,930,096**	**2,551,100**	**2,849,213**	2.9	2.8	2.2

Source: Philippine Statistical Authority (Results of 2015 Census)

3) Labor Force

A recognized resource of Metro Cebu is its abundant labor force that hosts 50% of the region's labor supply or 3% of the national pool. The labor force population in Metro Cebu continued to climb from 1.4 million in 2007 to 1.8 million in 2015 that basically maintained the same 61.8% share to total population of the metropolis and posted a modest 3.4% annual growth. The region, on the other hand, posted a negative growth for the same period. This indicates a higher economic attraction of the metropolis vis-a-vis other areas in the region. The supply of labor force is highest in Cebu City as shown in Table 2.1.2 and followed moderately by Lapu-Lapu and Mandaue Cities.

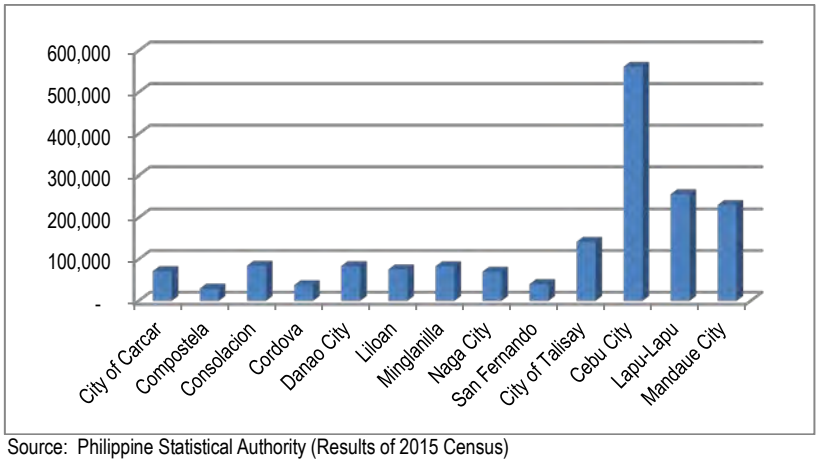
In terms of the types of workers or classification of occupations, approximately 52% are in the service sector while about 43% are in the industry sector. A strong reflection of its urbanization state, the metropolis has a very minor share of 4% of the workers in the agricultural sector (see Table 2.1.3).

1 *Although Mandaue City is practically classified as a highly urbanized independent city, it is legally classified as the first component city since its residents have voting rights for the Governor and legislator of the Province.

Table 2.1.2 Labor Force (Population of 15-60 Years Old) in Metro Cebu 2007 & 2015

	Labor Force 2007			Labor Force 2015			Annual Growth Rate (%)
	Persons 15–60 yrs old	% to Total LGU Pop.	% to Total Metro Cebu Pop.	Persons 15-60 yrs old	% to Total LGU Pop.	% to Total Metro Cebu Pop.	
City of Carcar	56,871	56.6	4.0	71,006	59.5	3.9	3.1
Municipality of Compostela	22,924	64.1	1.6	29,351	61.4	1.6	3.5
Municipality of Consolacion	54,218	58.5	3.8	83,968	64.0	4.7	6.9
Municipality of Cordova	26,890	62.0	1.9	37,223	62.5	2.1	4.8
Danao City	64,141	59.8	4.5	83,253	61.2	4.6	3.7
Municipality of Liloan	55,700	58.8	3.9	75,111	63.4	4.2	4.4
Municipality of Minglanilla	59,447	61.7	4.2	82,517	63.6	4.6	4.9
City of Naga	55,053	60.2	3.9	69,798	60.5	3.9	3.3
Municipality of San Fernando	31,070	63.2	2.2	39,859	60.2	2.2	3.5
Talisay City	107,189	60.1	7.5	141,609	63.2	7.8	4.0
Cebu City	507,784	57.9	35.7	560,886	61.6	31.0	1.3
Lapu-Lapu City	179,958	56.6	12.7	255,988	63.0	14.2	5.3
Mandaue City	200,846	61.1	14.1	229,976	63.9	12.7	1.8
Metro Cebu	1,422,091	61.8	100.0	1,760,546	61.8	100.0	3.4
Region VII	3,662,083	57.4		3,601,341	59.9		(0.2)
Philippines	51,416,747	58.2		61,537,914	61.2		2.5

Source: Population and Housing Census 2007 and 2015 from Philippine Statistics Authority



Source: Philippine Statistical Authority (Results of 2015 Census)

Figure 2.1.2 Distribution of the Labor Force by LGU in Metro Cebu 2015

Table 2.1.3 Workers by Type of Occupation in Metro Cebu 2015

LGU	Managers	Professionals	Technicians & Assoc Profession	Clerical Support Workers	Service & Sales	Skilled Agri., Forestry & Fishery	Craft & Related Trades	Plan & Machine Operators & Assemblers	Elementary Occupations	Armed Forces	Not Reported	Total	Share (%)
City of Carcar	3,561	2,035	2,163	1,965	8,792	4,374	9,190	4,440	8,160	10	11	44,701	3.87
Municipality of Compostela	1,801	1,140	1,023	1,105	2,287	2,007	2,651	3,752	3,762	8	16	19,552	1.69
Municipality of Consolacion	7,592	4,265	4,271	4,710	9,765	1,593	9,183	7,060	8,728	48	77	57,292	4.96
Municipality of Cordova	2,300	1,630	1,452	1,351	4,189	1,502	3,917	3,272	4,515	42	16	24,186	2.09
Danao City	5,031	2,448	2,433	2,361	7,758	5,810	8,496	12,842	10,076	35	23	57,313	4.96
Municipality of Liloan	5,685	3,540	3,181	3,851	8,249	2,162	7,300	7,274	8,015	32	27	49,316	4.27
Municipality of Minglanilla	4,842	5,111	3,650	4,425	8,009	1,893	11,525	6,666	6,950	31	45	53,147	4.60
City of Naga	1,944	2,269	2,345	2,097	6,360	3,734	8,915	5,441	8,296	19	66	41,486	3.59
Municipality of San Fernando	1,076	1,292	1,403	1,138	3,584	3,046	4,636	2,855	4,944	2	16	23,992	2.08
Talisay City	7,770	7,991	6,684	7,633	17,568	2,414	12,856	10,764	16,729	49	776	91,234	7.90
Cebu City	41,535	33,955	24,127	44,911	84,503	11,241	39,233	28,315	56,463	337	711	365,331	31.62
Lapu-Lapu City	13,713	10,843	11,723	12,677	28,200	5,693	34,595	26,913	22,676	820	133	167,986	14.54
Mandaue City	17,080	10,723	11,572	17,586	31,441	919	23,971	20,185	25,951	63	397	159,888	13.84
Metro Cebu	113,930	87,242	76,027	105,810	220,705	46,388	176,468	139,779	185,265	1,496	2,314	1,155,424	100.00
Share (%)	9.86	7.55	6.58	9.16	19.10	4.01	15.27	12.10	16.03	0.13	0.20	100.00	

Source: Philippine Statistical Authority (Results of 2015 Census)

4) Regional Economy

Based on the economic assessment of Region VII,[2] the Central Visayas Region showed a healthy economic growth for the most part of 2011 to 2016 except in 2015 where only half of its planned target was reached at 4.8% growth in gross regional domestic product (GRDP). Nevertheless, the region held the top 4th place in the per capita GRDP of the country. In the roll of years, Region VII saw an increase in its per capita GRDP with PHP 44,993 in 2009 (at constant 2000 prices) to PHP 64,858 in 2015. For comparison, Metro Manila or the National Capital Region had a per capita GDP of PHP 219,114 in the same year.

The regional economy grew at an annual rate of 7.2% for the period 2011–2015. The industry sector is fairly steady in driving the economy of the region since 2011 except in 2015 where its growth dipped from 9.3% in 2011 to -0.5% in 2015 as shown in Table 2.1.4. The service sector stood responsible for the expansion of the regional economy in that same year with an 8.9% growth rate and the primary sector had a good showing of 2.3% growth after a series of negative growth rate performance from 2012 to 2014.

[2] The Regional Development Report 2015 of NEDA Region VII.

Table 2.1.4 Growth Rates of Gross Regional Domestic Product by Sector of Region VII (2011–2015; at constant 2000 prices)

Sector	Growth Rates (%)					Contribution to 2014–2015 GRDP Growth Rate (percentage points)	Ave. Annual Growth Rate 2011–2015 (%)
	2010–2011	2011–2012	2012–2013	2013–2014	2014–2015		
Agri., Hunting, Forestry & Fishing	3.7	(1.6)	(0.3)	(1.9)	2.3	0.1	0.4
Agriculture and Forestry	6.3	(1.2)	0.2	0.6	2.8	0.1	1.7
Fishing	(7.2)	(3.7)	(2.9)	(14.7)	(0.7)	0.0	(6.0)
Industry	9.3	12.0	9.5	11.3	(0.5)	(0.2)	8.2
Mining and Quarry	13.0	6.5	(1.9)	28.1	3.0	0.0	9.2
Manufacturing	7.9	6.3	14.0	10.0	5.3	1.3	8.7
Construction	13.5	27.5	2.2	14.7	(14.7)	(1.6)	7.7
Electricity, Gas & Water Supply	4.6	7.8	4.9	2.3	5.4	0.1	5.0
Service	5.7	9.2	6.9	6.6	8.9	4.9	7.5
Transport, Storage & Communication	6.1	7.9	9.2	7.7	10.9	0.8	8.3
Trade & Repair of Motor Vehicles	4.6	12.1	5.7	7.3	6.9	1.0	7.3
Financial Intermediation	2.9	9.1	13.5	7.8	10.9	0.8	8.8
Real Estate, Renting & Business Activities	9.7	8.4	7.1	5.7	7.2	0.8	7.6
Public Adm. & Defense	1.0	9.1	5.3	4.2	1.8	0.1	4.2
Other Services	6.0	7.3	3.5	5.7	12.5	1.4	7.0
Gross Regional Domestic Product	6.8	9.4	7.4	7.8	4.8	4.8	7.2

Source: Regional Development Report 2015 with data from Philippine Statistics Authority, NEDA Region VII

5) Poverty Incidence and Informal Settler Families

Another positive economic indicator noted in the region for this period is the consistent post of high employment rates as compared to other regions (94.1% employment rate in 2015). Unemployment rate, meanwhile, was at 5.9% of the population.

However, poverty incidence was not reduced to the desired level. According to the results of national census in 2015, whereas poverty incidence among population in Metro Manila was 3.9%, the ratio in Cebu Province was 21.4%, which was the almost same as the national average (21.6%).

During the Roadmap Study, the recorded number of Informal Settler Families (ISFs) in Metro Cebu was 35,217 families. About 80% of this population was found in Talisay and Cebu Cities combined. The ISFs usually reside in coastal areas or riverbanks as well as in idle public or government lands.

6) Future Population and Economic Outlook

The Roadmap Study estimated the future population of the metropolis (based on the 2010 population census) to reach 3.8 million in 2030 and expected to become almost 5 million in 2050. This forecast is still valid (as a planning assumption) even with the recent 2015 population census results since the growth trajectory difference is very minimal at 0.02%. Details of population projection are described in Chapter 6.

The economic outlook of Cebu Province is strongly tied to that of Central Visayas Region as it is the driving force of the region. However, like any economic forecast, only a short-term horizon projection was made for a 2-year period of 2017 and 2018 as shown in Table 2.1.5. GDP is shown to continue its upward trend but this will drive inflation rate upward as well. While employment will increase, little is seen to improve unemployment rates as this will remain the same at 6.4% for both years. Metro Cebu, in particular, is expected to show strong growth in the near future as large infrastructure projects (e.g. Cebu–Negros Link Bridge and Cebu-Bohol Link Bridge Project by DPWH) are already planned under the Build, Build, Build Program of the national government in addition to the committed transport

projects such as the Mactan–Cebu Airport Passenger Terminal, Cebu BRT Project, New Cebu International Container Port, and widening of primary roads.

Table 2.1.5 Central Visayas Region's Economic Outlook

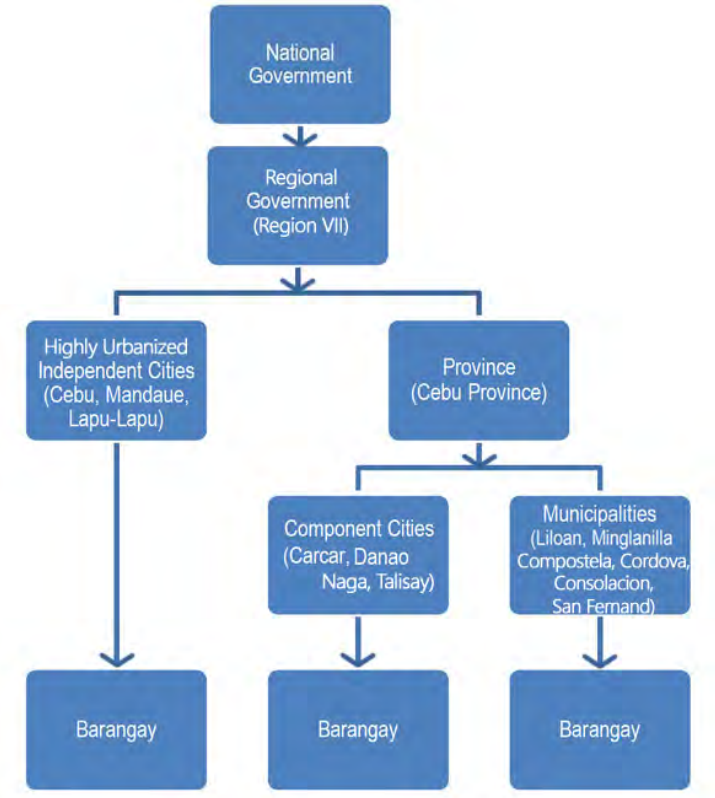
	2016	2017	2018	Change 2017/2016 (%)	Change 2018/2017 (%)
Gross Domestic Product (constant 2000 in USD millions)	525,164	547,411	585,183	4.24	6.90
Inflation Rate	11.5%	5.5%	8.6%		
Labor Force (000)	3,465	3,536	3,612	2.05	2.15
Employment (000)	3,235	3,308	3,381	2.26	2.21
Unemployment Rate	5.0	6.4	6.4		

Source: Central Visayas Economic Model from Canmac Economics Limited for Cebu's Economic Outlook 2017

2.2 Urban Planning

1) Urban Planning Framework in Metro Cebu

The Philippines is divided into administrative regions, and regional management is at the level immediately below the national government designed to cascade national policies, plans, and programs to the local level. As shown in Figure 2.2.1, LGUs in Metro Cebu are classified both in provincial and city or municipality levels.



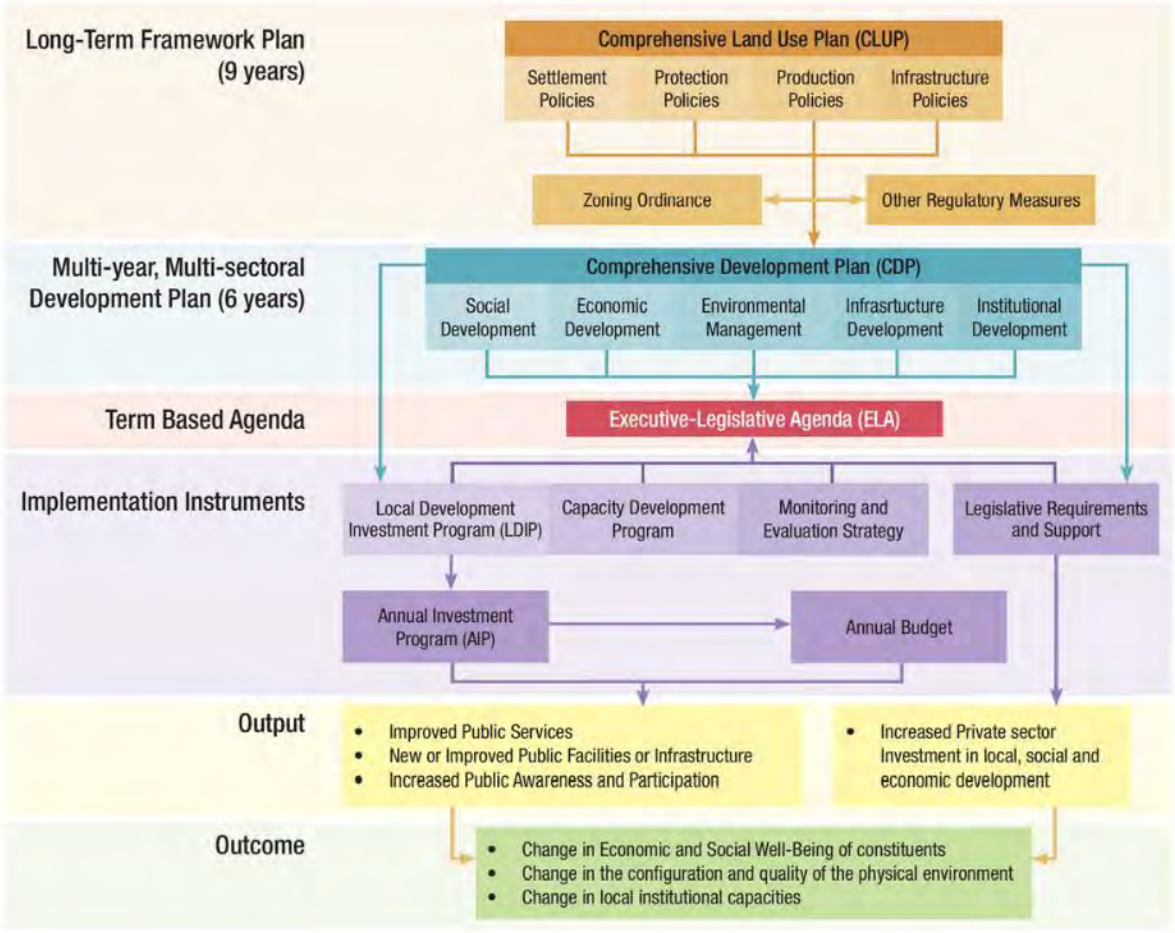
Spatial Plan	Socio-Economic Development Plan	Investment Plan/Program
National Physical Framework Plan (NPFP) 2001–2030	Philippines Development Plan (PDP) 2017–2022	Public Investment Program (PIP) 2017–2022
Regional Physical Framework Plan (RPFP) 2003–2030	Regional Development Plan (RDP) 2017–2022	Regional Development Investment Program (RDIP) 2017–2022
Provincial Development Physical Framework Plan (PDPFP) 2014–2019		Provincial Development Investment Program (PDIP) 2017–2022
Comprehensive Land Use Plan (CLUP)	Comprehensive Development Plan (CDP)	Local Development Investment Program (LDIP)/ Annual Investment Program (AIP)

Source: Green Growth in Cebu, Philippines 2017 and OECD (edited by JICA Project Team)

Figure 2.2.1 Composition of National to Local Governance and Planning

Whereas necessary planning documents for LGUs illustrated in Figure 2.2.2 are the same, the approval processes vary between highly urbanized cities and other LGUs. For example, while the Comprehensive Land Use Plan (CLUP) and Comprehensive Development Plan (CDP) of highly urbanized cities are submitted to the regional offices of Housing and Land Use Regulatory Board (HLURB) and Department of Interior and Local Government (DILG) respectively for their review and endorsement to the central offices, CLUP and CDP of other LGUs are submitted to the provincial government for approval.

As shown in Figure 2.2.2, CLUP is supposed to provide long-term (9 years) spatial planning principles including land use plan and zoning ordinance. CDP is a multi-sectoral mid-term (6 years) planning based on CLUP and supposed to build bridges for the implementation scheme such as Local Investment Program (LIP) and Capacity Development Program. To enhance coordination for the implementation, an Executive and Legislative Agenda (ELA) is needed, which covers 3-year period corresponding to the term of local executive officials. It is mutually developed and agreed upon by both executive and legislative departments of LGUs. Although these relevant plans should be correlated and updated in accordance with the determined cycle, many LGUs fail to formulate and interrelate these plans in a timely and effective manner.



Source: Local Planning Illustrative Guide (2017), DILG

Figure 2.2.2 Framework of Urban Planning of LGUs

2) Status of Relevant Urban Planning in Metro Cebu

While all national and regional level plans listed in Figure 2.2.1 were completed and approved, the Provincial Development Physical Framework Plan (PDPFP) is still being drafted and planned to be approved in 2018. On the other hand, the Provincial Development Investment Program (PDIP) was approved in November 2017.

RPFP 2003–2030 is a long term, region-wide and integrated land use, settlements and infrastructure plan to guide the allocation, utilization, development and management of Central Visayas Region's land and physical resources. Metro Cebu is regarded as the regional center intended to be compact and highly urbanized with tourism, light industries, high technology and service industries; especially those that have less environmental impact than conventional industries. Among the large infrastructure projects planned, a mass transit system is envisioned to be established for the metropolis within this period.

Although RPFP is the base framework that has to be updated every 10 years, no updates turned out recently.

RDP 2017–2022 was just completed at the helm of the previous RDP 2011–2016; it is newly prepared based on the President's directive to put the government's 0+10 point socio-economic agenda into solid strategies, programs, projects and activities. The RDP is anchored on the AmBisyon Natin 2040 that is the country's long-term vision of "a prosperous, predominantly middle class society where no one is poor" and "where people live long and healthy lives." Additionally, the goal of the people of Visayas is housing provision. Metro Cebu is positioned as the premier urban center of the region with 73% of the region found in the metropolis. The bulk of economic activities are recognized to be in Metro Cebu and, thus, serve as the economic, administrative, financial, and logistics center of the region.

Regional Development Investment Plan (RDIP 2017–2022) contributes to the sectoral outcomes in the PDP and RDP. The sectoral inputs of national government agencies and offices are intended to be spatially coherent with the RDIP as part of NEDA's continuing effort to link PIP with RDIPs.

PDPFP 2014–2019 is dubbed as the interim plan to provide development direction of the 51 cities and municipalities of Cebu Province, which is linked to the regional and national vision of development. It is the basis of the multi-year investment program or the PDIP. The PDIP, in turn, is meted out in the annual investment plan for the allocation of funds for programs, projects, and activities.

Provincial Development Investment Plan (PDIP 2017–2022). In view of PDPFP, the Province of Cebu crafted the PDIP 2017–2022 with tentative yearly budgets for 2018 to 2022 at a total of PHP 25.2 billion. The budgets will be translated to an approved annual investment plan. For 2017, the approved investment is close to PHP 600 million that covers projects for (i) hospitals, health and animal facilities; (ii) water supply development program; (iii) culture, sports, and manpower development; (iv) environment/resource and solid waste management program; (v) tourism infrastructure support; (vii) road/bridge/highway program; (viii) food production/livelihood/entrepreneurship support program; (ix) Philippine Rural Development Program Counterpart fund; (x) loan amortization; and (xi) assistance to LGUs/institution on investment/capital expenditure projects.

As previously mentioned, the status of formulation of relevant urban plans in each LGU varies as shown in Table 2.2.1. Since LIDP and AIP are directly related to their annual budget request, which is fundamental for all LGUs, both programs are well prepared. ELA is also well prepared as it supports the necessity for the investment.

On the other hand, many LGUs have not updated their CLUP and CDP for long time and, obviously, not well integrated with implementation instruments (LDIP and AIP) as shown in Figure 2.2.2. Varying years of update of the CLUP makes it difficult to keep the consistency of urban planning among LGUs.

The Metro Cebu Spatial Plan, which was proposed by the Roadmap Study based on the consideration for consistency of future land use of LGUs, was not identified in the recent CLUPs of Lapu-Lapu City and City of Naga that were approved after the Roadmap Study.

Table 2.2.1 Status of Relevant Urban Planning of LGUs in Metro Cebu

Name of LGU*	CLUP	CDP	ELA	LDIP	AIP
Danao City	1997 (2017–2027 is under review by Provincial Gov.)	None	2017–2019	2017–2019 is still under finalization	2018
Municipality of Compostela	1995-2004	None	2017–2019	2017–2019	2018
Municipality of Liloan	2009-2018	None	2017–2019*	2017–2019	2018
Municipality of Consolacion	2001-2010	2010-2015	2017–2019	2017–2019	2018
Municipality of Cordova	2005 (2018-2027 is under preparation)	2017-2022	2017–2019	2017–2019	2018
Lapu-Lapu City	2018-2027 (under review of HLURB central office)	None	None	2017–2019	2018
Mandaue City	2014-2024	2017-2022	2017–2019	2017–2019	2018
Cebu City	1980 (2017–2027 is under preparation)	None	2017-2019 is still under preparation	None	2018
Talisay City	2001-2010 (2018-2027 is under preparation)	None	2017–2019	2017–2019	2018
Municipality of Minglanilla	2002	None	2017–2019	2017–2019	2018*
City of Naga	2017	2017	2017–2019	2017–2019	2018
Municipality of San Fernand	2001-2010	2012–2018	2017–2019	2017–2019	2018
City of Carcar	2008 (2018-2027 is under review by Provincial Gov.)	None	2017–2019	2014–2019	2018

*Confirmation through the phone interview (copy has not been received)
Source: Detailed Planning Survey, Planning Office of LGUs and Cebu Province

3) Potential and Issues of Urban Planning in Metro Cebu

Towards the improvements on the formulation of relevant urban planning documents, both HLURB and DILG published several guidelines and conducted various capacity enhancement activities. The activities provide important opportunities for LGUs to establish fundamental planning skills. In order to raise awareness and motivation for local governance including urban planning, DILG started o evaluate LGUs nationwide unified criteria and provide incentive based on the evaluation.

On the other hand, coordination between HLURB and DILG becomes important in order to avoid the gap between the spatial and socio-economic planning. As previously described, CLUP is reviewed by HLURB and CDP by DILG. Therefore, their capacity enhancement activities are usually conducted separately. For example, while DILG issues a guidebook to prepare CDP together with LDIP by adopting term-based planning approach, the guideline does not mention CLUP.

However, due to complexity in the urban context, the CLUP has been required to integrate measures for climate change adaptation and disaster risk reduction and management since 2013. Therefore, coordination and integration among CLUP, CDP, ELA, LIDP, and AIP has become more important than ever before to meet the requirement.

Another major urban planning issue in Metro Cebu is the various level of urbanization. Since urbanization is quite different from the central area of Metro Cebu and its peripheries, the contents to be addressed in the urban planning should be varied based on the local context. While the current CLUP and CDP guidelines are uniformly designed for all LGUs, the UN-

Habitat supported the GOP to publish an urban planning guide in 2016 for LGUs located in the peripheries of the urban center in response to the urgent necessity to control urban growth. Since this support is a significant opportunity for LGUs to enhance their planning skills, existing resources including urban planning guides and manuals will be utilized for the capacity enhancement through the preparation of the transport master plan in the Project.

The Roadmap Study and the Detailed Planning Survey pointed out that insufficient information in CLUP prevents coordination with other plans as well as the utilization for the implementation of the relevant projects. While it is still a major issue, necessary capacity enhancement and securement of sufficient human resources in each LGU need to be implemented simultaneously to solve various urban planning issues in Metro Cebu.

2.3 Urban Development

1) Current Status of Urban Development in Metro Cebu

In addition to the urban planning and policy-making previously mentioned, some LGUs have adopted their own ordinances or codes and schemes to promote urban development as follows:

(1) Talisay City has their own City Tourism, Arts, and Heritage Council to establish city branding and promote tourism. It also formulates several city ordinances to implement balanced housing and PPP.

(2) Lapu-Lapu City has Tourism, Cultural and Historical Affairs Commission.

(3) Municipality of Liloan accredits tourism-oriented businesses/facilities to enforce standards and promote PPP.

(4) Municipality of Minglanilla has Municipal Tourism Development Council.

(5) Municipality of Consolacion has Municipal Tourism and Heritage Council and code for a PPP approach to urban development.

Due to the various policy-making and planning at regional, provincial, and LGU levels, the urban development in Metro Cebu has been significantly increasing during the last several years. The number of Philippine Economic Zone Agency (PEZA)[3] registered zones more than doubled from 2014 to 2017 with a large majority (65%) of IT Centers as shown in Table 2.3.1. In terms of land area, SRP (reclaimed land in Cebu City) Manufacturing Special Economic Zone (MSEZ) is the largest (256 hectares) followed by Mactan Economic Zone (Phase 1: 119 hectares, Phase 2: 63 hectares).

In SRP, the numbers of commercial, residential, and mixed-use development are on-going in addition to PEZA. SM Seaside City Cebu completed in December 2015 is the third largest shopping mall by area in the Philippines at 47 hectares.

Regarding residential development, while the rapid increase in numbers of development has been attenuating in the central area of Metro Cebu since around 2005, the number of development has been quickly increasing in the peripheral suburban areas such as in the Municipality of Compostela.

As shown in Figure 2.3.2, recent large scale mixed-use development was planned and implemented mostly in the central areas of Metro Cebu. Several development projects have

[3] An investment promotion and incentive granting agency attached to the Department of Trade and Industry (DTI). It controls registered Economic Zones consisting of 1. Manufacturing Special Economic Zone (MSEZ), 2. IT Park and IT Center, 3. Tourism Economic Zone (TEZ), 4. Medical Tourism Park/ Center, and 5. Agro-Industrial Park.

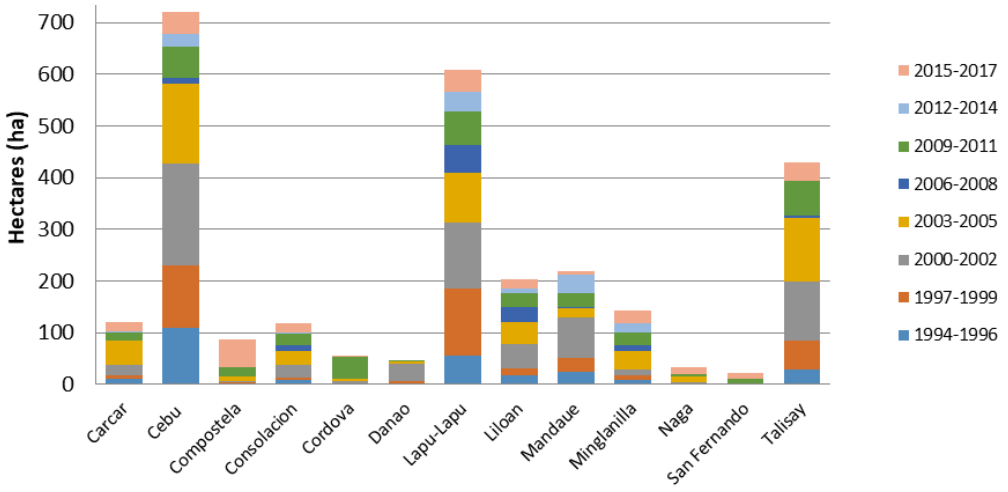
phased planning over the decades to establish new urban centers. Mandani Bay is currently under construction with phase 1 in the waterfront industrial area in Mandaue City—the vicinity of the proposed AGT corridor. Since the entire project site will be approximately 30 hectares when all phases are completed as shown in Figure 2.3.3, it will have certain influence on the adjacent waterfront development as well as AGT corridor.

Gatewalk Central is being developed by joint venture of Ayala Land and Aboitiz Land. Currently, phase 1 from across the existing North Bus Terminal is under construction. Since the project site is adjacent to the North Bus Terminal as shown in Figure 2.3.4. Mandaue City is currently considering to sell the property of the terminal based on the negotiation by the developer.

Table 2.3.1 PEZA Registered Economic Zones in Metro Cebu

Status	Nature	2017	2014	% Growth Rate
OPERATING		**41**	**18**	**128**
	Manufacturing (MSEZ)	6	6	0
	I.T. Centers	27	4	575
	I.T. Parks	5	4	25
	Tourism SEZ	3	3	0
PROCLAIMED		**13**	**4**	**225**
	Manufacturing	1	0	100
	I.T. Centers	10	3	233
	I.T. Parks	2	1	100
DEVELOPMENT IN PROGRESS		**20**	**9**	**122**
	Manufacturing	4	3	33
	I.T. Centers	11	4	175
	I.T. Parks	3	1	200
	Tourism SEZ	1	1	0
	Medical Tourism Center	1	0	100
TOTAL APPROVED		**74**	**31**	**139**

Source: PEZA



Source: HLURB Cebu Subdivision

Figure 2.3.1 Areas of Residential Land Development in Metro Cebu (1994–2017)



Source: HLURB Cebu Subdivision

Figure 2.3.2 Major Residential/ Mixed-use Development (>10ha) in Metro Cebu



Source: Mandani Bay Homepage (http://mandanibay.com/masterplan/)

Figure 2.3.3 Future Development Image of Mandani Bay Project



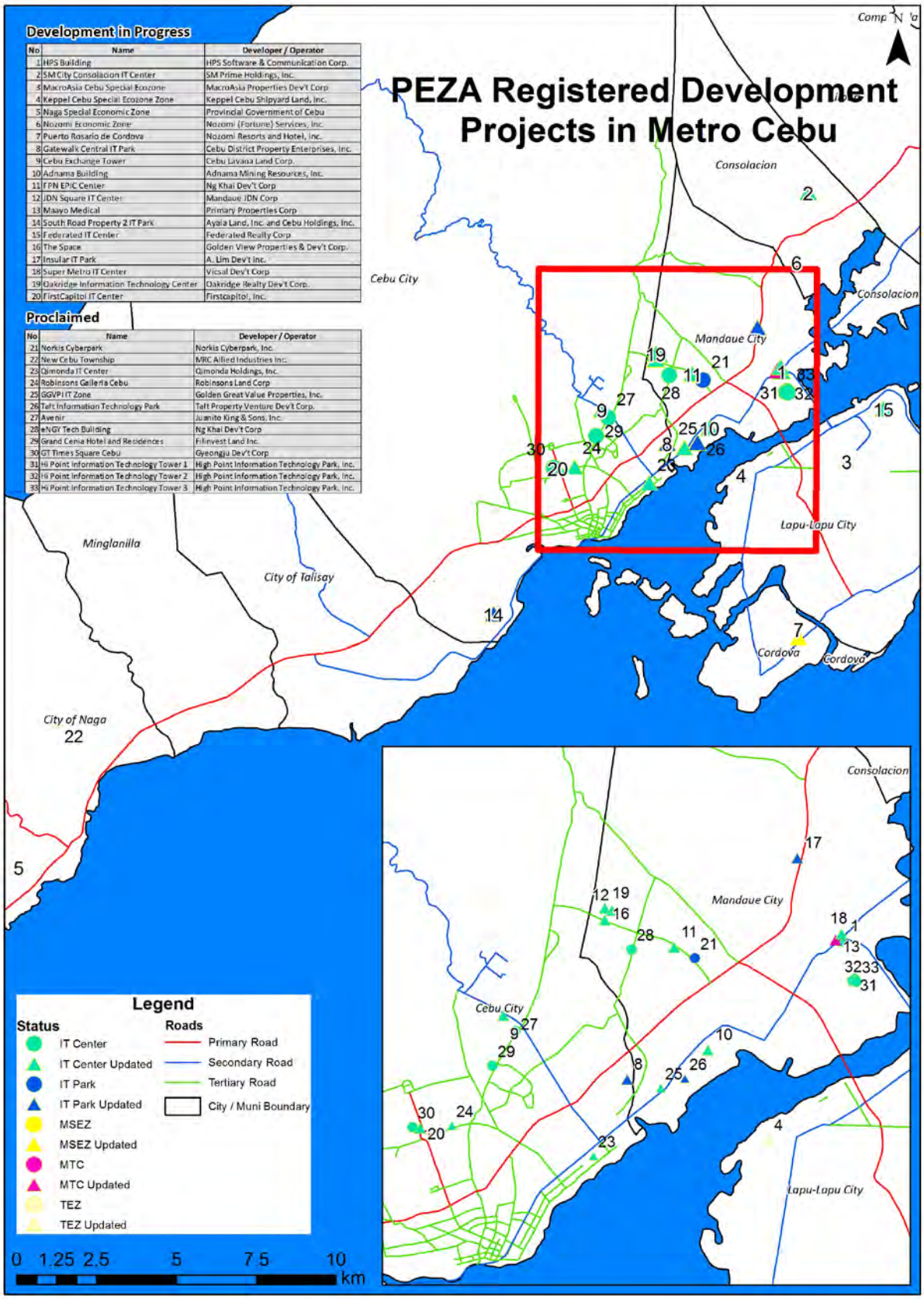
Source: Ayala Land Homepage (https://www.ayalaland.com.ph/2016/06/07/gatewalk-central-dynamic-center-mandaue/)

Figure 2.3.4 Site Plan of Gatewalk Central Project



Source: Roadmap Study and Rappler (https://www.rappler.com/life-and-style/travel/ph-travel/114147-sm-seaside-city-cebu-mall-opening)

Figure 2.3.5 Major Shopping Malls in Metro Cebu

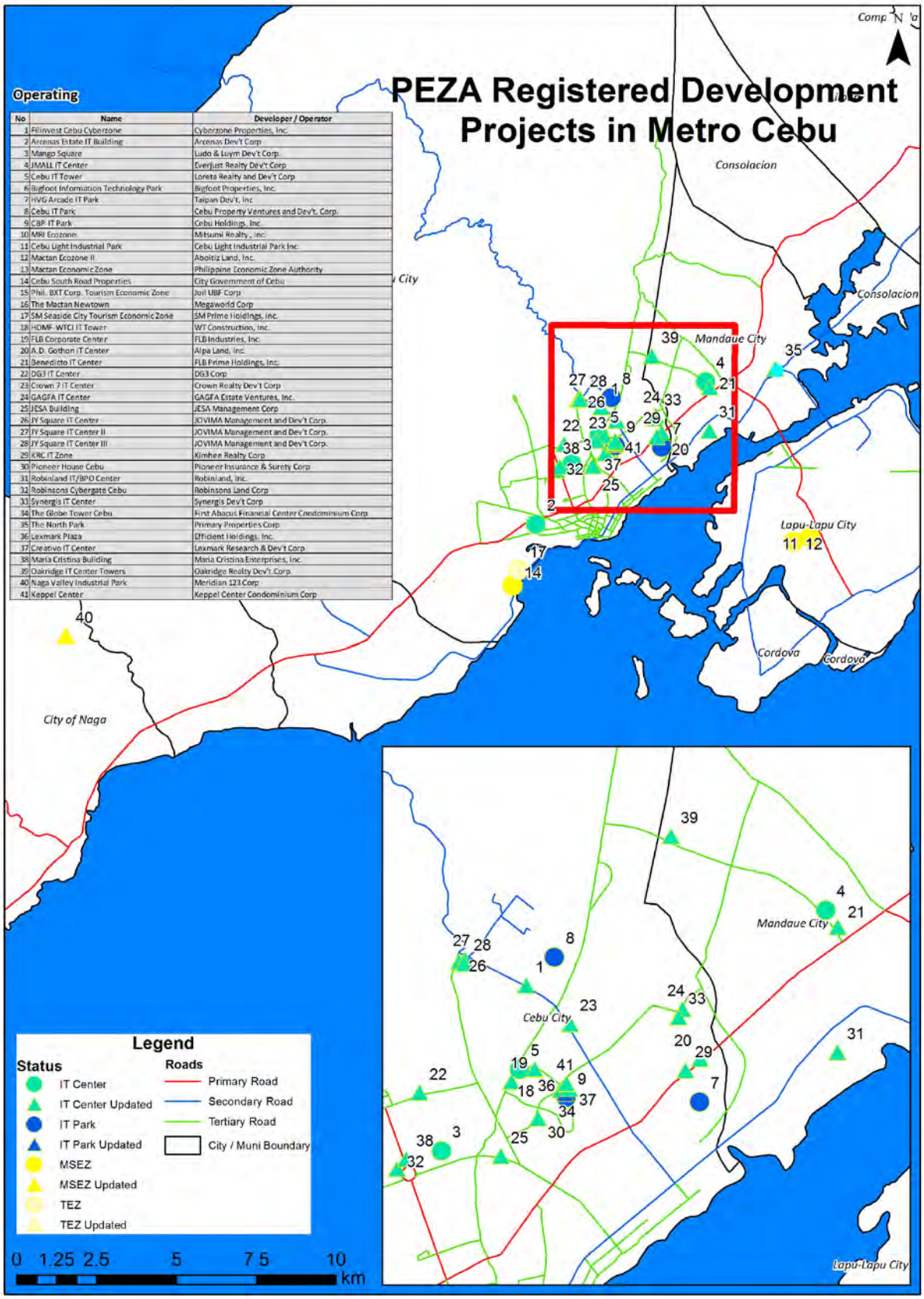


No	Name	Developer / Operator
1	HPS Building	HPS Software & Communication Corp.
2	SM City Consolacion IT Center	SM Prime Holdings, Inc.
3	MacroAsia Cebu Special Ecozone	MacroAsia Properties Dev't Corp
4	Keppel Cebu Special Ecozone Zone	Keppel Cebu Shipyard Land, Inc.
5	Naga Special Economic Zone	Provincial Government of Cebu
6	Nozomi Economic Zone	Nozomi (Fortune) Services, Inc.
7	Puerto Rosario de Cordova	Nozomi Resorts and Hotel, Inc.
8	Gatewalk Central IT Park	Cebu District Property Enterprises, Inc.
9	Cebu Exchange Tower	Cebu Lavaan Land Corp.
10	Adnama Building	Adnama Mining Resources, Inc.
11	FPN EPIC Center	Ng Khai Dev't Corp
12	JDN Square IT Center	Mandaue JDN Corp
13	Maayo Medical	Primary Properties Corp
14	South Road Property 2 IT Park	Ayala Land, Inc. and Cebu Holdings, Inc.
15	Federated IT Center	Federated Realty Corp
16	The Space	Golden View Properties & Dev't Corp.
17	Insular IT Park	A. Lim Dev't Inc.
18	Super Metro IT Center	Vicsal Dev't Corp
19	Oakridge Information Technology Center	Oakridge Realty Dev't Corp.
20	FirstCapitol IT Center	Firstcapitol, Inc.

No	Name	Developer / Operator
21	Norkis Cyberpark	Norkis Cyberpark, Inc.
22	New Cebu Township	MRC Allied Industries Inc.
23	Qimonda IT Center	Qimonda Holdings, Inc.
24	Robinsons Galleria Cebu	Robinsons Land Corp
25	GGVP IT Zone	Golden Great Value Properties, Inc.
26	Taft Information Technology Park	Taft Property Venture Dev't Corp.
27	Avenir	Juanito King & Sons, Inc.
28	eNGY Tech Building	Ng Khai Dev't Corp
29	Grand Cenia Hotel and Residences	Filinvest Land Inc.
30	GT Times Square Cebu	Gyeongju Dev't Corp
31	Hi Point Information Technology Tower 1	High Point Information Technology Park, Inc.
32	Hi Point Information Technology Tower 2	High Point Information Technology Park, Inc.
33	Hi Point Information Technology Tower 3	High Point Information Technology Park, Inc.

(Updated: Planned after the Roadmap Study)
Source: PEZA

Figure 2.3.6 Registered PEZA in Metro Cebu (Development in Progress and Proclaimed)



No	Name	Developer / Operator
1	Filinvest Cebu Cyberzone	Cyberzone Properties, Inc.
2	Arcenas Estate IT Building	Arcenas Dev't Corp
3	Mango Square	Ludo & Luym Dev't Corp.
4	JMALL IT Center	Everjust Realty Dev't Corp
5	Cebu IT Tower	Loreta Realty and Dev't Corp
6	Bigfoot Information Technology Park	Bigfoot Properties, Inc.
7	HVG Arcade IT Park	Taipan Dev't, Inc
8	Cebu IT Park	Cebu Property Ventures and Dev't. Corp.
9	CBP IT Park	Cebu Holdings, Inc.
10	MRI Ecozone	Mitsumi Realty., Inc.
11	Cebu Light Industrial Park	Cebu Light Industrial Park Inc.
12	Mactan Ecozone II	Aboitiz Land, Inc.
13	Mactan Economic Zone	Philippine Economic Zone Authority
14	Cebu South Road Properties	City Government of Cebu
15	Phil. BXT Corp. Tourism Economic Zone	Joil UBF Corp
16	The Mactan Newtown	Megaworld Corp
17	SM Seaside City Tourism Economic Zone	SM Prime Holdings, Inc.
18	HDMF-WTCI IT Tower	WT Construction, Inc.
19	FLB Corporate Center	FLB Industries, Inc.
20	A.D. Gothon IT Center	Alpa Land, Inc.
21	Benedicto IT Center	FLB Prime Holdings, Inc.
22	DG3 IT Center	DG3 Corp
23	Crown 7 IT Center	Crown Realty Dev't Corp
24	GAGFA IT Center	GAGFA Estate Ventures, Inc.
25	JESA Building	JESA Management Corp
26	JY Square IT Center	JOVIMA Management and Dev't Corp.
27	JY Square IT Center II	JOVIMA Management and Dev't Corp.
28	JY Square IT Center III	JOVIMA Management and Dev't Corp.
29	KRC IT Zone	Kimhee Realty Corp
30	Pioneer House Cebu	Pioneer Insurance & Surety Corp
31	Robinland IT/BPO Center	Robinland, Inc.
32	Robinsons Cybergate Cebu	Robinsons Land Corp
33	Synergis IT Center	Synergis Dev't Corp
34	The Globe Tower Cebu	First Abacus Financial Center Condominium Corp
35	The North Park	Primary Properties Corp
36	Lexmark Plaza	Efficient Holdings, Inc.
37	Creativo IT Center	Lexmark Research & Dev't Corp
38	Maria Cristina Building	Maria Cristina Enterprises, Inc.
39	Oakridge IT Center Towers	Oakridge Realty Dev't. Corp.
40	Naga Valley Industrial Park	Meridian 123 Corp
41	Keppel Center	Keppel Center Condominium Corp

(Updated: Planned after the Roadmap Study)
Source: PEZA

Figure 2.3.7 Registered PEZA in Metro Cebu (Operating)

2) Potential and Issues of Urban Development in Metro Cebu

As previously mentioned, control of urban growth area has become one of the major issues in Metro Cebu. While some LGUs have put efforts into tourism promotion through establishment of tourism councils, rapid urbanization can be conflicting with cultural and environmental conservation. Although each LGU has different development situations, coordination among them is important to enhance the linkage of environmental and cultural resources as well as to conduct strategic marketing. For such enhancement, endowment of legal authority for Metro Cebu is highly expected through the finalization of the draft of Traffic Crisis Act.

In order to avoid mistakes most developed countries experienced with their uncontrolled urban sprawl, clarification of urban structure based on existing and future transport network as well as urban center becomes essential. Through the identification of the desirable future urban structure in Metro Cebu, urban development should be strategically induced in the development corridor along the existing and future urban mass transport. In-advance land acquisition and development along the transport corridor should be implemented with the initiative of LGUs in collaboration with provincial, regional, and national government. They allow LGUs to enjoy the value capture through an integrated transport and urban development by offering safe, comfortable, and convenient accessibility and mobility for both local residents and visitors.

Metro Cebu is the business center of Cebu Province as well as Central Visayas Region and an internationally known tourist destination. Being a well-established metropolitan has attracted attention in terms of sustainable development. Mandaue City was selected as one of the low carbon cities in the Asia-Pacific Economic Cooperation (APEC) study conducted in 2016. In 2017, Organization for Economic Cooperation and Development (OECD) published a study of “Green Growth in Cebu, Philippines” to identify the issues and opportunities for sustainable development in Metro Cebu.

In addition to the consideration for the environmental aspects, socio-economic aspects should also be considered in the long run. For example, while IT parks and business process outsourcing (BPO) or knowledge process outsourcing (KPO) businesses are booming now, their future should be carefully considered as these fields can be mostly taken over by new technology after several decades. Consideration for the future urban lifestyle including its mobility is inevitable for the planning of sustainable Metro Cebu.

3 EXISTING CONDITIONS OF URBAN TRANSPORT IN METRO CEBU

3.1 Overview

The traffic situation in Metro Cebu in recent years has steadily deteriorated. Traffic congestion occurs on many roads and intersections not only during peak hours, but also off-peak hours. The main causes considered were:

(1) Increase of traffic demand due to population growth, economic development, and motorization;

(2) Insufficient road network and public transport services; and

(3) Inadequate traffic management.

In the Roadmap Study,[1] the estimated future population of Metro Cebu would increase to 3.8 million in 2030 and 5 million in 2050. As such, the level of service of the road network and public transport will only worsen if no interventions are to be introduced.

Per the records of the Land Transportation Office (LTO) Regional Office VII, the number of new registered vehicles in Region VII is 180,000 in 2017 (excluding motorcycles) with 13% of the volume recorded under new registration. As of 2014, LTO has differentiated new registrations from the regular yearly renewals of vehicle permits. New registrants' permits are valid for 3 years and, after said duration, the vehicles will then have to be registered on a yearly basis. Thus, a separate record for "renewal registration" is made. Registration records are further classified into “private,” “government,” and “for-hire.” Records show there is a consistent yearly increase of new vehicles coming into the stream of private vehicles from 125,000 in 2014 to 180,000 in 2017, compounding the growth in volume of vehicles already on the road.

Table 3.1.1 Number of Registered Private Motor Vehicles in Region VII 2014–2017

	Vehicle Type	2014		2015		2016		2017	
		Private	Govt.	Private	Govt.	Private	Govt.	Private	Govt.
NEW REGISTRATION									
	Cars	7,431	14	9,952	2	11,577	1	12,760	2
	UV	8,260	126	13,666	202	14,232	200	15,626	221
	SUV	3,537	6	4,351	18	6,045	14	6,663	16
	Trucks	1,496	3	2,322	16	2,445	39	2,695	43
	Buses	3	1	7	-	26	-	29	-
	MC w/o SC	103,207	90	122,641	408	127,555	313	140,579	345
	MC w/ SC	744	3	980	3	935	13	1,031	15
	TC	-	-	-	-	-	-	-	-
	TRL	425	-	355	-	192	-	212	-
	TOTAL	125,103	243	154,274	649	163,007	580	179,595	642
RENEWAL									
	Cars	40,399	76	39,819	66	39,200	58	43,203	
	UV	129,603	3,202	120,654	2965	114,643	2827	126,349	

[1] The Roadmap Study for Sustainable Urban Development in Metro Cebu, a JICA-funded project, 2014

	Vehicle Type	2014		2015		2016		2017	
		Private	Govt.	Private	Govt.	Private	Govt.	Private	Govt.
	SUV	20,414	160	21,279	123	22,634	135	24,945	
	Trucks	27,194	1,101	24,705	882	22,092	891	24,348	
	Buses	223	35	216	23	183	22	202	
	MC w/o SC	273,917	1,261	291,441	1259	306,379	1262	337,661	
	MC w/ SC	10,064	23	5,405	26	7,261	27	8,003	
	TC	-	-	-	-	-	-	-	
	TRL	2,356	5	2,431	3	2,464	3	2,716	
	TOTAL	504,170	5,863	505,950	5,347	514,856	5,225	567,427	

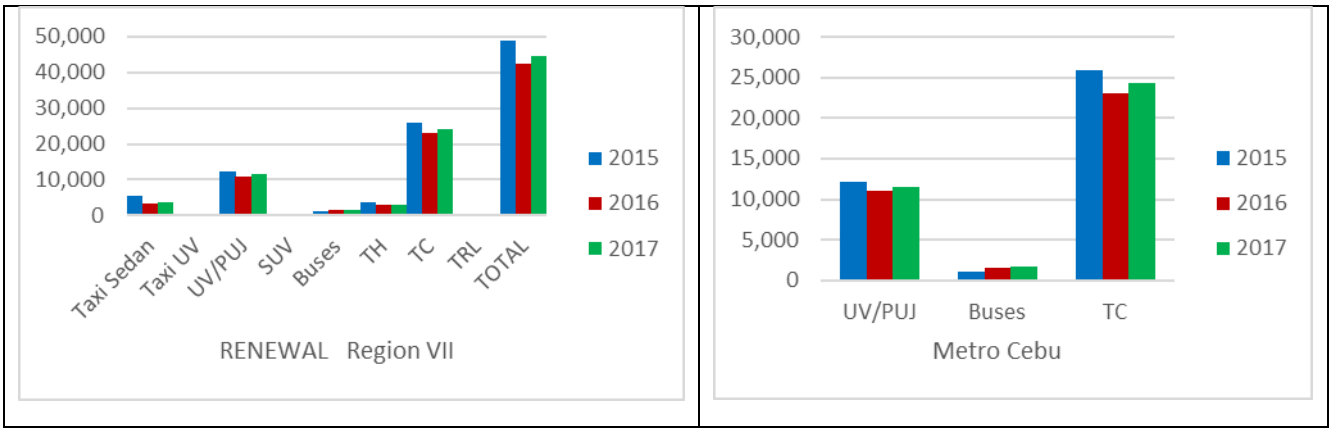
Source: LTO Regional Office VII data
Notes: UV is utility vehicle, SUV sports utility vehicle, MC w/o SC is motorcycle without side car, MC w/ SC is motorcycle with side car, TC tricycle, and TRL is trailer

In contrast, there is hardly any new registrants for public or for-hire since 2014 and there is a slight drop in their renewal number in 2017. For the region, there is 44,500 for-hire vehicles with 11,500 registered as jeepneys and 1,600 buses. Metro Cebu already accounts for 50% of both types of vehicles.

Table 3.1.2 Number of Registered "For Hire" Vehicles in Region VII

Vehicle Type		For Hire			
		2014	2015	2016	2017
NEW REGISTRATION					
	Taxi Sedan	334	-	-	-
	TC	81	-	-	-
	TOTAL	415	-	-	-
	(No records for other types)				
RENEWAL					
	Taxi Sedan	4,034	5,650	3,455	3,635
	Taxi UV	644	241	182	192
	UV PUJ	13,101	12,209	10,967	11,538
	SUV	4	3	3	3
	Buses	957	998	1,536	1,616
	TH	2,985	3,534	2,982	3,138
	TC	23,131	25,953	23,078	24,279
	TRL	242	196	153	161
	TOTAL	45,098	48,784	42,356	44,562

Source: LTO Regional Office VII
Notes: UV is utility vehicle, PUJ is public utility jeepney, SUV sports utility vehicle, TH is truck, TC tricycle, and TRL is trailer



Source: LTO Regional Office VII data
Notes: UV is utility vehicles, PUJ is public utility vehicles, SUV is sports utility vehicle, TH is trucks, TC is tricycles, and TRL is trailers.

Figure 3.1.1 Registered "For Hire" Vehicles in Region VII and Metro Cebu 2015-2017

Existing situations of urban transport subsectors such as highways, public transport, traffic management, and the like are described and analyzed in the following sections.

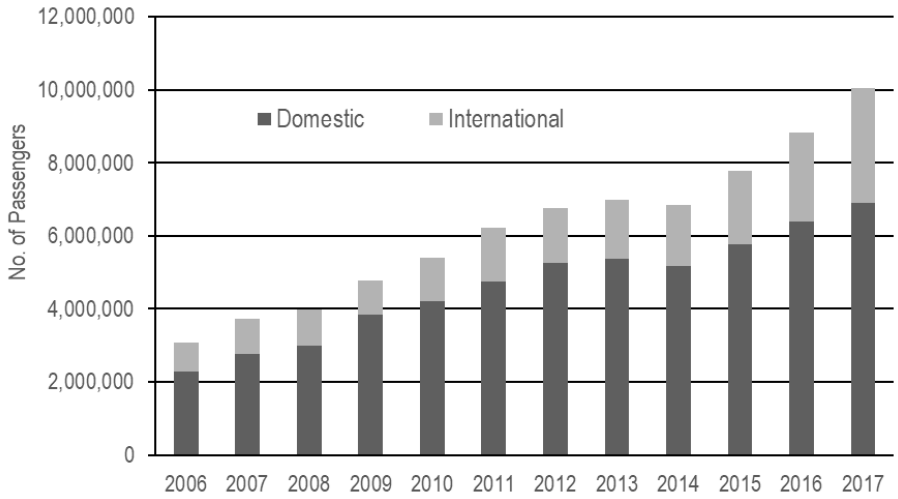
3.2 Air and Sea Gateway

1) Airport

The Mactan-Cebu International Airport (MCIA) located in Lapu-Lapu City is recognized as the southern air transport hub of the Philippines under the administration of the Mactan-Cebu International Airport Authority (MCIAA).[2] It started operating in mid-1960's and underwent several improvements since then. Among others, the runway was extended up to 3,300 m and the passenger terminal building was constructed with a floor area of 33,300 m2.

The airport witnessed significant growth in traffic and handled more than 6.9 million domestic passengers and more than 3.1 million international passengers in 2017. Average growth rates in the last decade are 10.8% for domestic flight passengers and 12.1% for international flight passengers. As of November 2017, the airport has 21 partner airline carriers with 18 international and 30 domestic destinations directly connecting with MCIA. The busiest international route is between Cebu and Inchon followed by Hong Kong and Singapore.

[2] The Mactan-Cebu International Airport Authority (MCIAA), created through Republic Act 6958, is a government-owned and controlled corporation and is an attached agency of DOTr that started to operate on 18 December 1990.



Source: Mactan-Cebu International Airport Authority (MCIAA)

Figure 3.2.1 Growth in Passenger Traffic at MCIA 2006–2017

Recent projects for the airport include the transfer of operations and maintenance of the airport to a private consortium (October 2014); rehabilitation, renovation, and expansion of Terminal 1; and construction of a second terminal (completed in July 2018), which are all awarded to GMR Cebu Airport Corporation (GMRCAC)[3] under a Built-Operate-Transfer (BOT) basis for 25 years. Plans for the construction of a second runway has been discussed, but stands as an unsolicited proposal and has not been made official.

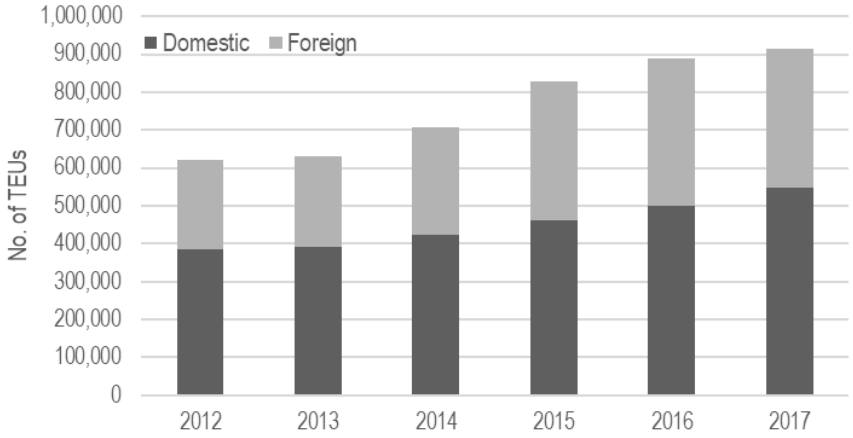
2) Seaport

Cebu is a historical port city where the port supports its local economy. It is the Philippines' main domestic shipping port and home to about 80% of the country's domestic shipping companies.

The Cebu Port Authority (CPA)[4] manages both Cebu International Port and Cebu Domestic Port. The former is a 14-hectare facility with berthing space of 512 meters and controlling draft of 8.5 meters at Mean Lower Low Water (MLLW) while the latter is a 10-hectare facility with berthing space of 3,838 meters and controlling draft of 6.5 meter at MLLW. Due to its shallow depths, the average overseas ship size is severely restricted to 11,929 (GRT). Despite such capacity constraint, container traffic has steadily increased by 5.3% since 2012. Along with the increase in logistics, traffic demand on the land side is also increasing.

[3] Consortium composed of Philippine-based Megawide Construction Corporation and Bangalore-based GMR Infrastructure that is collectively known as GMRCAC.

[4] The Cebu Port Authority was created through Republic Act 7621 in 1992 to specifically administer all ports located in Cebu Province and separate these ports from the Philippine Ports Authority system. CPA took over all Cebu ports in 1996.



Source: Cebu Port Authority

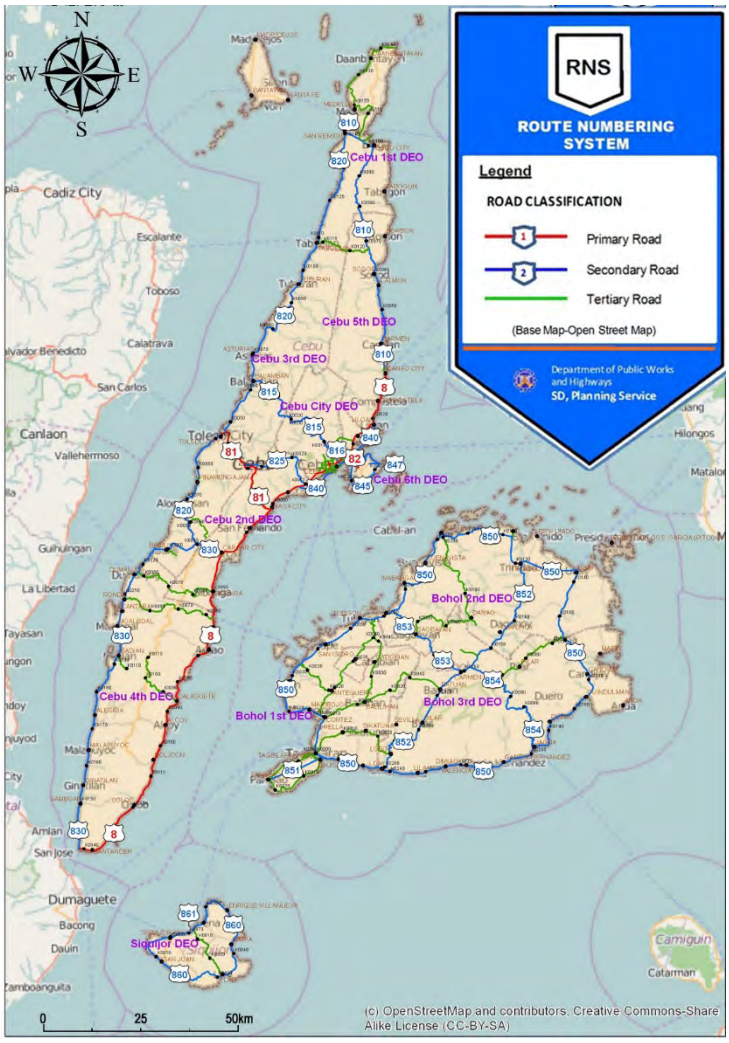
Figure 3.2.2 Growth of Container Traffic at Cebu Port

In order to meet the increasing international container movement and to decongest the existing Cebu International Port, the development of a New Cebu International Container Port (NCICP) was approved by the national government to be located at Barangay Tayud in the Municipality of Consolacion. The new port is proposed to be on a 25-hectare reclaimed island designed to handle 500,000 twenty-foot equivalent units (TEU). Construction is expected to start by mid-2018 and completed by 2021. For this project, an F/S was conducted with support of the Export-Import Bank of Korea and the implementation of the project is to be financed through a South Korean ODA.

3.3 Urban Roads and Bridges

1) Existing Road Network in Metro Cebu

The main island of Cebu Province stretches 225 km from north to south and is surrounded by 167 neighboring smaller islands that includes Mactan Island. The terrain of Metro Cebu is dominated by rugged mountain ranges that constraint urban expansion. The national road network in Cebu Province is shown on the Region VII map in Figure 3.3.1



Source: DPWH

Figure 3.3.1 National Road Network in Cebu Province (Region VII)

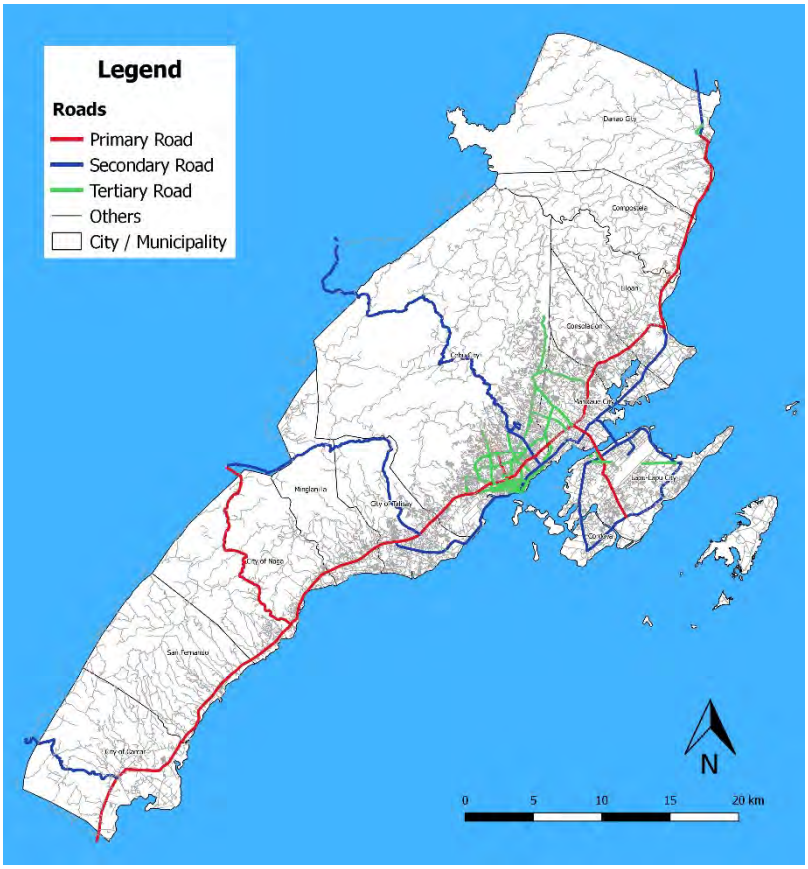
The urban core of Cebu Province is Metro Cebu, which is located along the central eastern portion of the province and includes the nearby Mactan Island. Cebu, Mandaue, and Lapu-Lapu Cities are highly urbanized central areas of Metro Cebu.

On the mainland side, urban development expanded from Cebu and Mandaue Cities towards LGUs along the coastal road up to Danao City in the north and Carcar City in the south. Lateral development also occurred from the main road significantly in Cebu and Mandaue Cities. With the construction of the Cebu–Mactan Bridge, the City of Lapu-Lapu, Cordova, and Cebu International Airport have become integrated with the mainland of the province. Westside of the core area is mostly mountainous; basically for forestry and agriculture land use.

The existing national road network in Metro Cebu is shown in Figure 3.3.2. The total length of the road network including the local roads (i.e. city, municipal, and barangay roads) is 1,398.2 km (see Table 3.3.1). The national roads account for 30% of the total network based on the 2014 new road classification system[5] of DPWH.

[5] The new road classification system is as follows: (a) National Primary Roads connects cities of >100,000 population; (b) National Secondary Roads are other roads which complement with the national arterial roads to provide access to main population areas, ports,

Most roads are generally narrow with two lanes. Even for some sections of the highway. Only a few of the roads are four lanes in the urban core areas. Moreover, the capacities of these roads are decreased by roadside and on-road activities such as jeepneys or taxis waiting for or loading/unloading passengers. 46% of roads are not paved, which are mostly barangay roads.



Source: JICA Project Team

Figure 3.3.2 Existing Metro Cebu Road Network

Table 3.3.1 Road Lengths in Metro Cebu by Road Classification

Road Classification	Length (km)
National Primary Road	121.0
National Secondary Road	191.0
National Tertiary Road	105.6
Provincial Road	112.5
City Road	171.1
Municipal Road	66.4
Barangay Road	630.6
Total	1,398.2

Source: JICA Study Team

2) On-going Road and Bridge Project in Metro Cebu

airports, tourist service centers, major national government infrastructure and production centers of the country; and (c) National Tertiary Roads are other roads under DPWH which perform a local function (as represented by only letters on maps).

Several studies were conducted for the improvement on transport sector in Metro Cebu including the Roadmap Study (details of the past studies are described in Chapter 7). Some projects proposed in the past studies are currently underway mostly by DPWH.

(1) Scenic Coastal Road

Scenic coastal road was proposed by the Roadmap Study. DPWH conducted F/S for this road namely Mandaue City – Consolacion – Liloan Bypass Road. Since a part of this bypass road will be linked to a new bridge (Mandaue-Lapu Lapu Link Bridge a.k.a. 4th Mactan Bridge) proposed by this master plan, the JICA Project Team identified the section to be served as an access road of 4th Mactan Bridge and named it "Mandaue Coastal Road". As Mandaue Coastal Road will be a part of Mandaue City – Consolacion – Liloan Bypass Road, the JICA Project Team consulted with DPWH to keep the consistency between these roads. 4th Mactan Bridge and Mandaue Coastal Road are planned to be completed in 2023 (details are described in Chapter 8 and Chapter 9).

Following are the relevant infrastructure projects to 4th Mactan Bridge and Mandaue Coastal Road which are also currently underway.

(i) Cebu International Container Port Project

The Cebu International Container Port will be located on a 25-hectar reclaimed island in Consolacion. This project was already identified during the Roadmap Study. South Korea had pledged in November 2017 to support finance the project. While this project is expected to be completed in 2022, it has not started yet as of September 2018. DOTr is an implementing agency and CPA is an attached office. After the project completion, the port will be turned over to CPA. The access road (national road) which connects to Mandaue City including the second Cansaga Bridge will be constructed by DPWH. CPA will manage the implementation of an access road between the port and the national road.

(ii) Mandaue Reclamation Project

The project site will be about 150 to 200 hectares located adjacent to Mandaue Coastal Road. After the suspension period due to legal dispute, the project started again and permit acquisition is currently underway.

(2) Metro Cebu Circumferential Road

While DPWH conducted F/S for this road namely Metro Cebu Expressway, alignment of Metro Cebu Circumferential Road proposed by the Roadmap Study and this master plan is different from the one proposed by DPWH (details are described in Chapter 8). In July 2018, construction of south segment (segment 3) was started.

(3) Cebu-Cordova Link Expressway (CCLEX)

The CCLEX project was approved by the Cebu Provincial Board in 2016. A joint venture agreement was signed by Metro Pacific Tollways Development Corporation (MPTDC) and the LGUs of Cebu City and Municipality of Cordova in April 2016.

The CCLEX Corporation was established by MPTDC to design, finance, construct, operate, and manage the CCLEX link through a BOT Scheme. However, it is not based on the BOT Law in the Philippines, but rather on a joint venture agreement between the firm and LGUs. The concession period is 35 years with an option to extend to 50 years.

There will be no ROW acquisition on the side of Cebu City while that on the Cordova side will be provided by the Municipality of Cordova. The official ground-breaking ceremony of the toll bridge was held in March 2017, while completion is scheduled in 2022.

(4) Improvement on Bottleneck Intersections

20 bottleneck locations were identified by the Roadmap Study and DPWH conducted F/S for several intersection improvements. While N. Bacalso (Mambaling) underpass project started their construction and will be completed in March 2019, construction of other major projects such as UN Avenue tri-level underpass project has not yet started.

Since the bottleneck can also be improved by traffic management measures described in Chapter 3.5 and Chapter 8, it is expected that these measures will be integrated with the intersection improvement projects.

3.4 Public Transport System

1) Background

In the last 50 years, the backbone of public transportation in Metro Cebu and Cebu Province has always been the jeepneys,[6] buses, taxis, and tricycles. The dominant mode of transport is jeepney that is technically registered as public utility vehicles (PUV). There is also the "trisikads" from areas where there is demand for public transportation, but s no PUVs. Another service that later emerged is the motorcycle-for-hire or “habal-habal.” Like the "trisikads," the service is illegal but thrive to cater to the mobility requirements of people outside the formal public transport service areas.

With the implementation of Republic Act No. 7160 (otherwise known as the Local Government Code of 1991), the control and regulation of tricycles was devolved to the LGUs. Cebu City is one of the few cities that have a local ordinance to control and regulate the operation of tricycles on barangay roads only. The operation of tricycles in other cities and municipalities of Metro Cebu, on the other hand, are tolerated on all roads within the city or municipality itself.

[6] World War 2 army jeeps converted and retrofitted as colorful public transport modes to carry more passengers than originally designed. The multi-cabs, an Asian utility vehicle, later emerged and were likewise converted and retrofitted to serve as jeepneys as well.



Source: Upper left from by Cebu Daily News, 11 October 2012; upper right from Moalboal Beach Resorts website; lower left from Biliran website; and lower right from Motorcycle Philippines website.

Figure 3.4.1 Photos of Public Transport in Metro Cebu

Urban rail transit does not exist in Metro Cebu although this was already considered back in the 1990s. A Bus Rapid Transit (BRT) system is currently being implemented for Cebu City, but suffered some delays.

2) Road-based Public Transport System

(5) PUVs

As of 2016, the records of LTFRB showed PUV with 600 routes and 12,778 authorized units. In comparison, the public transport survey conducted by Department of Transportation and Communications (now Department of Transportation) in 2011 showed only 130 PUV routes served by 9,252 units. The number of routes is probably lower since several of them are duplicates with variations in route names or have been abandoned or closed. Quite a few of the routes show the same descriptions, but carry different numbering. A closer examination would also show that many routes overlap each other in terms of catchments areas. Nevertheless, the jump from 130 to 602 routes (or 363% in 5 years) is quite high.

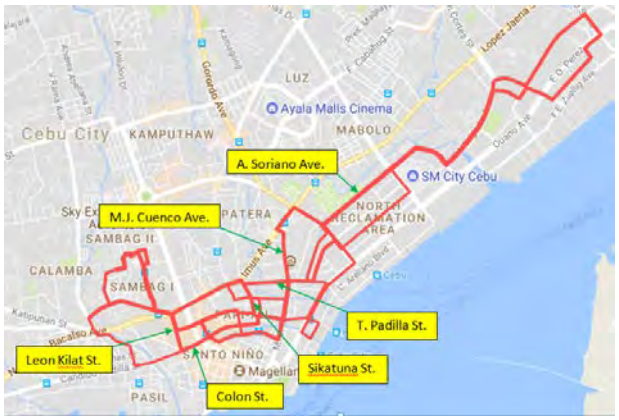
The increase cannot be explained as a product of route re-structuring since none was undertaken in the last decade. Also, it is significant to note that there was a moratorium in the issuance of franchises since 2003, so the actual number of units in operation should have been stagnant. However, there is a loop hole in the moratorium policy, which allowed new PUVs on new routes. This could explain the disproportionate increase in the number of routes (+363%) compared to the increase in units (+38%).

Most routes are Cebu City-centric; they either originate from or end at the city. In a way, this reflects the centrality of the city. Of the 602 routes, 165 (27% of total) are within Cebu City with operational 1,516 units of the total PUV fleet. If you count other PUVs with Cebu City as an origin or destination, the figure would exceed by 50%.

Another aspect of the route design is that the outbound journey often deviates from the original roads taken inbound, although the end-points are the same. There is also the assignment of same number to different routes and addition of letters A, B, or C after the

number. All PUV heads to the south end or terminate at the boundary of Cebu City or in Talisay because of a local ordinance. Many parts are unserved by PUV or are very far from a public transport route.

Within Cebu City itself, the overlapping routes to note of are as follows: six routes from Sambag I and II (routes 01-A, 01-B, 01-C, 01-G, 01-H, 01-K) pass thoroughfares going to the CBD like Leon Kilat St. and Colon St., and locations near the reclamation area like Sikatuna St., T. Padilla St., M.J. Cuenco Ave., and A. Soriano Avenue (see Figure 3.4.2).



Source: JICA Project Team

Figure 3.4.2 Route Map of the PUV Routes Coming from Sambag I and II, Cebu City

The three jeepney routes from Mabolo (03-A, 03-G and 03-L) overlap starting from M.J. Cuenco Ave. all the way to the Carbon Market Area and in returning to their corresponding starting points. Route 03-B overlaps the previously mentioned routes when it reaches the Carbon Market Area and returns from Mabolo area.

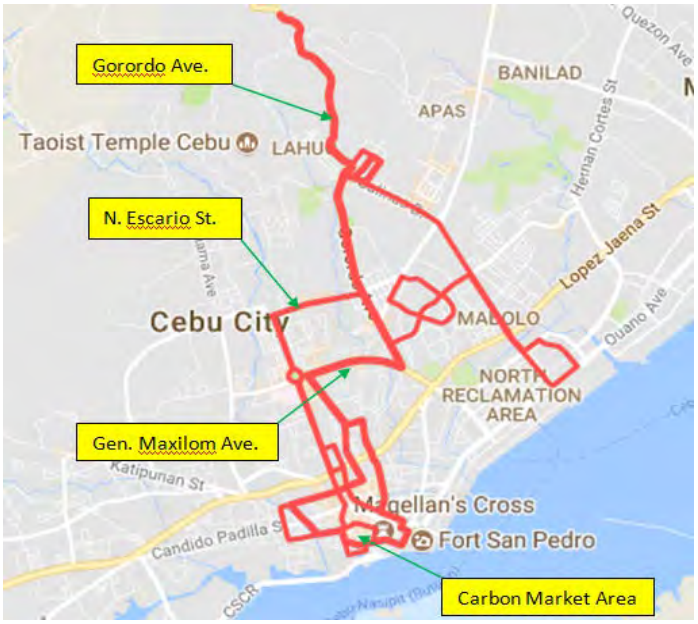


Source: JICA Project Team

Figure 3.4.3 Route Map of the PUV Routes Coming from Mabolo, Cebu City

Gorordo Ave. is the main thoroughfare used by Lahug PUJ routes. Three routes pass either N. Escario St. and Osmeña Blvd. in going to the CBD and returning to Lahug. Furthermore,

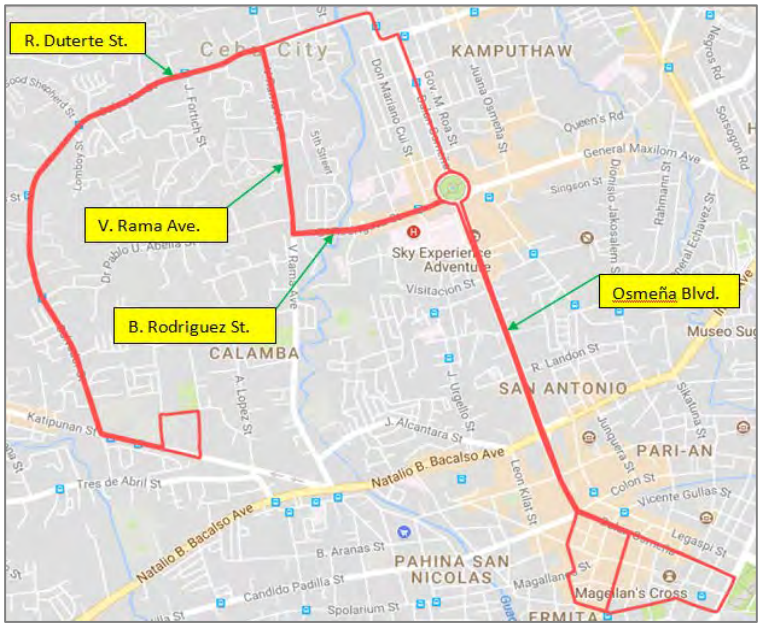
two routes use Gen. Maxilom Ave., F. Ramos St., and Magallanes St. as their main access to the city, and D. Jakosalem St. as one way to return to their respective starting points.



Source: JICA Project Team

Figure 3.4.4 Route Map of the PUV Routes Coming from Lahug, Cebu City

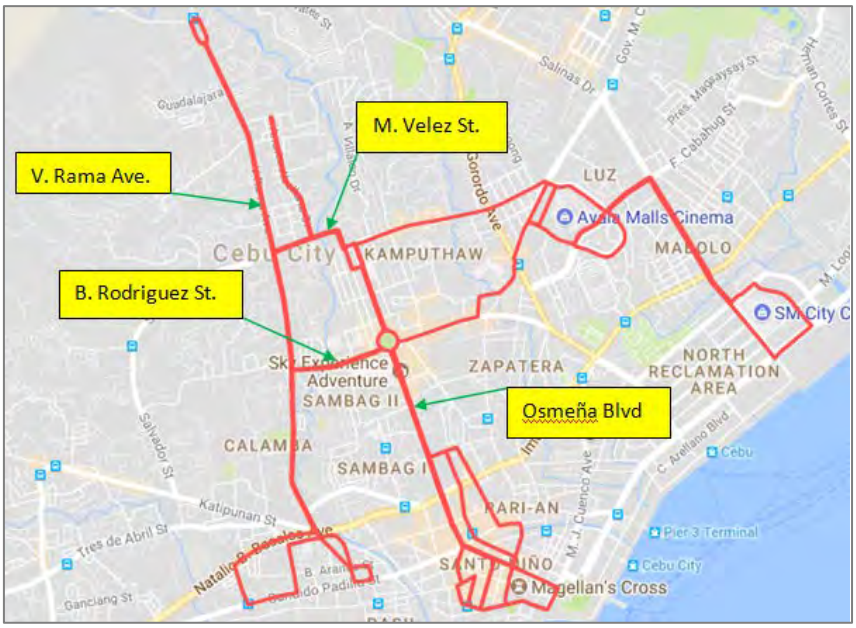
The PUV routes from Guadalupe (06-A, 06-B, 04-C, 04-F, 06-G, and 06-H) overlap on V. Rama Ave., Osmeña Blvd., M. Velez St., and B. Rodriguez St. (see Figure 3.4.5).



Source: JICA Project Team

Figure 3.4.5 Route Map of the PUV Routes Coming from Guadalupe, Cebu City

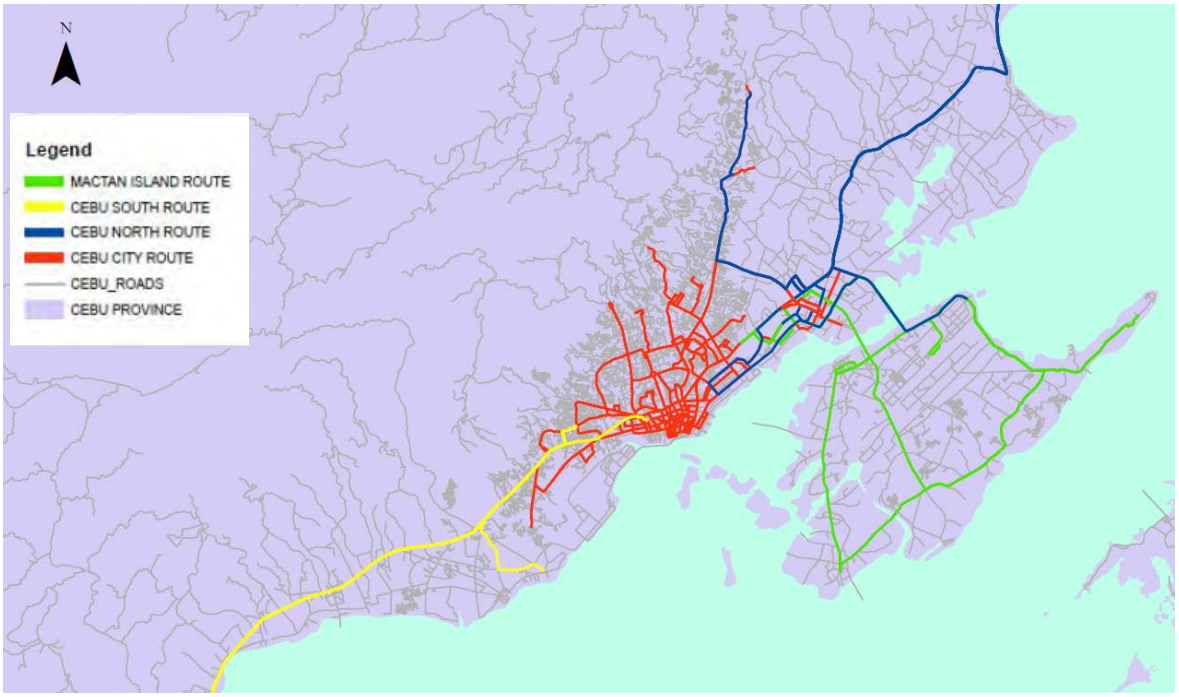
The routes from Banawa (07-B, 07-D and 07-E) overlap at R. Duterte St., V. Rama St., M. Velez St., B. Rodriguez St., and Osmeña Blvd.



Source: JICA Project Team

Figure 3.4.6 Route Map of the PUV Routes Coming from Banawa, Cebu City

695 PUVs are operating on 38 routes in Mactan Island with more than 450,000 people. That is a ratio of 1 PUV for every 647 persons or nearly 20 PUVs per square km. In comparison, the ratio for Cebu City is approximately 10 PUV per square km. A higher number (~853 PUVs) operate between Mandaue and Mactan reflecting stronger economic integration with LGUs outside the island.



Source: JICA Project Team

Figure 3.4.7 Configuration and Extent of Current PUV Routes

(6) Buses

Buses play a minor role with only 16 routes and 135 authorized units. Most buses are southbound (i.e. serve towns as far as Carcar City). Only a few operate to the north; the number of buses is similar to cross-town bus service. However, these routes are still classified as provincial in the sense that they connect LGUs to Cebu City.

(7) Corridors of High Demand

From a Metro Cebu viewpoint, the number of PUVs to the south are nearly the same as those to the north. However, the aggregate population of the 5 southern towns (City of Carcar, Minglanilla, City of Naga, San Fernando, and City of Talisay) is 1.6x more than the 4 northern LGUs of Danao City and Municipalities of Liloan, Consolacion, and Compostela.

Table 3.4.1 PUV Routes with the Highest Number of Units

Rank	Route Name	Route #	No. of Vehicles
1	Mandaue (Ibabao)–Jones, Ayala	21B	487
2	Talamban–Carbon via Ayala	13C	403
3	Urgello–North Bus Term via SM	01K	247
4	Inayawan–Colon	11A	216
5	Guadalupe–Carbon	06B	200

Source: LTFRB 2016

The road sections with the highest number of PUVs are those with multiple public transport routes converging on the same segment. In the 2013 study, the most congested road in regard to PUJ operation was MJ Cuenco Avenue—56 vehicles per minute on the right side and 39 vehicles on the left. If all of them get deployed during peak hours (which is expected since operators are independent of each other), the difference between left and right side on the same street suggests that not all routes loop back the same way on the return journey. The lowest ranking is Osmeña Blvd. with a recorded 32 PUVs per minute, which is still an extremely high level of service.

Table 3.4.2 Streets with Highest Number of PUVs

Rank	Name of Street	No. of Routes	No. of Vehicles	Frequency (vehicle/min)
1	M.J. Cuenco Avenue “R”	42	3,386	56
2	M.C Briones Street “R”	40	2,702	45
3	M.J. Cuenco Avenue “L””	29	2,321	39
4	Gen Maxilom Extension “L”	16	2,176	36
5	Osmeña Blvd “L”	24	1,911	32

Source: Derived data by Study Team from basic data contained in PT Strategic Plan Study 2011

Based on Department Order 2017-11 of DOTr Omnibus Guidelines on the Planning and Identification of Public Road Transportation Services and Franchise Issuance (OFG), those routes with more than 1,000 passengers per hour per direction should phase out PUVs and be replaced with buses or minibuses. That implies a threshold of 70 units. More than 45 routes already exceed this value and even more when one considers sectional flows where several routes converge and after route re-structuring (where overlapping routes get merged).

(8) Service Providers

In spite of the absence of recent studies in industry structure, it can be safely stated that public transport in Metro Cebu is served by thousands of independent PUV operators. Very few have more than one unit. It is a small enterprise structure due to low capital entry and as means of livelihood. Hence, the absence of brand or market for commuters to distinguish the "bad" from "good" operators. The "smallness" is also associated with the common practice of a "boundary system" where the driver pays a fixed amount per day to the owner of the unit once he takes out the vehicle on the assigned route. The commercial risk is therefore assumed by the driver. This leads to severe competition among PUV on the streets and force drivers to work beyond 10 hours a day to earn revenues much more than the boundary fee in order to earn something for themselves.

All units are based on original jeepneys from World War II and multi-cabs7 from vans and pick-ups. There is no original equipment manufacturer of these PUV even in other parts of the world. Jeepney capacity range from 15 to 22 passengers. A sampling of the units is shown on Figure 3.4.8.

Also, there is no recent financial data to establish their profitability. The current minimum fare of PHP 6.50 has remained the same in the last five years due to fuel price. Recent increase in global prices of petroleum as well as deterioration in the exchange rate (from PHP 45 to 51 per US dollar) have led to petitions for fare increase. LTFRB, however, has been strict on fare increases. The long term effect is for operators to reduce cost and lower service levels in order to maintain viability.



Source: langyaw.com

Figure 3.4.8 Colorful PUVs of Metro Cebu

Under this public transport situation, commuters that want a better level of service has opted to patronize "GTE" that is a form of shared taxi with point-to-point flexible route utilizing closed vans (often air-conditioned). LTO, which administers the registration of vehicles, has a Taxi-UV category that fits this new type of public transport. The number of GTE or van-for-hire seemed low at below 1,000 units as per LTO data. GTE grabs market share from buses rather than from jeepneys. The approved bus fare from Cebu City to Carcar City is PHP 60 compared to PHP 50.

Ceres, the biggest bus operator in Cebu Province, has a fleet of about 300 buses that operates inter-urban with almost half its fleet northbound to Bogo and the other half

[7] These vehicles emerged from backyard shops in the absence of mandatory government standards as to design and configuration. All copied the jeepney with rear entry, parallel seating and low ceiling.

southbound to Santander. Its fare system is discouraging to urban commuters. Ceres use Global Positioning System (GPS) that tracks the location of bus units throughout the province.

The only Metro Cebu bus service is MyBus that was introduced by SM sometime in 2015 to primarily encourage traffic to its mall in SRP and serve airport traffic that initially only allowed e-tickets yet later allowed cash payments for "traditional" commuters. It was granted a franchise by LTFRB as a high quality Public Transport System, which allows exemption from the moratorium. MyBus routes include Mandaue City to Mambaling, Talisay City to Mambaling, Talisay City to Mandaue City, and MCIA to Talisay City.



Source: Cebu Daily News (left), reenglish.jp (right)

Figure 3.4.9 GTE or Shared Taxi (left) and Buses on Cebu Roads (right)

(9) Terminals

Cebu City is one of the earliest cities that set up provincial bus terminals at its the periphery. These are Cebu South Bus Terminal and the Cebu North Bus Terminal. There are other smaller so-called terminals in Metro Cebu that cater to PUVs operating within the metropolis. Most notable is the Ayala PUV Terminal. Lapu-Lapu City has its Pueblo Verde PUV Terminal at the Mactan Economic Zone II. Citilink Terminal, which used to cater mostly GTE, was closed.



Source: terecambal.blogspot.com

Figure 3.4.10 Provincial Bus Terminals

3) Water Transport

In the past, ferry services between Mactan and Cebu mainland thrived because of the absence of a bridge. When Osmeña Bridge (first Mactan Bridge) got built and later followed by the construction of Fernan Bridge (second Mactan Bridge), the channel ferry services dwindled. Now, there is only the Metro Ferry Shipping with terminals in Muelle Osmeña Wharf in Lapu-Lapu City and Pier 3 in Cebu City.

Metro Ferry Shipping uses seven ferry boats of different sizes that operate from 6:00 am to 10:00 pm, although latter hours are reportedly irregular. Travel time is claimed to be 20 minutes, but waiting time at the terminal takes longer. Small boats can transport 112 passengers while big vessels can accommodate 312 passengers. The regular fare is PHP 14.00 for a one-way trip, PHP 12.00 for students and senior citizens, and PHP 8.00 for children. The company is surviving without any government subsidy.

Several ferry routes connect to outside of Metro Cebu (e.g. to Bohol, Cagayan De Oro, Camotes, Iloilo, Leyte, Manila, Misamis Occidental, and Negros Oriental from Carcar, to Camotes, and Leyte from Danao). Also, on-demand service using a pump boat operates between Lapu-Lapu City and Olango Island. The service within Metro Cebu is still a niche service due to its limited transport capacity, limited access to the ferry terminal, and competitive fare compared to PUVs.

Had it been otherwise, more private service providers (such as Metro Ferry Shipping) would have emerged. The national agency MARINA is the equivalent of LTFRB, but for ferry service. It welcomes applications for ferry service because of its rarity. The absence of a docking area is not an obstacle since several privately-owned wharfs could be tapped. The worsening traffic congestions on the two bridges is an automatic incentive to potential ferry operators between Mactan and some points within the mainland of Cebu.

Indeed, there are LGUs who think about urban water transportation systems. Since some LGUs have their ports in their localities, Cebuanos have already began to discuss using water transport as an option to consider when it comes to urban mobility. Urban connectivity can be sustained if there are alternative land public transport modes being used by the riding public at present. The use of water transport to travel from the southern to the northern part of Metro Cebu will make travel time faster for the Cebuanos.

The Municipality of Minglanilla, City of Naga, and Municipality of San Fernando plan to develop their respective ports not only for goods but also for passenger transport. On the northern part of Metro Cebu is the construction of an international port at the Municipality of Consolacion. A port for passengers might also be a possibility. On the other hand, the sub-port in Mandaue City and City of Danao may cater to the demand of additional volume of passenger vessels coming from the southern part of Metro Cebu. The interchange between land and water public transportations is going to be beneficial for these LGUs—for the workers' mobility requirements and the locals' and visitors' daily living and recreation.

Two new operators are about to launch their services, namely Water Bus and Island Express. Water Bus is a project of Maxboat Marine Corporation headed by CEO and founder Ms. Barbara Salmero. The company's office is in J. Alcantara St., Cebu City and their shipyard is in Danao City, Cebu.

According to Ms. Salmero, the transport service is set to serve all ports accessible to it around Cebu. Tentative routes of the water bus are Cebu City to Naga City, Dalaguete and Santander, and Cebu City to Danao City and Bogo City. the company is currently studying the use of pontoon docking systems to make the Water Bus more convenient and easily accessible to more people.

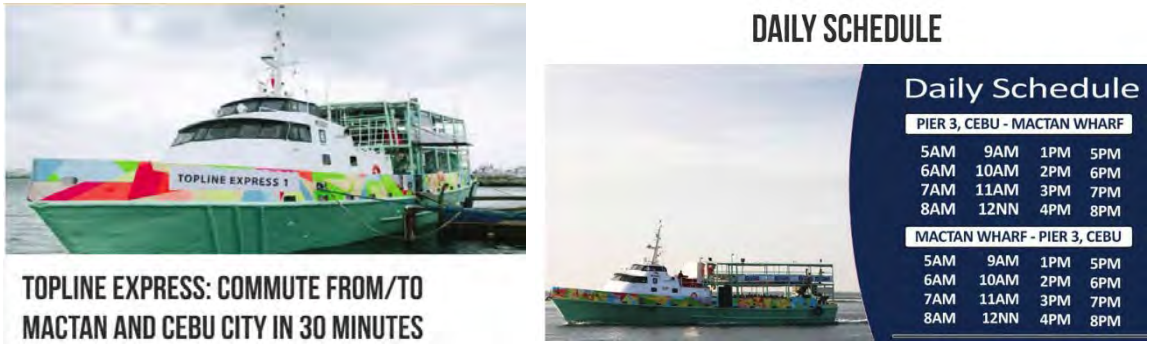
The Water Bus can accommodate 50–70 people per trip. Each trip may cost from Php100 to Php150 per person depending on travel distance; however, fares will be higher when the airconditioned water bus vessels start operation. As for the travel time of the water bus to the aforementioned routes, Ms. Salmero said that her company aims to reduce it to half the land travel time. The vehicles specifications and features are shown in Figure 4.3.2. At present, the construction of the docking piers for the Water Bus is still ongoing.



Source: Maxboat Marine Corp.(www.maxboatmarine.com)

Figure 3.4.11 Overview of Water Bus

On the other hand, Mayor Paz Radaza, the Lapulapu City Mayor, expressed her gratitude to the management of Topline Marina for successfully launching the maiden voyage of the Topline Express Ferry Service during the celebration of the Fiesta of the Patron Saint of Lapulapu City. Residents from the Mactan Island can now enjoy the 30-minutes travel from the Mactan Wharf to Pier 3 in Cebu City.



Source: Superbalita Cebu, 8 August 2018.

Figure 3.4.12 Vessel and Schedule of the Topline Express Ferry Service

Mr. Eugene Erik Lim, CEO and President of Topline Marina and owner of Island Express, said that two ferry boats will cater to thousands of passengers from Lapu-Lapu City to Cebu City and vice versa. Each ferry boat with a capacity of 325 passengers will operate hourly trips starting from 5 a.m. to 9 p.m. with a total of 16 trips per day per boat. Passengers will have to embark from Mactan Wharf at the back of Island Central Mactan (ICM) in Barangay Pusok, Lapu-Lapu City. The boat will transport passengers to Pier 3 in Cebu City. The estimated travel time is between 35 to 40 minutes per trip. Island Express will charge Php 25 per passenger per trip.

3.5 Traffic Management and Safety

1) Existing Traffic Situation

(1) Traffic Accident Landscape

The number of traffic accidents that occur in Cebu, Mandaue, and Lapu-Lapu Cities is quite high at 1,235 per month as shown in the table below. According to the Philippine Statistics Authority, the number of road accident fatalities in Central Visayas, which largely occurs in Metro Cebu, rose steadily from 486 in 2006 to 531 in 2013. In Cebu City alone, there is an average of 10,000 road accidents each year with at least 50 classified as fatal as reported by Cebu City Transportation Office. To reduce traffic accidents, both soft and hard (structural) measures are necessary.

Traffic accidents often occur on congested roads. Since traffic safety is always a major objective to manage traffic flow, it is therefore a vital consideration in the total traffic management system.

Table 3.5.1 Approximate Number of Traffic Accidents in Cebu, Mandaue, and Lapu-Lapu Cities

LGU	Number of Traffic Accidents (per month)
Cebu City	800 cases
Mandaue City	400 cases
Lapu-Lapu City	35 cases

Source: JICA Project Team

The Department of Transportation at each LGU is introducing database system regarding road traffic accident with the World Bank. It is an open-source, web-based system for data collection, analysis and reporting of traffic incident area across the country. It can extract accident data according to area, period, type of accident, etc. It helps the government to analyze accidents and make evidence-based decisions in road safety countermeasures including optimization of traffic enforcer assignment, identification of location where infrastructure and equipment is necessary, development of laws and policies, and so on. Currently, the system seems being prepared. Even after completion of the system, it still needs a lot of efforts to operate and maintain.

(2) Traffic Control at Intersections

At some major intersections in Metro Cebu, traffic enforcers intervene in managing the traffic flow during peak hours even if the intersection has a working signal. There are 20 intersections listed for improvement with measures such as flyovers or underpasses proposed in the previous Roadmap Study. DPWH picked up the proposals and expressed they would conduct an F/S on almost all of them. Cycle length of these 20 intersections are within a range of 180 seconds to 420 seconds. The average is approximately 300 seconds, which seems to be too long. The optimum cycle length should be set less than 200 seconds and then this will make possible to introduce the functions of actuated signal control. It should be noted that cycle length changes by time of day and values mentioned above are results from the survey conducted in 2014.

(3) Traffic Control Center (TCC)

Some LGUs, including Cebu City, Mandaue City and Lapu-Lapu City, in Metro Cebu have their own traffic control center to manage their signalized intersections. The functions and issues in 3cities are as follows:

(i) Cebu City

The city's TCC controls all traffic signals at 70 intersections. The center was built in 1991 and operation started in 1993. The software being used is Sydney Coordinated Adaptive Traffic System (SCATS) last upgraded in 1999. Instead of closed-circuit television (CCTV), there are 649 detectors in the city with only 200 operational and old. Therefore, the optimum harmonized coordination function between and among signals is not achieved. The system has several fixed cycle lengths for each intersection and cycle time changes by time of day.



Source: JICA Project Team

Figure 3.5.1 Traffic Control Center (Cebu City)

(ii) Mandaue City

The center controls all traffic signals at 21 intersections in Mandaue City that has been operational since 2013. The system has CCTVs at 17 intersections, detectors at 14 intersections, and can store images for a month. Each intersection has several fixed cycle lengths that change by time of day. The cycle length was set during the installation of the system and has not been changed since then.



Source: JICA Project Team

Figure 3.5.2 Traffic Command Center (Mandaue City)

(iii) Lapu-Lapu City

The city is installing signals at 10 intersections by the end of 2018. 3 intersections along National Highway, which is north side of Mactan Island, was already equipped with signals in 2017. After installation of signals, enforcers control the traffic flow like other intersections in Cebu City. Enforcers observes the traffic situation at the intersection and tell the operator in the control room through radio communication to change the signal through the console.



Source: JICA Project Team

Figure 3.5.3 Traffic Command Center (Lapu-Lapu City)

(4) Issues on Traffic Management

Traffic management issues are summarized in Table 3.5.2. Details are described in Chapter 8.

Table 3.5.2 Issues Concerning Traffic Management

Fields	Issues	Remark
(1) Traffic Signal Optimization	(a) Optimization of cycle lengths	Priority project
	(b) Optimization of Signal phases	
	(c) Harmonization with neighboring signals	
(2) Traffic Control Center	(a) Installation of traffic control center	Priority project
	(b) Area traffic control management	
(3) Proper Traffic Operation	(a) Traffic operation considering traffic demand	
	(b) Improvement of traffic behavior	
	(c) PUV management	
	(d) Enforcement of regulation on overloaded trucks	
	(e) Education of traffic engineer	
(4) Traffic Information Provision	(a) Installation of variable message signboards	
	(b) Information provision for Cebu-Mactan bridges	
(5) Others	(a) Introduction of efficient road asset management system	
	(b) Standardization of ETC specification	
	(c) Utilization of ITS technology for BRT system	

Source: JICA Project Team
Notes: (2) Traffic Signal Optimization and (3) Traffic Control Center are proposed transport projects of the Roadmap Study, and are also described as "Synchronized Signalization System in Urban Areas" and "Area Traffic Control System in Metro Cebu" respectively in Chapter 6 of this report.

4 EXISTING TRAFFIC DEMAND ANALYSIS

This chapter presents analysis of existing traffic demand in Metro Cebu.

4.1 Supplemental Traffic Surveys

1) Cordon Line Survey

The Cordon Line Survey aims to determine the trips to/from the survey area made by residents living outside the survey area and to calibrate the distributed traffic volume obtained from another survey (i.e., Household Interview Survey or HIS). In order to obtain such data/information, the roadside origin–destination (OD) interview and traffic count surveys were conducted on the boundaries of the survey area.

The survey covered the whole study area of Metro Cebu consisting of seven cities (Cebu City, Danao City, Mandaue City, Lapu-Lapu City, City of Talisay, City of Naga, and City of Carcar) and six municipalities (Municipality of Compostela, Municipality of Liloan, Consolacion, Municipality of Cordova, Municipality of Minglanilla, and Municipality of San Fernando).

(1) Survey Methodology

(i) Survey Items

The following items were observed simultaneously at each survey station.

(a) Vehicular traffic count; and

(b) Trip information (e.g., origin and destination, number of passengers, trip purpose, freight, access/egress mode, etc.).

(ii) Field Survey

In these roadside surveys, traffic counters counted vehicular traffic by vehicle type and direction for every 30 minutes.

The OD interview survey was conducted by interviewers to obtain trip information from private transportation drivers, public transportation passengers and drivers, freight mode drivers, ferry passengers, and air passengers. It should be ideal to interview as many samples as possible when the traffic/passenger volume is small, but the sample rate for this survey was determined by the supervisor at the site to ensure that the survey does not create queues at the survey station.

For the roadside surveys, vehicles are classified as follows:

(a) Motorcycle;

(b) Car / Owner-type Jeep;

(c) Pedicab;

(d) Tricycle;

(e) Taxi;

(f) Jeepney;

(g) Multicab;

(h) GT Express / V-hire;

(i) Minibus;

(j) Standard Bus;

(k) School / Company / Tourist bus;

(l) Pickup / Delivery truck;

(m) Truck;

(n) Trailer; and

(o) Others (including ambulance, fire truck, towing car, construction vehicle, armored car, animal-driven cart, etc.).

(2) Survey Coverage

There were 7 survey stations for the roadside at the Metro Cebu boundary, 4 stations at ferry terminals, and 2 stations at the MCIA. All the survey stations are listed in Table 4.1.1 together with the survey duration, while their locations are shown in Figure 4.1.1.

For the roadside survey sites, the 24-hour traffic count and OD interview surveys were conducted at 5 stations, while 16-hour surveys were conducted for the remaining 2 stations. Surveys at the 16-hour sites were conducted from 6:00 a.m. to 10:00 p.m. with two 8-hour shifts. Surveys at the 24-hour sites had no constraints on the start time but were conducted with three 8-hour shifts.

The OD interview survey was conducted at all public and private ferry terminals in the study area. The survey period at ferry terminals was basically 24 hours, but if not open for 24 hours, the survey period was fitted to the operating hours of each terminal or the timetable of ferries. At the ferry terminals, only departing passengers were interviewed.

A 24-hour OD interview survey was also conducted at both international and domestic terminals of the MCIA. At the airport terminals, both departing and arriving passengers were interviewed.

The surveys were conducted on Tuesdays, Wednesdays, or Thursdays, and not on a holiday or on days with special activities such as local festivals or bad weather.

Table 4.1.1 List of Cordon Line Survey Stations

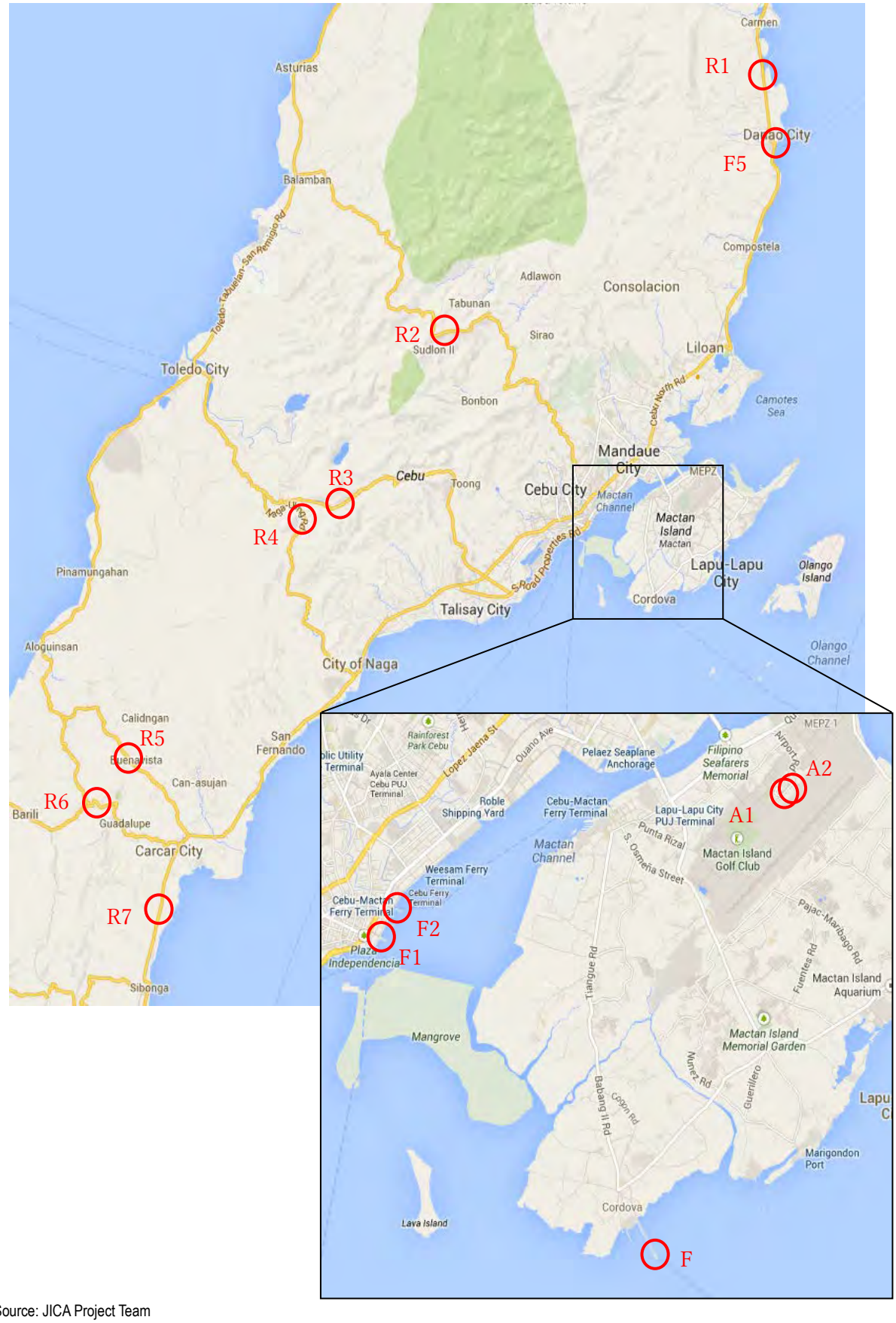
Seq.	Category	Code	Survey Station	Location		Survey Data	Survey Period (hours)	
							Traffic Count	OD Interview
1	Roadside	R1	Central Nautical Hwy	Boundary of Danao and Carmen	10°33'20.88'N 124°01'18.48'E	20 Sept. 2017	24	24
2		R2	Cebu Transcentral Hwy	Boundary of Cebu and Balamban	10°24'40.68'N 123°48'21.96'E	14 Sept. 2017	24	24
3		R3	Cebu – Toledo Wharf Rd	Boundary of Minglanilla and Toledo	10°18'43.20'N 123°45'18.00'E	14 Sept. 2017	16	16
4		R4	City of Naga – Uling Rd	Boundary of Naga and Toledo	10°01'18.48'N 123°42'38.88'E	14 Sept. 2017	24	24
5		R5	Liburon Rd	Boundary of Carcar and Aloguinsan	10°09'20.52'N 123°36'21.24'E	19 Sept. 2017	16	16
6		R6	City of Carcar – Barili Rd	Boundary of Carcar and Barili	10°07'41.52'N 123°35'02.04'E	19 Sept. 2017	24	24
7		R7	South National Hwy	Boundary of Carcar and Sibonga	10°03'55.08'N 123°37'40.44'E	19 Sept. 2017	24	24
8	Ferry Terminal	F1	Cebu Terminal 1	Pier 1, Cebu Port	10°17'33.94'N 123°54'29.27'E	20 Sept. 2017	-	20
9		F2	Cebu Terminal 2	Pier 3, Cebu Port	10°17'51.02'N 123°54'37.16'E	20 Sept. 2017	-	20
10		F4	Cordova Pier	Pier for Municipality of Cordova – Jetafe Ferry, Cordova Port	10°14'32.25'N 123°57'22.06'E	20 Sept. 2017	-	8
11		F5	Danao Terminal	Pier for the Danao – Camotes Ferry, Danao Port	10°31'13.36'N 124°01'48.57'E	20 Sept. 2017	-	12
12	Airport Terminal	A1	Domestic Terminal	Mactan Cebu International Airport	10°18'54.92'N 123°58'43.31'E	20 Sept. 2017	-	24
13		A2	International Terminal	Mactan Cebu International Airport	10°18'56.14'N 123°58'44.32'E	20 Sept. 2017	-	24

Notes:

1) Terminals F7 and F9 are private terminals owned by the shipping lines.

2) The Cordon Line Survey did not target passengers of the Cebu–Mactan Ferry, which terminal is located at Pier 3.

Source: JICA Project Team



Source: JICA Project Team

Figure 4.1.1 Location of Cordon Line Survey Stations

2) Screen Line Survey

The Screen Line Survey aims to provide vehicular and passenger traffic information to calibrate the current distributed traffic volume obtained from the HIS. In order to obtain the required data, the traffic count survey and vehicle occupancy survey were conducted at road sections crossing the screen lines in the study area.

Like the Cordon Line Survey, the Screen Line Survey also covered the whole study area of Metro Cebu.

(1) Survey Methodology

(i) Survey Items

The following items were observed simultaneously at each survey station;

(a) Vehicular traffic count; and

(b) Vehicle occupancy.

(ii) Field Survey

The vehicular traffic volume every 30 minutes by vehicle type and direction was counted on roadside survey stations. The classification of vehicles followed the one used for the cordon line survey (i.e., bicycle, motorcycle, car/owner-type jeep, pedicab, tricycle, taxi, jeepney, multi cab, GT Express/V-hire, minibus, standard bus, school/company/tourist bus, pickup/delivery truck, truck, trailer, and others).

The number of passengers of vehicles to be chosen at random was observed and recorded by vehicle type and direction for every 30 minutes.

(2) Survey Coverage

There was a total of 23 survey stations located at roadsides and Pier 3, Cebu Port. The survey stations are listed in Table 4.1.2, while their locations are indicated in Figure 4.1.2.

The traffic count survey at roadsides was conducted for 24 hours at 9 stations and 16 hours at 15 stations. The vehicle occupancy survey at roadsides was also conducted for 24 hours at 9 stations and 16 hours at 3 stations simultaneously with the traffic count survey. Surveys at the 16-hour sites were conducted from 6:00 a.m. to 10:00 p.m. with two 8-hour shifts. Surveys at the 24-hour sites had no constraints on the start time but were conducted with three 8-hour shifts.

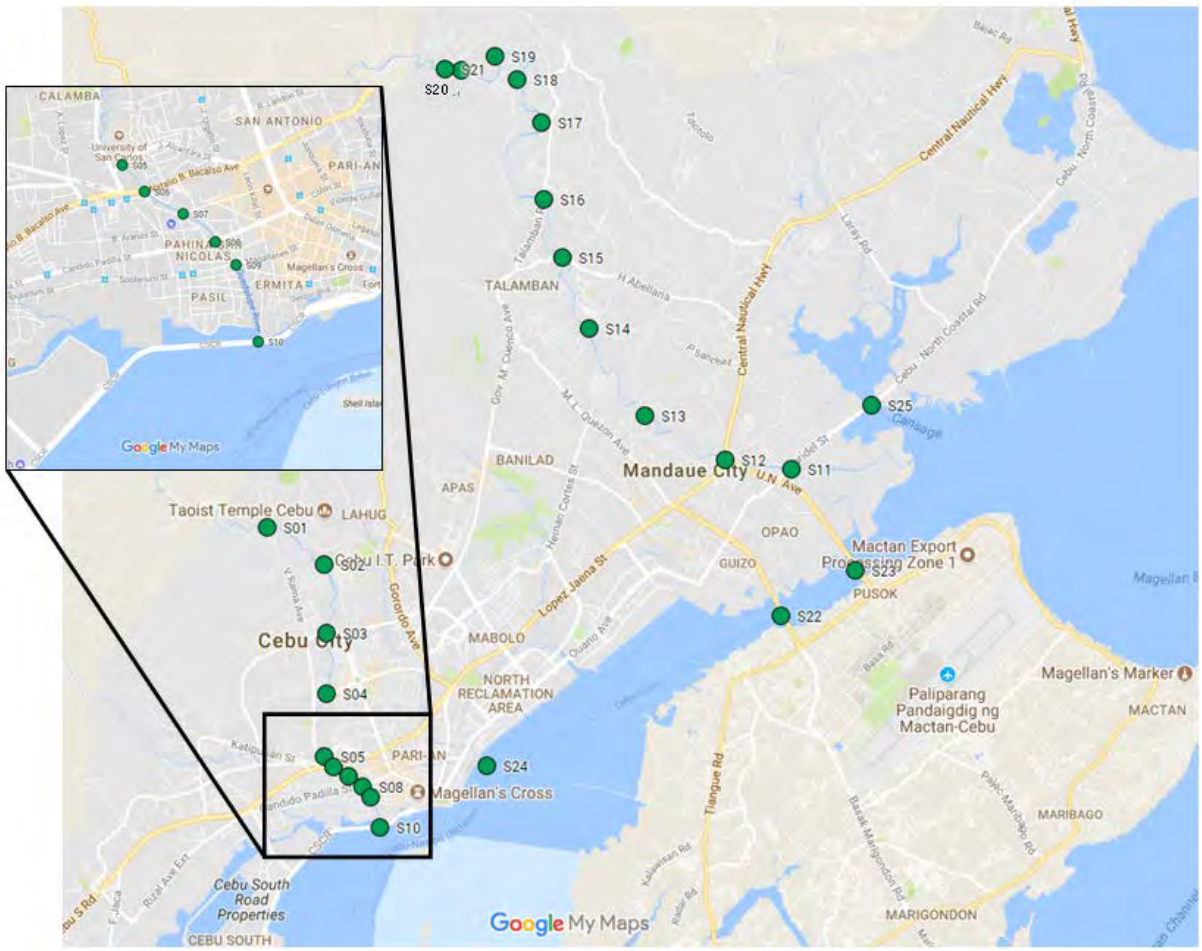
Similar to the other surveys, these surveys were done on Tuesdays, Wednesdays, or Thursdays, and not on a holiday or days with special activities or bad weather.

Table 4.1.2 List of Screen Line Survey Stations

Seq.	Code	Survey Station	Latitude	Date	Survey Period (hours)	
					Traffic Count	Vehicle Occupancy
1	S01	Guadalupe River–Kalunasan	10°19'55.88'N 123°52'47.26'E	5 Sept. 2017	16	-
2	S02	Guadalupe River–Lahug–Guadalupe Rd.	10°19'36.11'N 123°53'17.35'E	5 Sept. 2017	16	16
3	S03	Guadalupe River–M. Velez St.	10°19'0.66'N 123°53'18.81'E	5 Sept. 2017	16	-
4	S04	Guadalupe River–B. Rodriguez St.	10°18'29.02'N 123°53'18.86'E	5 Sept. 2017	24	24
5	S05	Guadalupe River–J. Alcantara St.	10°17'56.08'N 123°53'17.42'E	5 Sept. 2017	16	-
6	S06	Guadalupe River–Natalio B. Bacalso Ave.	10°17'50.42'N 123°53'22.46'E	5 Sept. 2017	24	24
7	S07	Guadalupe River–Sanciangko	10°17'45.93'N 123°53'30.53'E	5 Sept. 2017	16	-
8	S08	Guadalupe River–Candido Padilla St.	10°17'39.95'N 123°53'37.79'E	6 Sept. 2017	24	24
9	S09	Guadalupe River–Spolarium St.	10°17'35.04'N 123°53'42.13'E	6 Sept. 2017	16	-
10	S10	Guadalupe River–CSCR	10°16'55.28'N 123°53'1.18'E	6 Sept. 2017	24	24
11	S11	Butuanon River–Plandel St.	10°20'27.86'N 123°57'26.28'E	6 Sept. 2017	16	-
12	S12	Butuanon River–Central Nautical Hwy	10°20'33.61'N 123°56'51.14'E	6 Sept. 2017	24	24
13	S13	Butuanon River–Mardorio Ceniza	10°20'55.19'N 123°56'8.20'E	7 Sept. 2017	16	-
14	S14	Butuanon River–New Canduman–Pilit Bridge	10°21'40.29'N 123°55'38.57'E	7 Sept. 2017	16	16
15	S15	Butuanon River–Gov. M. Cuenco Ave.	10°22'17.65'N 123°55'24.84'E	7 Sept. 2017	16	-
16	S16	Butuanon River–Talamban Rd.	10°22'48.04'N 123°55'14.13'E	7 Sept. 2017	24	24
17	S17	Butuanon River–Daffodil St.	10°23'28.35'N 123°55'17.82'E	7 Sept. 2017	16	-
18	S18	Butuanon River–Pulangbato Bridge Rd.	10°23'50.15'N 123°54'59.98'E	7 Sept. 2017	16	16
19	S21	Butuanon River–No name	10°23'55.20'N 123°54'21.83'E	7 Sept. 2017	16	-
20	S22	Osmeña Bridge	10°19'28.85'N 123°57'10.72'E	13 Sept. 2017	24	24
21	S23	Marcelo Ferman Bridge	10°19'58.20'N 123°57'43.02'E	13 Sept. 2017	24	24
22	S24	Pier 3, Cebu Port[1)]	10°17'51.02'N 123°54'37.16'E	20 Sept. 2017	-	-
23	S25	Cansaga Bay Bridge	10°20'43.21'N 123°57'45.80'E	13 Sept. 2017	24	24

Note: Passenger manifests were obtained from port authorities, so the traffic count was not conducted.

Source: JICA Project Team



Source: JICA Project Team

Figure 4.1.2 Locations of Screen Line Survey Stations

3) Public Transport Passenger Survey

The Public Transport Passenger Survey aims to obtain the number of passengers that use public transport. In order to obtain the required data, the count of the boarding and alighting passengers in public transport modes was conducted.

The entire Metro Cebu study area was also covered by this survey.

(1) Survey Methodology

(i) Survey Items

The following items were observed simultaneously with public transport modes:

(a) Number of boarding and alighting passengers; and

(b) Location and time where and when the passengers boarded and alighted.

(ii) Field Survey

The survey was conducted on board and the number of boarding/alighting passengers and the time were recorded.

(2) Survey Coverage

The survey covered the following periods:

(i) Morning peak hours (7:00–9:00);

(ii) Off-peak hours (11:00–14:00); and

(iii) Evening peak hours (17:00–19:00).

Three samples per unit time and direction were taken. The survey covered the 50 major PUJ routes and 10 bus routes (see Table 4.1.3).

The survey was also done on the same days as the other surveys.

Table 4.1.3 List of Bus and PUJ Routes

No.	Route	Route No.	Type of Mode	Survey Date
01	Municipality of Liloan–North Bus Terminal	25	MultiCab	19 Sept. 2017
02	City of Naga–Basak (USJR)via Pardo	44A	MultiCab	19 Sept. 2017
03	Ibabao,Mandaue City–Cebu City	20B	PUJ	19 Sept. 2017
04	Talamban–Colon	13C	PUJ	19 Sept. 2017
05	Cordova–MEPZ 1 via BabagKinaLoocPM	MI-03B	MultiCab	13 Sept. 2017
06	SambagII (SWU)–SM–NBT	01K	PUJ, MultiCab	19 Sept. 2017
07	Punta Engaño–NB Terminal MC via Mepza	23I	MultiCab	19 Sept. 2017
08	Pit-os,Talamban-Carbon	62C	PUJ, MultiCab	19 Sept. 2017
09	Guadalupe-Carbon	06B	PUJ, MultiCab, ELF	19 Sept. 2017
10	City of Carcar-Tabunok Talisay City	46	MultiCab	13 Sept. 2017
11	Inayawan–Colon	11A	PUJ	19 Sept. 2017
12	Municipality of Minglanilla-Basak	43D	PUJ	19 Sept. 2017
13	Ouano,Mandaue City–Cebu City	22A	PUJ	13 Sept. 2017
14	Marigindon–Mandaue City	MI-02B	PUJ, MultiCab	13 Sept. 2017
15	Municipality of Consolacion-Foodland via AS Fortuna	24F	PUJ, MultiCab	19 Sept. 2017
16	Apas,Lahug-Carbon	17B	PUJ	19 Sept. 2017
17	Ibabao,Mandaue City–Manalili,Cebu City	21D	PUJ	19 Sept. 2017
18	Lahug–JY Square SM-Ayala	04L	PUJ	19 Sept. 2017
19	Labangon–Colon	12D	PUJ	19 Sept. 2017
20	Municipality of Liloan–-Mandaue City Public Mrkt via ASF	25	MultiCab	19 Sept. 2017
21	Labangon–Ayala	12L	PUJ	19 Sept. 2017
22	Bulacao–SM–Colon	10H	PUJ, MultiCab	19 Sept. 2017
23	Plaza Housing, Lahug–Carbon	04I	PUJ	20 Sept. 2017
24	Bulacao–Colon	10F	PUJ	19 Sept. 2017
25	Mabolo–Carbon	03A	PUJ	19 Sept. 2017
26	Municipality of Consolacion–Cebu City	24	PUJ	19 Sept. 2017
27	Capitol–Ayala–Colon	14D	PUJ	19 Sept. 2017
28	Guadalupe–BRodriguez–Carbon	06C	PUJ	26 Sept. 2017
29	Alumnos–Colon	08G	PUJ	19 Sept. 2017
30	Sabang,Danao City–Cebu City	27	PUJ	25 Sept. 2017
31	South Expressway Terminal-Pier–Colon	02B	PUJ	19 Sept. 2017
32	Municipality of Liloan–Cebu City and Vice Versa	25	PUJ, MultiCab	19 Sept. 2017
33	Municipality of Compostela–Makro	26	PUJ	19 Sept. 2017
34	Guadalupe–Carbon	06A	PUJ	3 Oct. 2017

No.	Route	Route No.	Type of Mode	Survey Date
35	MEPZ 2-Mandaue City	M1-04A	MultiCab	3 Oct. 2017
36	Municipality of Compostela–Foodland Mandaue	26	MultiCab	10 Oct. 2017
37	Punta Engaño–LLC PMarket via Mepza II	MI-0A1	Multi-Cab	19 Sept. 2017
38	Municipality of Liloan–Country Mall,Cebu City	25	Multi-Cab	19 Sept. 2017
39	Tabunok–Cebu City	41D	PUJ	12 Sept. 2017
40	Mandaue City, Lapu-Lapu City	23D	PUJ, MultiCab	19 Sept. 2017
41	Labangon–Colon–SM NBTerminal	12I	PUJ, MultiCab	19 Sept. 2017
42	Mabolo–Carbon	03B	PUJ	19 Sept. 2017
43	Labangon–SM	12G	PUJ, MultiCab	19 Sept. 2017
44	Basak–Colon	09F	PUJ	19 Sept. 2017
45	Apas, Lahug–Carbon	17C	PUJ, MultiCab	10 Oct. 2017
46	MEPZ 2–MEPZ 1 via MVP Ave.–ML Quezon Hi-Way	MI-04B	MultiCab	12 Sept. 2017
47	Mabolo–Carbon	03L	PUJ	19 Sept. 2017
48	Kalunasan–Carbon via Osmeña Blvd	15	PUJ	19 Sept. 2017
49	Danao City-Makro Mandaue City	27	PUJ	19 Sept. 2017
50	Banawa–Carbon-Capitol	07B	PUJ	19 Sept. 2017
51	Metro Cebu–Daanbantayan	-	PUB	19 Sept. 2017
52	My Bus (ParkMall–SM Seaside–ParkMall)	-	PUB	19 Sept. 2017
53	My Bus (SM City–ParkMall)	-	PUB	19 Sept. 2017
54	My Bus (Talisay–Parkmall–Talisay)	-	PUB	19 Sept. 2017
55	Danao City-Cebu City	-	PUB	19 Sept. 2017
56	My Bus (SM City–Mactan Airport–SM City)	-	PUB	19 Sept. 2017
57	My Bus (Talisay–SM Seaside–Talisay)	-	PUB	10 Oct. 2017
58	Metro Cebu–Balamban	-	PUB	19 Sept. 2017
59	Metro Cebu–Santander	-	PUB	19 Sept. 2017
60	City of Carcar–Cebu City	-	PUB	19 Sept. 2017

Source: JICA Project Team

4) Public Transport Terminal Survey

The Public Transport Terminal Survey aims to survey the frequency of PUJ and bus services and abstract of the terminals including location and operation system, operation hours, etc. At the same time, the survey also aimed to gather data related to PUVs.

Similar to other surveys, this covered the entire Metro Cebu study area.

(1) Survey Methodology

(i) Survey Items

The following items were surveyed:

(a) Frequency of PUVs (large bus, mini bus, jeepney, multi cab, elf); and

(b) Abstract of the terminals including location, operation system, and operation hours (abstract of roadside is not necessary).

(ii) Field Survey

The consultant assigned surveyors at suitable locations in each survey site to survey the frequency of PUV services. At the terminal, surveyors counted all PUVs departing from the terminal and passing through in front of the terminal. At the roadside, surveyors counted PUVs that pass through. PUVs that pass bound for the center of the city were the target for counting (only one direction).

For the survey of abstract of the terminals, surveyors drew the exit and entrance, and location of the bus bay. The consultant or surveyors surveyed the operator and owner of the terminal, operation hours, etc.

(2) Survey Coverage

There was a total of 340 survey stations (see Table 4.1.4 and Figure 4.1.3). The frequency survey was basically conducted for 24 hours from 6:00 a.m. to 6:00 p.m. with three 8-hour shifts at each terminal/stand. However, the consultant could propose the shortening of the survey period to the Project Team if no services were found late at night or in the off-peak hours during the preparatory survey.

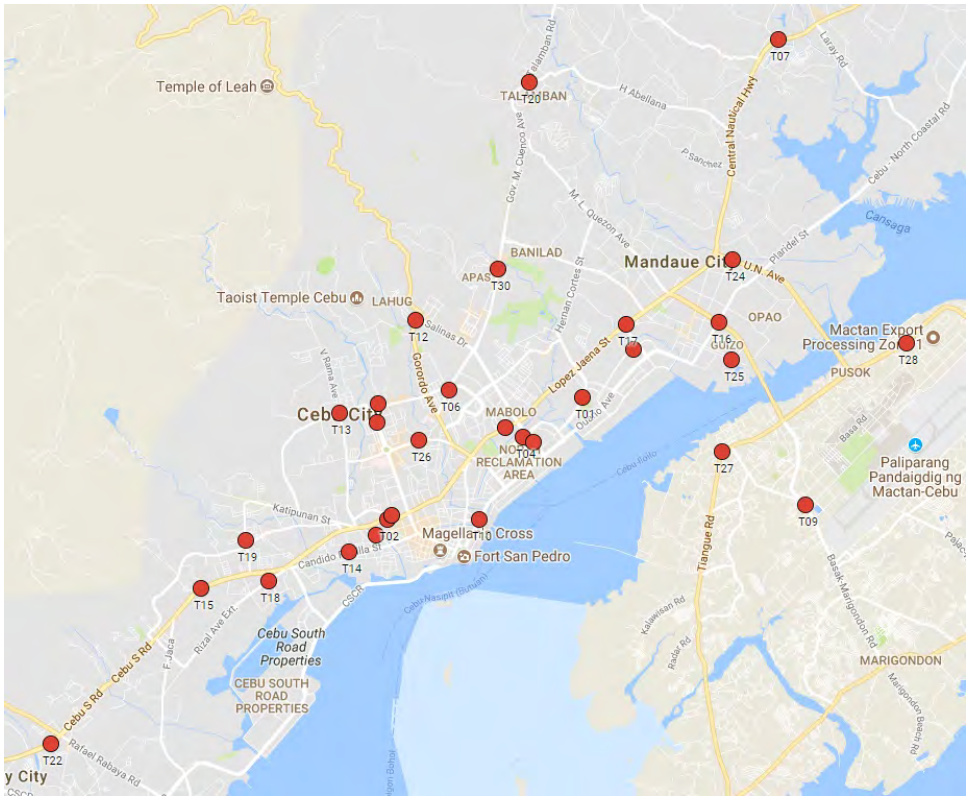
The survey was done on the same days as the other surveys.

Table 4.1.4 List of Public Terminal Survey Stations

Code	Survey Station	Survey Date
T01	North Bus Terminal (in front of CNBT)	25 Oct. 2017
T02	South Bus Terminal (in front of CSBT)	24 Oct. 2017
T03	Taboan PUJ Terminal (corner Tres de Abril St. / Lakandula St.)	24 Oct. 2017
T04	White Gold PUJ Terminal / A. Soriano Ave. (roadside near SunGold)	25 Oct. 2017
T05	SM city Cebu (roadside along Juan Luna Ave.)	25 Oct. 2017
T06	Ayala Public Utility Vehicle Terminal (roadside along Arch. Reyes Ave.)	25 Oct. 2017
T07	Municipality of Consolacion (in front of Consolacion Government Center)	27 Oct. 2017
T08	Sambag I (USC-GH), 1A, 1B, 1C, 1G, 1J, etc. (roadside of Corner Urgello St. and Alcantara St.), Sambag II (SWU), 1F, 1H, 1I,1K, etc.	24 Oct. 2017
T09	MEPZ II PUJ Terminal (roadside along Basak–Marigondon Road)	27 Oct. 2017
T10	Pier Area, 2A, 2B, 2C, 2D, 2E, etc. (Pier III)	25 Oct. 2017
T11	Mabolo (Panagdait), 3A, etc. (M.J. Cuenco Ave. corner Cabantan St.), Mabolo, 3B, 3C, 3D, 3G, 3K, 3M, 3Q etc., Mabolo (luyo), 3L, etc.	25 Oct. 2017
T12	Lahug Campo, 4A, 4B, 4C, 4E, 4F, 4G, (JY Square), Lahug (Plaza Housing), 4D, 4H, 4I, etc., lahug 04L, Apas, 17 etc.	25 Oct. 2017
T13	Guadalupe, 6A, 6B, 6C, 6D, 6E, 6F, 6G, 6H, 6J, etc. (Corner V. Rama Ave.- M. Velez St.), Banawa, 7A, 7B, 7D, 7E, 7G, etc.	25 Oct. 2017
T14	Sawang Calero, 8E, etc. (roadside, corner C. Padilla St. and Carlock St.)	24 Oct. 2017
T15	Basak, 9B, 9C, 9F, 9G, 9H, etc. (roadside near Skywalk of USJR Basak Campus), Basak (Ibabao), 9E, 9J, etc.	24 Oct. 2017
T16	MANDAUE (roadside along A.C. Cortes Ave. near corner Plaridel St.)	27 Oct. 2017
T17	High way Mandaue (roadside in front of San Miguel Corp.)	27 Oct. 2017
T18	Inayawan, 10A, 11D, 11E, 11G, 11F, etc. (corner of Tagunol St. and Cabreros St.), Mambaling, jeepney route 8F, 8G etc.	24 Oct. 2017
T19	Labangon, 12A, 12B, 12C, 12D, 12E, 12F, 12G, 12I, 12J, 12K, 12L, 12L, etc. (Punta Princesa)	24 Oct. 2017
T20	Talamban, 13b, 13C, 62B, C2C etc. (in front Talamban Gym)	27 Oct. 2017
T21	Osmeña Blvd. (roadside infront CocoMall)	24 Oct. 2017
T22	Tabunok Market (in front Saint Joseph Parish)	24 Oct. 2017
T23	Oppra, 15, etc. (Villalon Drive near Cebu Capitol)	25 Oct. 2017
T24	MANDAUE (Ibabao), 21A, 21B, 21C, 21D, 22H, 22I, 22L, etc. (roadside along U.N. Ave in front of Pacific Mall)	27 Oct. 2017
T25	MANDAUE (OUANO), 22A, 22B, etc. (corner of C.M. Cabahug St. and A. Mabini St.)	27 Oct. 2017

Code	Survey Station	Survey Date
T26	Gen Maxilom Ave. (Roadside in front of Fooda Savermart)	24 Oct. 2017
T27	Lapu-Lapu Public Market (near Lapu-Lapu Central School along G.Y. Dela Serna St.)	27 Oct. 2017
T28	MEPZA I (near Skywalk)	27 Oct. 2017
T29	Parkmall PUJ Terminal (roadside along Mantawe Ave.)	27 Oct. 2017
T30	Gaisano Country Mall PUJ Terminal/Foodland	25 Oct. 2017

Source: JICA Project Team



Source: JICA Project Team

Figure 4.1.3 Locations of Public Terminal Survey Stations

5) Public Transport Passenger Interview Survey

The Public Transport Passenger Interview Survey aims to know passengers' trip purpose, trip frequency, and perceptions on existing and future public transport services as well as their socioeconomic characteristics such as age, gender, occupation, car ownership, and so on. Development directions of mass rapid transit services and public transport terminals are analyzed using the data collected in this survey. At the same time, gathering data related to PUVs are part of the aims of this survey.

This survey covered the entire Metro Cebu study area.

(1) Survey Methodology

(i) Survey Items

The items surveyed were the:

(a) Socioeconomic characteristics of the passengers;

(b) Trip information and reason for modal choice;

(c) Perceptions on the level of present public transport services; and

(d) Willingness to pay for a planned mass rapid transit service.

(ii) Field Surveys

The consultant allocated surveyors at suitable locations in each survey site to conduct interviews of passengers waiting for their departure. Passengers were interviewed at random and the consultant set an hourly number of target samples by survey site and vehicle type in order to conduct interviews evenly for each time period in the morning peak, off-peak, and evening peak hours.

(2) Survey Coverage

There was a total of 5 survey stations with a target number of 1,200 samples as shown in Table 4.1.5.

The passenger interviews were basically conducted for 16 hours from 6:00 a.m. to 10:00 p.m. with two 8-hour shifts at each terminal/stand. The survey was done on the same days as the other surveys.

Table 4.1.5 List of Public Transport Passenger Interview Survey Stations

Seq.	Code	Survey Station	Number of Samples by Mode						Survey Date
			Bus	V-hire	Jeepney Multi-cab ELF	Taxi	Ferry	Total	
1	T1	North Bus Terminal	127	51	52	25		255	10–12 Oct. 2017
2	T2	South Bus Terminal	126		100	26		252	10–12 Oct. 2017
3	T3	Ayala Center Cebu		100	152	51		303	10–12 Oct. 2017
4	T4	SM City Cebu	30	102	150	55		337	10–12 Oct. 2017
5	T5	Cebu – Mactan Ferry Terminal (Pier 3)					104	104	3–4 Oct. 2017
		Total	283	253	454	157	104	1,251	

Source: JICA Project Team

6) Turning Movement Count Survey

The turning movement count survey was conducted at major intersections in the study area. The traffic count survey at major intersections was conducted to obtain the turning movement in terms of traffic volume by vehicle type. At the same time, gathering data on related intersections that become bottlenecks is one of the objectives of the survey.

Like the other surveys, the turning movement count survey covered the entire Metro Cebu study area.

(1) Survey Methodology

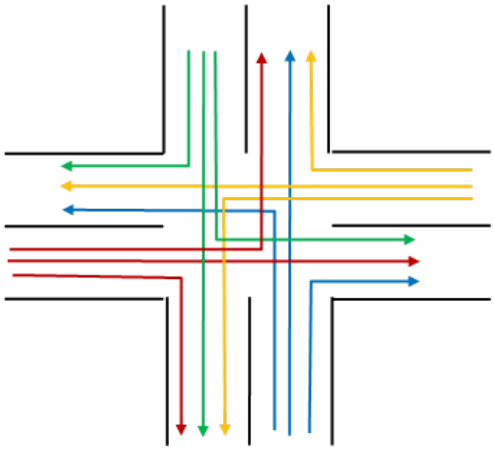
(i) Survey Items

Vehicular traffic count by turning movement, by vehicle type, and by hour at major intersections was observed at each survey station.

(ii) Field Survey

Vehicular traffic count by turning movement should be conducted in all possible turning movements at each intersection. Figure 4.1.4 shows an example of the

movement at the intersection. Survey duration is 16 hours on a weekday. Traffic volume was recorded by vehicle type, by direction, and in a 30-minute period. The classification of vehicles followed the one used for the cordon line and screen line surveys.



Source: JICA Project Team

Figure 4.1.4 Example of All Possible Turning Movement at Intersection

(2) Survey Coverage

There was a total of 10 survey stations as listed in Table 4.1.6. Their locations are indicated in Figure 4.1.5.

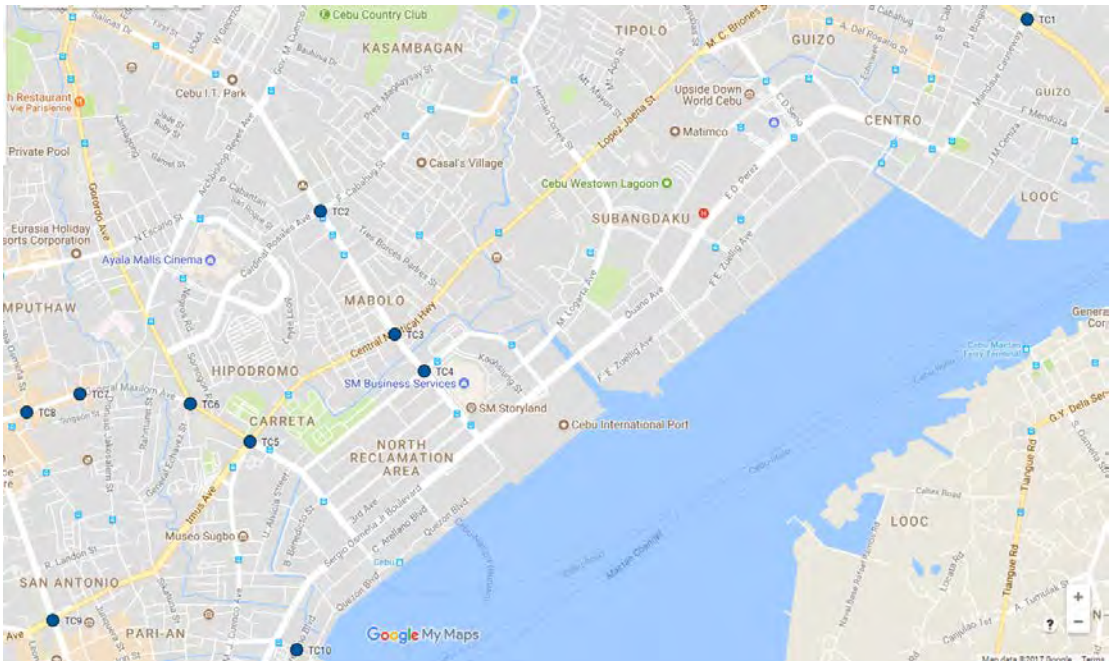
The traffic count survey at roadsides was conducted for 16 hours at 10 stations. Surveys at the 16-hour sites were conducted from 6:00 a.m. to 10:00 p.m. with two 8-hour shifts.

The survey was done on Tuesdays, Wednesdays, or Thursdays, and not on a holiday or days with special activities or bad weather.

Table 4.1.6 List of Intersection Turning Movement Count Survey Stations

Seq.	Code	Survey Station	Date	Survey Period (hours)
1	TC1	A. C. Cortes Ave. cor. Jose L. Briones	13 Sept. 2017	16
2	TC2	Juan Luna Ave. cor. Cardinal Rosales Ave.	13 Sept. 2017	16
3	TC3	M. J. Cuenco Ave. cor. Juan Luna Ave.	12 Sept. 2017	16
4	TC4	Juan Luna Ave. cor. A. Soriano Ave.	13 Sept. 2017	16
5	TC5	Gen. Maxilom Ave. cor. M. J. Cuenco Ave.	12 Sept. 2017	16
6	TC6	Gen. Maxilom Ave. cor. Gorordo Ave.	13 Sept. 2017	16
7	TC7	Gen. Maxilom Ave. cor. M. Gotianuy St.	14 Sept. 2017	16
8	TC8	Gen. Maxilom Ave. cor. Juana Osmeña St.	12 Sept. 2017	16
9	TC9	Osmeña Blvd. cor. N. Bacalso Ave.	12 Sept. 2017	16
10	TC10	V. Sotto St. cor. C. Arellano Blvd.	13 Sept. 2017	16

Source: JICA Project Team



Source: JICA Project Team

Figure 4.1.5 Locations of the Intersection Turning Movement Count Survey Stations

4.2 Brief Analysis of Updated Traffic Demand

1) Results of Cordon Line Survey

(1) Traffic Count and Mode Share

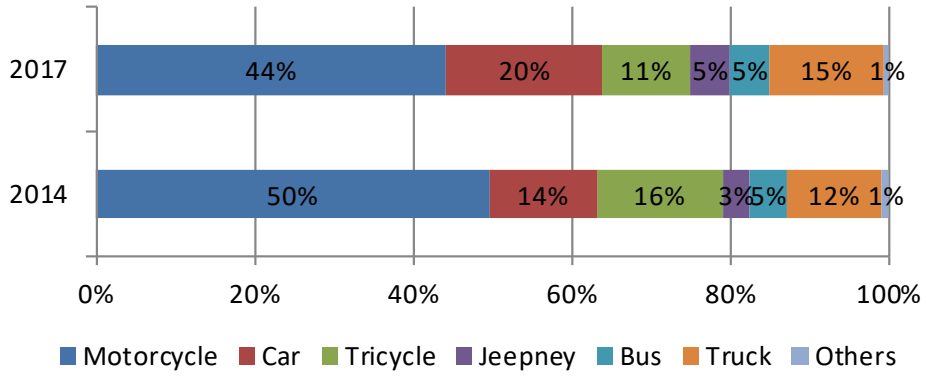
(i) Land Transport

The total number of vehicles at the survey stations increased by 1.17% from 2014 to 2017 (see Table 4.2.1). In particular, the number of vehicles at the west stations is large. Regarding mode share, the percentage shares of motorcycles and tricycles have decreased while that of the car increased (see Figure 4.2.1).

Table 4.2.1 Number of Vehicles at Each Survey Station

Survey Station		2014	2017	2017/2014 Growth Rate (%)
North	R1	14,239	14,475	1.02
West 1	R2	1,347	3,850	2.86
	R3	2,181	2,757	1.26
West 2	R4	6,451	7,887	1.22
	R5	1,675	1,416	0.85
West 3	R6	4,701	5,989	1.27
South	R7	8,080	8,744	1.08
Total		38,674	45,118	1.17

Source: JICA Project Team



Source: JICA Project Team

Figure 4.2.1 Mode Share

(ii) Ferry and Airport Terminals

Over the same four-year period, the number of airport passengers increased by 38%. On the other hand, the number of ferry passengers decreased by 13% as shown in Tables 4.2.2 and 4.2.3).

Table 4.2.2 Number of Passengers at Airport Terminals

Airport Terminal		2014	2017	2017/2014 Growth Rate (%)
A1	Domestic Airport	12,252	16,252	1.33
A2	International Airport	4,587	6,940	1.51
Total		16,839	23,192	1.38

Unit: Number of Passengers
Source: JICA Project Team

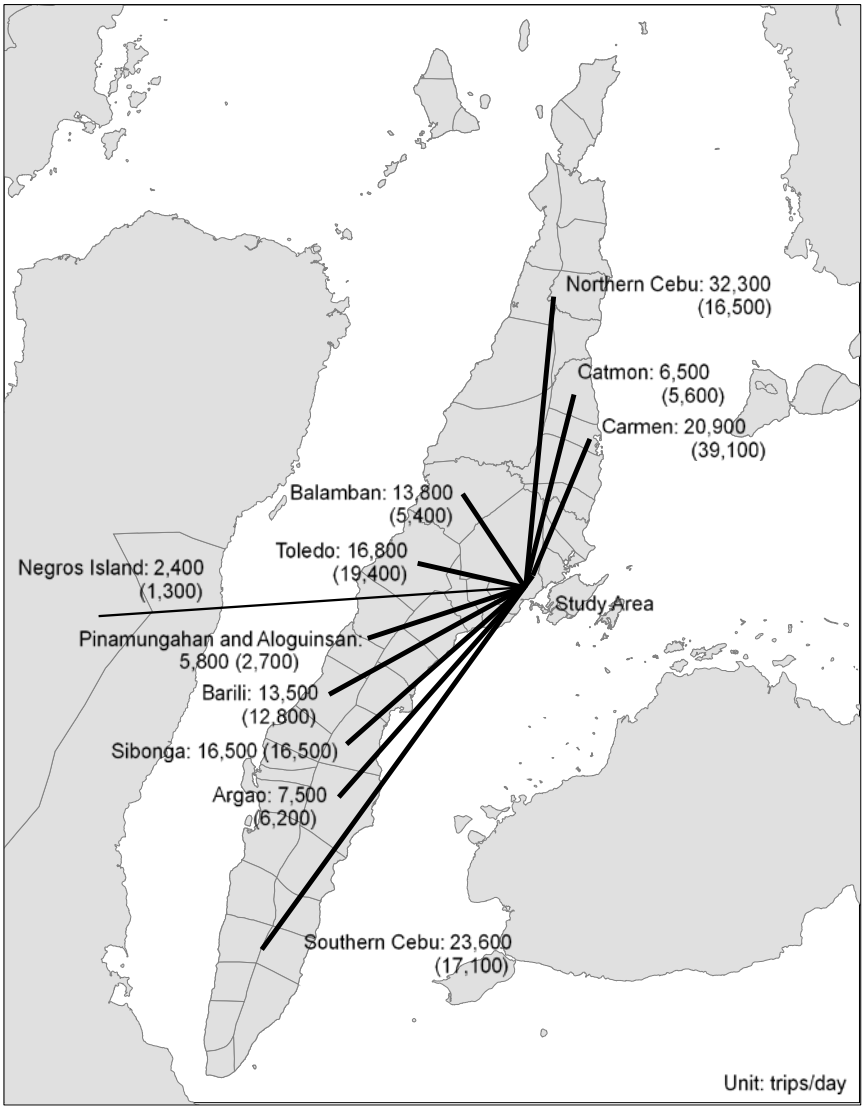
Table 4.2.3 Number of Passengers at Ferry Terminals

Ferry Terminal		2014	2017	2017/2014 Growth Rate (%)
F1	Pier 1	5,747	7,198	1.25
F2	Pier 3	7,360	6,541	0.89
F4	Cordova Pier	47	214	4.55
F5	Danao Terminal	885	967	1.09
F7	Pier 4	2,389	0	0.00
F9	Pier 5	966	0	0.00
Total		17,394	14,920	0.86

Unit: Number of Passengers
Source: JICA Project Team

(iii) Trip Distribution on Land Transport

There are more trips from the northern part of the study area. Compared with the 2014 data, the trips from Northern Cebu have increased while the trips from Carmen have decreased (see Figure 4.2.2).



Source: JICA Project Team

Figure 4.2.2 Number of Daily Trips From/To the Study Area by Land

2) Results of Screen Line Survey

(1) Traffic Count

(i) Number for Traffic by Screen Line

The three screen lines (SL) considered in this subsection are shown in Figure 4.2.3. Tables 4.2.4 and 4.2.5 show the number of passenger car unit (PCU) and passengers. Traffic at SL1 and SL3 stations decreased compared with those in the 2014 data. SL2 is the new SL and, therefore, there is no Roadmap data.



Source: JICA Project Team

Figure 4.2.3 Survey Locations

Table 4.2.4 Number of PCU by SL

	2014	2017	2017/2014
SL1	270,198	253,906	0.94
SL2	-	184,269	-
SL3	102,727	97,445	0.95

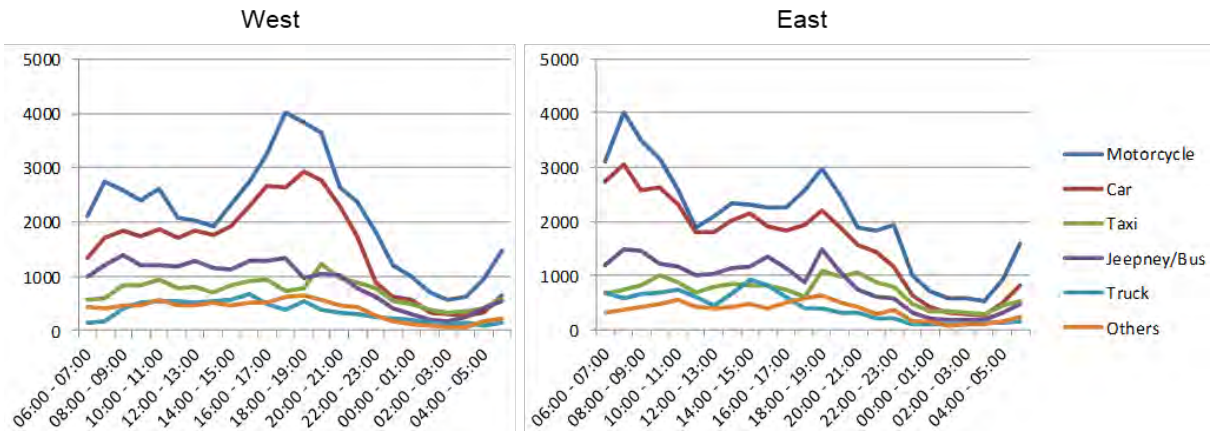
Table 4.2.5 Number of Passengers by SL

	2014	2017	2017/2014
SL1	947,962	918,498	0.97
SL2	-	577,702	-
SL3	306,353	305,172	1.00

Note: SL1 consists of survey stations S03–S10, SL2 consists of survey stations S11–S21, and SL3 consists of survey stations S22–S23.
Source: JICA Project Team

(ii) Hourly Vehicular Traffic Volume

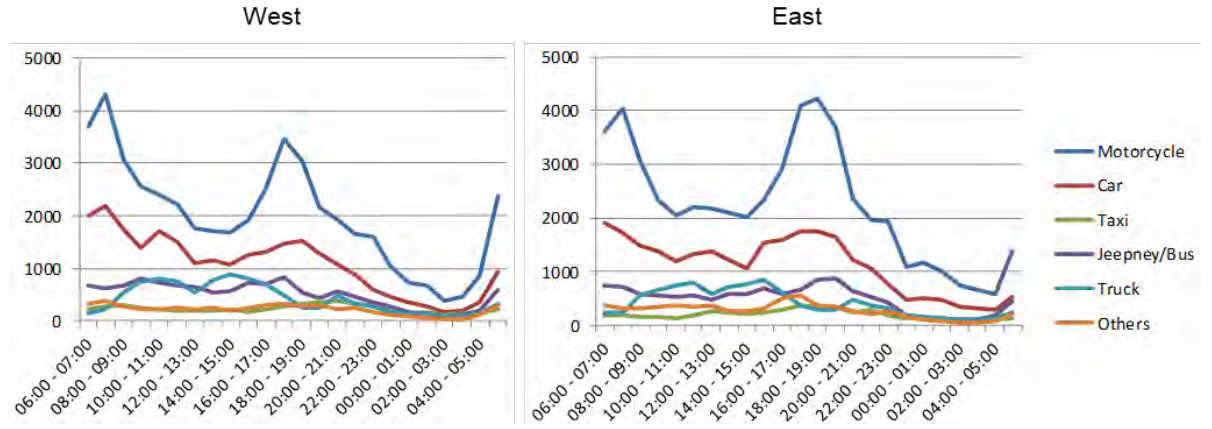
Figures 4.2.4 to 4.2.6 show the hourly vehicular traffic volume across each SL by direction and vehicle class. They show clear morning (between 6:00 and 8:00 a.m.) and evening (between 5:00 and 7:00 p.m.) peaks commonly seen in Metro Cebu. It should be pointed out that the morning peaks at SL1 (eastbound) and SL2 (westbound and eastbound) are particularly sharp.



Unit: The number of vehicles.

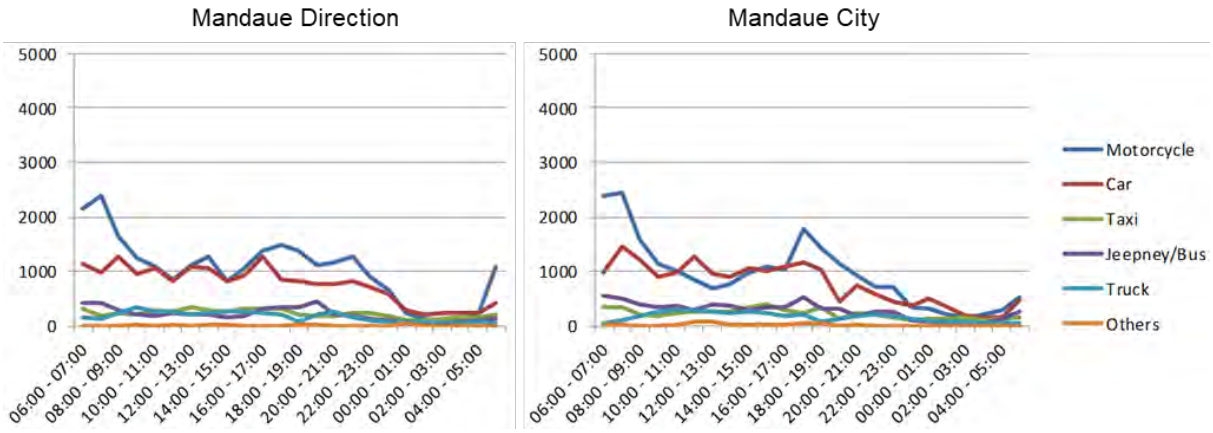
Source: JICA Project Team

Figure 4.2.4 Hourly Vehicular Traffic Volume Across SL1



Source: JICA Project Team

Figure 4.2.5 Hourly Vehicular Traffic Volume Across SL2



Unit: The number of vehicles.

Source: JICA Project Team

Figure 4.2.6 Hourly Vehicular Traffic Volume Across SL3

(2) Number of Passengers in Each Mode

The number of passengers in each transport mode shown in Figure 4.2.7 did not change compared with the Roadmap data.

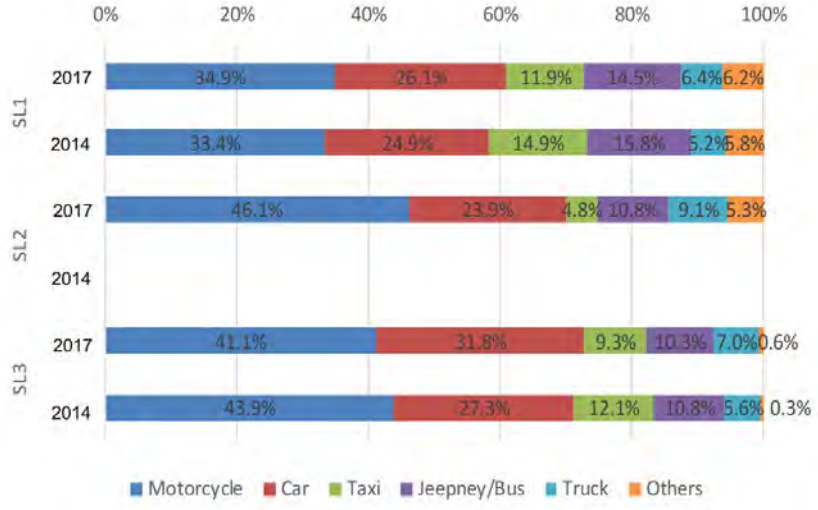


Source: JICA Project Team

Figure 4.2.7 The Average Number of Passengers in Each Mode

(3) Modal Share

Figure 4.2.8 shows the modal share at each screen line based on vehicular traffic volume. The combined shares of motorcycle and car at more than 50% have slightly increased compared with the Roadmap data.



Source: JICA Project Team

Figure 4.2.8 Modal Share on the Vehicular Traffic Volume Basis

3) Updated OD Table

(1) Summary of Changes Related to Person Trip Since 2014

Table 4.2.6 shows the changes related to person trip between the 2014 and 2017 data. The population has not changed.

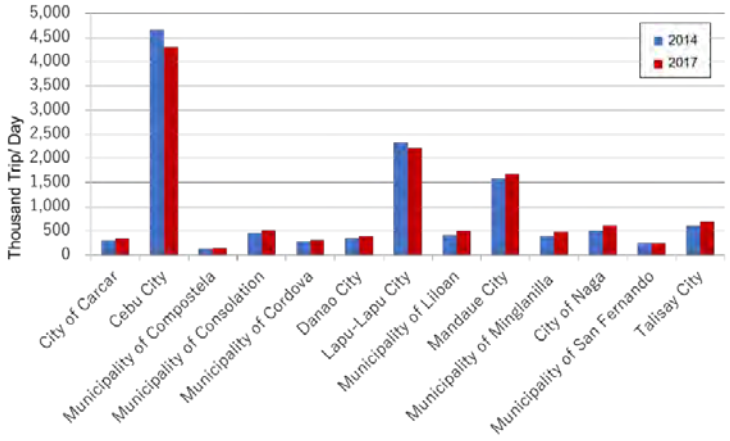
Table 4.2.6 Summary of Changes Related to Person Trip Since 2014

		2014	2017	2017/2014
Estimated Population in the Study Area (Thousand Person)		2,952.7	2,968.3	1.01
SL	SL1	948.0	918.5	0.97
	SL2	-	577.7	-
	SL3	306.4	305.2	1.00
CL	North	68.2	65.0	0.95
	South	56.1	81.7	1.46
	West	39.3	40.3	1.03

Unit: Thousand Trip/ Day
Source: JICA Project Team

(2) Trip Generation and Attraction

The number of trips generated and attracted in Cebu and Lapu-Lapu Cities have decreased compared with the 2014 data (see Figure 4.2.9). On the other hand, the number of trips in other cities and municipalities have increased.

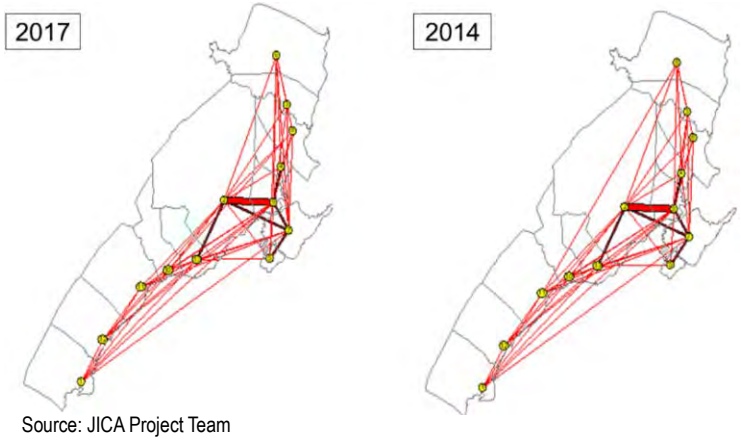


Source: JICA Project Team

Figure 4.2.9 Trip Generation and Attraction Compared Between 2014 and 2017

(3) Trip Distribution

There is no big difference between 2014 and 2017 regarding trip distribution data as shown in Figure 4.2.10.

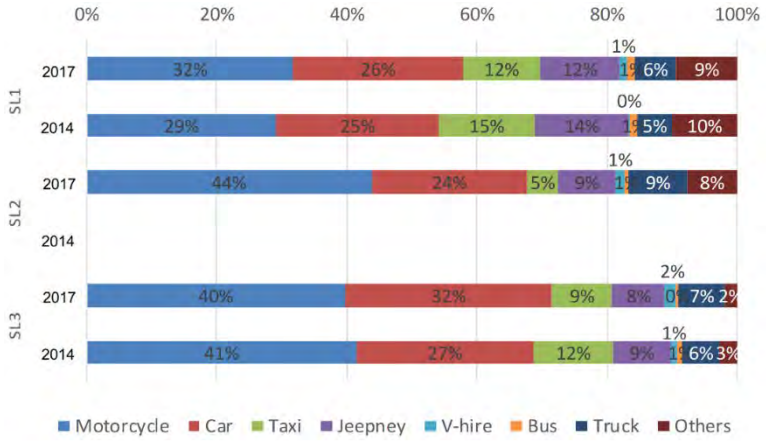


Source: JICA Project Team

Figure 4.2.10 Trip Distribution Compared Between 2014 and 2017

(4) Modal Share

There is also no big difference between 2014 and 2017 data regarding modal share. The share of tricycle has decreased while the share of jeepney has increased (see Figure 4.2.11).



Note: Traffic volume of survey station S01 and S02 is excluded in SL1
Source: JICA Project Team

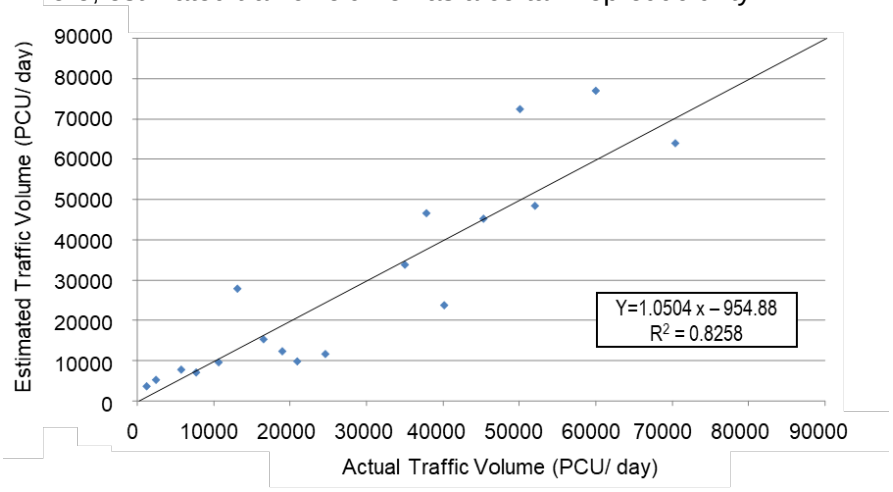
Figure 4.2.11 Modal Share on the Person Trip Basis Compared Between 2104 and 2017

4.3 Present Demand Analysis

Transport database developed in the Roadmap Study has been updated in this project based on the supplemental traffic surveys conducted in 2017. Although initial outputs were summarized and included in the above section, characteristics of the updated present demand are further described in this section.

1) Reproduction of Present Demand Forecast

There is strong correlation (coefficient of determination: R2=0.8258) between actual traffic volume obtained from screen line survey and estimated present traffic volume (see Figure 4.3.1). Th fore, estimated traffic volume has a certain reproducibility.



Source: JICA Project Team

Figure 4.3.1 Relationship Between Actual Traffic Volume and Estimated Traffic Volume

2) Analysis Demand Characteristic

(1) Total Generated Trip

The total number of generated trips is 6,197 thousand trips/day and 4,895 thousand trips/day when excluding walk. The number of trips excluding walk is used in this section because walk trip is only short distance (see Figure 4.3.2).

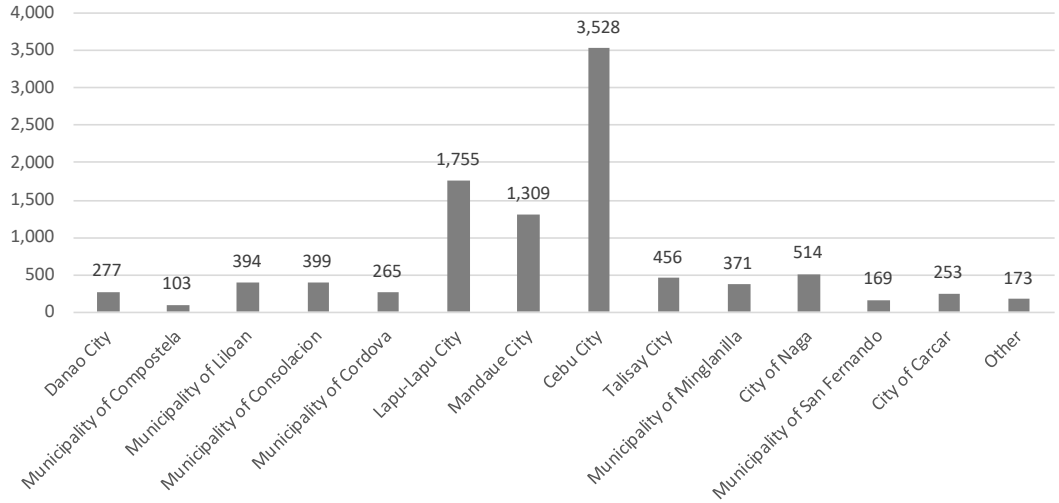


Note: The number of generated trips does not include the trip in external zone; Unit: Thousand Trips/Day
Source: JICA Project Team

Figure 4.3.2 Total Generated Trip

(2) Trip Generation and Attraction

Cebu City has the highest in trip generation and attraction trip by LGU, which is at 3.5 million trips/day, followed by Lapu-Lapu City and then Mandaue City. Other LGUs are smaller compared with these cities (see Figure 4.3.3).



Unit: Thousand Trips/Day
Source: JICA Project Team

Figure 4.3.3 Trip Generated and Attraction by LGU

(3) Trip Distribution

(i) Origin–Destination (OD) Trip

Regarding OD trip among LGUs, the trip between Cebu City and Mandaue City is the highest except with internal trip at 262 thousand trips/day. Trips between Cebu City

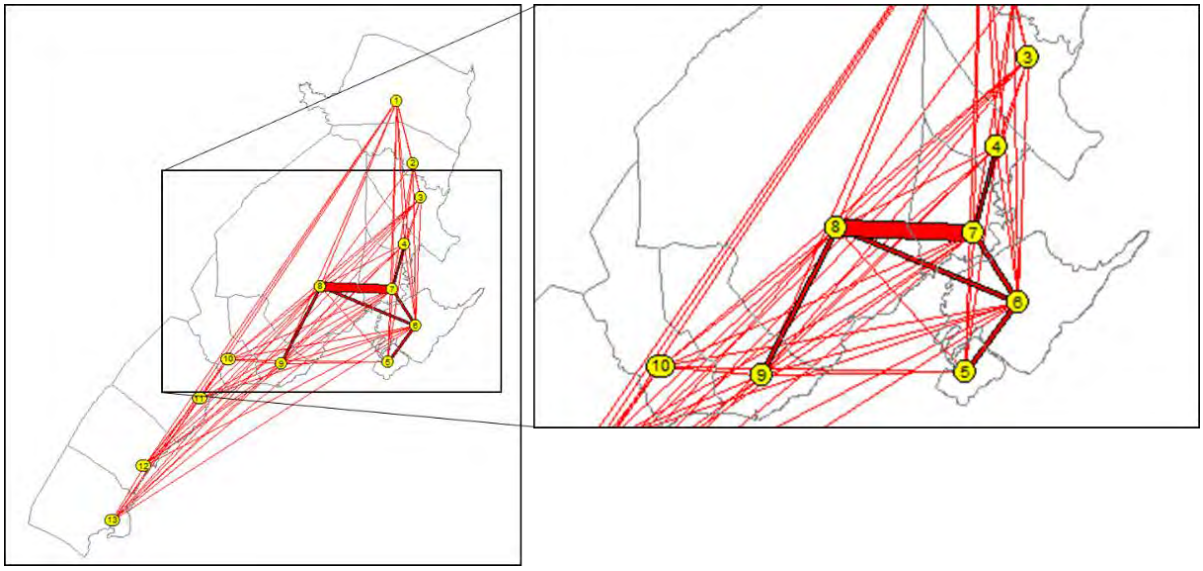
and Lapu-Lapu City, Mandaue City and Lapu-Lapu City, and Cebu City and City of Talisay are high (see Table 4.3.1 and Figure 4.3.4).

Table 4.3.1 O-D Table by LGU

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
1	99.4	3.9	3.6	2.2	0.0	0.6	7.3	9.8	0.1	0.0	0.4	0.2	0.0	8.2	135.6
2	4.1	30.2	8.7	0.5	0.0	2.4	3.8	0.7	0.0	0.0	0.0	0.0	0.0	1.4	51.8
3	3.2	9.0	108.3	17.6	0.0	10.5	21.1	28.0	0.3	0.5	0.0	0.2	0.0	0.7	199.5
4	1.9	0.5	17.0	100.5	0.0	11.0	48.5	23.2	0.2	0.0	0.0	0.2	0.0	0.6	203.6
5	1.6	0.0	0.0	0.0	60.9	66.2	7.5	10.2	0.0	0.0	0.0	0.0	0.0	0.1	146.5
6	0.6	0.9	14.5	10.9	44.2	677.0	57.6	53.8	3.2	1.3	1.9	0.3	1.2	4.6	872.0
7	10.1	6.0	18.1	42.4	2.9	51.3	348.2	134.3	6.1	3.0	8.7	1.1	2.1	18.0	652.5
8	9.0	0.4	21.6	20.2	8.9	48.8	127.9	1,332.8	61.5	27.2	37.2	6.6	7.9	26.7	1,736.7
9	0.0	0.0	0.4	0.3	1.2	5.1	6.4	69.2	103.2	19.0	16.0	3.0	2.7	3.7	230.0
10	0.0	0.0	0.5	0.0	0.0	1.4	6.5	42.2	26.2	89.9	28.5	3.5	0.5	2.6	201.8
11	0.4	0.0	0.0	0.0	0.0	2.0	10.4	41.5	15.7	20.5	139.9	18.3	2.8	2.9	254.3
12	0.2	0.0	0.2	0.2	0.0	0.4	1.1	8.0	3.0	3.5	19.5	43.7	4.8	0.8	85.5
13	0.3	0.0	0.0	0.0	0.0	1.3	2.2	5.5	2.4	0.5	3.2	5.6	91.8	12.2	124.9
14	10.1	0.6	1.6	1.0	0.0	4.6	8.1	31.6	4.3	4.0	4.0	0.7	14.2	3.0	87.9
Total	141.0	51.6	194.7	195.6	118.1	882.6	656.5	1,790.8	226.1	169.4	259.3	83.4	128.1	85.5	4,982.5

Unit: Thousand Trips/Day, Source: JICA Project Team

Note: 1. Danao City, 2. Municipality of Compostela, 3. Municipality of Liloan, 4. Municipality of Consolacion, 5. Municipality of Cordova, 6. Lapu-Lapu City, 7. Mandaue City, 8. Cebu City, 9. City of Talisay, 10. Municipality of Minglanilla, 11. City of Naga, 12. Municipality of San Fernando, 13. City of Carcar, 14. Other

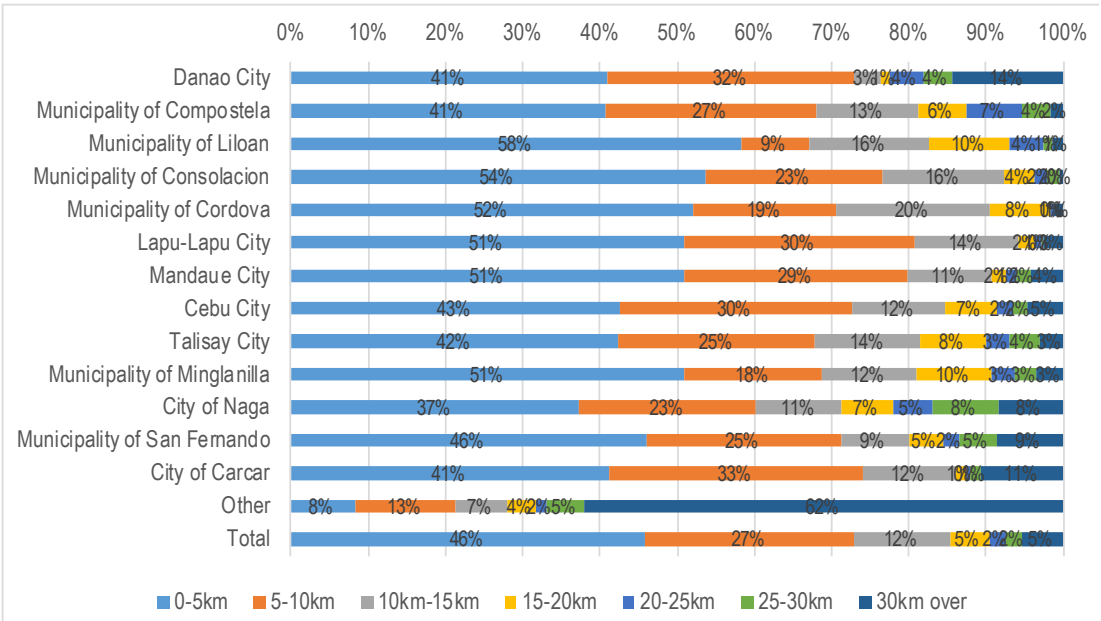


Source: JICA Project Team

Figure 4.3.4 Trip Distribution by LGU

(ii) Trip Length

About 80% of trips is with length 0–15km in each LGU. The share of trips with length more than 30 km is high in Danao City, City of Naga, Municipality of San Fernando, and City of Carcar compared with other LGUs (see Figure 4.3.5).



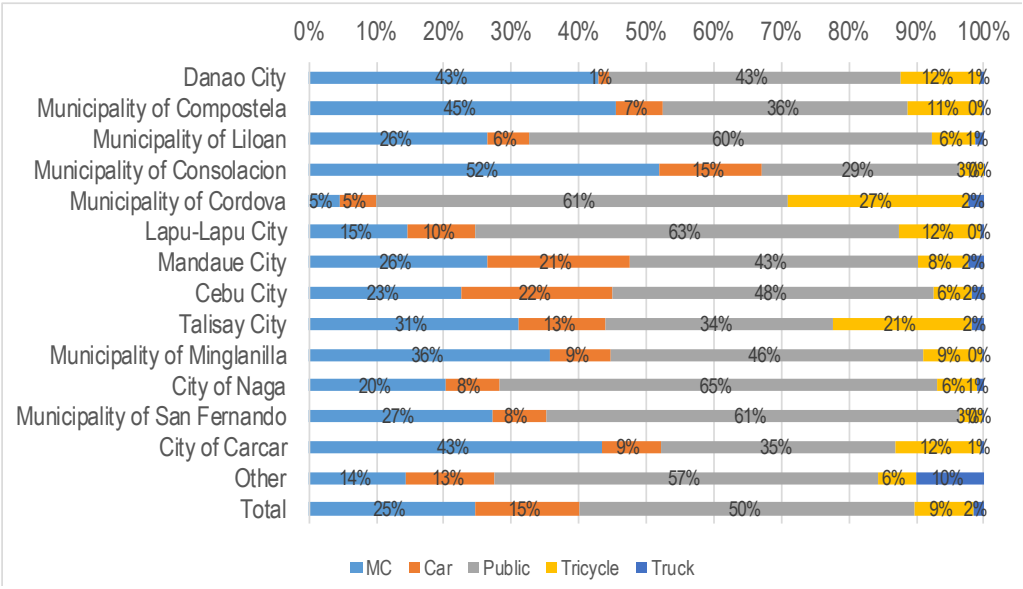
Source: JICA Project Team

Figure 4.3.5 Trip Distance by LGU

(4) Traffic Volume by Mode

(i) Model Share by LGUs

The share of car trips is about 20% in both Cebu City and Mandaue City that is higher than with other LGUs. The share of motorcycle is high in the suburb areas such as Danao City, Municipality of Compostela, and City of Carcar. The share of public mode is high in Municipality of Liloan, Municipality of Cordova, Lapu-Lapu City, City of Naga, and Municipality of San Fernando. Lastly, the share of tricycle is high in the Municipality of Cordova and City of Talisay compared with other LGUs (see Figure 4.3.6).



Source: JICA Project Team

Figure 4.3.6 Modal Share by LGU

(ii) Trip Distance by Mode

The share of trip of motorcycle, car, and public transport except tricycle from 0 to 15 km is more than 80%. The trip distance of tricycle is short as about 80% covers only 0–5 km. The trip distance of truck is longest compared with other modes (see Figure 4.3.7).

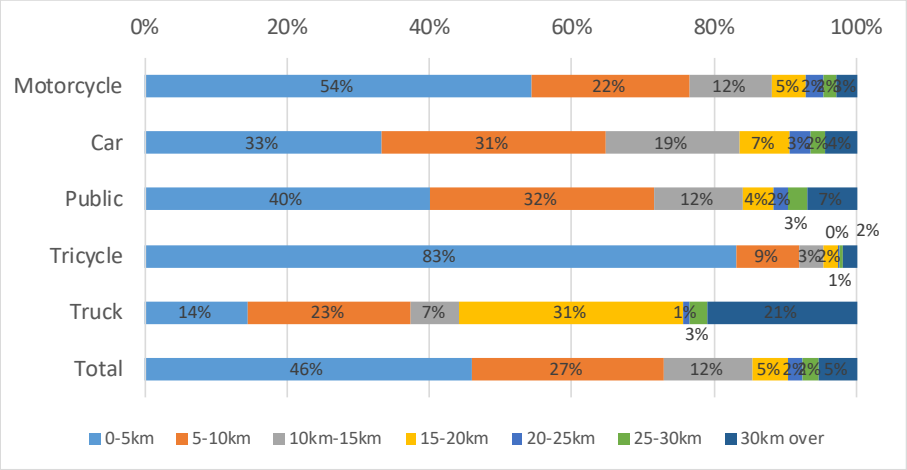
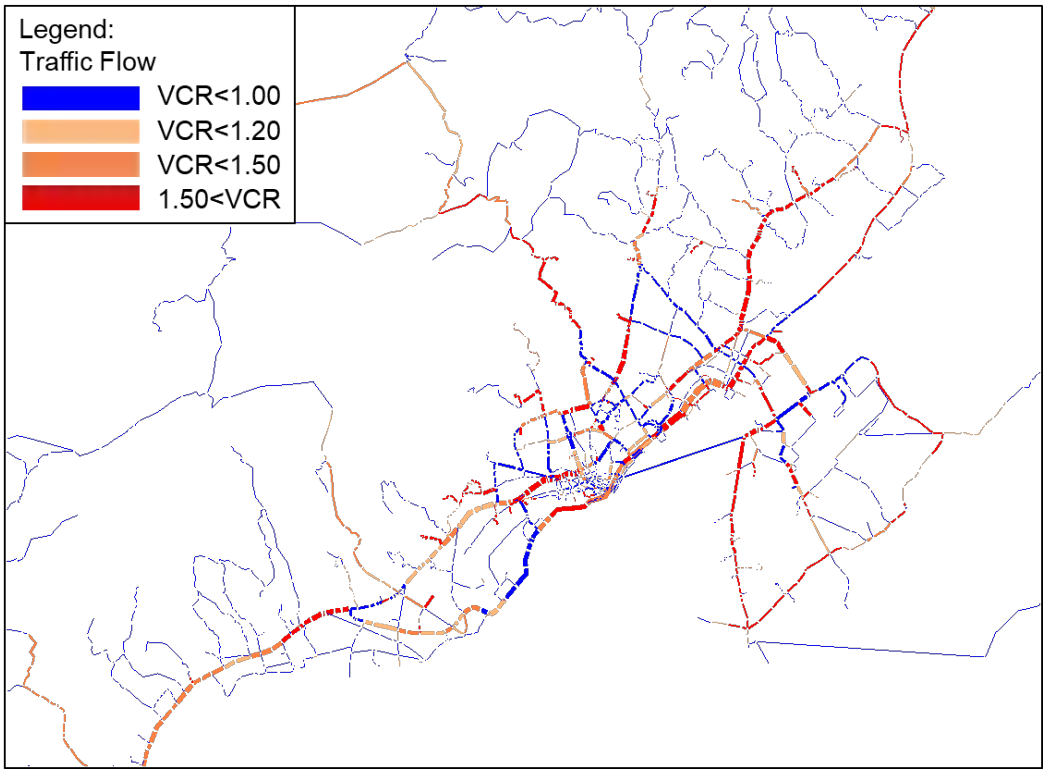


Figure 4.3.7 Trip Length by Mode

(5) Traffic Volume by Road Link

Traffic volume is high along Central Nautical Highway, Gov. M. Cuenco Ave., Quano Ave., and so on. The traffic volume is over-capacity (see Figure 4.3.8).

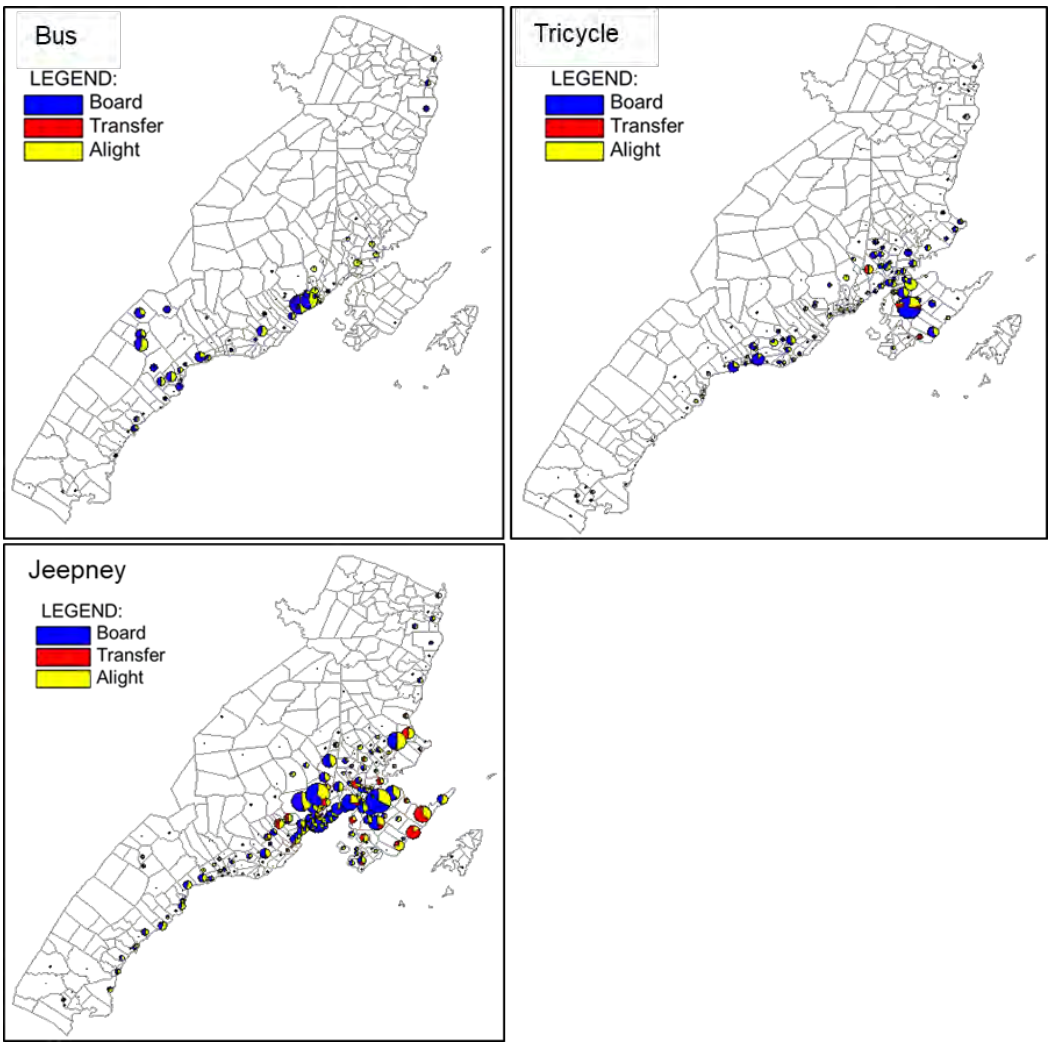


Source: JICA Project Team

Figure 4.3.8 Traffic Volume by Road Link

(6) Transfer Point

There are many boarding, alighting and transfer jeepney passengers in Cebu City, Mandaue City, and Lapu-Lapu City. In the North and South Bus Terminals, the number of bus transfer passengers is small yet there are many boarding and alighting. The number of tricycle passengers is high in Lapu-Lapu City (See Figure 4.3.9).



Source: JICA Project Team

Figure 4.3.9 Board/Transfer/Alight Point

3) OD Characteristic Between Cebu Mainland and Mactan Island

(1) Number of Vehicles across Bridges

The traffic volume on first Mactan Bridge is 43 thousand PCU/day and the second Mactan Bridge is 48 thousand PCU/day. Traffic volume of the second Mactan Bridge is higher than the former (see Table 4.3.2).

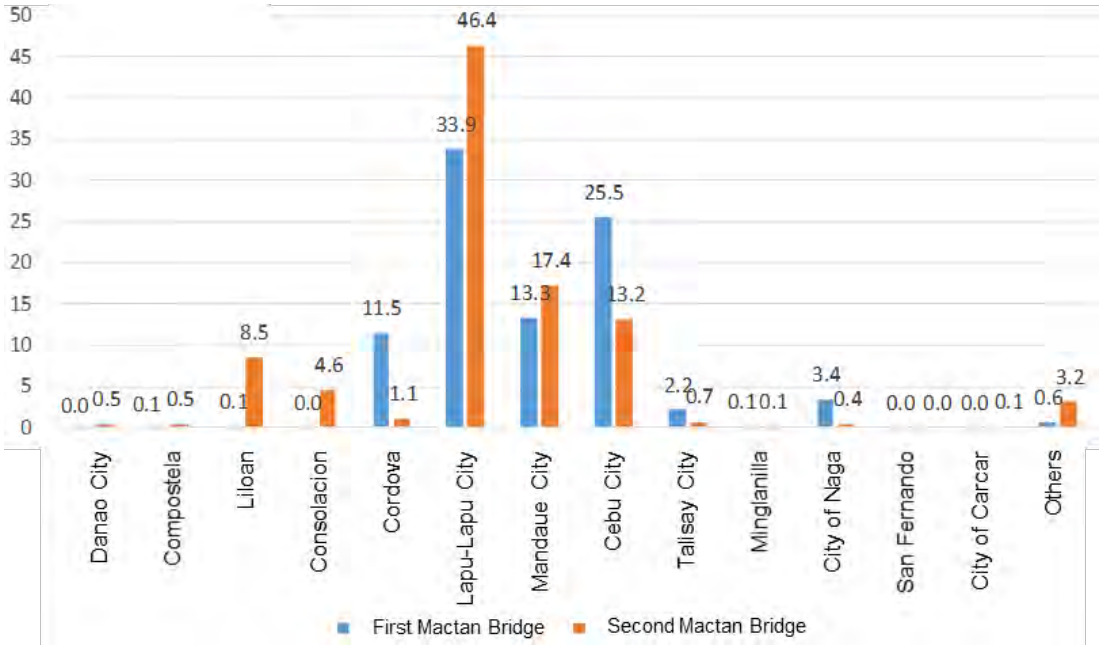
Table 4.3.2 Traffic Volume Crossing Mactan Bridges

Bridge Name	Traffic volume
First Mactan Bridge	45,300 PCU/ day
Second Mactan Bridge	48,300 PCU/ day

Source: JICA Project Team

(2) Trip Generation and Attraction

Regarding trip generation and attraction of the first and second Mactan Bridges, Lapu-Lapu City is the highest in both bridges. There are many first Mactan Bridge users from Cebu City, Mandaue City, and Municipality of Cordova while there are many second Mactan Bridge users from Cebu City, Mandaue City, and the northern part (see Figure 4.3.10).



Unit: Thousand PCU/ day
Source: JICA Project Team

Figure 4.3.10 Generation and Attraction of Traffic Crossing Mactan Bridge

(3) Trip Distribution

(i) OD Trip

Regarding OD trip among LGUs, there are large number of trips between Cebu City and Lapu-Lapu City, Cebu City and Municipality of Cordova, Mandaue City and Lapu-Lapu City on first Mactan Bridge. On the Second Mactan Bridge, there are a large number of trips between Mandaue City and Lapu-Lapu City, Cebu City and Lapu-Lapu City, and Municipality of Liloan and Lapu-Lapu City (see Tables 4.3.3 and 4.3.4, and Figure 3.3.11).

Table 4.3.3 O-D Table across First Mactan Bridge

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.9	5.2	0.0	0.0	0.0	0.0	0.0	0.0	6.2
6	0.0	0.1	0.1	0.0	0.0	0.0	7.0	9.3	0.8	0.0	1.7	0.0	0.0	0.4	19.4
7	0.0	0.0	0.0	0.0	0.3	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3
8	0.0	0.0	0.0	0.0	4.3	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0
9	0.0	0.0	0.0	0.0	0.6	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Total	0.0	0.1	0.1	0.0	5.3	14.4	8.0	14.5	0.8	0.0	1.7	0.0	0.0	0.4	45.3

Unit: Thousand trips/dDay, Source: JICA Project Team

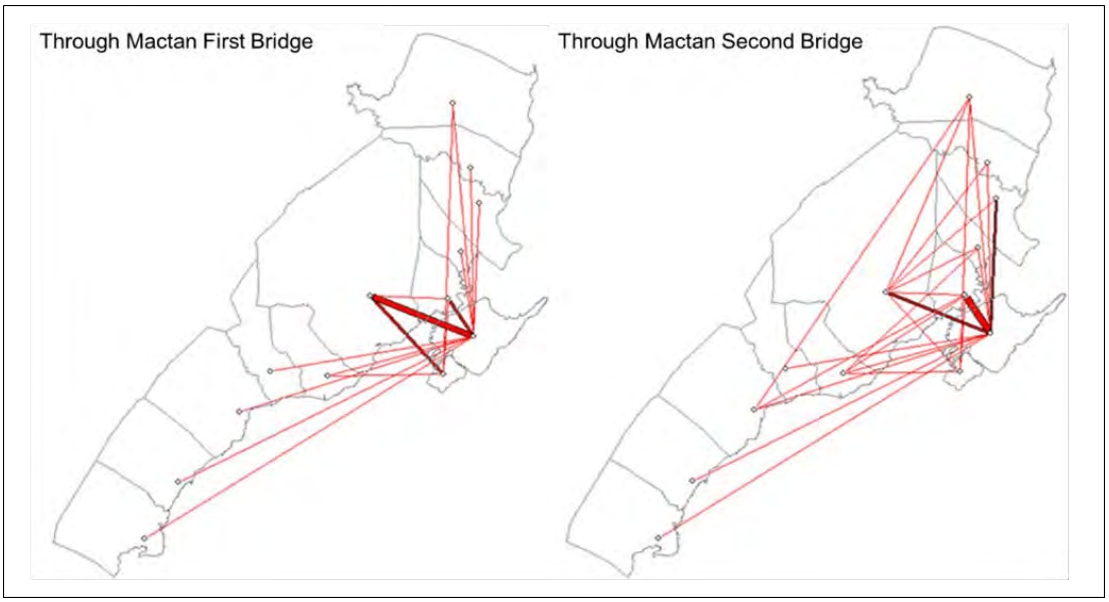
Note: 1. Danao City, 2. Municipality of Compostela, 3. Municipality of Liloan, 4. Municipality of Consolacion, 5. Municipality of Cordova, 6. Lapu-Lapu City, 7. Mandaue City, 8. Cebu City, 9. City of Talisay, 10. Municipality of Minglanilla, 11. City of Naga, 12. Municipality of San Fernando, 13. City of Carcar, 14. Other

Table 4.3.4 O-D Table Across Second Mactan Bridge

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
3	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	2.1
4	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4
5	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
6	0.1	0.1	6.4	2.2	0.0	0.0	8.0	5.6	0.2	0.1	0.1	0.0	0.0	1.4	24.4
7	0.0	0.0	0.0	0.0	0.4	8.4	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	9.0
8	0.0	0.0	0.1	0.0	0.3	6.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2
9	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.7
Total	0.4	0.1	6.5	2.2	0.7	22.0	8.4	6.0	0.3	0.1	0.2	0.0	0.0	1.4	48.3

Unit: Thousand Trips/Day, Source: JICA Project Team

Note: 1. Danao City, 2. Municipality of Compostela, 3. Municipality of Liloan, 4. Municipality of Consolacion, 5. Municipality of Cordova, 6. Lapu-Lapu City, 7. Mandaue City, 8. Cebu City, 9. City of Talisay, 10. Municipality of Minglanilla, 11. City of Naga, 12. Municipality of San Fernando, 13. City of Carcar, 14. Other

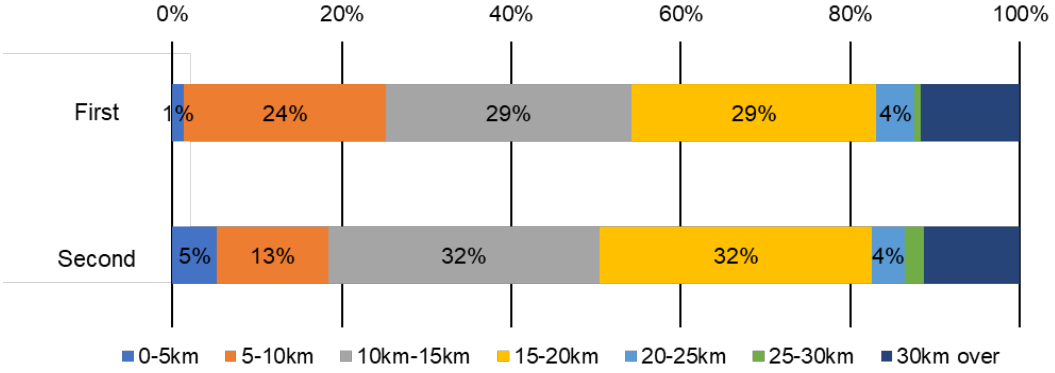


Source: JICA Project Team

Figure 4.3.11 Trip Distribution

(ii) Trip Length

Trip distance from 0 to 20 km covers 80% in both trips through first and second Mactan Bridges. The share of trip distance from 5 to 10 km is high in the trip through the first Mactan Bridge (see Figure 4.3.12).



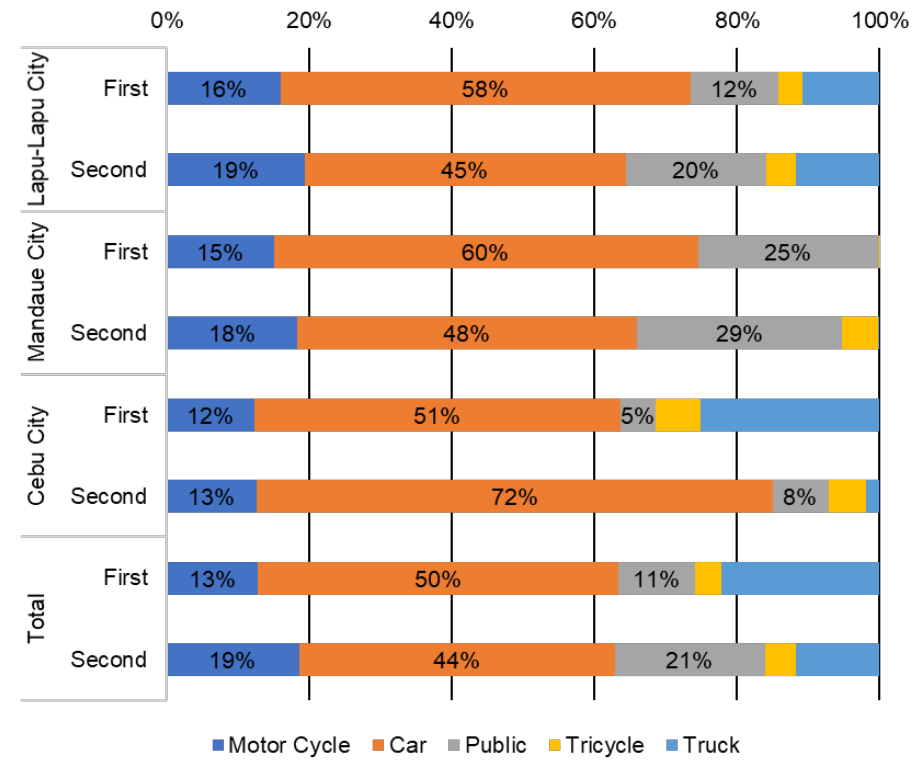
Source: JICA Project Team

Figure 4.3.12 Trip Distance

(4) Traffic Volume by Mode

(i) Model Share by LGUs

Focusing on the modal share in Cebu City and Mandaue City where traffic volume is high, the share of motorcycle and car cover more than 60%. The share of car is high in trips though second Mactan bridge to and from Cebu City, which is about 70% (see Figure 4.3.13).

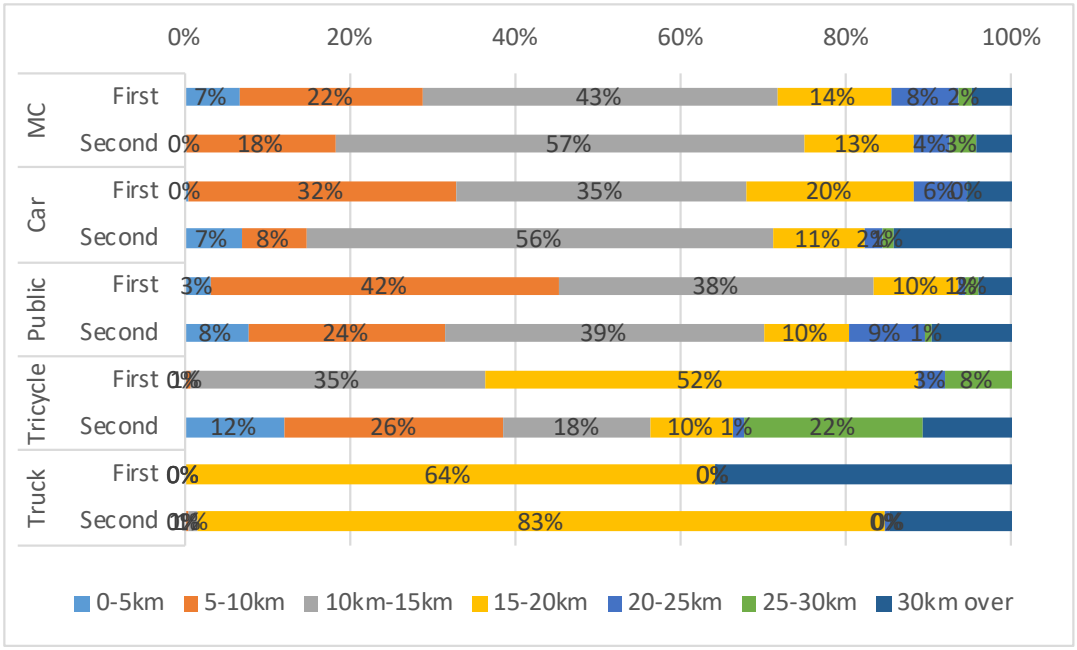


Source: JICA Project Team

Figure 4.3.13 Model Share by LGU

(ii) Trip Length by Mode

Share of trip from 0 to 20 km by different transport modes cover more than 80% except for tricycle on the Second Mactan Bridge and truck on the First Mactan Bridge (see Figure 4.3.14).



Source: JICA Project Team

Figure 4.3.14 Trip Length by Mode

4.4 Gap Assessment of Road-Based Public Transport Demand and Supply

1) Method of Analysis

Gap assessment is carried out by using the number of operations obtained from the public transport terminal survey and number of passengers obtained from the public transport passengers survey. Regarding demand, the congestion situation by route was analyzed after calculation of the number of total passengers, average congestion rate, and maximum congestion rate for each route. Regarding supply, the number of operations by route was compiled and volume of supply was analyzed. Furthermore, whichever section the high demand route operates was analyzed and corridor with high demand was identified.

2) Results of Analysis

(1) Outline of Routes

The outline of the volumes of demand and supply of each route are shown in Table 4.4.1. Most of the routes are full and only a few are not. The number of most operated routes is 300 lines/day.

Table 4.4.1 Result of Gap Analysis Between the Demand and the Supply

		Pax			Load Factor		Number & Percentage of Samples whose Max Load Factor is more than 100%		Frequency (one way)
		Boarding	Onboard		Avg.	Max			
		Total	Average	Max.					
1. Municipality of Liloan–North Bus Terminal 25									
Morning Peak	Direction 1	25.7	10.9	19.0	57.4%	100.0%	1	17%	1,445
Average	Direction 2	30.3	12.9	18.7	68.0%	98.2%	1		
Off-Peak	Direction 1	30.3	9.1	14.3	48.1%	75.4%	0		
Average	Direction 2	29.3	12.1	16.3	63.5%	86.0%	0		
Evening Peak	Direction 1	25.3	10.7	17.3	56.4%	91.2%	0		
Average	Direction 2	29.3	13.3	18.0	69.8%	94.7%	1		
2. City of Naga–Basak (USJR) via Pardo 44A									
Morning Peak	Direction 1	34.3	12.4	18.0	68.7%	100.0%	2	50%	715
Average	Direction 2	27.0	12.0	17.7	64.4%	93.9%	2		
Off-Peak	Direction 1	33.7	11.8	17.0	63.1%	90.7%	1		
Average	Direction 2	22.0	10.4	17.7	55.2%	94.4%	1		
Evening Peak	Direction 1	25.7	10.5	15.7	58.5%	87.0%	1		
Average	Direction 2	28.7	12.8	18.7	71.3%	103.7%	2		
3. Ibabao, Mandaue City–Cebu City 20B									
Morning Peak	Direction 1	23.7	7.4	13.7	31.0%	56.9%	0	17%	306
Average	Direction 2	29.3	7.4	12.0	31.0%	50.0%	0		
Off-Peak	Direction 1	23.3	11.6	23.0	48.4%	95.8%	2		
Average	Direction 2	25.0	5.1	11.3	21.1%	47.2%	0		
Evening Peak	Direction 1	23.3	12.7	23.3	53.0%	97.2%	1		
Average	Direction 2	24.0	6.4	10.7	26.5%	44.4%	0		
4. Talamban–Colon, 13C									
Morning Peak	Direction 1	27.7	12.2	19.3	55.0%	87.3%	2	28%	969
Average	Direction 2	27.0	10.9	16.3	48.4%	73.2%	0		
Off-Peak	Direction 1	26.0	10.0	17.3	48.9%	84.2%	1		
Average	Direction 2	23.7	8.9	16.3	43.1%	79.2%	1		
Evening Peak	Direction 1	26.3	12.4	19.7	53.1%	85.4%	0		
Average	Direction 2	28.0	12.1	18.7	53.4%	82.7%	1		
5. Cordova–MEPZ 1 via BabagKinaLoocPM, M1-03B									
Morning Peak	Direction 1	30.0	12.1	16.0	75.8%	100.0%	3	61%	470
Average	Direction 2	26.0	10.9	16.0	67.9%	100.0%	2		
Off-Peak	Direction 1	28.7	8.7	14.3	54.1%	89.6%	1		
Average	Direction 2	21.7	6.5	11.3	40.7%	70.8%	0		
Evening Peak	Direction 1	27.7	9.0	15.7	56.3%	97.9%	2		

		Pax			Load Factor		Number & Percentage of Samples whose Max Load Factor is more than 100%		Frequency (one way)
		Boarding	Onboard		Avg.	Max			
		Total	Average	Max.					
Average	Direction 2	30.3	11.9	16.7	74.3%	104.2%	3		
6. SambagII (SWU)–SM–NBT, 01K									
Morning Peak	Direction 1	30.0	11.0	21.0	50.9%	97.1%	1	28%	1,297
Average	Direction 2	32.0	10.9	18.3	51.9%	87.7%	1		
Off-Peak	Direction 1	37.3	10.9	20.3	52.4%	96.6%	1		
Average	Direction 2	36.0	10.9	19.0	53.3%	91.9%	0		
Evening Peak	Direction 1	34.3	10.6	19.7	47.9%	90.1%	0		
Avg.	Direction 2	43.3	13.5	22.0	65.0%	102.6%	2		
7. Punta Engaño–N.B. Terminal MC via Mepza, 23I									
Morning Peak	Direction 1	26.0	9.5	17.7	59.3%	110.4%	3	39%	11
Average	Direction 2	17.0	7.7	12.0	47.9%	75.0%	0		
Off-Peak	Direction 1	11.0	5.6	8.7	35.3%	54.2%	0		
Average	Direction 2	18.0	7.6	12.0	47.7%	75.0%	0		
Evening Peak	Direction 1	31.3	8.1	16.3	50.8%	102.1%	3		
Average	Direction 2	26.0	9.0	14.3	56.1%	89.6%	1		
8. Pit-os, Talamban–Carbon, 62C									
Morning Peak	Direction 1	40.7	13.8	22.3	65.1%	106.1%	2	72%	372
Average	Direction 2	36.7	16.0	21.7	77.2%	103.8%	2		
Off-Peak	Direction 1	35.0	11.5	18.7	64.8%	103.8%	2		
Average	Direction 2	34.7	11.5	18.0	62.6%	97.7%	2		
Evening Peak	Direction 1	41.7	16.1	24.0	79.3%	118.1%	3		
Average	Direction 2	36.0	14.5	20.7	71.3%	101.4%	2		
9. Guadalupe–Carbon, 06B									
Morning Peak	Direction 1	24.3	9.8	16.7	48.3%	80.2%	1	28%	1,246
Average	Direction 2	30.3	12.0	20.0	55.6%	93.0%	2		
Off-Peak	Direction 1	19.3	6.5	11.7	36.5%	66.3%	0		
Average	Direction 2	25.0	9.0	15.3	39.7%	69.3%	0		
Evening Peak	Direction 1	23.0	12.2	19.3	60.2%	96.0%	2		
Average	Direction 2	21.3	8.4	14.0	41.5%	69.1%	0		
10. City of Carcar–Tabunok Talisay City, 46									
Morning Peak	Direction 1	44.3	12.5	17.3	69.5%	96.3%	2	39%	389
Average	Direction 2	33.0	12.9	17.3	71.6%	96.3%	2		
Off-Peak	Direction 1	38.3	7.8	12.7	43.5%	70.4%	0		
Average	Direction 2	31.0	10.7	15.0	59.7%	83.3%	0		
Evening Peak	Direction 1	44.3	14.0	20.0	77.9%	111.1%	2		
Average	Direction 2	38.0	11.7	16.7	64.9%	92.6%	1		
11. Inayawan–Colon, 11A									
Morning Peak	Direction 1	39.3	17.8	23.0	77.6%	100.0%	3	56%	756
Average	Direction 2	28.7	14.3	21.0	62.0%	91.3%	1		
Off-Peak	Direction 1	33.7	16.3	20.7	70.0%	89.2%	1		
Average	Direction 2	28.7	15.8	21.3	68.6%	92.8%	2		
Evening Peak	Direction 1	33.7	15.5	22.0	67.2%	95.7%	1		
Average	Direction 2	30.7	17.0	23.3	71.9%	98.6%	2		
12. Municipality of Minglanilla–Basak, 43D									
Morning Peak	Direction 1	63.0	10.3	16.7	44.9%	72.1%	0	11%	510
Average	Direction 2	-	-	-	-	-	-		
Off-Peak	Direction 1	81.7	11.8	21.3	50.2%	90.9%	1		
Average	Direction 2	-	-	-	-	-	-		
Evening Peak	Direction 1	91.0	12.3	21.0	49.9%	85.0%	0		
Average	Direction 2	-	-	-	-	-	-		
13. Ouano, Mandaue City–Cebu City, 22A									
Morning Peak	Direction 1	39.3	10.2	22.0	43.4%	92.6%	1	56%	202
Average	Direction 2	25.7	12.4	18.0	53.8%	78.0%	1		
Off-Peak	Direction 1	33.7	13.8	20.7	61.8%	93.5%	2		
Average	Direction 2	23.7	10.8	17.3	51.0%	81.6%	1		
Evening Peak	Direction 1	36.3	12.5	21.3	58.7%	100.1%	2		
Average	Direction 2	34.7	14.9	25.0	68.5%	113.9%	3		
14. Marigindon–Mandaue City, MI-02B									
Morning Peak	Direction 1	34.0	9.5	15.7	59.2%	97.9%	2	94%	288
Average	Direction 2	48.0	12.2	16.7	76.4%	104.2%	3		
Off-Peak	Direction 1	22.3	7.4	16.0	46.2%	100.0%	3		

		Pax			Load Factor		Number & Percentage of Samples whose Max Load Factor is more than 100%		Frequency (one way)
		Boarding	Onboard		Avg.	Max			
		Total	Average	Max.					
Average	Direction 2	26.7	10.4	16.3	65.3%	102.1%	3		
Evening Peak	Direction 1	44.3	8.9	16.0	55.7%	100.0%	3		
Average	Direction 2	47.3	9.5	16.7	59.7%	104.2%	3		
15. Municipality of Consolacion–Foodland via AS Fortuna, 24F									
Morning Peak	Direction 1	18.3	11.7	15.7	69.0%	92.6%	1		
Average	Direction 2	24.0	10.1	15.3	58.7%	89.3%	1		
Off-Peak	Direction 1	24.0	12.4	16.0	73.4%	94.4%	2	39%	22
Average	Direction 2	20.3	8.3	12.7	49.4%	75.6%	0		
Evening Peak	Direction 1	18.3	11.2	15.3	66.3%	90.7%	2		
Average	Direction 2	26.0	9.8	15.7	56.8%	92.2%	1		
16. Apas, Lahug–Carbon, 17B									
Morning Peak	Direction 1	51.0	10.6	19.7	51.3%	94.9%	2		
Average	Direction 2	27.3	11.4	18.0	58.8%	92.4%	1		
Off-Peak	Direction 1	49.3	13.7	23.3	66.1%	112.6%	2	56%	858
Average	Direction 2	38.0	10.1	17.3	50.7%	86.7%	0		
Evening Peak	Direction 1	38.0	15.1	21.0	75.5%	105.0%	2		
Average	Direction 2	49.3	17.9	26.7	86.8%	128.2%	3		
17. Ibabao, Mandaue City–Manalili, Cebu City, 21D									
Morning Peak	Direction 1	31.0	8.8	14.7	45.9%	76.4%	2		
Average	Direction 2	29.3	7.1	11.7	36.5%	60.2%	0		
Off-Peak	Direction 1	23.7	7.7	11.3	39.7%	58.2%	0	22%	428
Average	Direction 2	12.0	3.4	6.3	17.5%	32.6%	0		
Evening Peak	Direction 1	22.7	10.6	15.0	50.4%	73.6%	2		
Average	Direction 2	32.3	8.6	12.3	44.7%	62.8%	0		
18. Lahug–JY Square SM–Ayala, 04L									
Morning Peak	Direction 1	37.0	9.3	15.7	58.4%	98.1%	2		
Average	Direction 2	-	-	-	-	-	-		
Off-Peak	Direction 1	27.7	6.9	11.0	44.1%	69.2%	0	33%	1,138
Average	Direction 2	-	-	-	-	-	-		
Evening Peak	Direction 1	38.7	10.3	15.0	64.6%	94.0%	1		
Average	Direction 2	-	-	-	-	-	-		
19. Labangon–Colon, 12D									
Morning Peak	Direction 1	28.7	11.8	22.0	62.1%	115.2%	2		
Average	Direction 2	33.0	9.3	15.3	46.5%	78.5%	0		
Off-Peak	Direction 1	32.0	11.5	17.3	58.6%	88.9%	1	39%	1,532
Average	Direction 2	44.7	12.1	20.0	62.3%	104.4%	2		
Evening Peak	Direction 1	28.7	9.0	16.7	49.9%	92.6%	1		
Average	Direction 2	38.0	10.9	17.7	60.8%	98.1%	1		
20. Municipality of Liloan-Mandaue City Public Mrkt via ASF, 25									
Morning Peak	Direction 1	29.0	10.4	16.7	60.9%	98.0%	2		
Average	Direction 2	31.7	12.8	19.0	75.1%	111.8%	2		
Off-Peak	Direction 1	22.3	12.3	16.3	72.5%	96.1%	2	61%	1,445
Average	Direction 2	35.7	10.0	16.7	59.1%	98.0%	2		
Evening Peak	Direction 1	26.3	12.8	18.0	75.3%	105.9%	3		
Average	Direction 2	26.7	7.7	14.0	45.2%	82.4%	0		
21. Labangon–Ayala, 12L									
Morning Peak	Direction 1	33.3	13.0	19.0	51.6%	75.3%	0		
Average	Direction 2	25.3	10.2	16.0	39.3%	61.5%	0		
Off-Peak	Direction 1	21.0	10.8	14.0	46.8%	60.4%	0	0%	928
Average	Direction 2	23.0	8.3	13.3	33.8%	55.1%	0		
Evening Peak	Direction 1	24.7	13.0	17.7	53.8%	73.3%	0		
Average	Direction 2	27.0	11.9	18.7	50.0%	77.6%	0		
22. Bulacao-SM-Colon, 10H									
Morning Peak	Direction 1	29.3	13.8	19.3	63.1%	88.5%	1		
Average	Direction 2	41.3	14.2	22.7	65.4%	102.2%	2		
Off-Peak	Direction 1	29.7	14.2	19.7	54.6%	75.6%	0	44%	486
Average	Direction 2	43.0	14.8	22.0	56.9%	84.6%	0		
Evening Peak	Direction 1	31.3	18.0	23.7	83.4%	110.8%	2		
Average	Direction 2	36.7	21.3	26.7	99.2%	126.1%	3		
23. Campo, Lahug–Carbon, 04I									
Morning Peak	Direction 1	61.0	16.8	21.3	74.0%	94.3%	1	28%	748

			Pax			Load Factor		Number & Percentage of Samples whose Max Load Factor is more than 100%		Frequency (one way)
			Boarding	Onboard		Avg.	Max			
			Total	Average	Max.					
	Average	Direction 2	65.7	14.6	24.3	60.9%	101.4%	2		
	Off-Peak	Direction 1	47.0	10.5	16.0	49.7%	76.4%	0		
	Average	Direction 2	51.0	9.5	15.3	45.6%	72.6%	0		
	Evening Peak	Direction 1	42.7	11.2	16.3	53.2%	77.6%	1		
	Average	Direction 2	75.0	11.3	16.7	53.1%	80.1%	1		
24. Bulacao–Colon, 10F										
	Morning Peak	Direction 1	24.3	9.4	15.0	40.2%	64.2%	1		
	Average	Direction 2	29.3	13.0	21.0	63.5%	101.4%	3		
	Off-Peak	Direction 1	21.7	12.3	16.7	63.0%	85.4%	1	56%	854
	Average	Direction 2	25.7	13.7	22.3	64.3%	105.0%	3		
	Evening Peak	Direction 1	23.0	13.7	20.3	68.0%	100.4%	1		
	Average	Direction 2	31.7	14.8	20.3	65.1%	90.1%	1		
25. Mabolo–Carbon, 03A										
	Morning Peak	Direction 1	25.3	9.7	14.7	48.3%	73.3%	0		
	Average	Direction 2	38.0	11.7	20.0	58.3%	100.0%	2		
	Off-Peak	Direction 1	28.7	10.2	15.3	51.2%	76.7%	0	44%	649
	Average	Direction 2	33.0	6.6	15.3	34.7%	80.0%	1		
	Evening Peak	Direction 1	41.7	14.7	21.0	73.6%	105.0%	2		
	Average	Direction 2	41.0	13.8	20.0	73.7%	106.9%	3		
26. Municipality of Consolacion–Cebu City, 24										
	Morning Peak	Direction 1	31.3	12.5	17.0	65.9%	89.5%	1		
	Average	Direction 2	29.0	11.9	17.3	62.4%	91.2%	1		
	Off-Peak	Direction 1	32.0	11.7	17.7	61.5%	93.0%	1	28%	5
	Average	Direction 2	31.0	9.7	16.0	51.1%	84.2%	1		
	Evening Peak	Direction 1	24.7	10.4	16.3	54.6%	86.0%	0		
	Average	Direction 2	31.0	11.0	16.3	57.8%	86.0%	1		
27. Capitol–Ayala–Colon, 14D										
	Morning Peak	Direction 1	18.0	9.3	13.7	43.9%	63.9%	0		
	Average	Direction 2	25.0	10.2	15.3	50.0%	74.4%	1		
	Off-Peak	Direction 1	20.0	6.2	12.3	28.4%	56.0%	0	17%	898
	Average	Direction 2	24.7	7.7	12.7	36.7%	59.6%	0		
	Evening Peak	Direction 1	26.7	14.1	18.3	63.3%	82.2%	1		
	Average	Direction 2	33.7	10.8	16.3	49.9%	75.0%	1		
28. Guadalupe–BRodriguez–Carbon, 06C										
	Morning Peak	Direction 1	29.7	12.5	17.0	65.9%	89.5%	1		
	Average	Direction 2	20.0	9.0	12.7	47.3%	66.7%	0		
	Off-Peak	Direction 1	28.0	12.6	16.0	66.1%	84.2%	1	17%	58
	Average	Direction 2	19.3	8.4	11.0	44.4%	57.9%	0		
	Evening Peak	Direction 1	31.0	12.3	18.0	64.7%	94.7%	1		
	Average	Direction 2	19.0	8.7	12.0	45.9%	63.2%	0		
29. Alumnos–Colon, 08G										
	Morning Peak	Direction 1	23.7	9.7	17.0	48.7%	85.0%	0		
	Average	Direction 2	11.3	3.3	4.7	16.6%	23.3%	0		
	Off-Peak	Direction 1	13.0	5.1	8.0	25.7%	40.0%	0	0%	1,052
	Average	Direction 2	13.3	4.6	6.3	23.0%	31.7%	0		
	Evening Peak	Direction 1	18.3	4.6	7.3	23.2%	36.7%	0		
	Average	Direction 2	19.7	7.5	12.3	37.5%	61.7%	0		
30. Sabang, Danao City–Cebu City, 27										
	Morning Peak	Direction 1	45.0	17.9	21.3	68.9%	82.1%	0		
	Average	Direction 2	45.3	17.5	23.7	67.3%	91.0%	0		
	Off-Peak	Direction 1	45.3	16.5	22.0	63.5%	84.6%	0	6%	541
	Average	Direction 2	38.3	15.3	19.3	58.7%	74.4%	0		
	Evening Peak	Direction 1	39.7	17.7	22.7	68.1%	87.2%	1		
	Average	Direction 2	37.3	15.7	20.3	60.4%	78.2%	0		
31. South Expressway Terminal–Pier–Colon, 02B										
	Morning Peak	Direction 1	18.0	9.3	12.7	53.5%	72.4%	0		
	Average	Direction 2	15.7	7.2	11.3	41.3%	65.0%	0		
	Off-Peak	Direction 1	16.3	6.6	11.7	35.0%	62.4%	0	22%	521
	Average	Direction 2	15.3	7.2	12.0	38.6%	65.1%	0		
	Evening Peak	Direction 1	24.3	12.5	18.0	70.7%	102.0%	3		
	Average	Direction 2	29.3	10.4	17.0	56.8%	93.0%	1		

			Pax			Load Factor		Number & Percentage of Samples whose Max Load Factor is more than 100%		Frequency (one way)
			Boarding	Onboard		Avg.	Max			
			Total	Average	Max.					
32. Municipality of Liloan–Cebu City and Vice Versa 25										
	Morning Peak	Direction 1	34.0	9.7	18.0	47.6%	88.0%	0	39%	1,445
	Average	Direction 2	33.0	13.1	21.3	66.2%	107.9%	3		
	Off-Peak	Direction 1	20.0	6.3	12.3	32.4%	63.1%	0		
	Average	Direction 2	32.3	10.4	16.3	61.1%	96.1%	1		
	Evening Peak	Direction 1	24.3	12.2	19.3	63.6%	100.6%	2		
	Average	Direction 2	29.0	9.1	15.0	53.4%	88.2%	1		
33. Municipality of Compostela–Makro 26										
	Morning Peak	Direction 1	38.0	10.2	17.7	59.8%	103.9%	2	33%	645
	Average	Direction 2	29.3	9.9	16.0	58.0%	94.1%	1		
	Off-Peak	Direction 1	38.0	10.2	16.0	59.8%	94.1%	0		
	Average	Direction 2	41.3	9.9	16.7	58.5%	98.0%	1		
	Evening Peak	Direction 1	49.3	10.9	16.0	64.3%	94.1%	2		
	Average	Direction 2	36.0	9.8	14.3	57.6%	84.3%	0		
34. Guadalupe–Carbon, 06A										
	Morning Peak	Direction 1	60.7	9.0	18.0	50.2%	100.0%	2	33%	397
	Average	Direction 2	-	-	-	-	-	-		
	Off-Peak	Direction 1	51.3	8.1	14.0	45.1%	77.8%	0		
	Average	Direction 2	-	-	-	-	-	-		
	Evening Peak	Direction 1	68.7	8.4	17.3	46.6%	96.3%	1		
	Average	Direction 2	-	-	-	-	-	-		
35. MEPZ 2–Mandaue City, MI–04A										
	Morning Peak	Direction 1	16.7	9.8	13.7	57.6%	80.4%	2	94%	1,703
	Average	Direction 2	21.3	12.8	18.0	75.2%	105.9%	3		
	Off-Peak	Direction 1	18.7	9.6	17.7	56.3%	103.9%	3		
	Average	Direction 2	17.0	10.6	17.0	62.2%	100.0%	3		
	Evening Peak	Direction 1	20.3	13.1	17.0	77.0%	100.0%	3		
	Average	Direction 2	21.3	11.9	17.7	70.1%	103.9%	3		
36. Municipality of Compostela-Foodland Mandaue 26										
	Morning Peak	Direction 1	34.3	10.1	16.3	59.6%	96.1%	2	83%	645
	Average	Direction 2	33.7	12.5	18.0	77.0%	110.1%	3		
	Off-Peak	Direction 1	33.7	11.2	16.7	66.0%	98.0%	2		
	Average	Direction 2	42.0	12.0	18.7	70.8%	109.8%	3		
	Evening Peak	Direction 1	39.7	12.3	17.0	72.2%	100.0%	2		
	Average	Direction 2	42.7	11.4	18.0	67.0%	105.9%	3		
37. Punta Engaño–LLC PMarket via Mepza II MI-01A										
	Morning Peak	Direction 1	23.7	6.1	10.3	32.1%	54.4%	0	11%	83
	Average	Direction 2	22.7	6.6	11.7	35.0%	61.4%	0		
	Off-Peak	Direction 1	21.3	5.9	10.0	31.0%	52.6%	0		
	Average	Direction 2	19.0	5.9	9.7	30.9%	50.9%	0		
	Evening Peak	Direction 1	24.3	7.8	13.0	41.1%	68.4%	0		
	Average	Direction 2	28.3	8.9	16.0	46.7%	84.2%	2		
38. Municipality of Liloan–Country Mall, Cebu City, 25										
	Morning Peak	Direction 1	39.7	9.1	16.0	54.1%	95.4%	1	61%	1,445
	Average	Direction 2	34.3	13.0	20.7	75.9%	119.2%	3		
	Off-Peak	Direction 1	37.7	10.2	16.3	58.2%	92.9%	1		
	Average	Direction 2	36.0	10.6	18.0	63.9%	108.1%	2		
	Evening Peak	Direction 1	34.7	15.3	21.0	79.1%	108.4%	3		
	Average	Direction 2	31.3	13.8	18.7	68.3%	92.2%	1		
39. Tabunok–Cebu City, 41D										
	Morning Peak	Direction 1	23.3	13.0	20.3	67.9%	105.7%	2	39%	251
	Average	Direction 2	14.7	8.3	12.0	43.4%	62.6%	0		
	Off-Peak	Direction 1	23.7	12.2	19.7	59.3%	95.3%	1		
	Average	Direction 2	19.7	13.0	17.3	62.6%	83.3%	2		
	Evening Peak	Direction 1	23.7	13.8	19.3	66.7%	93.6%	1		
	Average	Direction 2	19.3	12.5	17.0	61.4%	83.2%	1		
40. Mepza, Lapu-Lapu City, 23D										
	Morning Peak	Direction 1	13.7	6.9	12.3	41.9%	75.2%	0	61%	250
	Average	Direction 2	19.7	14.8	17.0	90.4%	104.2%	3		
	Off-Peak	Direction 1	19.0	9.0	15.0	49.9%	83.3%	1		
	Average	Direction 2	22.0	14.2	20.7	67.8%	100.0%	3		

		Pax			Load Factor		Number & Percentage of Samples whose Max Load Factor is more than 100%		Frequency (one way)
		Boarding	Onboard		Avg.	Max			
		Total	Average	Max.					
Evening Peak Average	Direction 1	19.0	9.6	16.7	52.3%	90.8%	1		
	Direction 2	18.3	13.8	17.3	79.3%	100.0%	3		
41. Labangon–Colon–SM NBTerminal, 12I									
Morning Peak Average	Direction 1	35.7	13.6	21.7	59.0%	93.9%	2	11%	670
	Direction 2	21.3	5.5	9.7	31.8%	56.2%	0		
Off-Peak Average	Direction 1	28.0	10.0	15.0	43.2%	65.7%	0		
	Direction 2	24.7	8.2	16.0	39.5%	76.7%	0		
Evening Peak Average	Direction 1	29.3	8.3	13.7	41.7%	68.4%	0		
	Direction 2	27.3	9.3	15.3	50.8%	83.3%	0		
42. Mabolo–Carbon, 03B									
Morning Peak Average	Direction 1	15.7	8.5	13.3	48.5%	75.5%	1	22%	982
	Direction 2	24.3	9.8	16.0	55.9%	90.6%	0		
Off-Peak Average	Direction 1	21.7	10.0	15.7	53.7%	83.7%	0		
	Direction 2	33.0	15.0	19.7	62.6%	84.0%	2		
Evening Peak Average	Direction 1	27.3	11.3	15.7	62.4%	86.8%	0		
	Direction 2	34.0	12.9	16.7	69.5%	89.8%	1		
43 Labangon–SM, 12G									
Morning Peak Average	Direction 1	21.0	10.4	15.7	60.2%	90.3%	1	11%	500
	Direction 2	14.7	6.1	9.7	26.7%	42.4%	0		
Off-Peak Average	Direction 1	21.7	7.7	11.3	43.9%	65.0%	0		
	Direction 2	23.3	5.8	10.0	26.4%	45.9%	0		
Evening Peak Average	Direction 1	35.3	10.6	16.0	61.3%	92.3%	1		
	Direction 2	26.3	10.6	19.7	45.7%	85.0%	0		
44. Basak–Colon, 09F									
Morning Peak Average	Direction 1	26.3	12.4	19.0	64.5%	98.5%	1	17%	371
	Direction 2	18.7	9.6	14.3	48.1%	72.1%	0		
Off-Peak Average	Direction 1	20.7	8.3	12.3	44.7%	66.1%	0		
	Direction 2	12.3	5.9	9.7	31.3%	51.2%	0		
Evening Peak Average	Direction 1	30.3	10.7	16.7	55.5%	85.9%	1		
	Direction 2	15.7	9.3	13.7	48.4%	70.6%	1		
45. Apas, Lahug–Carbon, 17C									
Morning Peak Average	Direction 1	32.7	14.0	20.3	72.3%	106.2%	2	39%	398
	Direction 2	35.7	12.4	20.3	62.6%	103.4%	1		
Off-Peak Average	Direction 1	26.0	7.3	11.7	38.4%	61.4%	0		
	Direction 2	28.3	10.1	14.0	53.3%	73.7%	1		
Evening Peak Average	Direction 1	32.0	14.4	22.0	70.2%	107.6%	2		
	Direction 2	38.3	12.3	18.7	59.9%	91.1%	1		
46. MEPZ 2–MEPZ 1 via MVP Ave.–ML Quezon HiWay, MI-04B									
Morning Peak Average	Direction 1	16.7	7.3	14.7	45.7%	91.7%	0	11%	144
	Direction 2	13.0	6.4	11.3	40.0%	70.8%	0		
Off-Peak Average	Direction 1	21.7	7.8	13.7	48.7%	85.4%	1		
	Direction 2	8.3	3.9	7.7	24.3%	47.9%	0		
Evening Peak Average	Direction 1	17.7	6.6	14.0	41.1%	87.5%	1		
	Direction 2	15.7	6.7	13.3	42.0%	83.3%	0		
47. Mabolo–Carbon, 03L									
Morning Peak Average	Direction 1	23.7	6.8	12.3	37.6%	68.5%	0	11%	566
	Direction 2	17.3	7.3	10.0	40.3%	55.6%	0		
Off-Peak Average	Direction 1	25.3	8.4	12.7	41.6%	61.7%	0		
	Direction 2	19.7	8.6	13.7	42.6%	67.0%	1		
Evening Peak Average	Direction 1	31.0	10.9	16.7	60.4%	92.4%	1		
	Direction 2	27.7	8.9	14.0	49.1%	77.1%	0		
48. Kalunasan–Carbon via Osmeña Blvd, 15									
Morning Peak Average	Direction 1	9.3	4.0	8.0	17.4%	34.8%	0	17%	310
	Direction 2	22.3	10.7	19.7	46.3%	85.5%	0		
Off-Peak Average	Direction 1	16.3	6.5	13.0	28.4%	56.5%	0		
	Direction 2	28.3	14.1	22.3	61.2%	97.1%	1		
Evening Peak Average	Direction 1	24.3	11.2	18.0	48.6%	78.3%	0		
	Direction 2	42.0	18.3	25.7	79.5%	111.6%	2		
49. Danao City–Makro Mandaue City 27									
Morning Peak Average	Direction 1	27.7	16.4	24.0	70.1%	102.9%	3	39%	541
	Direction 2	40.7	15.3	22.0	66.8%	96.3%	1		

		Pax			Load Factor		Number & Percentage of Samples whose Max Load Factor is more than 100%		Frequency (one way)
		Boarding	Onboard		Avg.	Max			
		Total	Average	Max.					
Off-Peak	Direction 1	33.7	13.5	23.0	62.1%	104.7%	2		
Average	Direction 2	30.7	10.0	16.3	45.3%	74.4%	0		
Evening Peak	Direction 1	28.0	13.3	19.3	59.4%	87.5%	1		
Average	Direction 2	21.3	9.5	16.0	44.1%	74.3%	0		
50. Banawa–Carbon–Capitol 07B									
Morning Peak	Direction 1	40.3	11.3	21.0	51.1%	95.7%	1	33%	406
Average	Direction 2	-	-	-	-	-	-		
Off-Peak	Direction 1	42.0	10.1	19.0	44.2%	83.3%	1		
Average	Direction 2	-	-	-	-	-	-		
Evening Peak	Direction 1	45.7	13.3	21.7	56.7%	92.7%	1		
Average	Direction 2	-	-	-	-	-	-		
Cebu–Daanbantayan									
Morning Peak	Direction 1	21.0	15.4	20.0	48.3%	63.5%	0	0%	-
Average	Direction 2	18.0	13.6	18.0	37.5%	48.7%	0		
Off-Peak	Direction 1	17.0	14.1	16.7	36.0%	42.6%	0		
Average	Direction 2	32.7	18.7	29.0	46.3%	71.7%	0		
Evening Peak	Direction 1	32.7	27.6	32.3	69.1%	80.8%	0		
Average	Direction 2	31.0	23.4	28.3	59.9%	72.5%	0		
Parkmall–SM Seaside									
Morning Peak	Direction 1	13.3	7.3	13.3	17.3%	31.7%	0	0%	-
Average	Direction 2	7.0	3.7	6.3	8.7%	15.1%	0		
Off-Peak	Direction 1	23.3	9.3	20.3	22.1%	48.4%	0		
Average	Direction 2	15.7	8.1	13.3	19.4%	31.7%	0		
Evening Peak	Direction 1	35.3	12.1	25.7	28.8%	61.1%	0		
Average	Direction 2	28.7	14.6	25.3	34.6%	60.3%	0		
SM Cebu Parkmall									
Morning Peak	Direction 1	17.0	15.9	17.0	17.6%	18.9%	0	0%	-
Average	Direction 2	3.3	2.5	3.3	2.8%	3.7%	0		
Off-Peak	Direction 1	6.3	5.6	6.3	6.2%	7.0%	0		
Average	Direction 2	4.0	2.7	4.0	3.0%	4.4%	0		
Evening Peak	Direction 1	15.0	13.6	15.0	15.1%	16.7%	0		
Average	Direction 2	6.0	5.6	6.0	6.2%	6.7%	0		
My Bus Talisay Parkmall									
Morning Peak	Direction 1	62.3	37.9	61.7	42.1%	68.5%	0	11%	-
Average	Direction 2	17.3	9.3	15.7	10.4%	17.4%	0		
Off-Peak	Direction 1	45.0	21.6	37.0	24.0%	41.1%	0		
Average	Direction 2	27.7	13.0	21.7	14.5%	24.1%	0		
Evening Peak	Direction 1	46.3	24.6	45.3	27.3%	50.4%	0		
Average	Direction 2	89.3	47.7	85.7	52.9%	95.2%	2		
Danao Church to North Bus Terminal									
Morning Peak	Direction 1	43.7	23.1	35.3	55.2%	85.0%	1	33%	-
Average	Direction 2	46.7	28.0	41.0	71.2%	104.0%	2		
Off-Peak	Direction 1	39.7	27.6	36.0	74.9%	97.9%	2		
Average	Direction 2	19.0	9.4	15.0	24.5%	38.9%	0		
Evening Peak	Direction 1	42.7	23.3	33.3	59.1%	84.6%	0		
Average	Direction 2	36.3	22.6	35.7	60.1%	94.3%	1		
HY Bus-SM City North to Mactan Airport									
Morning Peak	Direction 1	26.7	16.4	25.3	58.4%	90.5%	1	33%	-
Average	Direction 2	13.3	4.8	9.0	17.3%	32.1%	0		
Off-Peak	Direction 1	22.3	14.9	20.0	53.1%	71.4%	0		
Average	Direction 2	22.3	13.6	21.3	48.4%	76.2%	1		
Evening Peak	Direction 1	32.7	20.3	32.0	72.4%	114.3%	3		
Average	Direction 2	51.3	30.1	49.0	76.5%	120.3%	1		
Sm Seaside Lawaan									
Morning Peak	Direction 1	6.7	2.8	5.3	6.6%	12.7%	0	0%	-
Average	Direction 2	28.3	17.7	28.0	42.1%	66.7%	0		
Off-Peak	Direction 1	7.0	4.2	6.0	10.1%	14.3%	0		
Average	Direction 2	14.7	9.3	14.7	22.1%	34.9%	0		
Evening Peak	Direction 1	27.3	17.0	25.0	40.5%	59.5%	0		
Average	Direction 2	13.7	8.1	12.3	19.3%	29.4%	0		
Cebu–Balamban									

			Pax			Load Factor		Number & Percentage of Samples whose Max Load Factor is more than 100%		Frequency (one way)
			Boarding	Onboard		Avg.	Max			
			Total	Average	Max.					
	Morning Peak Average	Direction 1	53.3	40.7	47.0	67.8%	78.3%	0	17%	-
		Direction 2	70.0	30.5	45.7	50.8%	76.1%	0		
	Off-Peak Average	Direction 1	37.7	24.1	31.0	40.2%	51.7%	0		
		Direction 2	54.7	32.6	39.3	54.3%	65.6%	0		
	Evening Peak Average	Direction 1	65.0	50.6	61.0	84.3%	101.7%	2		
		Direction 2	57.0	39.9	52.0	66.6%	86.7%	1		
Metro Cebu–Santander										
	Morning Peak Average	Direction 1	43.3	24.6	31.0	43.9%	55.3%	0	0%	-
		Direction 2	46.7	31.9	42.7	56.8%	75.7%	0		
	Off-Peak Average	Direction 1	43.3	36.6	39.7	63.0%	68.3%	0		
		Direction 2	42.3	31.9	39.0	54.9%	67.2%	0		
	Evening Peak Average	Direction 1	57.0	38.3	45.0	68.4%	80.1%	0		
		Direction 2	48.7	33.2	40.3	59.7%	72.5%	0		
Carcar–Cebu										
	Morning Peak Average	Direction 1	40.7	22.3	27.0	40.5%	49.1%	0	6%	-
		Direction 2	42.7	29.5	34.0	53.7%	61.8%	0		
	Off-Peak Average	Direction 1	27.7	14.3	19.7	26.0%	35.8%	0		
		Direction 2	32.3	24.4	27.7	44.3%	50.3%	0		
	Evening Peak Average	Direction 1	34.3	22.5	27.0	40.9%	49.1%	0		
		Direction 2	45.0	27.1	35.3	49.2%	64.2%	1		

Source: JICA Project Team

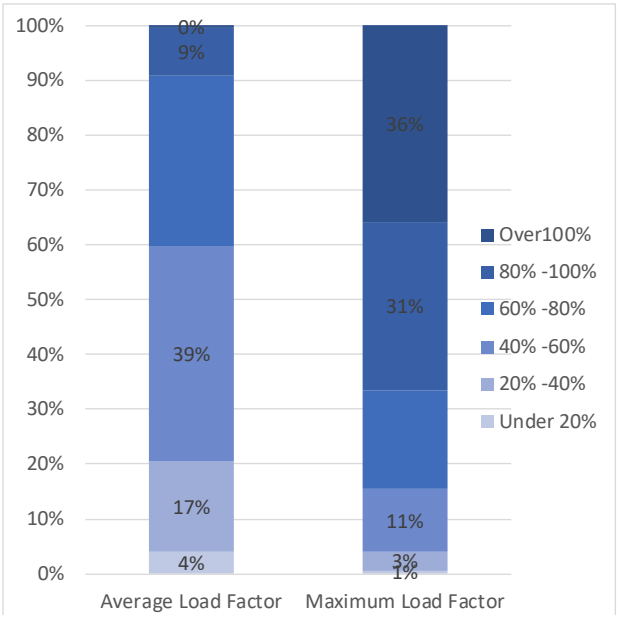
(2) Demand Analysis

The scatter plot between maximum and average load factor is shown in Figures 4.4.1 and 4.4.2. The maximum congestion rate of samples of most of the routes ranges from 50% to 120%, and the average occupancy is distributed between 30% to 80%. The number of samples with the highest congestion rate of over 80% accounts for over 60%. The number of samples with the highest congestion rate of over 100% accounts for over 36%. It turns out that many among the samples carry many passengers.



Source: JICA Project Team

Figure 4.4.1 Scatter Plot Between Maximum and Average Load Factor

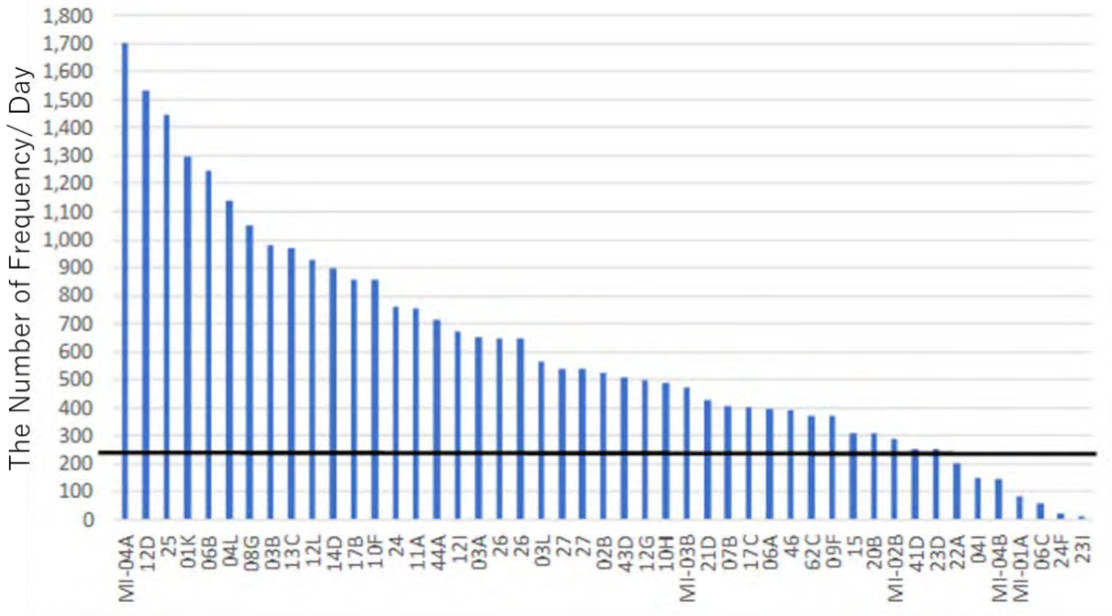


Source: JICA Project Team

Figure 4.4.2 Ratio of Surveyed Samples by Load Factor

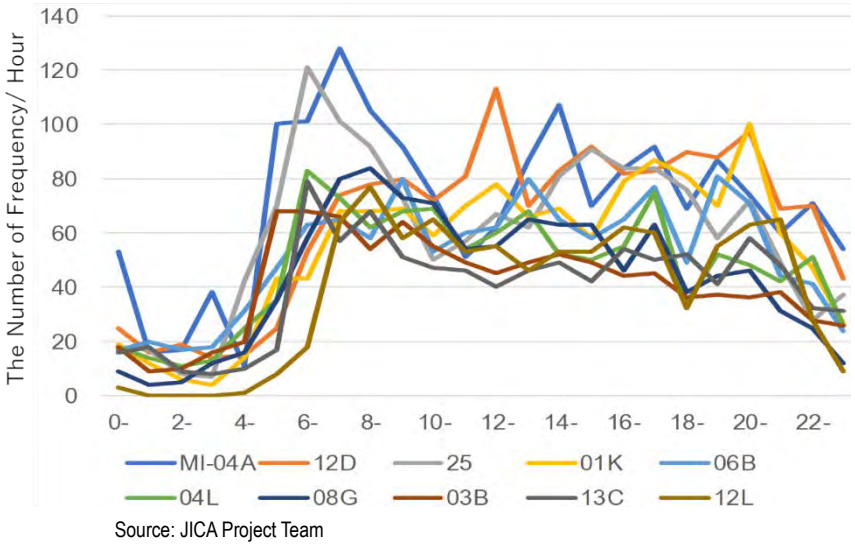
(3) Analysis of the Volume of Supply

Figure 4.4.3 shows the number of frequency by route. Most of the target routes operate more than 300 lines/day in this day. This is the operation with considerable frequency. Despite a certain level of supply volume, the route is crowded. Therefore, it is considered that the demand exceeds the mode's transport capacity. In addition, Figure 4.4.4 shows the hourly fluctuation of frequency by major routes. Although there is a peak in the morning time zone, it turns out that there is a considerable number of operations even during daytime.



Source: JICA Project Team

Figure 4.4.3 Number of Frequency by Route

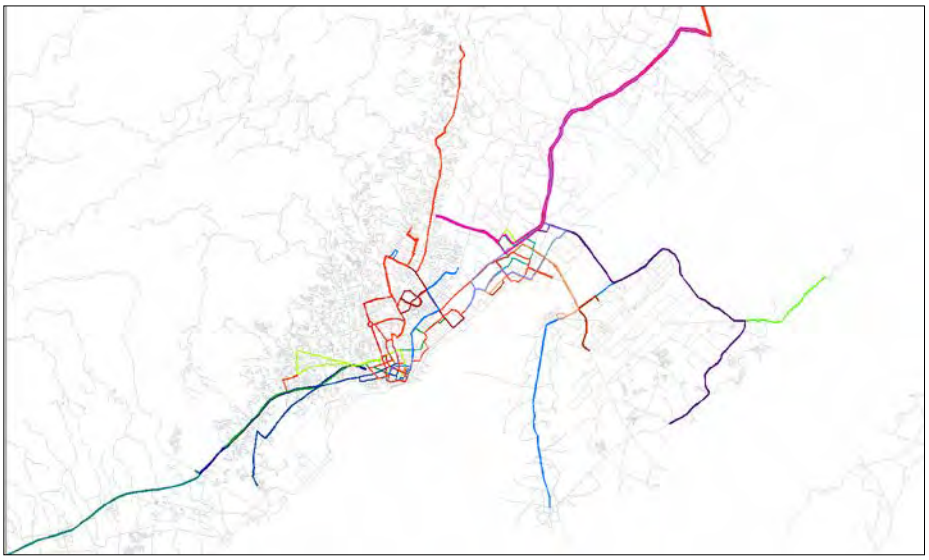


Source: JICA Project Team

Figure 4.4.4 Hourly Fluctuation of Frequency by Major Route

(4) Routes with Large Volumes of Supply and Demand

Routes with many operations and samples that have over 100% congestion rate was the focus of this analysis. The target routes are shown in Figure 4.4.5. Most routes are from the south to the center of Cebu, from the north side to the center of Cebu, connect Mactan Island to the center of Cebu, connect Tarampan to the center of Cebu, and in the central route of Cebu. Looking at the congestion rate of the road shown in Figure 4.3.8, the roads these routes run are crowded. Therefore, it is plausible that PUV is one factor of road congestion.



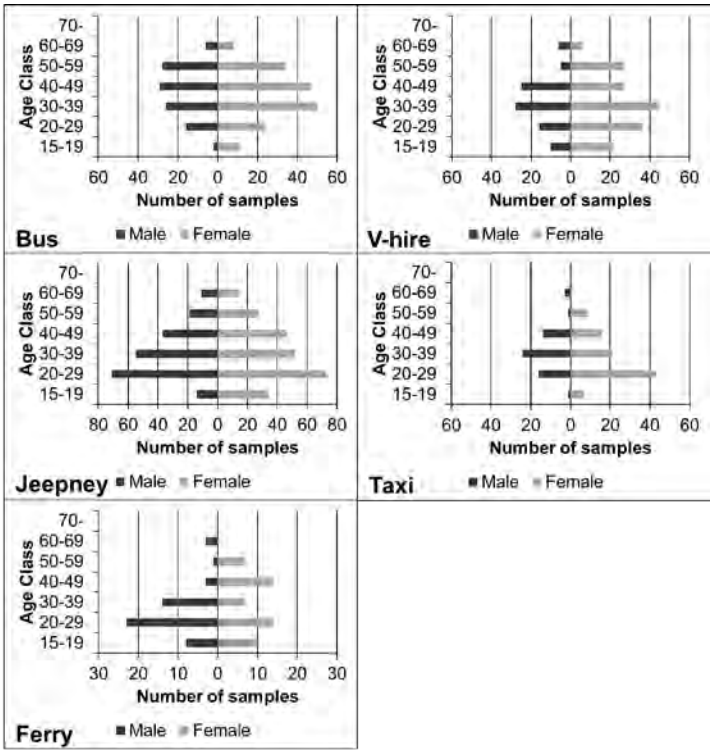
Source: JICA Project Team

Figure 4.4.5 PUV Routes with High Load Factor and Frequency

4.5 Result of the Public Transport Passenger Interview Survey

1) Attributes of Sample by Age and Sex

Figure 4.5.1 shows the number of respondents by gender and age class.



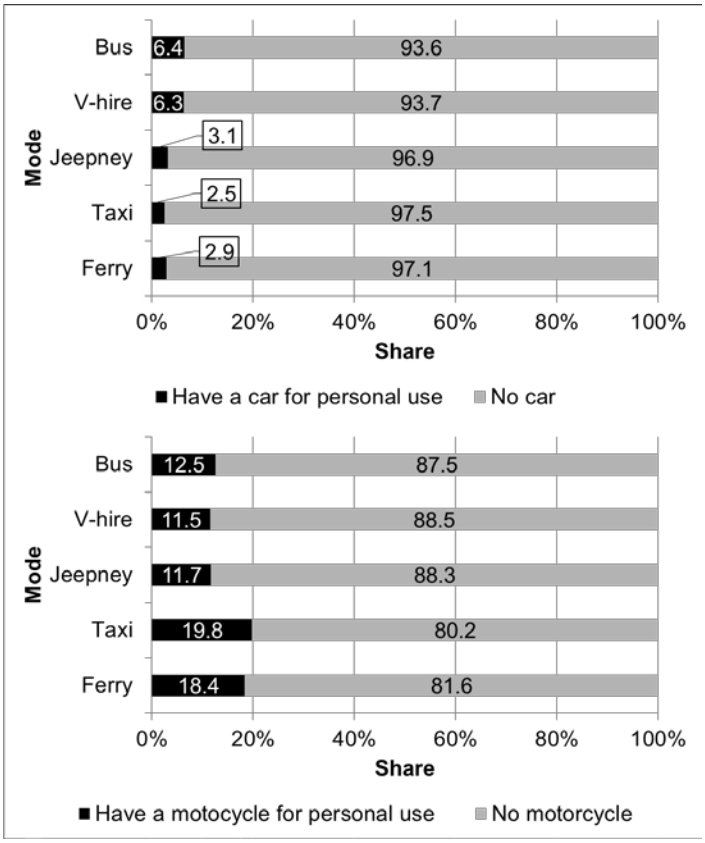
Note) This result does not have to be the same as actual passengers' profile since the survey can be biased by survey location.

Source: JICA Project Team

Figure 4.5.1 Number of Collected Samples by Respondents' Gender and Age Class and Mode

2) Car and Motorcycle Ownership of Passengers

Figure 4.5.2 shows the patronage of public transport system by car- and motorcycle-owning respondents. Around 4% of interviewees have a car for personal use. Around 19% of interviewees that wait for ferry and taxi have a motorcycle for personal use. At the same time, around 12% of interviewees that wait for jeepney, V-hire, and bus have a motorcycle for personal use. The passenger survey results show that people with privately-owned vehicles still intend to use the public transport. The public transport system should provide more comfortable and quality services to attract these passengers.

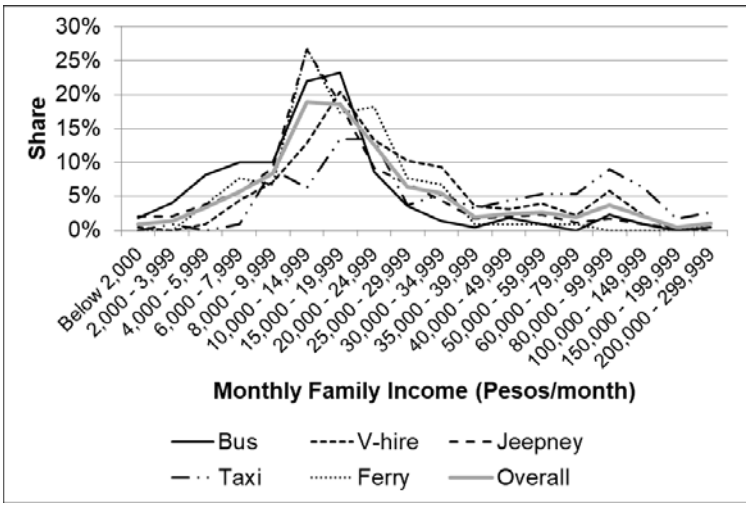


Source: JICA Project Team

Figure 4.5.2 Car and Motorcycle Ownership

3) Distribution of Monthly Family Income

Figure 4.5.3 and Table 4.5.1 shows the distribution of monthly family income of passengers by transport mode and overall. According to the results of this survey, public transport is also an important infrastructure for the lower income citizens. Passengers with a monthly family income of less than Php10,000 account for about 20%, which is one-fifth of the total. In light of the rising prices of fuel, vehicle maintenance costs, and other items over the years, the public transport system must retain affordable fare rates to protect the citizens' free movement.



Source: JICA Project Team

Figure 4.5.3 Distribution of Monthly Family Income

Table 4.5.1 Distribution of Monthly Family Income

Monthly Family Income (Php/month)	Bus	V-hire	Jeepney	Taxi	Ferry	Overall
Below 2,000	2%	0%	2%	0%	0%	1%
2,000–3,999	4%	0%	2%	1%	0%	1%
4,000–5,999	8%	1%	4%	0%	4%	3%
6,000–7,999	10%	4%	6%	1%	8%	6%
8,000–9,999	10%	7%	9%	9%	7%	8%
10,000–14,999	22%	13%	27%	6%	27%	19%
15,000–19,999	23%	20%	19%	13%	17%	19%
20,000–24,999	9%	13%	9%	13%	18%	13%
25,000–29,999	4%	10%	7%	4%	8%	6%
30,000–34,999	1%	9%	4%	5%	7%	5%
35,000–39,999	0%	4%	2%	3%	1%	2%
40,000–49,999	2%	3%	2%	4%	1%	2%
50,000–59,999	1%	4%	2%	5%	1%	3%
60,000–79,999	0%	2%	1%	5%	1%	2%
80,000–99,999	2%	6%	2%	9%	0%	4%
100,000–149,999	1%	2%	1%	6%	0%	2%
150,000–199,999	0%	0%	0%	2%	0%	0%
200,000–299,999	0%	0%	1%	3%	1%	1%

Source: JICA Project Team

4) Passengers' Opinions on the Current Level of Public Transport Services

The survey asked for passengers' opinions on the current level of public transport services based on 15 criteria that used a five-point rating scale with 1 as the lowest and 5 as the highest. The average scores in each mode, compared with the results of the Roadmap Study in 2014, are shown in Figure 4.5.4. The results suggest the following points:

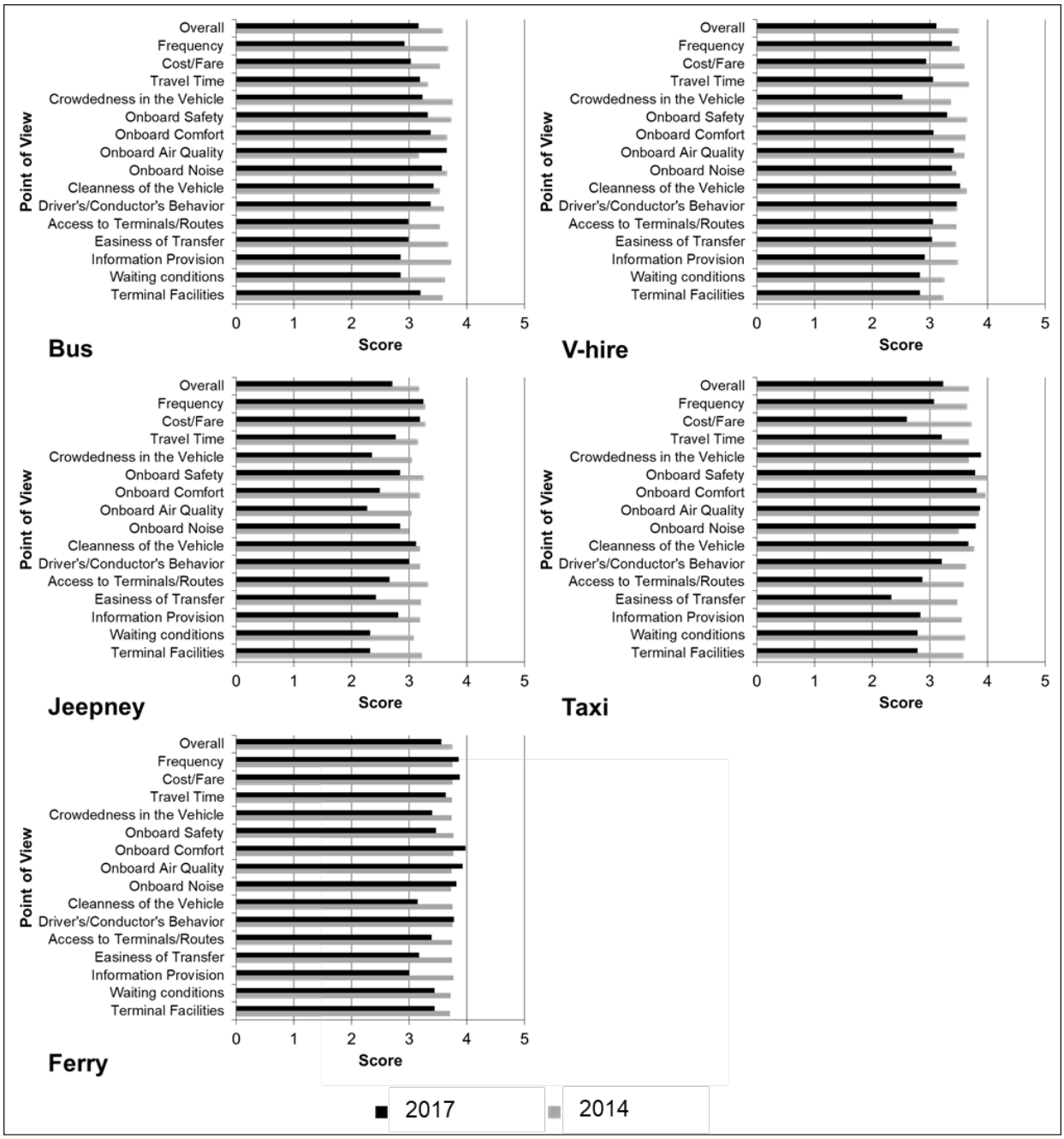
(a) Compared with 2014 data, passengers' satisfaction levels for each transport service became somewhat lower or still the same.

(b) The overall evaluation for bus was slightly above 3, which was not a satisfying level for passengers in all aspects. This was worse than 2014 data. The satisfaction levels for terminal facilities and waiting conditions were particularly low therefore needing improvements.

(c) The satisfaction level for V-hire was also low and the overall evaluation was slightly higher than 3. In particular, it is necessary to improve the situation of crowdedness in the vehicle, terminal facilities, and waiting conditions.

(d) Passengers were less satisfied with the jeepney than bus and V-hire with only 4 items that exceed 3 points. Jeepney conditions need to be improved in almost all aspects, particularly, the terminal facilities, waiting conditions, easiness of transfer, onboard air quality, and crowdedness in the vehicle. Satisfaction level for terminal facilities declined greatly to about 30%.

(e) The satisfaction level for taxi also declined to about 30% especially in terms of transportation convenience and cost. Chronic congestion and rise in fare might be some of the causes for this low evaluation.



Source: JICA Project Team

Figure 4.5.4 Assessment of Current Level of Public Transport Services

4.6 Intersection Analysis

1) Method of Analysis

(1) Precondition

(i) PCU

In this analysis, the traffic volume counted by vehicle type was converted into PCU by using the conversion factors shown in Table 4.6.1.

Table 4.6.1 PCU by Vehicle Type

Bicycle	Motorcycle	Car/Jeep/	Pedicab	Tricycle	Taxi	Jeepney	Multi-cab
0.25	0.33	1.00	0.25	0.50	1.00	1.50	1.50
UV Exp/ Vhire	Mini-bus	Std. Bus	School/Co. Bus	Delivery Van/P-up	Truck	Trailer	Others
1.50	2.00	2.50	2.00	1.50	2.50	3.00	1.00

Source: JICA Project Team

(ii) Setting of Saturation Flow Rate

The following saturation flow rates were used for the conversion:

Straight through traffic flow: 2,000 (PCU/1-hour green signal).

Left and/or right turning traffic flow: 1,600 (PCU/1-hour green signal).

(2) Calculation Method of Degree of Saturation

In the calculation of the degree of saturation, traffic volume by lane is required, but in this survey, it was measured by the total number of lanes. Therefore, on the premise that the lane change was made to balance the level of congestion at each lane of each approach, the degree of saturation was calculated after calculating the total number of vehicles by each flow-out direction.

Following is an example of this calculation:

The calculation of the degree of saturation by each lane. Terms are below:

The number of approach lanes is 4;

Left turn volume is 400 (PCU/1-hour green time);

Right turn volume is 500 (PCU/1-hour green time);

Straight-through volume is 1200 (PCU/1-hour green time).

The l degree of saturation per one lane

= [(400 ÷ 1600) + (500 ÷ 1600) + (1200 ÷ 2000)] ÷ 4 = 0.2906

If the most in-side lane is an exclusive left-turn lane, this lane must be calculated separately from the other three lanes, as follows:

Degree of saturation of left-turn exclusive lane = 400÷1600 = 0.25

Degree of saturation of other 3 lanes = [(500 ÷ 1600) + (1200 ÷ 2000)] ÷ 3 = 0.3042

(3) Calculation Method of Optimum Cycle Length

The optimum cycle length was calculated by using the most common Webster's formula shown below:

$C_o = (1.5\ L + 5) \div (1 - \rho)$

L: Loss time by changing signal phase (sum of yellow signal time and all red signal time)

$C_o = (1.5\ L + 5) \div (1 - \rho)$

L: Loss time by changing signal phase (sum of yellow signal time and all red signal time)

Here, it is assumed that L = 5 (sec/phase)

ρ : degree of saturation for 1 cycle （=Σ ρ_i:）

ρ_i: degree of saturation for phase i

i : signal phase number i

The maximum value of optimum cycle length was set to 240 sec and the minimum value was at 90 sec. In the calculation results, there were cases that the degree of saturation was 1.0 that it became impossible to calculate. In those cases, however, the maximum value was applied to the calculation result.

(4) Considerations

In the analysis, there were some cases when the degree of saturation exceeded 1.0, but that is impossible based on the definition of the degree of saturation. Instead, the following are possible causes.

(a) Accuracy of the conversion factors for each type of vehicle to PCU. Although the degree of saturation uses the values in Table 2, it is assumed that this value is different from the actual situation. Reviewing the conversion factors should be listed as a future issue.

(b) Setting the value of saturation flow rate. When left or right-turning flow at 1,600 PCU/h and straight through flow at 2,000 PCU/h were applied, the verification of the validity of this is also subject to examination in the future.

In recognition of the existence of the subject relating to the degree of saturation as described above, the features related to relative value instead of absolute value was discussed in the following.

2) Results of Analysis

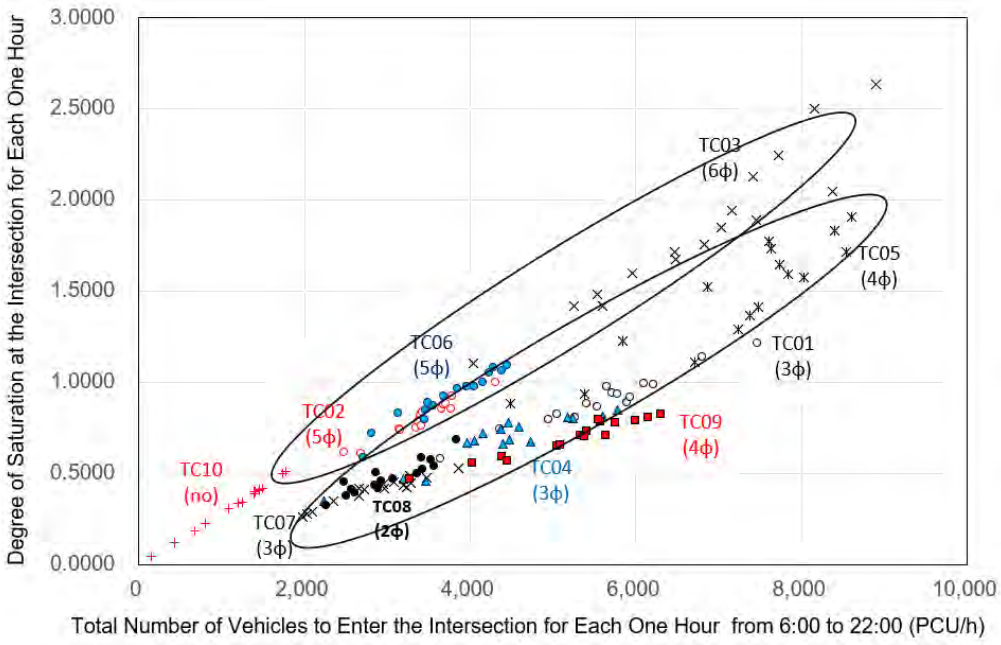
(1) Relationship between the Total Number of Vehicles to enter the Intersection and the Degree of Saturation by Intersections

The location of analyzed intersections, relationship between the total number of vehicles to enter the intersection (total traffic volume), and degree of saturation by intersections are shown in Figures 4.6.1 and 4.6.2. As the total traffic volume increases, the degree of saturation tends to increase. The degree of saturation is higher at intersections with more signal phases and lower at intersections with less signal phases.



Source: JICA Project Team

Figure 4.6.1 Location of Analyzed Intersections



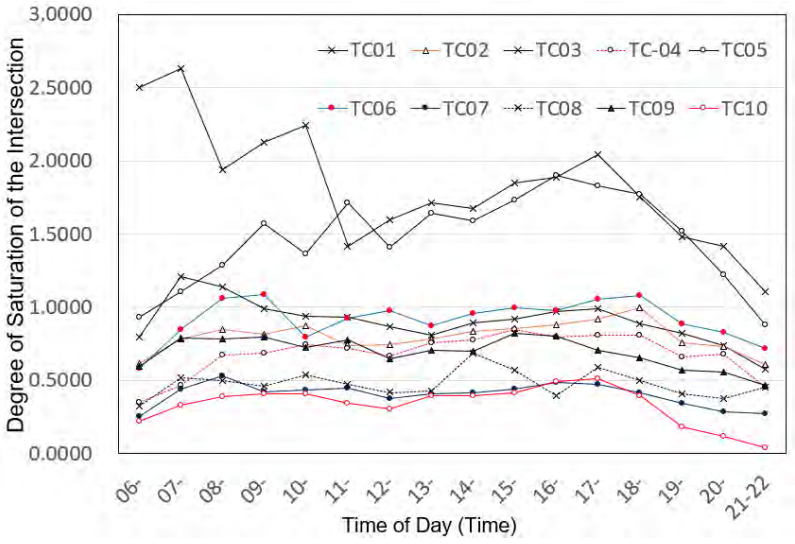
Note: TC - traffic count

Source: JICA Project Team

Figure 4.6.2 Relationship Between Total Traffic Volume to Enter Intersection and the Degree of Saturation by Intersections

(2) Time Variation of the Degree of Saturation

The time variation of the degree of saturation is shown in Figure 4.6.3. The degree of saturation greatly differs according to the time. In particular, the shift of the intersections TC03 and TC05 is remarkable, and the level of saturation from 6:00 to 11:00 is remarkably higher than in other time zones at intersection TC03.

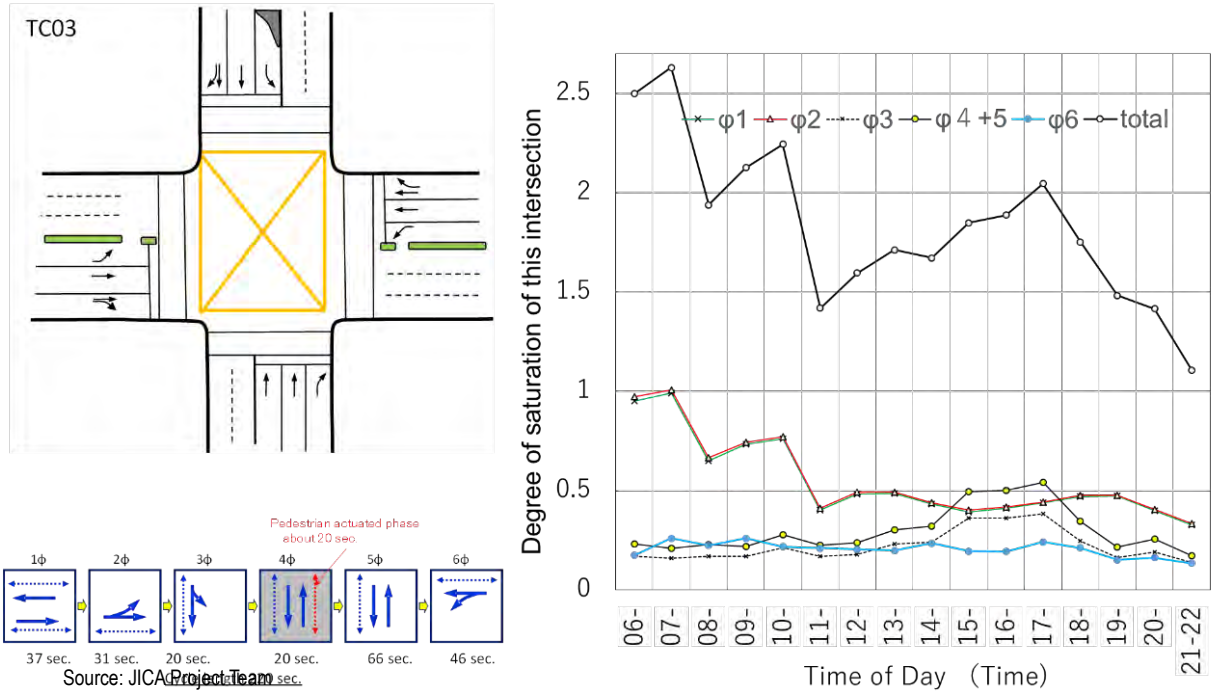


Source: JICA Project Team

Figure 4.6.3 Time Variation of the Degree of Saturation (TC03)

(3) Time Variation of the Degree of Saturation by Signal Phases and Intersections

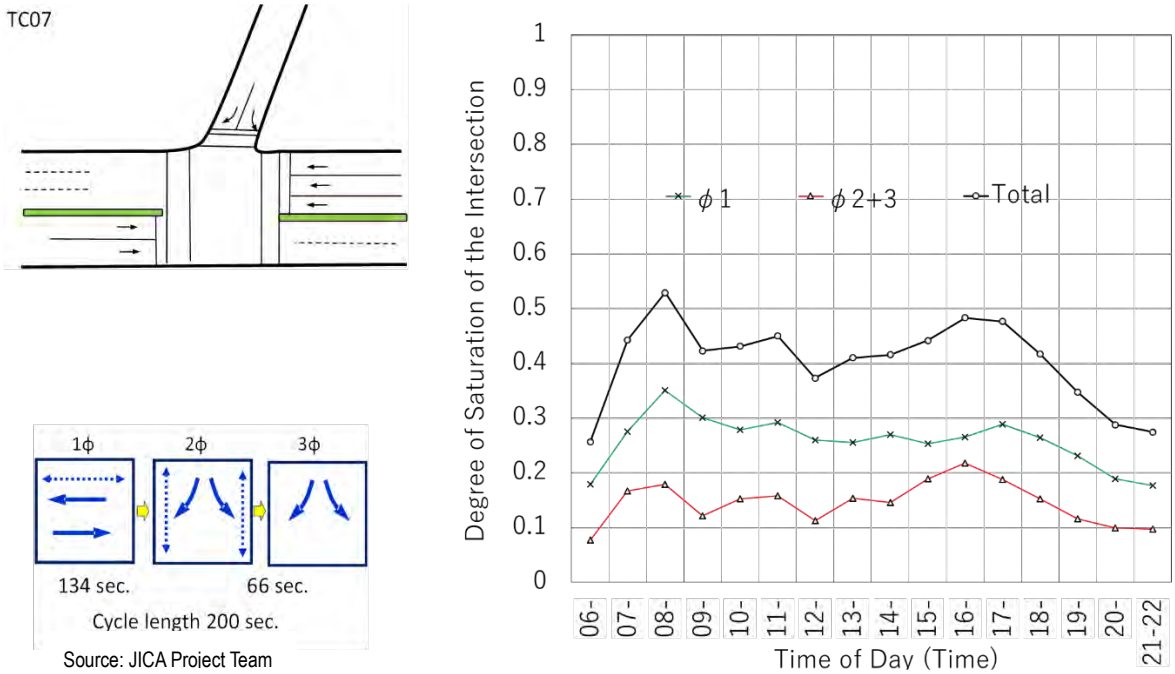
Figures 4.6.4 to 4.6.6 show the time variation of the degree of saturation by signal phases at intersections TC3, TC07, and TC09. The degree of saturation exceeds 1.0 the whole time from 6:00 to 22:00 at the intersection TC3. Particularly, the degree of saturation is high during the first and second phases from 6: 00 to 11: 00, but this is low during other phases. Therefore, it is important to consider the countermeasures to adjust the balance between the degree of saturation at the first and second phases from 6: 00 to 11: 00. The degree of saturation is expected to be balanced and possibly suppressible to less than 1.0 during other time zones by this type of adjustment. If the problem cannot be solved by the adjustment as described above, it is necessary to revise the phasing itself.



Source: JICA Project Team

Figure 4.6.4 Time Variation of the Degree of Saturation by Signal Phases (TC03)

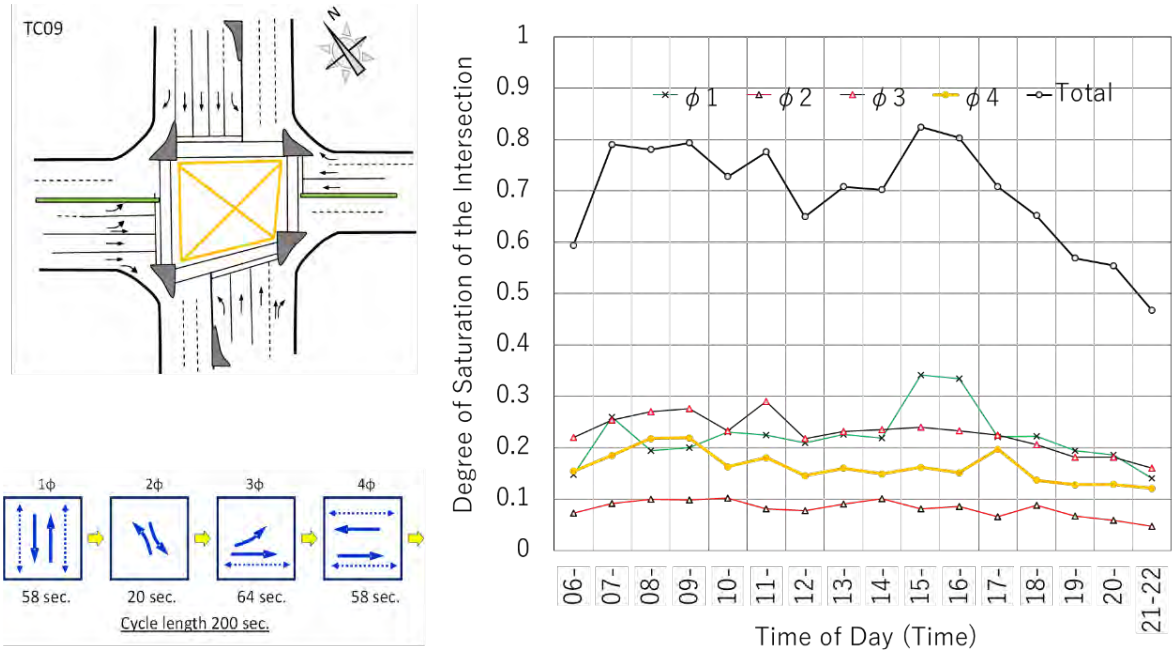
TC07 has no problem at all from the viewpoint of traffic treatment because the degree of saturation for each phase is less than 1.0. However, the degree of saturation is high during first phase and the degree of saturation is low during second phase. Therefore, more balanced traffic control becomes possible by considering countermeasures at the viewpoint of adjusting the balance of the degree of saturation between phases.



Source: JICA Project Team

Figure 4.6.5 Time Variation of the Degree of Saturation by Signal Phases (TC07)

The degree of saturation at TC09 was less than 1.0 the whole time. In addition, the degree of saturation at each phase is almost consistent except during the second phase. However, there is a tendency that the degree of saturation becomes high by increasing the number of phases. Therefore, there is a possibility that the degree of saturation can be further suppressed by reviewing the phasing that is not only the number of phases but also the contents of each.



Source: JICA Project Team

Figure 4.6.6 Time Variation of the Degree of Saturation by Phases (TC09)

The same analysis was conducted at other intersections and countermeasures were tabulated (see Table 4.6.2), which are considered to be the most important for the problem at each intersection. At any intersection, either the review of present signal phasing or balanced adjustment of the degree of saturation between signal phases is necessary. Furthermore, the review of cycle length is necessary at all intersections. On the other hand, regarding the prerequisites for signal control, it is essential to arrange regulation signs, guidance signs, pavement markings, road surfaces themselves, or review them.

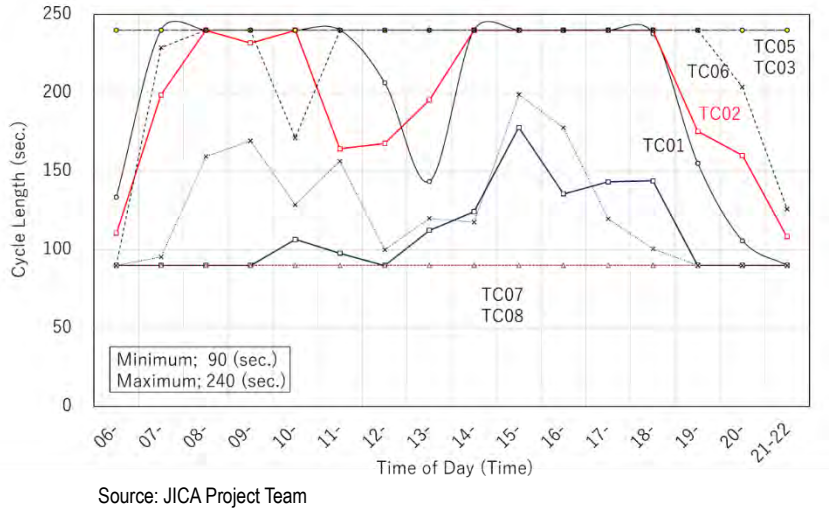
Table 4.6.2 Most Important Countermeasures for the Issues on Current Signal Control

Intersection	Phasing	DS balance	Cycle length
TC01		✓	✓
TC02	✓		✓
TC03	✓	✓	✓
TC04		✓	✓
TC05	✓	✓	✓
TC06	✓		✓
TC07		✓	✓
TC08		✓	✓
TC09	✓		✓

Source: JICA Project Team

(4) Optimum Cycle Length by Intersection and Time Zone

Figure 4.6.7 shows the time variation of optimum cycle lengths by intersection. TC03 and TC05 have the maximum cycle length for whole-time zones, and TC07 and TC08 have the minimum cycle length for whole-time zones. In these intersections, the signal is not functioning because the degree of saturation is more than 1.0 or very low. Measures to reduce the degree of saturation are necessary for intersections with long signal cycle. Sometimes, it is useful to use no signal control or introduce actuated signal control at the intersection where level of saturation is low.

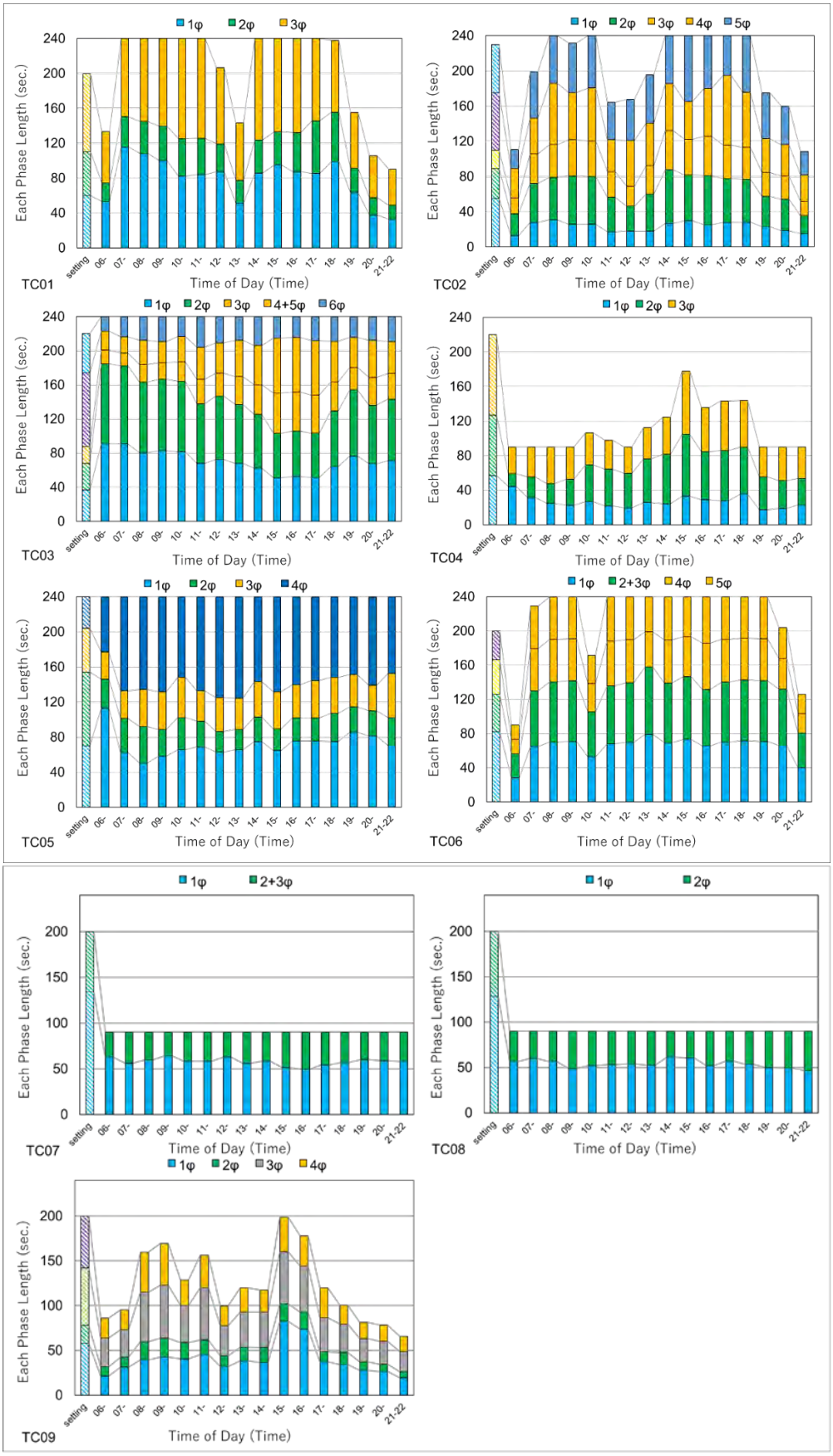


Source: JICA Project Team

Figure 4.6.7 Time Variation of Optimum Cycle Length (Estimated Value) by Intersections

(5) Time Variation of Each Phase Length by Intersections

Figure 4.6.8 shows the estimated value of each phase length at each intersection and at different times. The sum of each phase length is the optimum cycle length. There are differences in each phase length that depends on cycle length by time zone at each intersection. It is necessary to adjust cycle length and each phase length to finely correspond to the time shift in actual signal control.



Source: JICA Project Team

Figure 4.6.8 Time Variation of Optimum Cycle Length and Each Phase Length (Estimated Value) at Intersections

Summary of the time variation of actual situation of optimum cycle length and each phase length at each intersection aided in the determination of effective signal control methods for each intersection (listed in Table 4.6.3). Selection of a control method that corresponds to the traffic situation at each intersection when signal control is performed effectively is important. Therefore, it is essential to investigate the traffic situation and data analysis data before the signal settlement.

Table 4.6.3 Considerable Appropriate Signal Controls

Intersection	Fixed-time	Macro-actuated	Micro-actuated	Vehicle or Pedestrian actuated
TC01		✓	✓	
TC02		✓	✓	
TC03	✓			✓
TC04		✓		
TC05		✓	✓	
TC06		✓		✓
TC07	✓			✓
TC08	✓			
TC09		✓		

Source: JICA Project Team

Fixed-time signal control. Signal control by cycle length and split (signal phase) for each time zone is predetermined based on the traffic volume.

Macro-actuated signal control. Signal control by readjusting the setting value of phase lengths is predetermined by the fixed time intervals based on the traffic volume data by the sensor.

Micro-actuated signal control. Signal control by determining the termination timing of current signal phase based on traffic arrival patterns measured by sensor. This control is normally optional to add macro-actuated signal control.

Vehicle- or pedestrian-actuated signal control. In this control, usually the traffic light does not turn on or just flashes yellow light, but makes traffic lights go red and the green light corresponds to the condition. The condition is such when the pedestrian cross walking button is pushed and when traffic inflow from a cross road is detected.

5 EXISTING URBAN TRANSPORT INSTITUTIONS IN METRO CEBU

5.1 Institutional System of Urban Transport Development

1) Overall Picture of Roles and Functional Responsibilities of Transport Sector

Roles and functional responsibilities of urban transport development and management are divided into two tiers, those under the national government agencies and local government units. Local Government Code indicates that transport planning and traffic management of the jurisdiction of local government units are the responsible of respective local government units, while national government agencies cast policies and measures on urban transport development and provide guidance for transport management. The DOTr is the main national agency to govern all transport modes, land, sea and air transports. Yet, unlike the DPWH, it does not have any regional offices, but project management unit/office, which is merely a project base and not a permanent office. The main function on urban transport development and management of the DOTr is to make policies, measures, programs and guidelines, as well as design road network and any other land-based transport, such as bus rapid transit, railway, mass rapid transit and so on.

Urban transport development covers roads, railways, public utility vehicles, supporting transit infrastructure, traffic management, and TOD in recent transport development planning. Table 5.1.2 shows an overall picture of roles and functional responsibilities of urban transport development related agencies from the perspectives of planning, regulation, fare and marketing, infrastructure development, asset management, operation and management, and law enforcement. It is understood that some components could be further itemized pursuant to the functions vested to agencies by law, regulations and ordinance, but for the purpose of simplicity, the table shows the most salient features of respective assignments. The table was made based on desk research; thus, a further scrutiny is needed in due course of the project.

At present, road-based public transportation is the dominant mode of land-based transportation; thus, an integration planning and strategy of different transport modes is not much taken into consideration. In future, however, when a mass transit is introduced, it is important to design such integrated transport plan and to determine an accountable organization for planning, regulating and monitoring the operations.

Although the table does not explicitly illustrate it, law enforcement on traffic is somehow complicated in the Metro Cebu area. Except 4 LGUs, namely Lapu-Lapu City and City of Carcar, and the Municipality of Cordova and San Fernando, LGUs have their own traffic code and/or ordinances on traffic violations. Traffic enforcers of LGUs, the LTO, the LTFRB and the police have authority respectively to apprehend and to ticket to drivers subject to their vested authority. The Sub-Committee on Transport and Traffic Management of the MCDCB has strived to harmonize the traffic codes among the LGUs in Mega Cebu.

DOTr has launched Public Utility Vehicle Modernization Program (PUVMP) in June 2017, and issued Department Order No. 2017-011 regarding OFG, and Joint Memorandum Circular No.001 series of 2017 (2017-01) regarding Guidelines on the Preparation and Issuance of Local Ordinances, Orders, Rules and Regulations concerning the Local Public Transport Route Plan (LPTRP), in coordination with the DILG.

This sequence of regulations has changed the functional demarcation between DOTr (LTFRB) and LGUs dramatically. The new department order requests cities and municipalities to plan their own PUV route plan for intra-city, and provincial governments to plan for travel between component cities and municipalities within the province.

In case of the Metro Cebu area, consisting highly urbanized cities, component cities and municipalities under Cebu Province, it is not easy to demarcate by administrative boundaries because identification of public transport supply gaps and public transport planning between and among independent cities (presumably highly urbanized cities are included in this classification considering the hierarchy of local government administrative structure), provinces, cities and municipalities shall be the responsibility of the DOTr. Whether highly urbanized cities are classified in independent city is needed to clarify with the DOTr. If it is, then the formulation of LPTRP must be vested in the DOTr, otherwise, each highly urbanized city shall formulate the LPTRP, and the DOTr shall be responsible for the LPTRP for between and among three highly urbanized cities, considering provincial governments are only responsible for between and among component cities and municipalities within the province, according to the Omnibus Guidelines.

2) Central Government Agencies

Central government agencies are divided into two major functions, the former is a planning, and the latter is public administration and management. The DOTr makes plans and its attached agencies, such as the Land Transportation Office (LTO), the LTFRB, Toll Regulatory Board (TRB) among others executes policies and measures determined by the DOTr. The DPWH and its regional offices implement public works, such as the construction of roads, bridges, toll roads and so on. The DPWH builds and maintains national highways, toll roads and bridges which cross municipal and/or provincial borders as well as carries out projects considered as national strategic projects, which are approved by NEDA.

Department of Transportation

Table 5.1.1 shows the functions and responsibilities of the DOTr.

Table 5.1.1 Excerpt of Functions of the DOTr

Functions	− Promote the development and coordinated networks of transportation and communications systems; − Guide government and private investment in the development of the country's inter- model transportation and communication systems in a most practical, expeditious, and orderly fashion for maximum safety, service, and cost effectiveness; − Impose appropriate measure so that technical, economic and other condition for the continuing economic viability of the transportation and communication entities are not jeopardized and do not encourage inefficiency and distortion of traffic patronage; − Develop an integrated plan for a nationwide transmission system in accordance with the national and international telecommunication service requirement including, among others, radio and television broadcast relaying, leased channel services and data transmission; − Guide government and private investment in the establishment, operation and maintenance of an international switching system for incoming and outgoing telecommunication services; − Encourage the development of a domestic telecommunication industry in coordination with the concern entities particularly, the manufacture of communications/ electronics equipment and components to complement and support as much as possible, the expansion, development, operation and maintenance of the nationwide telecommunications network; − Provide for a safe, reliable and efficient postal system for the country.
Authorities	− Formulate and recommend national policies and guidelines for the preparation and implementation of integrated and comprehensive transportation and communication system at the national, regional and local levels; − Establish and administer comprehensive and integrated program for transportation and communications, and for its purpose, may call on any agency corporation, or organization, whether public or private, whose development progress include transportation and communications, as an integral part thereof, to participate and assist in the preparation and implementation of such programs;

	– Assess, review and provide direction to transportation and communication research and development programs of the government in coordination with other institutions concerned; – Administer all laws, rules and regulations in the field of transportation and communication; – Coordinate with the Ministry of Public Works and Highways in the design, development, rehabilitation, improvement, construction, maintenance and repair of telecommunications, ports, airports and railways project and facilities including navigational aids and implement its development works through competitive bidding, negotiated, contracts or other methods as the President may authorize; – Establish, operate and maintain a nationwide postal system that shall include mail processing delivery services, and money order services and promote the art of philately; – Sub-allocate series of frequencies of bands allocated by the International Telecommunications Union to the specific services; – Accredit foreign aircraft manufacturer and/or international organizations for aircraft certification in accordance with procedures and standards established by the Bureau of Air Transportation; – Deputize the Philippine Airlines and/or the Airline Pilots Association of the Philippines for licensing of pilots in accordance with the rules, procedures and the standards established by the Bureau of Air Transportation; – Perform such other power and function as may be prescribed by law.
Functions and Authorities of Road Sector	– Establish and prescribe rules and regulations for routes, zones and/or areas of particular operators of public land services; – Establish and prescribe rules and regulations for the issuance of certificates of public convenience for the operation of public and land transportation utilities and services such as motor vehicles, trimobiles, and railroad lines; – Establish and prescribe rules and regulation for the inspection and registration of public and land transportation facilities such as motor vehicles, trimobiles, and railroad lines; – Establish and prescribe rules and regulations for the issuance of licenses to qualified motor vehicle drivers, trimobile drivers, motor vehicle conductors, train engineers and train conductors; – Establish and prescribe the corresponding rules and regulation for the enforcement of laws governing land transportation, including the penalties for violation thereof, and for the deputation of appropriate law enforcement agencies in pursuance thereof; – Determine, fix and/or prescribe charges and/or rates pertinent to the operation of public and land utility facilities and services except in cases where charges or rates are established by international bodies or association of which the Philippines is a participating member or by bodies or association recognized by the Philippine Government as the proper arbiter of such charges or rates; – Establish and prescribe the rules, regulations, procedures and standards for the accreditation of driving schools; – Performs such other functions as may be provided by law.

Source: Executive Order No. 125 s.1987. Reorganizing the Ministry of Transportation and Communications defining its Powers and Functions and for other Purpose. Official Gazette. January 30, 198

Department of Public Works and Highways (DPWH)

The DPWH functions as the engineering and construction arm of the Government tasked to continuously develop its technology for the purpose of ensuring the safety of all infrastructure facilities and securing for all public works and highways the highest efficiency and quality in construction. The DPWH is currently responsible for the planning, design, construction and maintenance of infrastructure, especially the national highways, flood control and water resources development system, and other public works in accordance with national development objectives.

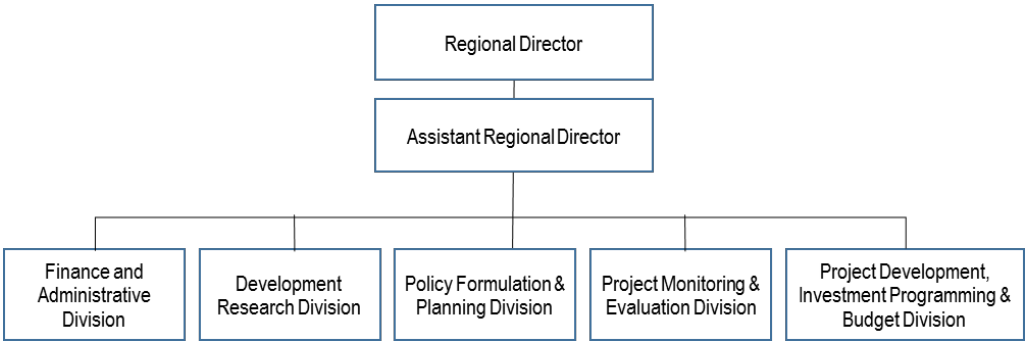
The DPWH has five divisions, six offices and 16 regional offices. Under the regional offices, there are 118 sub-region technical office. The DPWH Region-7 covers the Central Visayas

and is responsible for the Metro Cebu area. Technical office 2, 5, 6 and Cebu office manage the Metro Cebu area.

National Economic and Development Authority (NEDA) and Regional Development Council (RDC)

NEDA is the highest decision-making body for socioeconomic development and it is responsible for making and approving the national socioeconomic plan, infrastructure development plans, investment plans and strategic programs and plans. It has regional offices and NEDA Region VII oversees Central Visayas, which includes Metro Cebu. It does not have a specific committee or a council exclusive for Metro Cebu. All the development proposals need the approval of the full board of the RDC before they are submitted to the central government agencies. It also decides mid-term socioeconomic development plan and also infrastructure investment plans. The NEDA Region VII office is also function as a secretariat of the RDC.

Figure 5.1.1 and Figure 5.1.2 show the organization structure of the NEDA Region VII and the RDC respectively.



Source: Based on the NEDA Website, JICA Project Team depicted it)

Figure 5.1.1 Organization Structure of the NEDA Region VII



Source: Based on the RDC Region VII Website, JICA Project Team depicted it)

Figure 5.1.2 Organization Structure of the RDC

Table 5.1.2 Roles and Functional Responsibilities

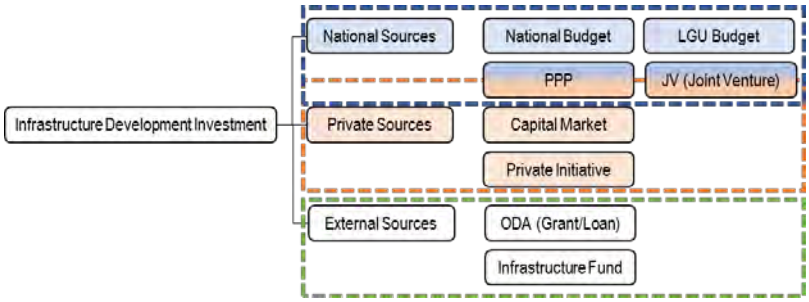
Sector	Sub-sector	Planning					Regulation			Fare/ Marketing	Infrastructure Development			Asset Management			Operation and Management				Law
		Strategic Planning	Approval/Decision-making	Service Planning, Bus/Railway Integration	Planning Public Transport Infrastructure Developme	License and Permit Approval	Regulator/Supervising Authority	Administrative & Technical Standards, Norms, Minimum Service Standards and Guidelines	Business License (Franchise)	Fare Setting/Approval	Managing Fare Collection System	Marketing Public Transportation Services	Financial Planning, Budgeting and Procurement	Infrastructure Development (Construction)	Construction Supervision & Technical Inspection	Land	Base Infrastructure	Upper Infrastructure (Facility)	Operation and Maintenance of Constructed Infrastr (Base)	Operation and Management for Facilities and Equipment's	Financial Arrangement for Business Operation	Business Operation	Business Operation Performance Evaluation	Law Enforcement
Road Network (Cebu Province)	National Highway	DPWH-R7	DPWH					DPWH					DPWH	Private	DPWH-R7	DPWH	DPWH	DPWH	DPWH-R7	DPWH-R7				
	Provincial Road	Prov	Prov					DPWH					Prov Eng	Private	Prov Eng	Province	Prov Eng	Prov Eng	Prov Eng	Prov Eng				
	City/Municipality Road	LGU	LGU					DPWH					LGU Eng	Private	LGU Eng	LGU	LGU Eng	LGU Eng	LGU Eng	LGU Eng				
	Barangay Road	LGU	LGU					DPWH					LGU Eng	Private	LGU Eng	LGU Eng	LGU Eng	LGU Eng	LGU Eng	LGU Eng				
	Tollway	DPWH	DPWH					DPWH		TRB	Operator		DPWH	Private	DPWH	DPWH	Private	Private	Operator	Operator	Operator	Operator	DPWH	
Rail-based Transport	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Busway Transport	BRT	DOTr	DOTr	DOTr	DOTr	DOTr	DOTr	DOTr	DOTr/LTFRB	LTFRB	DOTr	Unknown	DOTr	Private	DOTr	LGU	Unknown	SPV	SPV	SPV	SPV	SPV	Unknown	Unknown
	Feeder bus connecting busway	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bus Transport	Inter-city bus service in Cebu province	Prov	LTFRB	Unknown	Unknown	LTFRB	LTFRB/LTO	LTFRB/LTO	LTFRB	LTFRB	DOTr	Unknown	Prov	Private	Prov	Unknown	Unknown	Unknown	Unknown	Operator	Operator	Operator	LTFRB	LTFRB/LTO
	Intra-city bus service (General)	LGU	LTFRB	Unknown	Unknown	LTFRB	LTFRB/LTO	LTFRB/LTO	LTFRB	LTFRB	DOTr	Unknown	LGU	Private	LGU	LGU	LGU	LGU	Unknown	Operator	Operator	Operator	LTFRB	LTFRB/LTO
	Intra-city PUV (Jeepney)	LGU	LTFRB	Unknown	Unknown	LTFRB	LTFRB/LTO	LTFRB/LTO	LTFRB	LTFRB	DOTr	Unknown	LGU	Private	LGU	LGU	LGU	LGU	Unknown	Operator	Operator	Operator	LTFRB	LTFRB/LTO
Taxi	Taxi (Province-wide)	Unknown	LTFRB	Unknown	Unknown	LTFRB	LTFRB/LTO	LTFRB/LTO	LTFRB	LTFRB	LTFRB	Unknown								Operator	Operator	Operator	LTFRB	LTFRB/LTO
Paratransit	Motorized Tricycle	Unknown	LGU	Unknown	Unknown	LGU	Unknown	Unknown	LGU	Unknown	Unknown	Unknown										Operator	LGU	LGU
	Pedicab	Unknown	LGU	Unknown	Unknown	LGU	Unknown	Unknown	LGU	Unknown	Unknown	Unknown										Operator	LGU	LGU
Supporting Infrastructure	Traffic Signal	DPWH/PL	DPWH/PL				Unknown	Unknown					DPWH/PL	Private	DPWH/PL	DPWH/PL	DPWH/PL	DPWH/PL	DPWH/PL	DPWH/PL				
	Traffic Information System																							
	Street light	DPWH/PL	DPWH/PL				Unknown	Unknown					DPWH/PL	Private	DPWH/PL	DPWH/PL	DPWH/PL	DPWH/PL	DPWH/PL	DPWH/PL	n.a.	n.a.	n.a.	n.a.
Traffic Management	Traffic Regulation (Code)						Unknown	Unknown																Police/LGU
	Traffic Safety (Law Enforcement, Traffic Education)	Unknown					Unknown	Unknown																PoL/LF/LTL
	Traffic Signal Control	Unknown					Unknown	Unknown					LGU	Private	LGU	LGU	LGU	LGU	LGU	LGU	n.a.	n.a.	n.a.	n.a.
	Public Parking (on road parking)																							
	Public Parking (off road parking)																							
Other	Development permit (in terms of traffic impact)	Unknown	Unknown			LGU	Unknown	Unknown																LGU
	Transit-Oriented Development	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Driver's License	LTO/LTFRB	DOTr				LTO/LTFRB	LTO/LTFRB																PD/LF/LT

Source: JICA Project Team

5.2 Project Evaluation Procedure

1) Infrastructure Investment Project

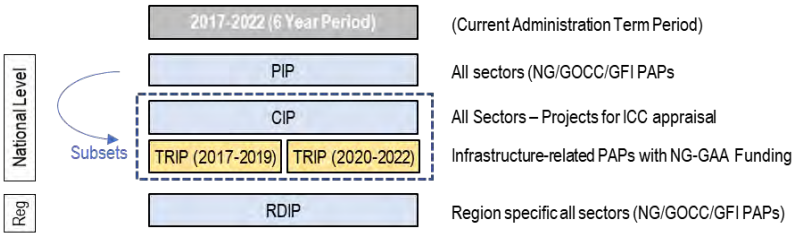
This section shows a mapping of the sources of infrastructure financing in he Philippines and administrative procedures from project identification, planning, appraisal, and the implementation.



Source: JICA Study Team. Referring "Financing Infrastructure in the Philippines: Fiscal Landscape and Resources Mobilization – Discussion Paper Series No.2014-01. Philippine Institute for Development Studies. January 2014."

Figure 5.2.1 Mapping of the Sources of Financing Infrastructure

Figure 5.2.2 shows the investment programing overview. The NEDA has formulated the draft of the 2017-2022 PIP (as of 25 July 2017) and posted it to its website[1] and started to formulate the three-year rolling infrastructure program (TRIP). The TRIP will be updated annually and the NEDA will review and consolidate the PAPs into the TRIP, which shall be presented to the INFRACom (NEDA national) for approval and confirmation.



Source: "Three-Year Rolling Infrastructure Program [TRIP]" PPT. NEDA. 2017.

Figure 5.2.2 Three-year Rolling Infrastructure Program

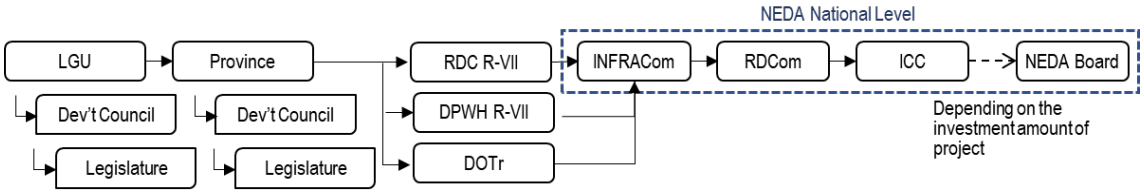
2) Project Evaluation Procedure

Figure 5.2.3 shows the simplified project evaluation procedures of national budget, PPP and Joint Venture (JV) project. Figures show a case when a component city/municipality proposes a transport infrastructure development project through different financial resources. At LGU, a project proposal needs to be discussed at development council, and needs the approval of local legislature, and then go through the same procedures at the provincial level.

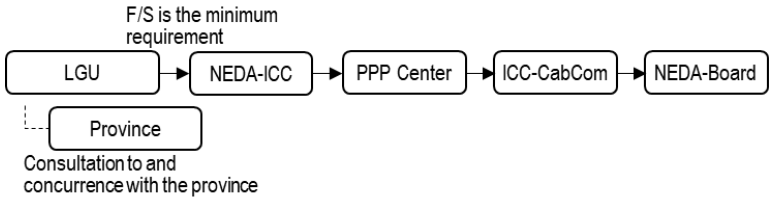
The salience feature of a joint venture project, such as CCLEX, is that a proponent LGU does not need to go through any project evaluation procedures of national government agencies. It needs an ordinance to stipulate the Joint Venture Guidelines set by the NEDA and the agreement with a private entity.

[1] http://www.neda.gov.ph/2017/01/24/2017-2022-public-investment-program/

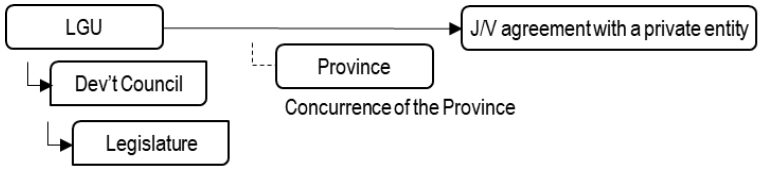
1. National Budget Project



2. PPP Project



3. Joint Venture Project



Note: Dev't Council = Development Council, RDC = Regional Development Council, INFRACom = Infrastructure Committee, RDCom = Regional Development Council, ICC = Investment Coordination Committee, NEDA-ICC = NEDA Investment Coordination Committee, ICC-CabCom = Investment Coordination Committee – Cabinet Committee

Source: JICA Project Team. Composed from various resources of the NEDA, PPP Center and JV Guidelines

Figure 5.2.3 Project Evaluation Procedures

3) RDC Project Endorsement Process

The proponent requesting endorsement by the RDC shall submit to the RDC Secretariat the comprehensive project profile, detailed project proposal, pre-feasibility study or feasibility study of a project. A project proponent may be a line agency, government-owned-and-controlled corporation, local government unit, state university/college, private sector organization.

The RDC Secretariat shall then evaluate the proposed project. The Project Development, Investment Programming and Budgeting Division (PDD) of NEDA shall conduct initial assessment of the proposed project and may refer it to appropriate NEDA Division for a more detailed evaluation.

Once the RDC Secretariat's evaluation is completed, the project shall be included in the agenda of the next regular meeting of the concerned RDC Sectoral Committee for review and endorsement to the RDC. Evaluation for project profile and project proposal shall be within 15 calendar days. For pre-feasibility study and feasibility study, it shall be within 30 calendar days.

Project profile and project proposal shall be received by the RDC Secretariat at least 15 days prior to the Sectoral Committee meeting to give time for its evaluation. Otherwise it will be calendared in the succeeding meeting of the Sectoral Committee.

The RDC Secretariat's evaluation shall be incorporated in the Secretariat's Brief. The brief shall contain the background of the project, the evaluation and the recommendation of the evaluator. This shall be included in the reference folder.

The proponent shall present the proposal to the Sectoral Committee. The proponent shall prepare a presentation about the project and shall reproduce enough copies of handouts for inclusion in the meeting's reference folder.

The proponent shall be given a copy of the evaluation report prior to the scheduled RDC sectoral committee meeting to give time for the proponent to prepare and address issues and concerns raised in the evaluation report.

All coordination work with the proponent shall be undertaken by the Project Development, Investment PDD of NEDA. It shall inform the proponent of the action of the Sectoral Committee and shall advise to comply with the recommendation of the Sectoral Committee.

Upon endorsement of the project to the RDC by the Sectoral Committee, the Secretariat shall include the project in the proposed agenda of the RDC Full Council meeting.

The Sectoral Committee Chairman shall present the proposed project to the RDC. The proponent may be invited to attend the RDC meeting to answer queries on the project.

The proponent shall provide feedback to the RDC on the status of funding of the endorsed project[2].

5.3 Recent Updates of the related Laws and Regulations

1) Traffic Crisis Act of 2017

Committee Report No. 389 regarding House Bill No. 6425, dated 19 September 2017, was submitted by the Committee on Transportation and the Appropriation, recommending its approval in substitution of House Bills numbered 03, 38, 554, 1315, 1666, 3048, 3314, 3442, 3617, 3712, 3716, 4309, 4334, 4669 and HR 119. It was submitted in the Second Regular Session of the Seventeenth Congress.

Full title of the act is "An act prescribing an urgent, comprehensive and integrated land-based traffic management policy to effectively address the traffic congestion crisis in Metro Manila, Metropolitan Cebu and Metropolitan Davao and appropriating funds therefore," and the short title is "Prescribing an urgent, comprehensive and integrated land-based traffic management policy to effectively address the traffic congestion crisis in metro Manila, Metropolitan Cebu and Metropolitan Davao," and its short tile of the act is "Traffic Crisis Act 2017. Makiisa, Makisama, Magkaisa."

The bill has completed the third step out of twelve legislative processes, which is Committee Consideration/Action, and the committee report was registered and numbered by the Bills and Index Service. The Second Regular Session adjourned in October and will resume on 13 November for a month, and the bill will follow the succeeding processes as a continual consultation bill.

The salient features of the House Bill 6425 are provided in the following paragraphs[3].

Declaration of policy stated the following:

(a) To adopt responsive, effective and comprehensive measures that will immediately

[2] Source: NEDA

[3] Committee Report No. 389 regarding House Bill No. 6425. 19 September 2017. House of Representatives.

address the crisis brought about by the land traffic congestion and gridlock and shortage of safe, secure, efficient, predictable, integrated, environmentally sound, people oriented, persons-with-disability accessible, and inclusive mass transportation in the Metropolitan Manila Area, Metropolitan Cebu, and Metropolitan Davao:

(b) To establish a strong primary policy, planning, programming, coordinating, implementing, regulating, enforcement, and administrative authority under the control and supervision of the DOTr vested with exclusive power to control, manage, and regulate land-based traffic and structures in the Metropolitan Manila, Metropolitan Cebu, and Metropolitan Davao;

(c) To harmonize all traffic rules, regulations, ordinances. issuances, and policies in the metropolitan areas to achieve a comprehensive and integrated statutory and regulatory framework for land-based traffic;

(d) To reform, modernize and streamline the mass transportation systems to the end of attaining sustainable, organized, predictable, accessible and safe networks of public transportation;

(e) To institute a system of responsibility and accountability for all land-based traffic stakeholders, including public officials, public utility operators, road users, private property owners and business establishments, in the furtherance of mobility within the metropolitan areas; and

(f) To ensure transparency, accountability, and compliance with applicable legal requirements in the procurement, award, and execution of all projects implemented pursuant to this Act and with the objective of alleviating the land-traffic crisis.

The Secretary of the DOTr is to be designated as the *de officio* Traffic Chief during the effectivity of this Act, with full power and authority as enumerated in this Act to streamline the management of traffic and transportation and control road use in the identified metropolitan areas of Manila, Cebu and Davao.

The Act is limited only in scope, application and effectivity to the Metropolitan areas. The Act shall authorize and apply only to projects, programs, policies, rules, and regulations that will have immediate, significant, and measurable impact on the land-based traffic crisis within the three (3) metropolitan areas of Manila, Cebu and Davao.

In Section 9 of this Act, there is a formation of the Cebu Coordinating Council (Cebu Council) and designation of a Metropolitan Davao Traffic Administrator (Davao Administrator). The Cebu Council shall be composed of the local chief executives of Metropolitan Cebu, which is by the definition of the Act, refers to the area composed of the cities of Cebu, Mandaue, Lapu-Lapu, and any other city or municipality in the Province of Cebu as may be identified for inclusion by the Traffic Chief, upon the recommendation of the Metropolitan Cebu Traffic Coordinating Council. Thus, by the definition of the Act, the pre-determined cities of the Metropolitan Cebu are abovementioned three cities. The Cebu Council and the Davao Administrator shall be the sole, centralized authority for land-based traffic in their respective areas.

Furthermore, in Section 11, the Metro Manila Development Authority (MMDA), the Cebu Council, and the Davao Administrator, with the approval of the Traffic Chief, shall set the policies concerning land-based traffic and road use in their respective metropolitan areas, and coordinate and regulate the implementation of all programs and projects concerning traffic management specifically pertaining to enforcement, engineering, and education. Upon request, all other government agencies, local government units and offices involved with traffic management and enforcement, including but not limited to, assignment of personnel and logistical support.

At the end of one year from the creation of the Cebu Council and the appointment of the Davao Administrator, the DOTr Secretary shall make a recommendation on whether Congress should create a permanent and separate Development Authority for Cebu and Davao analogous in powers, authority, and functions to the MMDA. (Section 7).

In Section 12, the Act indicates the establishment of the Joint Congressional Oversight Committee (JCOC) tasked with the monitoring of the implementation of this Act during the effectivity of the Act. The JCOC shall be composed of a) Senate President, b) Speaker of the house of Representatives, c) Chairperson of the Committee on Public Services of the Senate, d) Chairperson of the Committee on Transportation of the House of Representatives, e) Chairperson of the Committee on Finance of the Senate, f) Chairperson of the Committee on Appropriations of the House of Representatives, g) Member of the Committee on Public Services of the Senate, and h) Member of the Committee on Transportation of the House of Representatives.

Section 13 is all about the formulation of the Traffic Management Plan (TMP) for land-based traffic, of which the Traffic Chief, in consultation with the MMDA, the Cebu Council, and/or Davao Administrator, as the case may be, to formulate a separate TMP for each of the metropolitan areas. Although the Act aims to alleviate current traffic crisis in three metropolitan areas, the contents of TMP in Section 13 are partially only related to Metro Manila.

From Section 15 to 19, and 21 to 26 are all about route rationalization and modernization of PUV, and their related contents. The Act indicates a route rationalization plan for PUV shall be established and the modernization of PUV fleets shall be expedited through proposed financial scheme.

Similar to the formulation of route rationalization plan for PUV, the DOTr, in coordination with the DILG and LTFRB, has issued department order, joint memorandum circular with the DILG, and published a manual for LGUs to formulate a local public transport route plan. DOTr also has launched PUVMP in June 2017. (The full contents of the PUVMP was not available as the time of preparing this report).

- Department Order No. 2017-11: Omnibus Guideline on the Planning and Identification of Public Road Transportation Services and Franchise Issuance. (19 June 2017)

- Joint Memorandum Circular No. 001 series of 2017: Guidelines on the Preparation and Issuance of Local Ordinances, Orders, Rules and Regulations concerning LPTRP. (19 June 2017)

- Local Public Transport Route Plan Manual – Volume 1. DOTr, DILG and LTFRB. (October 2017)

- PUVMP (June 2017)

Another special salient feature is the clauses about “priority projects.” The Act outlines the traffic crisis is to be an emergency case, as defined in Section 53 of Republic Act No. 9184, the Government Procurement Reform act (GPRA) and Section 53.2 of its Implementing rules and Regulations (IRR). In accordance with the Act, thus, the President through the Traffic Chief is authorized to enter into negotiated contracts for priority projects, which must be aimed to immediately and effectively alleviate the traffic crisis.

In Section 33 on Power of Eminent Domain, the Traffic Chief will reasonably exercise the power of eminent domain for right-of-way (ROW) acquisition or expropriation of private property necessary for priority projects, including but not limited to construction, rehabilitation, or maintenance of infrastructure projects, road widening, clearance, or setback.

For Section 34 on Judicial Support for this Act, provides for the creation of a Special Traffic Crisis Court (Special Court) in each of the metropolitan areas. The Special Court will have exclusive jurisdiction to hear and expeditiously resolve ail actions that may emanate from the implementation of this Act, except those that will be filed against public officials which shall be filed before the Joint Committee of the Commission on Audit, Civil Service Commission, and the Ombudsman created under Section 35 of this Act.

In Section 41 on Traffic Education, the DOTr, LTO, LTFRB, DepEd, and TESDA shall jointly develop a program for driver's education and road and pedestrian etiquette education that shall be incorporated as a mandatory subject in the Senior High School curriculum.

On the other hand, on the 1st Regular Session of the Seventeenth Congress, Senate Bill No. 1284 was prepared and submitted jointly by the Committees on Public Services, Constitutional Amendments and Revision of Codes, and Finance, and it is known as the "Traffic and Congestion Crisis Act of 2016."

For the Declaration of Policy in Section 2, the following declarations are stated:

(a) To adopt adequate, responsive, comprehensive and effective measures that will immediately address the crisis;

(b) To promote a shift towards safe, secure, efficient, viable, competitive, dependable, integrated, environmentally sustainable, people-oriented, and inclusive transportation system for the benefit of all citizens, the economy, and society;

(c) To harmonize all traffic rules, regulations, ordinances, issuances, and policies in the Metropolitan Areas to achieve a comprehensive and integrated statutory and regulatory framework for land-based traffic;

(d) To properly plan infrastructure projects that will respond to this paradigm shift in the transportation system, increase mobility options of the general public, and promote the use of alternative modes of transportation to address the crisis and increase economic productivity and tourism appeal;

(e) To adopt a strong system of accountability and transparency in the pursuit of its objectives;

(f) To adopt the use of information and communications technology (ICT) as a tool to manage and mitigate the problem of traffic congestion in the Philippines, especially in Metro Manila and other highly urbanized areas;

(g) To establish a holistic enabling environment in promoting and propagating telecommuting, both in the private and public sectors, and to capacitate public sector institutions and their personnel in the adoption of telecommuting and the use of ICT to improve planning, management, delivery of functions and monitoring and evaluation;

(h) To adopt telecommuting in the long-term as a means to foster global competitiveness of the Filipino workforce and institutionalize other related and relevant transportation demand management strategies and incentives in furtherance of this policy; and

(i) after the period of emergency, to adopt mid-term, and long-term development plans for the efficient and cheaper transport of people and delivery of goods and services, as well as a comprehensive long-term national transport policy, in order to sustain the significant gains and to meaningfully reduce the risk of a traffic and congestion crisis from happening again in the future.

In Section 3, this Act is limited in scope, application and effectivity to Greater Metro Manila and Metro Cebu as to projects, programs, policies, rules, and regulations that will have immediate, significant, and measurable impact on the land-based traffic crisis.

The granting of emergency powers of the President/Executive Branch is indicated in Section 5 of this Act. In this section, the President is authorized to exercise all powers necessary and proper to carry out the declared state policies. Thus, the President is granted Emergency Powers to urgently utilize all necessary government resources, exercise police power, including eminent domain, and employ executive actions and measures to ensure the effective implementation, reconfiguration, and harmonization of national and local government projects intended to directly address the traffic and congestion crisis.

The Creation of the Office of the Traffic Crisis Manager is indicated in Section 6. The Office of the Traffic Crisis Manager is going to be under the Office of the President. Furthermore, the Office of the Traffic Crisis Manager shall be headed by the Traffic Crisis Manager. The Traffic Crisis Manager shall be appointed by the President and shall have the rank, emoluments, benefits and privileges of a Member of the Cabinet. The President shall exercise supervision and control over the Traffic Crisis Manager and the Office of the Traffic Crisis Manager. The Traffic Crisis Manager shall hold office for the duration of the grant of Emergency Powers to the President. The Traffic Crisis Manager shall be ultimately responsible for transportation and traffic-related functions; thus, exercising overall traffic management and overseeing the execution of the Traffic Crisis Action and Decongestion Plan. For the duration of the emergency powers, the Traffic Crisis Manager as the delegated representative of the President, shall have all the authority to implement a policy framework and manage agency functions over land, air, and seaport traffic, and shall coordinate with the relevant local government units on the implementation of projects that will facilitate the ease of traffic in the Metropolitan Areas.

Section 7 is all about the Powers of the Traffic Crisis Manager. As the alter ego of the President, the Traffic Crisis Manager is hereby authorized to exercise all powers necessary, and to utilize all necessary government resources, exercise police power, and employ executive actions and measures to ensure the effective implementation of the program of action stipulated in Section 3 of this Act. In addition, at the Traffic Crisis Manager's sound discretion and in the interest of efficiency, he shall consult and may delegate any of the aforementioned powers and authority to the MMDA for Greater Metro Manila, and the MCDCB for Metro Cebu.

As for Section 10, this section identified the formulation of the Traffic Crisis Action and Decongestion Plan, of which the Traffic Crisis Manager, in coordination with the Traffic Crisis Advisory Council, shall create a Traffic Crisis Action and Decongestion Plan, which shall sufficiently detail the concrete steps to be taken to immediately and effectively alleviate the traffic crisis in the Greater Metro Manila and Metro Cebu in a measurable/quantifiable manner.

Alternative Methods of Procurement is indicated in Section 13. Pursuant to the above policy declaring the traffic and congestion crisis a national public calamity, the existence of emergency and/or extraordinary cases is presumed. To expedite the implementation of all projects covered by this Act, the Alternative Methods of Procurement provided in Article XV of Republic Act No. 9184 and Rule XVI of its Implementing Rules and Regulations shall be utilized.

Section 24 discussed about the Transparency and Right to Information. The Traffic Crisis Manager, in coordination with the DICT, must maintain a separate website for the publication of complete and accurate information regarding the implementation of this Act.

Traffic Education is indicated in Section 25 wherein DOTr, LTO, LTFRB, DepEd, and TESDA will jointly develop a program for driver's education and road and pedestrian etiquette education that shall be incorporated as a mandatory subject in the Senior High

School curriculum. For Capacity building, provided in Section 26, the Traffic Crisis Manager shall promote and encourage capacity-building and the sharing of best practices with local government units and other government agencies with regard to transportation planning, and traffic management, and enforcement.

Lastly, the Congressional Oversight Committee is introduced in Section 28, of which the Congressional Oversight Committee (COC) is created involving both Houses of Congress, which will monitor the implementation of this Act and the exercise of the powers herein granted. The Committee will be composed of the Chair of the Senate Committee on Public Services: The Chair of the House of Representatives Committee on Transportation: and 2 other members from each House, to be designated by the Senate President, in the case of the Senate, and the Speaker, in the case of the House of Representatives. The Chair of the Senate Committee on Public Services and the Chair of the House of Representatives Committee on Transportation shall constitute an Executive Committee, to be headed by an Executive Director, who will oversee day-to-day coordination with the concerned officials and stakeholders affected by this Act.

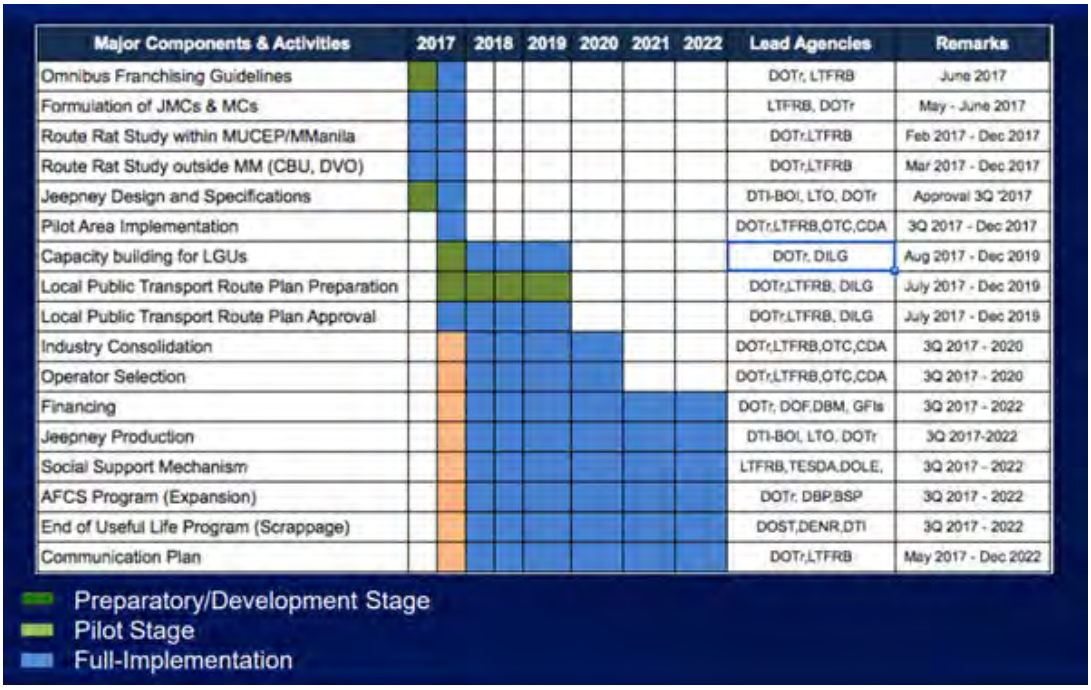
Although Senate Bill No. 1284 are pending in status, DOTr has already started to implement a few of the mitigating measures mentioned in both proposed Acts in order to provide possible solutions to the traffic congestion crisis being experienced by the metropolitan areas in Manila and Cebu. One of such measures is the issuance of Department Order (DO) No. 2017–011 which is the Omnibus Guidelines on the Planning and Identification of Public Road Transportation Services and Franchise Issuance. Consequently, DOTr and DILG issued a Joint Memorandum Circular (JMC) No. 001 Series of 2017 which provides for the Guidelines on the Preparation and Issuance of Local Ordinances, Orders, Rules and Regulations concerning LPTRP. The other program that DOTr has taken the initiative to implement is the PUVMP, which is going to be discussed in the next section.

2) Public Utility Vehicle Modernization Program

The PUV Modernization is a road-based public transport reform program which envisions a restructured, modern, well-managed, and environmentally sustainable transport sector where drivers and operators have stable, sufficient, and dignified livelihoods while commuters get to their destinations quickly, safely, and comfortably. The main objectives of the PUV Modernization Program are the following:

- Modernize the current PUV fleet;
- Reform and consolidate the industry;
- Move towards low emission PUVs;
- Improve welfare of commuters and encourage modal shift; and
- Improve standards of living of drivers, operators, and their families.

The overall implementation plan of the PUVMP is shown in Figure 5.3.1.



Source: DOTr

Figure 5.3.1 The Overall Implementation Plan of the PUVMP

The major components of the program are the following:

(1) Regulatory Reform

DOTr DO No. 2017–011 otherwise known as the Omnibus Franchising Guidelines (OFG) provides new LTFRB guidelines on franchise issuance for road based public transportation services. With DOTr-DILG JMC No. 001 series 2017, the LGUs are required to conduct local public transport route planning and route rationalization and of which the LGUs are informed that tricycles are no longer allowed to use any national highways. On the other hand, DOTr has commenced on introducing new designs of public transport, such as the PUJ, which are compliant with safety and environmental laws and standards. Information dissemination for fleet and industry consolidation for efficient operations have begun through presentations in various transport-related forums and conferences both in the local and international venues as well as in the social media.

(2) LGU's Local Public Transport Route Planning

DOTr has seen the need for LGU capacity building for transport planning. Thus, in cooperation with the University of the Philippines – National College of Public Administration and Governance (UP-NCPAG), capacity building activities to identified LGUs in Metro Manila, nearby provinces of Metro Manila and highly urbanized cities is to be undertaken. At the same time, government-to-government (G2G) procurement of consultants from the University of the Philippines – National Center for Transportation Studies (UP-NCTS) is to be used for capacity building for LGUs outside Metro Manila.

For local public transport route planning, the LPTRP guidelines are to be implemented and used by the local governments through the DOTr-DILG JMC. In addition, DOTr is going to incorporate the LPTRP in HLURB training modules. The LGUs are going to prepare the LPTRP to make the routes more responsive to passenger demand and to determine the appropriate vehicle type depending on road hierarchy and configuration. DOTr is encouraging the LGUs to conduct participatory planning in the preparation of the route plan. The LGUs will then submit the LPTRP to the LTFRB for review and approval. After the approval, the LTFRB will issue a Notice of Compliance (NOC) to the LGUs for the passing

of the appropriate ordinance. The ordinance adopting the LPTRP will be endorsed to the LTFRB for the conduct of a transparent operator selection and issuance of franchise(s). If a Notice of Non-Compliance (NONC) is issued by the LTFRB, the LGUs are required to revise the submitted LPTRP.

(3) Route Rationalization

DOTr is prescribing for route planning and restructuring to be based on road network and passenger demand. The basic policy to be used, as advised by DOTr, is that higher capacity PUVs should be assigned to high demand routes. For Metro Cebu, a gap analysis of PUV for the route rationalization is to be included in the ongoing JICA Project on Master Plan Study and Institutional Development of Urban Transport System in Metro Cebu.

(4) Fleet Modernization

The Department of Trade and Industry – Bureau of Product Standards (DTI-BPS) is drafting a Philippine National Standard (PNS) on PUVs under the fleet modernization component of the PUV Modernization Program. The PNS will include the dimensional standard for PUVs on maximum vehicle weight, overall height, width and length, wheelbase, front and rear overhang, seat and seat layout, step board, service door and emergency exit. BPS technical committee composed of various representatives from the academe, industry, consumers' organization, professional association, research institution, government agencies, and, testing institutions will develop the standards concerning compatibility, interchangeability and safety, with particular reference to terminology and test procedures for evaluating the performance of the road vehicles.

Republic Act No. 8749 otherwise known as the "Philippine Clean Air Act of 1999" will also be used as basis for the standards on smoke emission coming from the PUV vehicle. At the same time, incentives for PUJ manufacturers are being conceptualized in collaboration with the Department of Trade and Industry – Philippine Board of Investments (DTI-BOI). Table 5.3.1 shows features of the modernized PUJ with its corresponding requirements.

Table 5.3.1 Features of the Modernized PUJ with its Corresponding Requirements

Feature	Requirements
Environment-friendly	Clean Air Act compliant engine. Euro 4 emission or better. Electric, Solar, Alternative Fuel
Safety	Side door, Speed limiter, Automatic Braking System, Compliant with safety standards
Security	CCTV, GPS, AFCS, Dashboard Camera
Comfort/Convenience	PWD/elderly-friendly, Free Wi-fi

Source: DOTr

(5) Industry Consolidation

The current state of the PUJ Industry is that majority are one franchise, one operator, one vehicle. In the Omnibus Franchising Guidelines, the operators' requirements are a) maximum number of operators per route, b) off-street terminal, and c) safety officer. At the same time, the DOTr has asked the help of the Office of Transport Cooperatives (OTC) and Cooperative Development Authority (CDA) in the formation of cooperatives or other legal entities for the PUJ operators and drivers. The benefits of consolidation are the access to credit facilities, shared operation and maintenance costs, and operational efficiency by using the fleet management system.

(6) Financing PUV Modernization

The government financial institutions (GFIs) are going to provide special financing terms for the procurement of new PUJs. A memorandum of understanding (MOU) is already in place with Landbank. Furthermore, a proposed MOU with the Development Bank of the Philippines (DBP) is still on process. A special loan program is shown in Table 5.3.2 in relation to financing the PUV modernization.

Table 5.3.2 Special Loan Program for Financing the PUV Modernization

Government Financial Institute	Equity – Loan Structure		Interest Rate	Repayment Period	Remarks
	Equity	Loan			
LandBank	5%	95%	6%/annum	7 years	• Borrowers may be individual (about to belong or already part of the cooperatives) or legal entity • AFCS, GPS • Franchise for 7 years
DBP	5%	95%	6%/annum	7 years	• Borrowers should be coop or corporation • Chattei Mortgage • AFCS, GPS • Franchise for 7 years

Source: DOTr

In addition, a government subsidy is being thought of as proceeds from the gains of the Comprehensive Tax Reform Program. On the other hand, an automatic fare collection system (AFCS) is conceptualized to facilitate easier repayment to the lending institutions.

(7) Vehicle Useful Life Program

The objective of the Vehicle Useful Life Program is to ensure that the old public utility vehicles are surrendered and effectively scrapped.



Source: DOTr

Figure 5.3.2 Vehicle Useful Life Program

(8) Pilot Implementation

DOTr has seen the need for Pilot Implementation in order to support the readiness of the PUVMP and to gain more support from the stakeholders. Table 5.3.3 indicates the time schedule for the pilot implementation.

Table 5.3.3 Pilot Implementation Timetable

Pilot Implementation Timetable	2017							
	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Agencies
Issuance and Signing of the OFG								DOTr, LTFRB
Pilot Area and Operator Selection								DOTr, LTFRB, OTC, CDA
Final Design and Specifications (Jeepney)								DTI-BOI, LTO, DOTr
Industry Consolidation								DOTr, LTFRB, OTC, CDA
Stakeholder Support (Training)								LTFRB, TESDA, DOLE
Franchise Application								LTFRB
Jeepney Production (Importation and Assembly)								DTI-BOI, LTO, DOTr
Acquisition of New Jeepney Units								LandBank, DBP
Vehicle Useful Life (Scrappage)								DENR, DOST, DTI

Source: DOTr

(9) Stakeholder Support Mechanisms

The Driver's Academy is to be implemented by the LTFRB in cooperation with LTO and TESDA. The public transport drivers need to be certified with NC III. On the other hand, TESDA training programs to be availed of are a) Mechanics Training, b) Customer Service Officer, c) Fare Collection Staff (fare card selling and reloading), and d) Safety Inspector. The other programs to be linked with for the stakeholder support mechanism are a) Department of Labor and Employment Integrated Livelihood & Emergency Employment Program (DOLE DILEEP), b) Department of Social Welfare and Development (DSWD) Sustainable Livelihood Program, and c) DTI Microfinance/SME Development.

(10) Communication

In order for DOTr to attain success in the PUV Modernization Program, communication to all stakeholders is a must. These stakeholders are the PUV operators and drivers, the local government units, the passengers, the government agencies, the manufacturers, the international agencies/donors and the lending institutions.

3) Traffic Code by LGUs

Table 5.3.4 indicates the latest updates on the status of the traffic codes in the respective LGU. The Sub-Committee on Transport and Traffic Management is responsible in doing the following-up on its members in relation to amendments of their respective code or an approval of a new traffic code.

Table 5.3.4 Status of the Traffic Code of LGUs

LGU	Submission of Traffic Code (as of October 2017)
Cebu City	Submitted
Danao City	Amendments for approval by the Council
Mandaue City	Amendments for approval by the Council
Lapu-Lapu City	No traffic code
Municipality of Consolacion	Submitted
Municipality of Compostela	Submitted
Municipality of Minglanilla	Amendments for approval by the Council
Talisay City	Amendments for approval by the Council
City of Carcar City	No traffic code
Municipality of Liloan	Submitted
City of Naga	On-going process for approval by the Council
Municipality of Cordova	No traffic code
Municipality of San Fernando	No traffic code

Source: The Sub-Committee on Transport and Traffic Management, MCDCB. November 2017

4) Truck Corridor

The members of the Sub-Committee on Transport and Traffic Management have observed the increasing number of vehicles transporting goods within the metropolitan area of Cebu. Inasmuch as there are LGUs which are implementing local ordinances on truck ban, the Sub-Committee has seen the need to address the congestion brought about by the presence of trucks, trailers and delivery vans during the time when truck bans are enforced. Thus, stated in the following paragraphs the series of activities which led to the establishment of the Metro Cebu Truck Corridor.

(a) In 2015, the City of Mandaue conducted a study identifying and quantifying the type and number of vehicles passing through their area of responsibility. The study found out that 54% of vehicles passing through the city are private vehicles. The study also showed that of the vehicles passing through, 13.6 % are trucks and 9.28% are delivery vans with a total of 22.88%. The said study also cited the number of accidents caused by trucks. For the months of July-October 2016, they listed 1,353 accidents mainly caused by trucks and vans.

(b) On the other hand, in a 2012 study on The New Cebu Container Port and the Redevelopment of the Existing Cebu Port, the Oriental Consultants estimated that the annual cargo handling capacity of Cebu Baseport was about 12 million metric tons for domestic containers, break-bulk and bulk cargoes; in addition to 300,000 metric tons for international containers at the Cebu International Port.

(c) This study further assumed that the cargo handling capacity of the Cebu Baseport will be exceeded sometime in 2018, and that overflow cargoes will be handled in the other ports of Cebu Island and transported over land by trucks to and from the consignees/consignors.

(d) In a Cebu Daily News article published last February 14, 2016, MCDCB RPOD Sub-Committee on Infrastructure and Utilities Chairman, Engr. Jun Sanchez was quoted to have said that at least P132 million worth of man-hours is wasted and economic opportunities lost in a day in Metro Cebu due to traffic congestion.

(e) With all these data and information, the MCDCB RPOD Sub-Committee on Transport and Traffic Management saw the urgency and importance of addressing the issue of traffic congestion and thus aimed to alleviate, if not totally solve, the congestion problem in Metro Cebu through various program and policy recommendations.

(f) The plan originated in November 2016 during a Sub-Committee meeting when Mandaue City presented its Transport Plan. Before that, the solution identified by the Sub-Com was to recommend the implementation of a synchronized truck ban policy.

(g) The Sub-Committee then convened a series of talks with its members. In one meeting, an observation was raised that implementing a truck ban can adversely affect the economy of the Metropolitan area and the Province of Cebu or it will significantly restrict the flow of goods. The Sub-Committee then came up with an alternative solution, and that is to propose the creation of an aligned Cargo Truck Corridor.

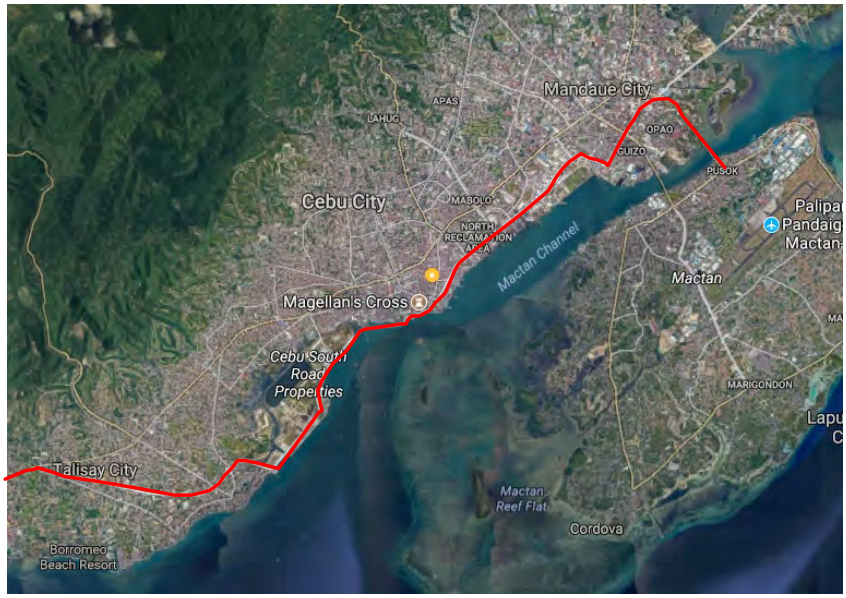
(h) The Sub-Committee then met with the Cebu Truckers Association (CTA) and the business chambers, forming a study/working group for the proposed cargo truck corridor. Essentially, the Metro Cebu Truck Corridor will serve as a designated route for trucks, trailers which are carrying containers and delivery vans. An identified route was then designated as the corridor for trucks, trailers and vans so as to free the other roads used by other motorists and at the same time, provide a designated roadway for 24/7 truck and van access.

(i) Basing on the Sub-Committee discussions, a Metro Cebu Truck Corridor from Lapu-Lapu, Mandaue, Cebu and Talisay, passing through the second bridge, Opao, Guizo, Centro, North Reclamation area, South Road Properties and up to Cebu South Coastal Road (CSCR) Talisay was then designated.

(j) The MCDCB Full Board is thus requested to support the committee's initiative by endorsing the Metro Cebu Truck Corridor and by commending and recognizing the LGUs' efforts namely that of the Cities of Talisay, Cebu, Mandaue and Lapu-Lapu in the formulation and establishment of the Metro Cebu Truck Corridor.

(k) Furthermore, for the MCDCB Full Board to enjoin the said LGUs to monitor the implementation of the said corridor and to share the data, information, and results of the said policy measure to the MCDCB for review.

(l) Moreover, the MCDCB Full Board is requested to encourage the other LGUs in Metro Cebu to consider this measure, i.e., creation and adoption of a designated and aligned truck corridor, as one possible intervention in alleviating traffic congestion.



Source: MCDCB

Figure 5.3.3 Integrated Truck Corridor

5) Mega Cebu Traffic Enforcers Academy

Indicated below is a brief summary of the series of activities that was undertaken by the Sub-Committee on Transport and Traffic Management in relation to the approval of the Mega Cebu Traffic Enforcers Academy (MCTEA) program by the MCDCB Full Board.

(a) MCDCB RPOD PMO organized a strategic planning last February 2016 for the Focus Area Based Committee and its corresponding sub-committees which were attended by the different Chairs, Co-Chairs and members of the committee.

(b) The committees were tasked to develop a project that is in line with the Mega Cebu Anchor and flagship projects that is doable for the next two to three years.

(c) The Sub-Committee on Transport and Traffic Management led by the committee members, came up with a Project Action Plan: Operation Plan "OPLAN" Smooth Flow, which was presented to and approved by the MCDCB Full Board last March 2016.

(d) The action plan focuses on six (6) primary objectives that are to 1) synchronize the Traffic Code of every LGU in Metro Cebu, 2) provide Traffic Education for the enforcers, 3) help in the education of drivers and pedestrian, 4) capacitate the LGUs on the need to conduct a Traffic Impact Analysis (TIA) for buildings taller than 4 stories, 5) gather accurate data on traffic load count, and 6) enforce/advocate the use of roads for mobility purposes only.

(e) Seeing the need to capacitate and build technical knowledge and promote character building of Metro Cebu Traffic Enforcers, MCDCB RPOD linked with TESDA Region 7 in terms of standardization and professionalization of Traffic Enforcers through education and training.

(f) Thus, MCTEA was conceptualized and thru the guidance of the TESDA, a timeline was made for the next steps and presented in the April 2016 Sub-Committee Monthly Meeting. On September 2016, the MCDCB EXECOM discussed about MCTEA and last June 2016, the MCTEA was approved by the MCDCB Full Board during its meeting as one of the projects of the Sub-Committee on Transport and Traffic Management.

(g) The standard requirements of TESDA, shown in Table 5.3.5, are the Proposed Training Regulation for Traffic Enforcer NC 11. Training standards are set as follows:

Course title: Traffic Enforcer

Nominal Training Duration:
1. 28 Hrs. (Basic Competency)
2. 36 Hrs. (Common Competency)
3. 280 Hrs. (Core Competency)
Total: 344 Hrs. (2 months)

NC Level: National Certificate II

Trainee Entry Requirements:
1. Filipino Citizen
2. At least Grade 10th level
3. Physically and mentally fit
4. Not less than 18 of age nor more than 35 years old (for new applicants)

(h) The Training Regulation was already submitted to TESDA Cebu Province for review. Afterwards, TESDA Cebu Province will endorse the Training Regulation to TESDA Region VII. Mega Cebu has decided to have the Training Regulation be validated. Hence, TESDA Region VII will endorse the Training Regulation to TESDA Central Office for validation.

Table 5.3.5 Training Regulation – Curriculum Design

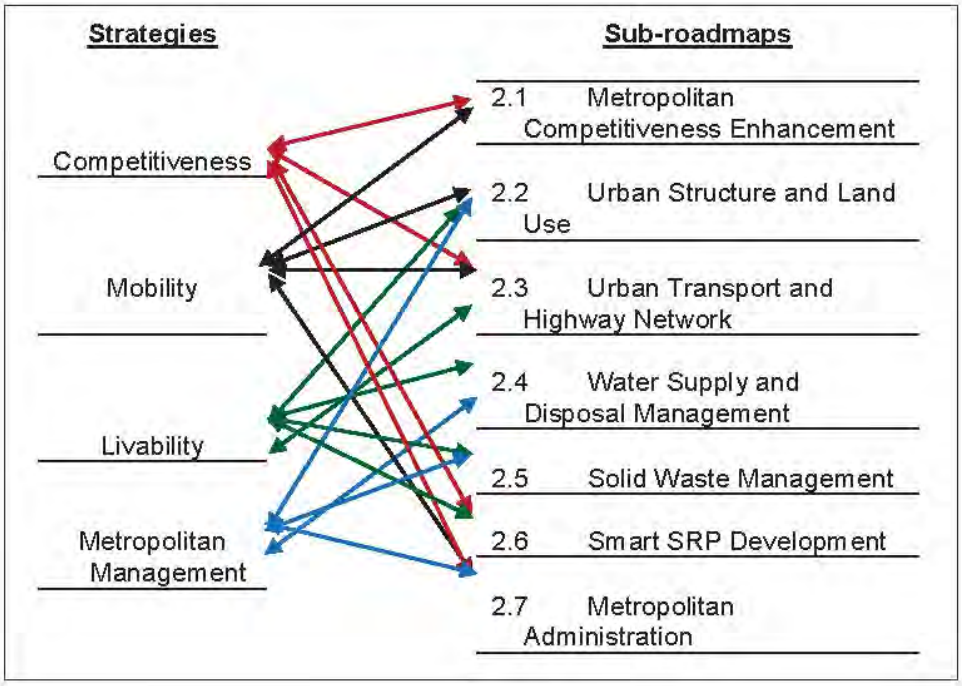
Competency	Curriculum Design
Basic Competencies	• Receive and respond to workplace communication • Work with others • Demonstrate work values
Common Competencies	• Maintain an effect relationship with clients/customers • Manage own performance • Practice professionalism in traffic enforcement
Core Competencies	• Enforce traffic laws • Direct and control traffic • Respond to traffic accidents

Source: MCDCB

6 BASIC POLICY OF URBAN PLANNING IN METRO CEBU

6.1 Overall Development Vision

The Roadmap Study adopted the Mega Cebu Vision 2050 that was formulated in 2013 by MCDCB in cooperation with JICA and Yokohama City. As shown in Figure 6.1.1, Mega Cebu Vision consists of four strategic pillars and the Roadmap Study formulated seven Sub-Roadmaps as the concrete steps towards implementation of the Mega Cebu Vision.



Source: JICA Project Team

Figure 6.1.1 Strategies of Mega Cebu Vision and Sub-Roadmaps Proposed by the Roadmap Study

Since Mega Cebu Vision 2050 is still applicable to all Sub-Roadmaps including the urban transport master plan, the following vision statement as well as the catchphrase "Mega Cebu-Making W.A.V.E.S.," which stands for Wholesome, Advanced, Vibrant, Equitable and Sustainable, have also been adopted for the Project.

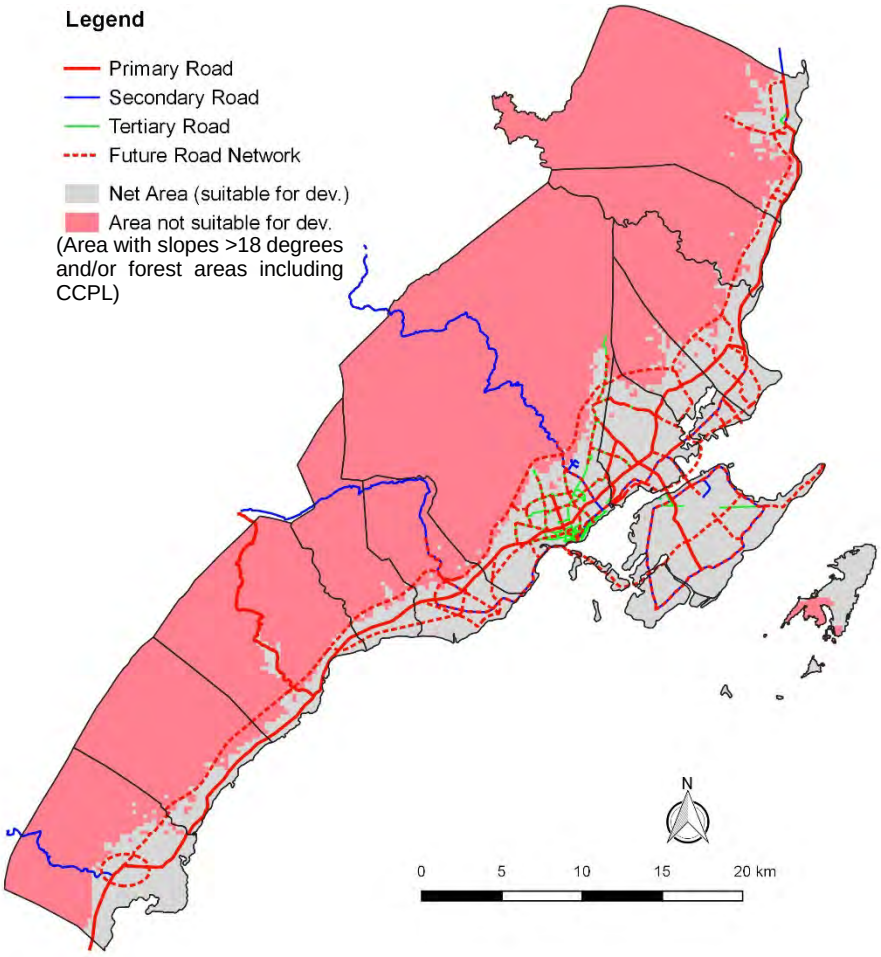
"A vibrant, equitable, sustainable and competitive environment that embraces Cebu's creativity and its culture, historical and natural resources, with strong citizen participation and responsive governance."

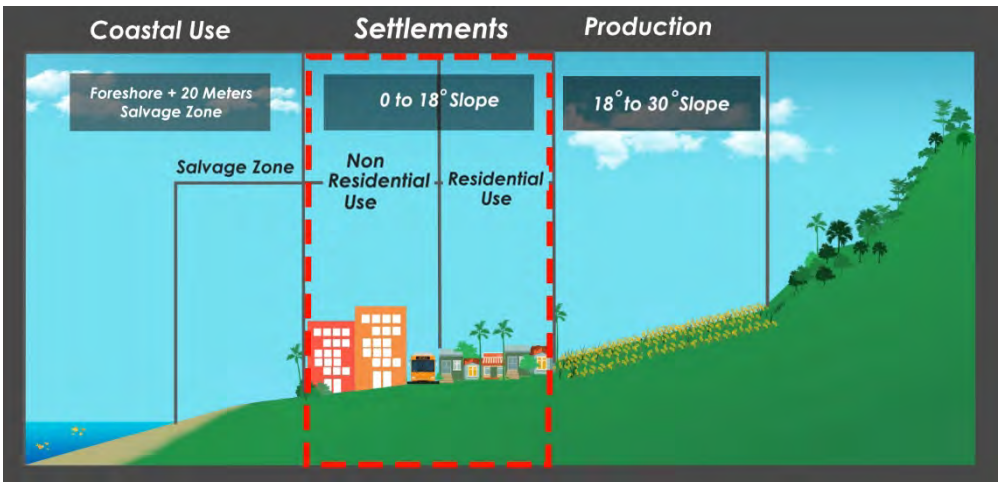
6.2 Development Scenario and Framework

1) Population Projection

Future population in Metro Cebu until 2050 was projected in the Roadmap Study by regressing logistic curves from the past census data of 1980, 1990, 1995, 2000, 2007, and 2010. Population densities were taken into account to prepare the population projection for LGUs in Metro Cebu.

While the Roadmap Study analyzed mainly the population density per gross area, the areas appropriate for human settlement are limited due to the environmental constraints such as steep slopes and the Central Cebu Protected Landscape (CCPL) designated by the National Integrated Protected Areas System (NIPAS) as shown in Figure 6.2.1. The Cebu Provincial Development and Physical Framework Plan suggests to locate human settlements in areas with slopes less than 18 degrees as shown in Figure 6.2.1. Therefore, the Project adopted the net areas excluding those with slopes of more than 18 degrees and/or forest areas for the analysis of population density.





Source: Cebu Province, JICA Project Team

Figure 6.2.1 Areas Suitable and Not Suitable for Human Settlement

Table 6.2.1 Projection of Population and Net Population Density

LGU Name	Land Area (km2)	Population (000) (red: revised by the Project)										Net Population Dencity (persons/ha, red: revised by the Project)								
		Actual		Projection by RM Study				Projection by the Project				Actual	Projection by RM Study				Projection by the Project			
		2010	2015	2020	2030	2040	2050	2020	2030	2040	2050	2010	2020	2030	2040	2050	2020	2030	2040	2050
City of Carcar	117	107	120	156.9	186.4	215.3	243.8	156.9	186.4	215.3	243.8	35.5	51.9	61.7	71.2	80.7	51.9	61.7	71.2	80.7
Cebu City	326	866	923	967.3	1,086.7	1,205.4	1,323.6	967.3	1086.7	1205.4	**1279.9**	196.3	219.2	246.2	273.1	299.9	219.2	246.2	273.1	**290.0**
Compostela	45	43	48	63.1	77.5	91.9	106.1	63.1	77.6	91.9	106.1	66.0	97.8	120.1	142.5	164.5	97.8	120.1	142.5	164.5
Consolacion	39	107	132	155.2	196.6	238.2	279.8	155.2	196.6	238.2	279.8	67.3	97.9	124.0	150.2	176.5	97.9	124.0	150.2	176.5
Cordoba	7	50	60	57.6	68.4	79.1	89.8	**62.9**	**78.6**	**92.2**	**108.1**	51.2	58.6	69.6	80.5	91.4	**64.0**	**80.0**	**93.8**	**110.0**
Danao City	143	119	136	176.1	212.2	247.8	283.0	176.1	212.2	247.8	283.0	67.4	99.5	119.9	140.0	159.9	99.5	119.9	140.0	159.9
Lapu-Lapu City	64	350	408	445.6	544.5	643.0	740.9	**482.4**	**663.9**	**749.0**	**845.0**	58.1	73.8	82.7	95.5	129.7	**79.9**	**110.0**	**124.1**	**140.0**
Liloan	52	101	119	153.3	192.8	232.4	272.0	153.3	192.8	232.4	272.0	45.9	70.1	88.1	106.2	124.3	70.1	88.1	106.2	124.3
Mandaue City	31	331	363	391.7	461.8	531.6	601.1	391.7	461.8	531.6	601.1	110.8	131.0	154.5	177.9	201.1	131.0	154.5	177.9	201.1
Minglanilla	66	113	132	169.3	211.1	252.9	294.6	**141.5**	**176.9**	**197.8**	**221.1**	128.0	191.4	238.7	285.9	333.1	**160.0**	**200.0**	**223.6**	**250.0**
City of Naga	93	102	116	152.2	184.4	216.3	248.0	152.2	184.4	216.3	248.0	84.0	125.9	152.5	178.9	205.2	125.9	152.5	178.9	205.2
San Fernando	74	61	66	88.9	107.7	126.3	144.7	88.9	107.7	126.3	144.7	60.8	88.7	107.4	126.0	144.3	88.7	107.4	126.0	144.3
City of Talisay	44	201	228	236.4	279.7	322.7	365.5	236.4	279.7	322.7	365.5	106.6	125.5	148.4	171.3	194.0	125.5	148.4	171.3	194.0
Metro Cebu	**1,100**	**2,551**	**2,849**	**3,214**	**3,810**	**4,403**	**4,993**	**3,228**	**3,905**	**4,467**	**4,998**	**89.2**	**112.8**	**136.5**	**156.1**	**174.7**	**112.8**	**136.5**	**156.1**	**174.7**

Source: The Roadmap Study, JICA Project Team

According to the population projection by the Roadmap Study, the net population density of Cebu City and Municipality of Minglanilla will exceed or close to 300 people per hectare in 2050 as shown in Table 6.2.1. On the other hand, population as well as net population density of LGUs in Mactan Island (Lapu-Lapu City and Municipality of Cordova) seems to be relatively low considering the future large scale reclamation projects as shown in Table 6.2.1.

Overall population projection in Metro Cebu by the Roadmap Study, which estimates the population in Metro Cebu will reach around 5 million by 2050, is still reasonable based on macro scale economic analysis and population forecast at the provincial and regional scale. Adjustments were made between the LGUs with excessive net population density and LGUs including the potential of further growth in accordance with the development scenario described in the next section.

2) Development Scenario

The Roadmap Study proposed two development scenarios, namely (i) monocentric and densely inhabitant urban society and (ii) polycentric and equitably developed urban society and concluded that the latter is the preferred scenario. While the Project adopts the basic policy of polycentric development scenario, the timing for the establishment of the Central Business Districts (CBDs) and sub-centers outside central Metro Cebu were considered in accordance with the planning of the transport network as well as the major urban development.

Major urban development projects that are expected to include more than 10,000 residents and/or employees concentrate on central Metro Cebu as shown in Figure 6.2.2 and Table 6.2.2. The scale of the reclamation projects is relatively large. As indicated in Table 6.2.2, the reclamation project in the Municipality of Cordova will cover 1,800 hectares, which is more than twice as large as the existing area of Cordova.

In response to the current and future traffic demands, which will include the impact by these projects, the Mandaue–Lapu-Lapu Link Bridge (4th Mactan Bridge) was proposed to be complete around 2023 in addition to the 3rd Mactan Bridge that is currently under construction. The Urban Mass Rapid Transit (UMRT) system was also proposed to be introduced by 2030. However, the operation section will be limited to central Metro Cebu in 2030 as it will take time to extend the system from Danao City to the Municipality of Carcar (currently planned by 2040). Details of the transport network planning is described in Chapter 8.

Considering these urban and transport development aspects, an efficient and effective land use in the central Metro Cebu should be promoted to maximize the benefits of the transport development and induce the multiplier effects through the integration with urban development. Since urban sprawl has already begun in the suburban areas in Metro Cebu, rapid urbanization should be controlled until sufficient transport network is provided.

As shown in Figure 6.2.1, since major transport network was planned in the areas suitable for development, control of urban sprawl is also necessary in terms of the inducement of development by restriction of development in unsuitable areas. Such control is beneficial to maximize usage of the transport network as well as reduce disaster risk.

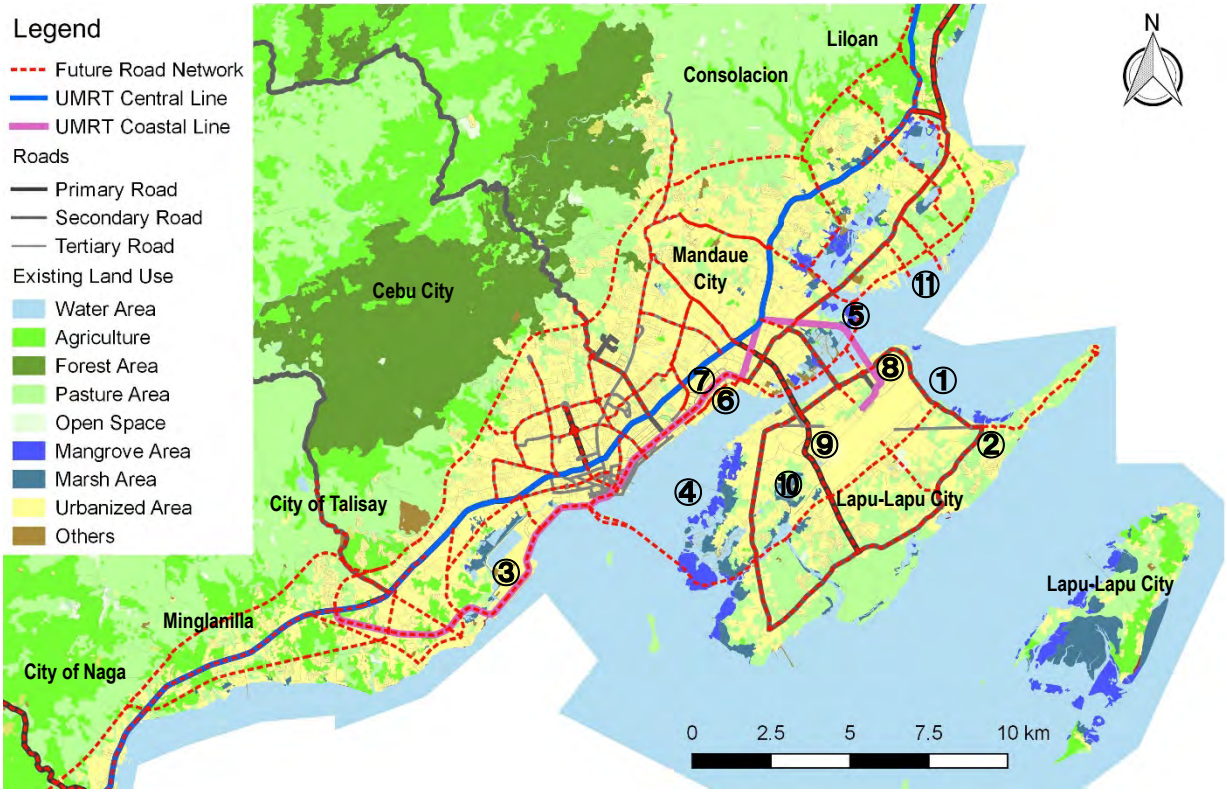
According to this general development scenario, which promotes an efficient and effective urban development in central Metro Cebu and control excessive urban sprawl in the areas not appropriate for the development, the population projection has been slightly revised as shown in Table 6.2.1.

Table 6.2.2 Large Scale Major Urban Development Projects in Metro Cebu

No.	Name	Location	Area (ha)	Summary	Completion Year
	Residential/Mixed Use Development				
1	North Mactan Reclamation Development Project	Lapu-Lapu	400	Reclamation project to be implemented by JV consisting of Lapu-Lapu City and private companies.	Phase 1 in 2021 Phase 2 in 2030 Full completion in 2050
2	The Mactan Newtown	Lapu-Lapu	30	Mixed-use development by Megawide including the 8 Newtown Boulevard, One Pacific Residence, One Manchester Place, Mactan Newtown Beach Club, and offices	Phase 1 in 2017 Full completion in 2021
3	South Road Properties (SRP)	Cebu	300	Reclamation project including SM Seaside City, Citta di Mare, Kawit Island development, and PEZA (265ha, shown below).	SM Seaside City in 2015 Citta di Mare in 2025 Kawit Island development in 2030
4	Cordova Reclamation Project	Cordova	1800	Total of mixed use development project (1420ha), port facility (80 ha) and three eco-tourism projects (300 ha).	TBD
5	Mandaue Global City	Mandaue	130	Reclamation project. While land use has not been determined, it can be a mix of residential, commercial, office, industrial and tourism.	2030
6	Mandani Bay	Mandaue	20	Mixed-use development by Hongkong Land and Taft Properties including a 44-story residential building (1,200units, phase1).	Phase 1 in 2021 Full completion in 2030
7	Gatewalk Central	Mandaue	18	Mixed-use development by Ayala with 16 buildings per master plan.	2019 (Phase1) Full completion in 2025
	Industrial Development				
8	Mactan Export Processing Zone 1 (MEZ1)	Lapu-Lapu	119	Manufacturing Special Economic Zone. Established in 1986. Fully occupied by 158 companies.	Completed
9	Mactan Export Processing Zone 2 (MEZ2)	Lapu-Lapu	63	Manufacturing Special Economic Zone. Fully occupied by 54 companies.	Completed
10	Cebu Light Industrial Park	Lapu-Lapu	63	Manufacturing Special Economic Zone. Sales based. 5-6 years to be filled (currently 35 companies are located).	Completed

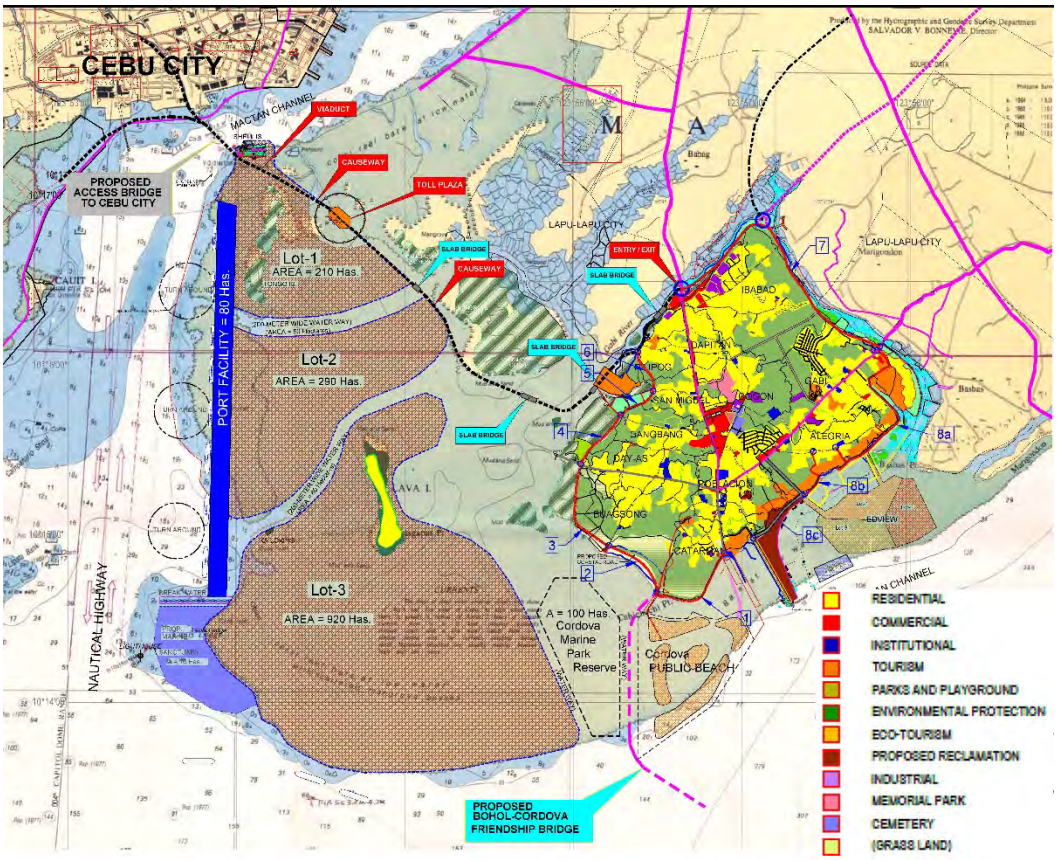
Industrial Development					
3	Cebu South Road Properties (Part of SRP shown above)	Cebu	296	Manufactuaring Special Economic Zone: Bigfoot Entertainment (moview studio), Filvest Land Inc. (50 ha mixed use), UP Visayas Cebu College	Phase 1: Completed Phase 2: 2030
11	Consolacion International Port Project	Consolacion	25	New International Container Port on reclamation land. Current 12ha Cebu Base Port will remain at least for passenger transport.	2022 (construction will start August 2018)

Source: JICA Project Team



Note: Numbers are correlate with the project numbers listed in Table 6.2.2.
Source: JICA Project Team, the Roadmap Study

Figure 6.2.2 Large Scale Major Urban Development Projects in Metro Cebu



Source: Municipality of Cordova

Figure 6.2.3 Reclamation Project in Municipality of Cordova



Source: Lapu-Lapu City

Figure 6.2.4 Image of Mactan North Reclamation and Development Project

6.3 Strategies for Urban Planning and Development

1) Planning and Development Principles

Integrated urban and transport planning and development such as Transit Oriented Development (TOD) enables Smart Growth, which ensures the sustainability of the city.

Smart Growth aims for the sustainable urban development and management in terms of environmental, economic and social aspects. Major organizations such as Smart Growth America and Smart Growth Network introduce the following 10 principles for the implementation of smart urban growth.

(i) Mix land uses

(ii) Take advantage of compact design

(iii) Create a range of housing opportunities and choices

(iv) Create walkable neighborhoods

(v) Foster distinctive, attractive communities with a strong sense of place

(vi) Preserve open space, farmland, natural beauty, and critical environmental areas

(vii) Direct development towards existing communities

(viii) Provide a variety of transportation choices

(ix) Make development decisions predictable, fair, and effective

(x) Encourage community and stakeholder collaboration in development decisions

All these principles are also necessary for the integration of urban and transport planning/development. Therefore, in other words, these principles can be adopted for the implementation of integrated urban and transport planning/development.

2) Enhancement of Urban Core by Integrated Urban and Transport Development

Considering current traffic congestion and a number of large scale projects in the central area of Metro Cebu as shown in Figure 6.2.2, the connectivity between Cebu and Mactan Islands needs enhancement. Enhancement of the linkage between Cebu and Mactan Islands includes both road bridge (4th Mactan Bridge) and railway bridge (UMRT Coastal Line). An integrated urban development should be promoted prior to 2030—since both bridges are proposed to be completed by then—along these major transport corridors to induce the multiplier effects between transport and urban development. For example, while certain numbers of resettlements are expected for the construction of UMRT and new arterial roads, such resettlements should be considered an opportunity for the urban redevelopment. Therefore, application of urban redevelopment schemes such as land readjustment and urban redevelopment should be considered especially at/around the UMRT stations as well as along major transport corridors in the central Metro Cebu. As shown in Figures 6.3.1, 6.3.2 and 6.3.3, urban redevelopment schemes enable to secure open spaces for the improvement on urban amenity and securement of evacuation places in case of disaster; both of which are lacking in the current central Metro Cebu. Most of

central Metro Cebu is appropriate for development with less disaster risks compared to the other areas (see Figure 6.2.1). Therefore, establishment of competitive urban core with sufficient transport network would be effective for the sustainable growth of Metro Cebu in terms of disaster risk management as well.

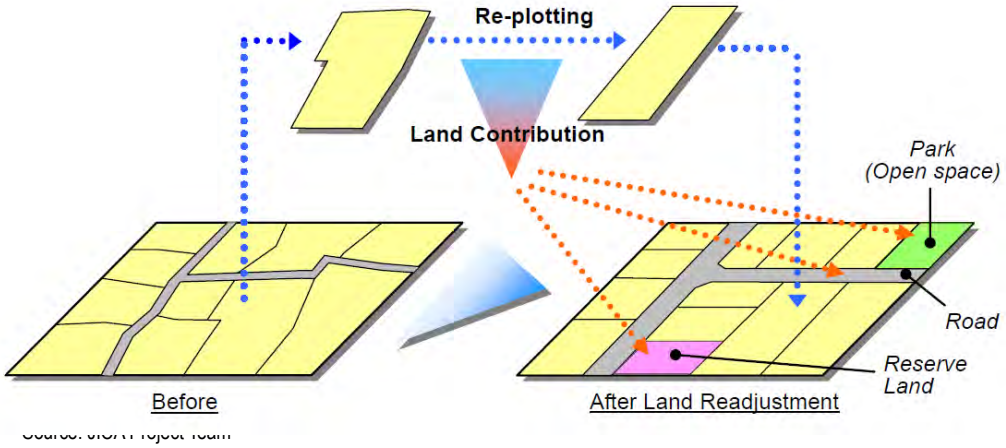
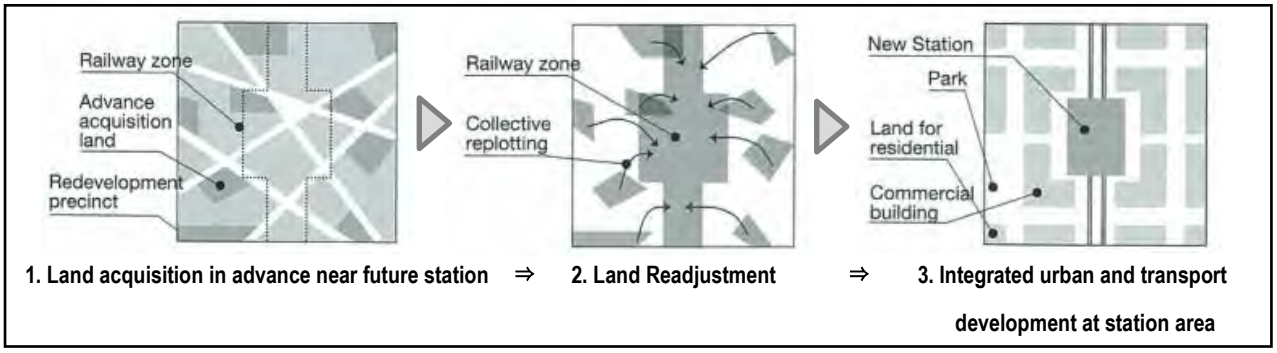
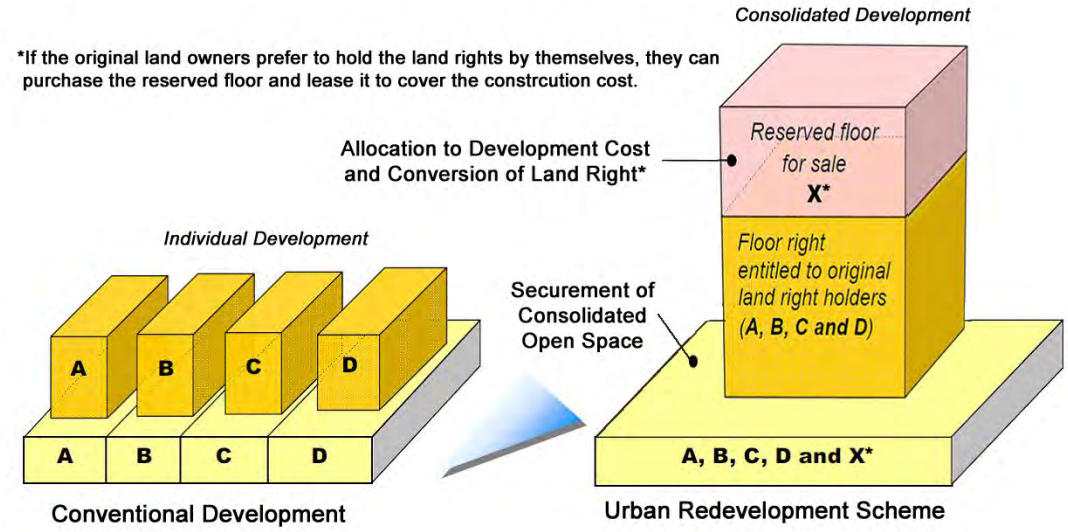


Figure 6.3.1 Land Readjustment Scheme



Source: JICA Project Team

Figure 6.3.2 Land Readjustment for Integrated Mixed-use urban development and Intermodal Facilities at UMRT Station Area



Source: JICA Project Team

Figure 6.3.3 Urban Redevelopment Scheme

In order to promote the urban redevelopment along the transport corridor through the utilization of private fund, certain incentive schemes such as bonus of floor area ratio (FAR) should be introduced. Financing options for the integrated urban and transport development are described in Chapter 10.

Since these schemes are new to the Philippines, it is desirable to conduct the relevant capacity development in the course of urban and transport planning.

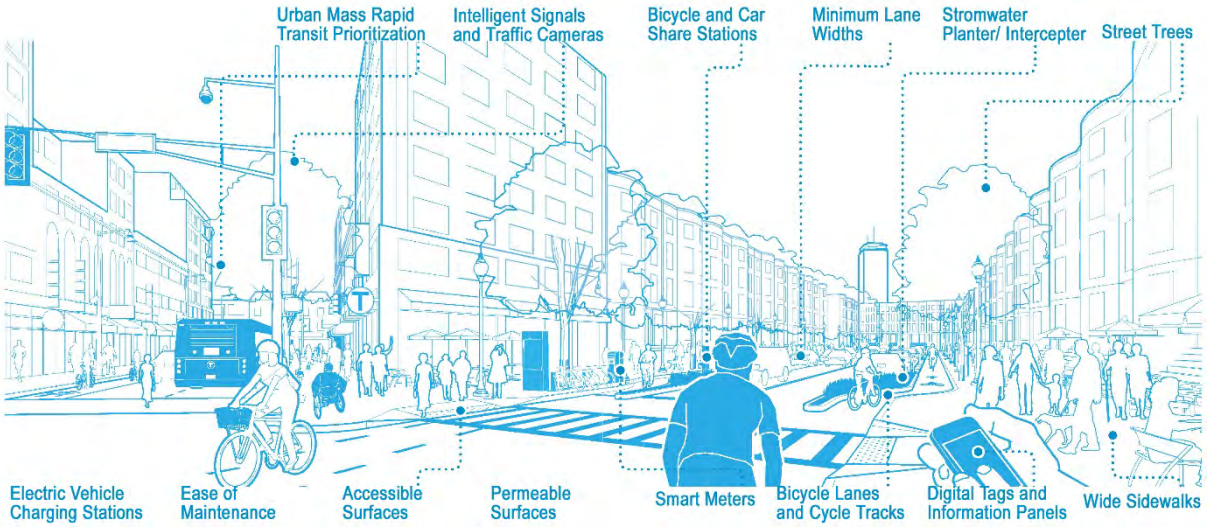
Through these strategic urban redevelopment that aims for the implementation of effective and efficient land use, central Metro Cebu would be revitalized as the urban core of not only Metro Cebu but also Cebu Province and Central Visayas Region.

3) Control of Urban Sprawl and Establishment of Social/ Environmental Network in Transport Corridor

As previously described, establishment of a competitive urban core will be the focus of urban development in the short- to mid-term as major transport development projects concentrate in the central Metro Cebu during the period in order to mitigate the current severe traffic congestion.

On the other hand, rapid urban sprawl has already started in the suburban areas in Metro Cebu and some of the residential development projects are planned and implemented in the hilly areas not suitable for human settlement. Inducement of development along the major transport corridor located in the areas suitable for human settlement (as shown in Figure 6.2.1) is then necessary not only for the prevention of unnecessary urban sprawl, but also for the mitigation of disaster risks as well as for the maximization of the benefits of transport development.

Since right-of-way (ROW) acquisition is always the challenge in an urban area for implementation of transport projects, the designation and securement of sufficient width of ROW at the early planning stage in the suburban areas when land availability is relatively ample is the key for successful implementation of transport development. For the securement of sufficient width of ROW, a variety of functions of transport corridor needs to be considered. For example, the concept of “Complete Street” has recently become popular to maximize the function of street space to share the benefits among the various users as shown in Figure 6.3.4.

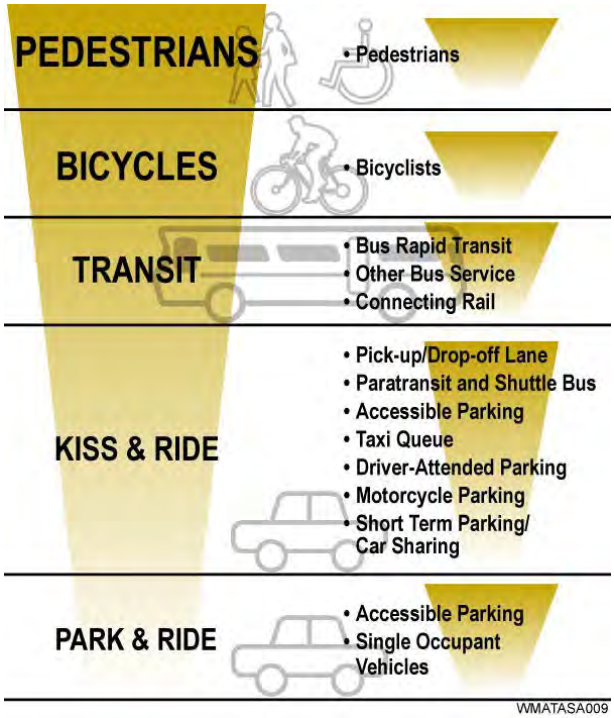


Source : City of Boston

Figure 6.3.4 Typical Components of Complete Street

Through the integration of social and environmental spaces such as urban plazas, continuous sidewalk, and planting strips in the transport corridor, it also works as social and environmental network. In order to design such multi-functional space in a sustainable manner, hierarchy of access should be clarified as shown in Figure 6.3.5.

Establishment of a green network along the major transport corridor enables to extend the "green loop" proposed by the Roadmap Study, which is limited to the central Metro Cebu from the entire Metro Cebu as shown in Figure 6.4.1.



Source： Washington Metropolitan Area Authority

Figure 6.3.5 Hierarchy of Access for Sustainable Transport Development

4) Coordination with Urban Planning of LGUs

The coordination of LGUs tend to be limited for land acquisition and resettlement issues and are not fully reflected on their planning documents since most major transport projects are managed by the national government, such as DOTr and DPWH. While the Comprehensive Land Use Plan (CLUP) is a long-term (9 years) spatial framework plan of LGUs, many of them do not indicate the future transport projects including the necessary ROW as well as the areas for implementation of integrated urban and transport development due to the inappropriate scale not feasible to indicate such information.

As connectivity between Cebu and Mactan Islands were proposed to be enhanced by both road and railway bridges in the short- to mid-term (by 2030), the existing CLUP of the LGUs with high relevancy will be updated by the Project. The proposed LGUs for CLUP updating are Mandaue City, Lapu-Lapu City, and Municipality of Cordova as they have direct access to the 3rd or 4th Mactan Bridges and have large scale reclamation projects that have significant impact on the transport network. Since the Roadmap Study prepared a long-term land use plan at a Metro Cebu scale (Metro Cebu Spatial Plan 2050), the CLUP of these target LGUs will be updated through the revisions on Metro Cebu Spatial Plan 2050 as well as the latest existing CLUP of these LGUs.

Through the CLUP updates, the design guideline relevant to integrated urban and transport development such as TOD will be prepared. An integrated transport and urban development should also be a solution for social issues in urban planning such as socialized housings which Metro Cebu currently suffers from the shortage.

Only the City of Mandaue and City of Talisay, at the moment, have the following ordinances that promote socialized housing development. The City of Mandaue also has an ordinance that promote green building.

City of Mandaue

- **Ordinance on Reclassifying Social Housing Finance Corporation's (SHFC) Community Mortgage Program (CMP) Mobilizer Fee from General Fund to Trust Fund (2016).** This ordinance stipulates that the CMP Mobilizer's Fee (trust fund) must be used only for housing project since the city has adopted SHFC's CMP to address the housing needs by implementation of low cost and socialized housing program.

- **Green Building Ordinance (2015).** This ordinance clarifies the city's holistic approach to design, construction, and operation of green buildings based on the consideration for the basic principles of environmental protection and conservation.

City of Talisay

- **3rd Special Ordinance No. 2008-04 Amending Ordinance No. 2003-001 Implementing balanced housing compliance as provided for in section 18 of RA 7279, otherwise known as "Urban Development and Housing Act of 1992."** This ordinance encourages the location of both main subdivision/condominium projects and compliance projects (socialized housing units) within the city.

- **Moratorium on Simple Subdivisions – 6th Special Resolution No. 656 (s. 2017):** A resolution aims to implement the approved Special Local Economic and Development Area Board Resolution No. 2017-0018; a moratorium to all application of housing projects that include an area larger than 1,000 m^2 or a property subdivided into more than 10 lots for 3 years except for the socialized housing projects by the city or the projects in accordance with the socialized housing compliance.

  The moratorium also prohibits housing projects outside the 300 m strip of Cebu South Coastal Road also known as the Special Local Economic and Development Area to promote the city's public safety, health, and general welfare through appropriate land use planning. This moratorium gives enough time for the city to review, conduct research, receive public input, evaluate, and establish the necessary policies and ordinances for the revision of CLUP.

Considering the current situation of urban planning in an LGU scale, the updating of CLUP is expected to provide opportunities not only for the target LGUs but all Metro Cebu LGUs to learn how to integrate major national transport projects with local urban development towards the implementation of sustainable growth of Metro Cebu.

6.4 Urban Structure Plan

1) CBD and Sub-Centers (Mixed-Use Cluster)

While the current central Metro Cebu include some business and commercial centers (e.g. Cebu Business Park) and government office centers (e.g. Provincial Capitol and Lahug

area in Cebu City), their functions are not fully diversified. Since the accessibility between Cebu and Mactan Islands will be enhanced by 2030, consolidated CBDs are expected to be established especially in Cebu City, Mandaue City, Lapu-Lapu City, and Municipality of Cordova that have direct access to 3rd or 4th Mactan Bridges. With the planned development of UMRT Central and Coastal Lines in the City of Talisay, Cebu City, Mandaue City, Municipality of Consolacion, and Lapu-Lapu City by 2030, strategic establishment of CBDs and sub-centers are necessary especially at the major stations with intermodal facilities for the transfer to feeder services. In order to ensure the sustainable operation of public transport including UMRT and buses, improvements on convenience for the users are necessary; therefore, diversification of the function of CBDs and sub-centers in terms of public, commercial, educational, and business is essential.

From mid- to long-term, some sub-centers are expected to grow to become regional CBDs. Since the UMRT Central Line was proposed to extend to the entire Metro Cebu from the City of Carcar to Danao City, both city centers should have intermodal facilities where passengers can transfer to local and regional buses as well as other transport modes. The City of Carcar already started the construction of a 37-hectare new city center with an intermodal facility. This new city center needs a long-term development plan as it has potential to grow. Similar planning is also necessary for Danao City as the gateway to northeastern and northwestern municipalities in Cebu Province. Danao City is also designated as the Urban Service Center according to the Central Visayas Regional Development Plan 2017-2022. City of Naga also includes potential to grow as a regional CBD to induce development of adjacent LGUs based on the current establishment of light industry.

2) Industrial and Tourism Cluster

The total number of approved Philippine Economic Zone Authority (PEZA) in Metro Cebu more than doubled from 31 in 2014 to 74 in 2017 due to the rapid increase of IT Centers and IT Parks (from 17 in 2014 to 58 in 2017; total of operating, proclaimed, and development in progress). Among 58 approved IT Centers and IT Parks, the majority are concentrated in Cebu City (31) and Mandaue City (24). The rest are located in Lapu-Lapu City (2) and Municipality of Consolacion (1). Many of these IT Centers and IT Parks support the growth of Business Process Outsourcing (BPO) or Business Process Management (BPM) and Knowledge Process Outsourcing (KPO), which has become one of the major industries in the Philippines. As the City of Talisay is of close proximity to the central Metro Cebu, it also has potential to host IT, BPO/BPM, and KPO businesses.

While IT Centers and IT Parks are dominant in a number of sites, Manufacturing Special Economic Zone (MSEZ) is dominant in the land areas of approximately 75% of the total approved PEZA areas as the hub of light industry in Metro Cebu. Light industries such as electronics, furniture, fashion accessories, etc. have been steadily growing over several decades in Cebu Province. Table 6.4.1 indicates the list of MSEZ in Metro Cebu. Cebu South Road Properties in Cebu City has the largest size of MSEZ at 296 hectares. Due to the limited availability of land, manufacturing industrial sites have been proposed mainly at the reclamation sites in central Metro Cebu. In addition to the Cebu South Road Properties, similar manufacturing industrial sites have been planned at North Mactan Reclamation Development in Lapu-Lapu City, Mandaue Global City in Mandaue City, and Cordova Reclamation Project in Municipality of Cordova. Therefore, central Metro Cebu still has the potential to foster the light industry in addition to IT, BPO, and KPO. However, for the implementation of polycentric and equitably developed urban structure as proposed by the Roadmap Study, sound distribution and coordination among the industrial clusters should be considered in the long run. The policy framework should be established to provide incentives for spatial linkages among industry locators and service providers in order to control the arbitrary location of not only light industries but also other industries.

As shown in Table 6.4.1, the City of Naga already started to establish light industrial hubs in a variety of locations such as the Menlo Renewable Energy Corp that plans to build a 60-megawatt solar power plant in New Cebu Township. Municipality of Minglanilla plans to develop a 100-hectare international port and 52-hectare industrial park on a reclamation land by PPP. The Municipality of San Fernando also has a plan to transform its municipal wharf into an international port to accommodate cargoes of industries that operate in neighbor LGUs. While these port projects require further coordination and elaboration due to their proximity from one another, considering the geographical advantage of cargo shipping, these LGUs (Minglanilla–Naga–San Fernando) have a potential to establish a cluster of light industry.

Table 6.4.1 List of Manufacturing Special Economic Zones in Metro Cebu (as of Nov.2017)

Name	Area (ha)	Location	Status
Cebu South Road Properties	296	Cebu City	Operating
Cebu Light Industrial Park	63	Lapu-Lapu City	Operating
Mactan Economic Zone (Mactan Export Processing Zone)	119	Lapu-Lapu City	Operating
Mactan Economic Zone 2 (Mactan Export Processing Zone 2)	63	Lapu-Lapu City	Operating
MRI Eco-Zone	28	Danao City	Operating
New Cebu Township	86	City of Naga	Operating
Naga Valley Industrial Park	39	City of Naga	Proclaimed

Source: PEZA

The Municipality of Consolacion, where a new international port has been proposed, includes the potential for the growth of shipbuilding and repair industry. The Steel Asia Manufacturing Plant in Municipality of Compostela is under construction and planned to be completed in 2019. These areas (Compostela–Liloan–Consolacion) have potential to grow as the hub of shipbuilding and repair in Metro Cebu as well as in Cebu Province.

Danao City has two more industrial areas in addition to the MRI Eco-Zone where Mitsumi Inc., (major cement factory) is located. Due to the role of future CBD and potential development as previously described, a well-balanced growth of variety of industries including IT, BPO/BPM, KPO, and tourism in addition to light industry is necessary. Similar development of industry is also expected in City of Carcar, the south gateway of Metro Cebu.

Tourism is the major industry to sustain the growth of Metro Cebu. Tourist arrival at Mactan International Airport has been steadily increasing (see Table 6.4.2) and the average increase rate of international, domestic, and total passengers over the last decade are 24%, 15%, and 17%, respectively.

Table 6.4.2 Number of Passengers at Cebu Mactan International Airport

Year	International		Domestic		Total Passengers	
	No. of Pax	Change %	No. of Pax	Change %	No. of Pax	Change %
1991	57,998		1,401,671		1,459,669	
1992	97,842	68.70%	1,592,173	13.59%	1,690,015	15.78%
1993	172,966	76.78%	1,635,779	2.74%	1,808,745	7.03%
1994	244,602	41.42%	1,714,104	4.79%	1,958,706	8.29%
1995	307,203	25.59%	1,841,904	7.46%	2,149,107	9.72%
1996	354,818	15.50%	2,047,566	11.17%	2,402,384	11.79%
1997	387,190	9.12%	2,331,431	13.86%	2,718,621	13.16%
1998	312,663	(19.25)%	1,759,141	(24.55)%	2,071,804	(23.79)%
1999	384,047	22.83%	1,912,107	8.70%	2,296,154	10.83%
2000	403,735	5.13%	1,899,114	(0.68)%	2,302,849	0.29%
2001	397,370	(1.58)%	1,855,363	(2.30)%	2,252,733	(2.18)%
2002	425,957	7.19%	1,709,259	(7.87)%	2,135,216	(5.22)%
2003	422,329	(0.85)%	1,850,453	8.26%	2,272,782	6.44%
2004	578,206	36.91%	2,033,556	9.90%	2,611,762	14.91%
2005	672,284	16.27%	2,106,380	3.58%	2,778,664	6.39%
2006	778,210	15.76%	2,291,952	8.81%	3,070,162	10.49%
2007	965,977	24.13%	2,795,523	21.97%	3,761,500	22.52%
2008	994,089	2.91%	2,997,161	7.21%	3,991,250	6.11%
2009	920,913	(7.36)%	3,841,990	28.19%	4,762,903	19.33%
2010	1,206,801	31.04%	4,206,651	9.49%	5,413,452	13.66%
2011	1,467,613	21.61%	4,748,333	12.88%	6,215,946	14.82%
2012	1,513,377	3.12%	5,257,941	10.73%	6,771,318	8.93%
2013	1,626,183	7.45%	5,369,929	2.13%	6,996,112	3.32%
2014	1,679,740	3.29%	5,160,109	(3.91)%	6,839,849	(2.23)%
2015	2,012,135	19.79%	5,769,104	11.80%	7,781,239	13.76%
2016	2,436,355	21.08%	6,394,283	10.84%	8,830,638	13.49%
2017	3,145,962	29.13%	6,904,978	7.99%	10,050,940	13.82%

Source: Mactan Cebu International Airport Authority

The terminal, which was originally designed for 4.5 million passengers per year, was renovated to handle 8 million as response to the rapid increase passengers. An additional new terminal is about to open in July 2018 to accommodate a total of 12.5 million passengers.

In comparison to the increase in the number of tourists, the increase in number of accommodations has been slow as shown in Table 6.4.3. The increase rate of total numbers of rooms is only 4.8% over 2 years and the potential capacity for accommodation is smaller than the number of passengers of the airport. Furthermore, the total number of rooms in some LGUs decreased from 2012 to 2014 whereas extreme concentrations occurred in Cebu City and Lapu-Lapu City that have 50% and 22% of total rooms in Metro Cebu, respectively.

Table 6.4.3 Results of Accommodation Survey by Department of Tourism

Name of Municipality/ City	2014			2012		
	No. of Establishments	Total Rooms	Possible Pax 2014[1]	No. of Establishments	Total Rooms	Possible Pax 2012[1]
Carcar City	5	58	16,936	12	110	32,120
Cebu City	152	10,724	3,131,408	141	9,905	2,892,260
Compostela	8	116	33,872	16	215	62,780
Cordova	8	555	162,060	8	215	62,780
Danao City	3	77	22,484	12	362	105,704
Lapu-lapu City	71	4,646	1,356,632	55	4,233	1,236,036
Liloan	4	59	17,228	8	144	42,048
Mandaue City	22	1,148	335,216	21	809	236,228
Minglanilla	5	76	22,192	5	95	27,740
Naga City	1	16	4,672	1	15	4,380
San Fernando	3	88	25,696	3	88	25,696
Talisay City	10	184	53,728	11	233	68,036
Total Metro Cebu	292	17,747	5,182,124	293	16,424	4,795,808
Cebu Total	631	21,570	6,298,440	728	20,575	6,007,900

Source: Department of Tourism, Region 7

Judging from these existing conditions, establishment of the tourism industry in the entire Metro Cebu integrated with the proposed transport network is essential to implement polycentric and equitably developed urban society, which will result in the increase in number of accommodations.

Multi-functional industrial cluster was introduced in the previous section and includes the tourism cluster; therefore, establishment of the tourism clusters as part of the North Multi-functional Industrial Cluster in the Municipality of Danao and South Multi-functional Industrial Cluster in the Municipality of Carcar by 2040 when UMRT Central Line is extended to these municipalities is necessary. While tourism cluster includes both business and leisure tourism, these clusters have the potential to promote natural and historic resources-oriented tourism. The Central Multi-functional Industrial Cluster is the industrial core of Metro Cebu. The importance of business tourism such as meetings, incentives, conferences/conventions, and events/exhibitions (MICE) becomes more important than other clusters.

In December 2017, the Tourism Code of the Province of Cebu that includes the code of conduct, establishment of the provincial tourism council, as well as physical, legal, and human resource infrastructure was enacted. Establishment of the Provincial Tourism Council is expected to provide guidance to promote the collaboration in tourism development among LGUs in Metro Cebu since the tourism development at the LGU level has not been well-coordinated.

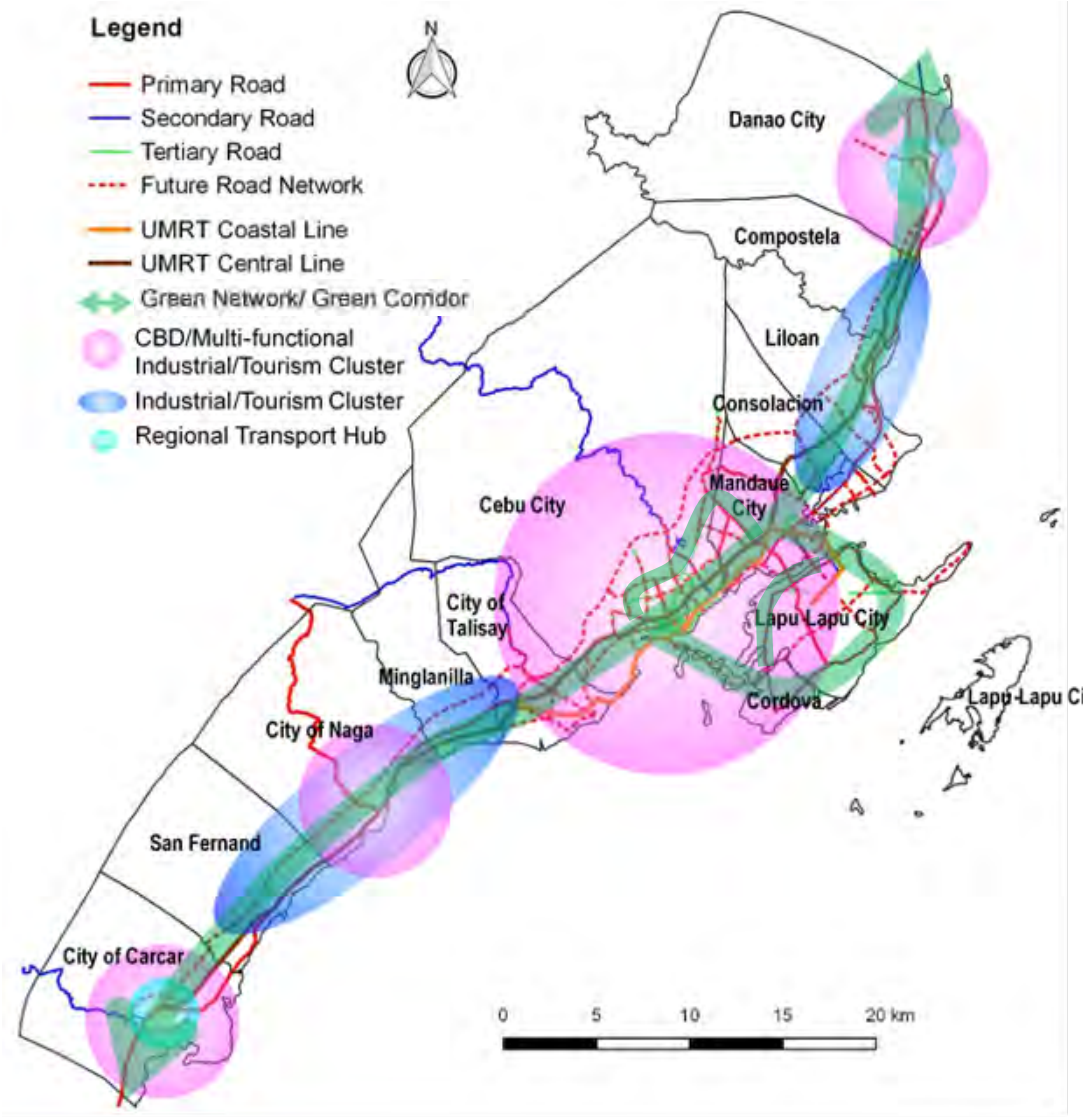
Table 6.4.4 summarizes the projects and programs under current development policy and future development potential of each LGU. As it states, all LGUs are expected to establish a multi-functional industrial and tourism cluster as shown in Figure 6.4.1.

[1] Possible number of pax was calculated based on the assumption that, on the average, each room has 2-person occupancies and visitors stay 1.5 days under the overall occupancy rate of 60%.

Table 6.4.4 Current Project/ Program and Development Potential of LGUs

LGU	Projects and programs per Urban Transport Planning and Urban Development Policy	Development Potential
Danao City	• Enhancement on road network • Traffic management program • Satellite terminal facility program • MRI Eco-Zone (PEZA)	• Proximity to Comotes Islands (tourism development) • Regional transport hub (terminal of UMRT Central Line) and CBD
Compostela	• Road development/ improvement/ rehabilitation • Reclamation • Water transport, proposed wharf • Development of IT park with fiber-optic line • Forest land use plan for Central Cebu Protected Area Landscape (CCPL) • Steel Asia Manufacturing Plant	• Shipbuilding and repair industry stemmed from International Container Port in Consolacion • Community based area management (e.g. on-going coastal cleaning by the community)
Liloan	• Water Transport • Coastal resource management program • Green and Wholesome Environment that Nurtures (GWEN) program • Establishment of municipal tourism and heritage commission	• Enhancement on local governance through Purok system • Well balanced tourism and industrial development based on the current various consideration for environmental protection/ conservation measures.
Consolacion	• International Container Port • Enhancement on road network • Conduct of community-based land use monitoring system • Implementation of new investment code • Preparation of Tourism Master Plan	• Mixed use development in the vicinity of International Container Port • Emergence of relevant industry to port (e.g. shipbuilding and repair industry)
Mandaue City	• Enhancement on road network • Upgrade of traffic control center • Mandaue Global City (reclamation project) • Waterfront mixed use development (e.g. Mandani Bay) • Redevelopment of Cebu International Convention Center • APEC Low-carbon Model Town	• Promotion of MICE (Meeting, Incentive, Conference/ Convention, Exhibition/ Event) Tourism • Establishment of Eco-model city/ Smart city • Regional CBD
Cebu City	• Enhancement on road network • CCLEX (3rd Mactan Bridge) • Cebu South Road Properties (PEZA) • Introduction of new public transport (BRT) • Enforcement of traffic management (e.g. regulation of tricycle and trisikad) • Resettlement of informal settlers • Improvement on public market	• Regional CBD • Promotion of MICE Tourism • Traffic management hub for Metro Cebu • Leading LGU in Metro Cebu implementing compact, effective and efficient integrated transport and urban development.
Lapu-Lapu City	• Enhancement on road network and intermodal transport facilities • Mactan north reclamation and development project • Cebu Light Industrial Park, Mactan Economic Zone 1 & 2 (PEZA) • Urban redevelopment (e.g. The Mactan New Town) • Upgrade of traffic control center	• Regional CBD and center of tourism • Well balanced residential, industrial, commercial and tourism development in less disaster risk areas than other LGUs in Metro Cebu

LGU	Projects and programs per Urban Transport Planning and Urban Development Policy	Development Potential
Cordova	• CCLEX (3rd Mactan Bridge) • Enhancement on road network • Cordova RORO port • Cordova reclamation project • Cebu-Bohol Friendship bridge • Socialized housing program • Green loop/ development of Esplanade	• Integration with regional CBD due to the new development on the reclamation land • Center of eco-tourism • Well balanced residential, commercial and tourism development which are integrated with transport development in less disaster risk areas than other LGUs in Metro Cebu
Talisay City	• Enhancement on road network • Improvement on public market • Resettlement of informal settlers • Enforcement of traffic management (e.g. training, enforcement and amendment of Traffic Code) • International marina • Talisay fish port operation	• Integration with regional CBD through the urban redevelopment • Hub of IT, BPO/BPM, and KPO business • Well balanced residential, industrial, commercial and tourism development integrated with transport development
Minglanilla	• Enhancement on road network incl. trunk road development (old PNR ROW) • New public market (incl. public transport terminal) • 100 ha. International port and 52 ha. industrial park on reclamation land by PPP • Modernization of traffic signal	• Well balanced residential, industrial, commercial and tourism development integrated with transport development
Naga City	• Enhancement on road network incl. road maintenance/ repair • Tourism development • Port development • New Naga public market • New Cebu Township, Naga Valley Industrial Park (PEZA)	• Regional CBD • Well balanced residential, industrial, commercial and tourism development integrated with transport development
San Fernando	• Enhancement on road network incl. diversion road • Coastal project incl. port reclamation • Enforcement of traffic management (e.g. no parking on fire truck lane area, establishment of traffic commission)	• Well balanced residential, industrial, commercial and tourism development integrated with transport development
City of Carcar	• New city center • Enhancement on road network incl. road widening, street lighting and diversion bypass roads • Improvement on public market	• Regional transport hub (terminal of UMRT Central Line) and CBD



Source: JICA Project Team

Figure 6.4.1 Urban Structure Plan in 2050

6.5 Integrated Transport and Urban Development

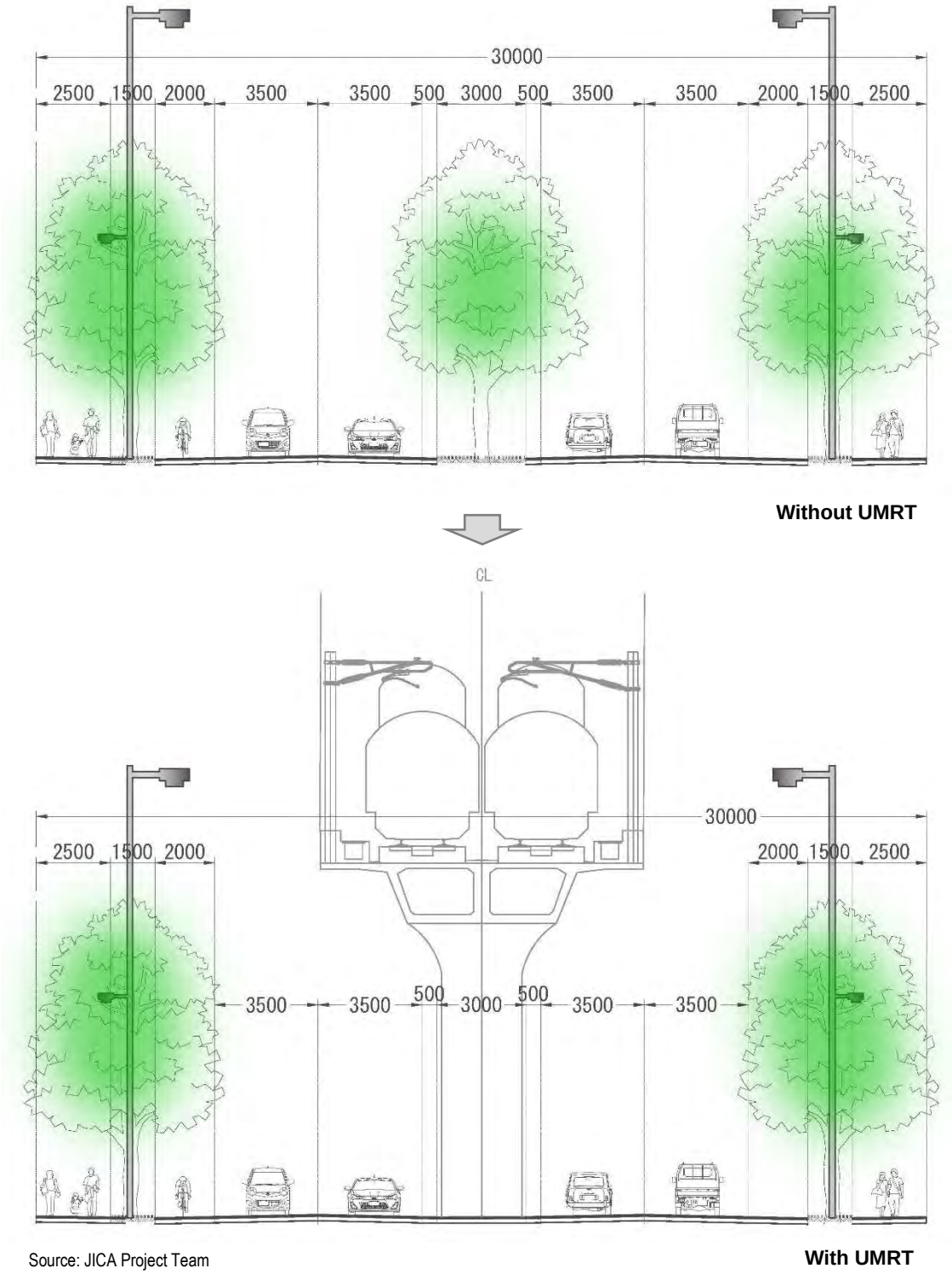
1) Updates on CLUP

Updates on the CLUP of Lapu-Lapu City, Mandaue City, and Municipality of Cordova were proposed to clarify the concrete measures for the integration of urban and transport development. These LGUs have been selected due to their proximity to the priority projects introduced in Chapter 8 and the level of influence by these projects.

According to the basic policies and strategies of urban development previously described, the following are the major aspects of the updates on the CLUP.

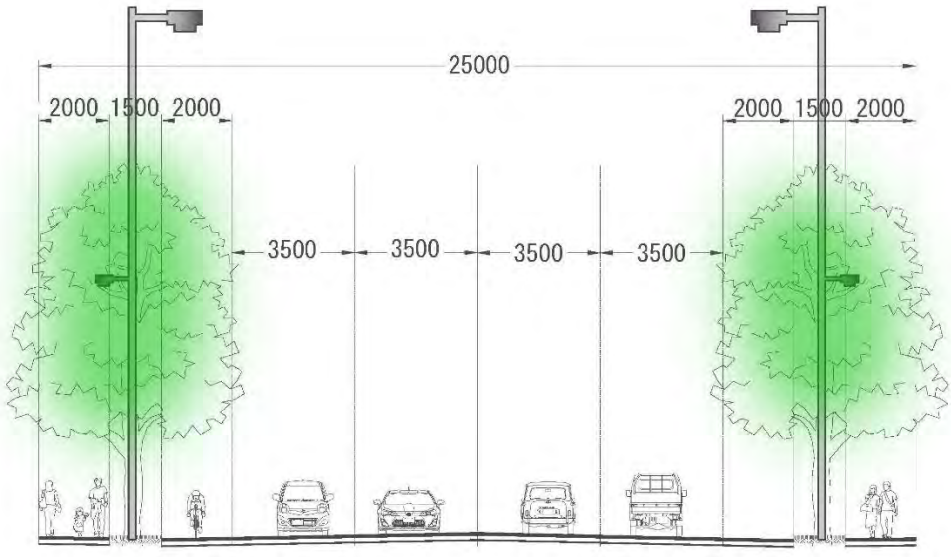
- **Transformation of arterial streets into multi-functional networks**. As previously introduced, the concept of “Complete Street” has been proposed for all arterial streets to maximize their functionality and provide access for all users including pedestrians and bicyclists. Acquisition of sufficient ROW is essential for the implementation of Complete Street based on the consideration for all users as well as for future introduction of UMRT. Therefore, Complete Streets are categorized into

2 types as shown in Figures 6.5.1 and 6.5.2. While Complete Street Type A will be adopted for the arterials including the possibility for the future introduction of UMRT, Type B can be applied for all the other arterial streets. While the components of Complete Streets (roadway, planting strip, sidewalk, and bicycle lane) are the same, the ROW width can vary according to the required number of lanes.



Source: JICA Project Team

Figure 6.5.1 Typical Section of Complete Street Type A (4-lane: w=30 m, 6-lane: w=37 m)



Source: JICA Project Team

Figure 6.5.2 Typical Section of Complete Street Type B (4-lane: w=25 m, 6-lane: w=32 m)





Source: City of Philadelphia

Figure 6.5.3 Stormwater Planter

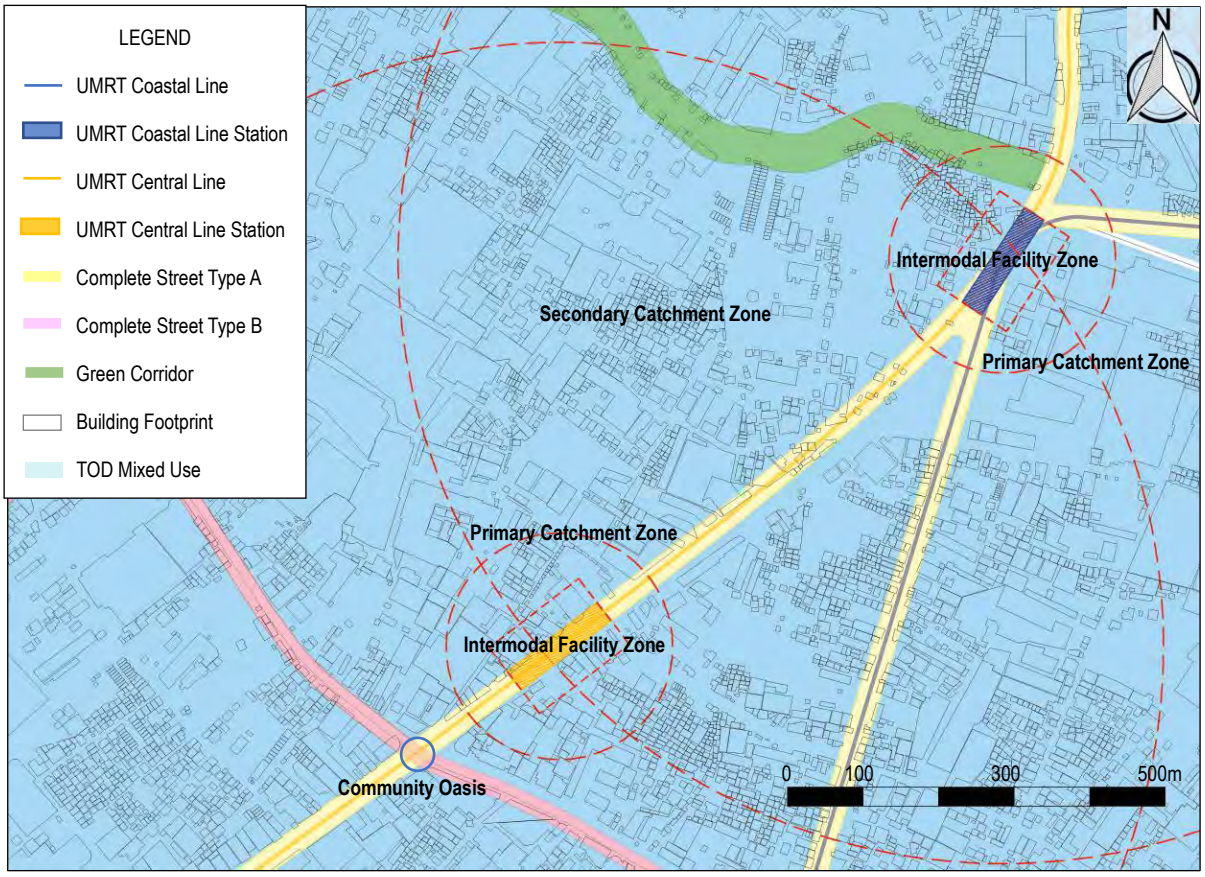
Continuous planting strip provides shade for pedestrians and bicyclists as well as habitat for urban fauna. Furthermore, it serves as a stormwater planter (temporal stormwater interceptor) to mitigate road flooding as shown in Figure 6.5.3.

- **Introduction of Land Use Type with the Consideration for Transport Network**. In order to enhance the impact of the Complete Streets, the adjacent areas to the Complete Streets (mainly Type B)[2] should be designated as special land use

[2] Majority of roadside areas along Complete Street Type A are designated as TOD Mixed Use Area.

(Roadside Mixed-use) based on the consideration for the connectivity with the street such as the introduction of setback and commercial facility on the ground floor to encourage vibrant activities and social interaction. TOD Mixed-use was also proposed for the area of influence by UMRT to enhance accessibility and mobility in the vicinity of the UMRT as well as to boost integrated urban development/redevelopment. As previously described, since promotion of mixed-use is the principle of smart urban growth as well as TOD, a conventional commercial area was proposed to be changed to various types of mixed-use areas. In addition to Roadside Mixed-use and TOD Mixed-use, Commercial-based Mixed-use and Residential-based Mixed-use were also designated according to the intensity of the development.

- **Appropriate Scale and Contents of CLUP**: Although the CLUP Guideline suggests preparing a base map at a scale around 1:5,000–1:25,000 and a zoning map around 1:5,000–1:10,000, majority of the LGUs prepare maps at a scale which fits in A4 paper to include in their report. This results in showing the map at a scale too small to identify necessary details. Without necessary details such as building footprints and future major transport projects, the CLUP cannot be used as a guideline for the implementation of integrated urban and transport development. Therefore, inclusion of these details as well as representation of a map at an appropriate scale are recommended as shown in Figure 6.5.4.



Source: JICA Project Team

Figure 6.5.4 Example of Updated CLUP at a scale of 1:10,000

(1) Mandaue City

The City of Mandaue has a detailed land use classification in its CLUP as shown in Figure 6.5.5 consolidated with the zoning ordinance. The city's residential zones consist of three types as shown in Table 6.5.1 and commercial zones also consist of three types as shown in Table 6.5.2.

Table 6.5.1 Types of Residential Zones in Mandaue City

	R-1	R-2	R-3
General Characteristics	Low density, single-family residential / Limited mixed use	Mid-density, multi-family residential/ Limited mixed use	High-density residential/ Mixed use
Density	20 Dwelling Units (DUs)/ hectare	21–65 DUs/ hectare	Maximum of 66 DUs / hectare
Allowable Use	• Single-detached DUs • Semi-detached family DUs • Single-detached and duplex residential subdivisions • Home occupation for the practice of one's profession • Home industry (cottage industry) • Recreational facilities (limited use/purpose) • Customary accessory use	• All use in R-1 except for residential subdivisions • Apartments • Boarding houses • Dormitories • Museums • Libraries • High School • Vocational School • Drugstore	• All use in R-2 except for residential subdivisions • Residential condominiums* • Townhouses* • Pension houses • Hotel apartments or apartels • Hotels and Motels • Parking buildings

*Including minimum of 20% socialized housing on site

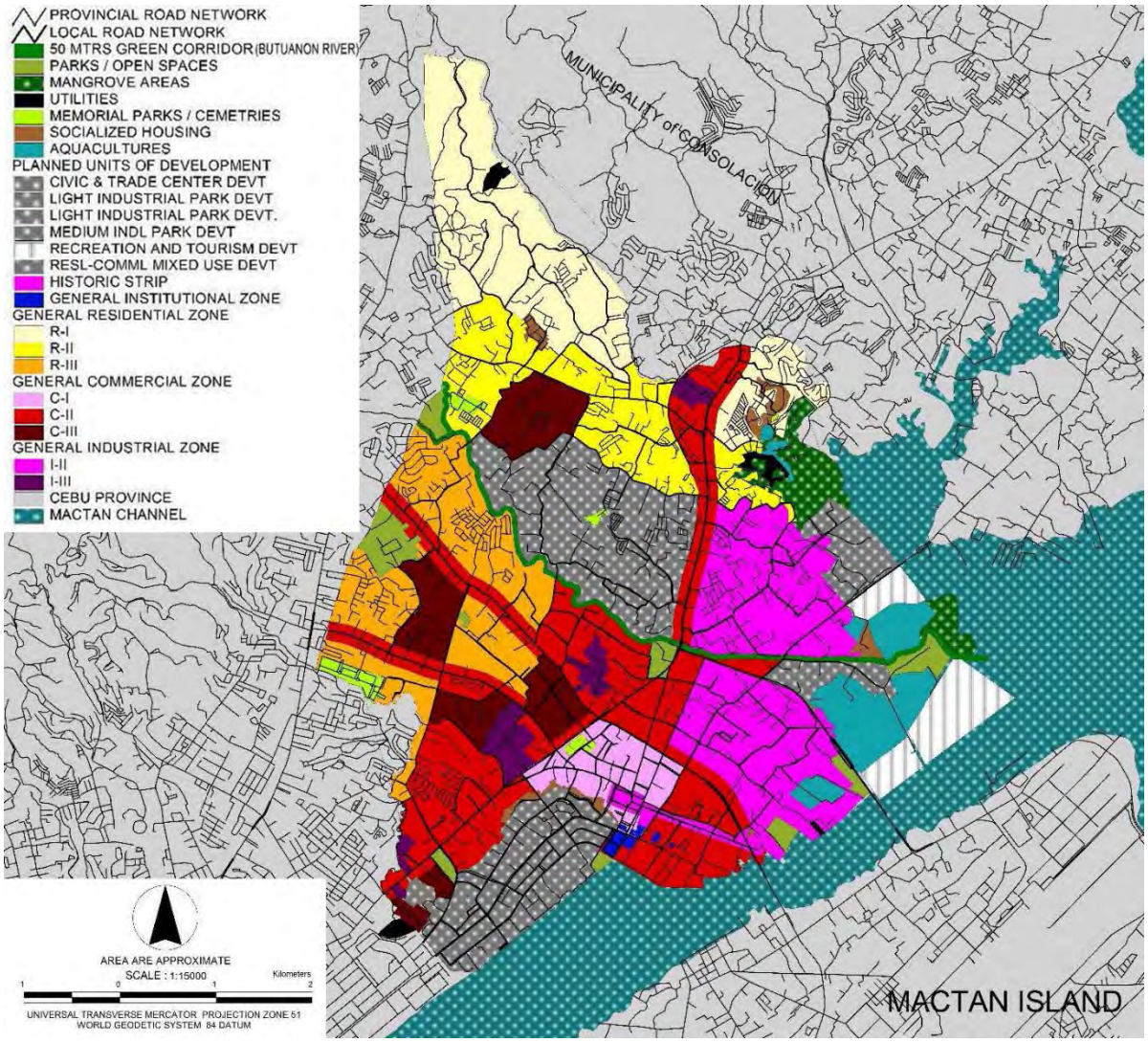
Source: Mandaue City

Table 6.5.2 Types of Commercial Zones in Mandaue City

	C-1	C-2	C-3
General Characteristics	Low density commercial including low density residential	Mid to high density commercial including low/mid density residential	High-density commercial area
Allowable Use	• All use in R-1 except for residential subdivisions • Retail stores and shop • Food market and shop • Product showroom/display stores • Personal service shops • Bayad centers • Laundries • Internet café / cyber stations • Photo/ video, lights & sound services • Catering services • Event planners • Water stations • Courier services • Travel agencies • Photo and portrait studios • Repair shop • Recreational centers • Mini-theaters • Video-karaoke houses • Electric amusement facilities	• All use in R-1, R-2 and C-1 • Wholesale stores • Wet and dry markets • Shopping centers, malls and supermarkets • Recreational centers • Bars, lounges, pubs etc. • Exhibit halls • Convention centers and related facilities • Business Process Outsourcing services • Radio and television stations • Janitorial services • House furniture and appliances repair shops • Motor vehicles and accessory repair shops • Battery shops and repair shops • Auto repair, tire, vulcanizing shops and car wash • Construction supply stores • Funeral parlors • Transportation terminals	• Regional shopping malls/ centers • Convention Centers • High-rise hotels and condominiums • High-rise office building • Columbarium

	C-1	C-2	C-3
	• Restaurants • Lotto terminals • Parks and playgrounds • Plant nurseries • Vocational/ technical school • Short-term special education • Embassies/ consulates • Libraries/ museums • Financial institutions/service • Offices • Parking lots/garage/building • Engraving, photo developing and printing shops • Electronic printing, publication and graphic shops • Manufacture of insignia, badges and similar emblem • Columbarium • Commercial housing (hotel etc.) • Customary accessory use	• Auto sales, car display, and dealer stores • Boat storage • Vehicle emission testing center • Machinery display shop • Welding shops • Glassware and metalware stores, household equipment • Signboard and streamer painting, and silk screening • Electronic printing, copiers • Recording and film laboratories • Gardens and landscaping supply/ contractors • Lechon stores • Bakery • Shops for repacking of food products • Commercial condominiums • Commercial housing (motel, condotel etc.)	

Source: Mandaue City



Source: Mandaue City

Figure 6.5.5 Proposed CLUP of Mandaue City

Since several mixed-use areas were already proposed, updates on the CLUP of Mandaue City are the addition of Complete Streets and the following land uses, which intend to enhance the accessibility and integration with the transport projects.

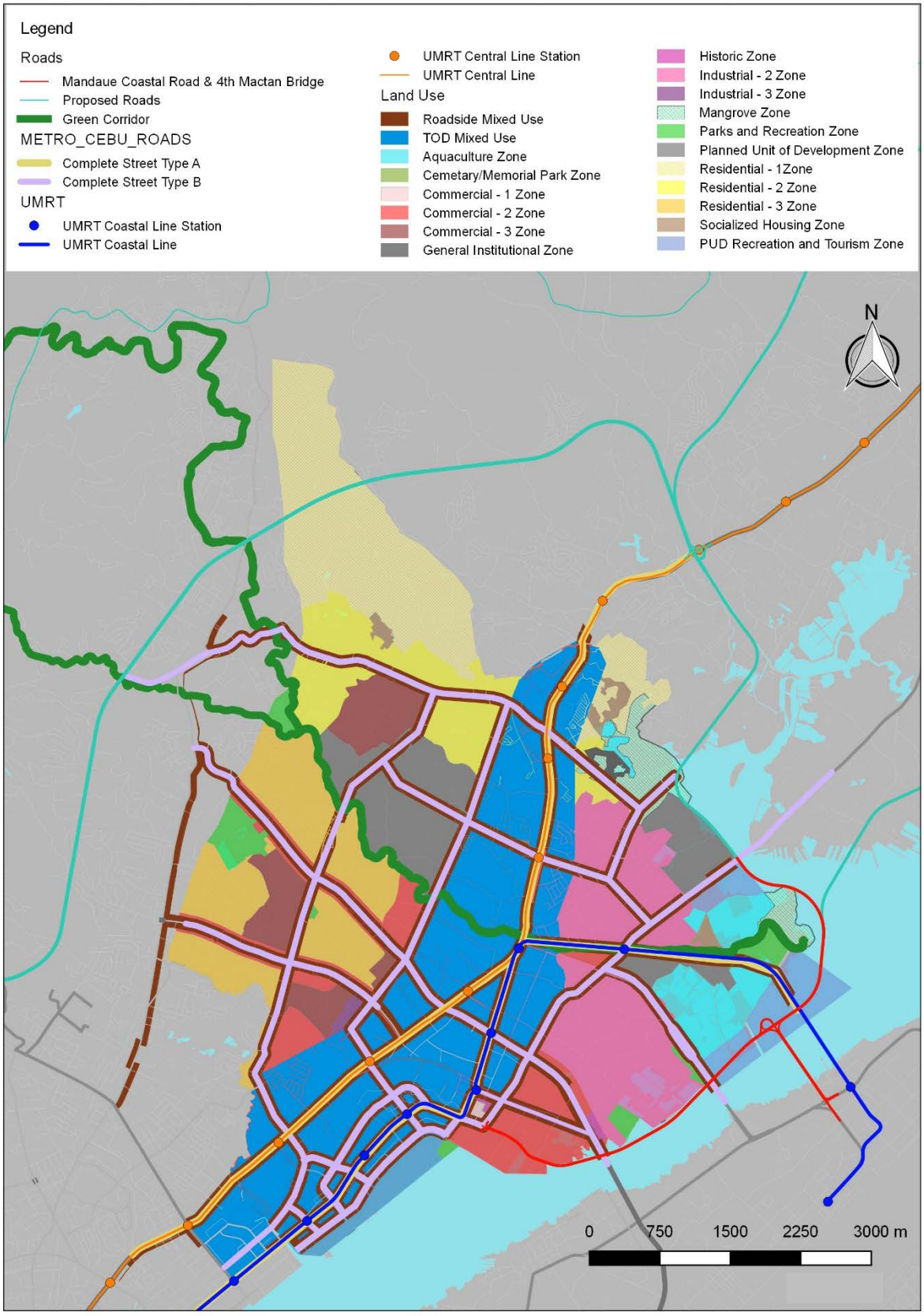
(i) TOD Mixed-use

TOD Mixed-use was proposed for the area of influence of UMRT corridor (Figure 6.5.6) to maximize the benefits of UMRT through integration with the adjacent urban development and enhancement on accessibility/ mobility within the area.

(ii) Roadside Mixed-use

Roadside Mixed-use was proposed along the major arterials where the Complete Streets (Type B) would be to enhance the unity with the street space and induce multiplier effects between the streets and adjacent building for the establishment of vibrant urban areas.

Guidelines of these proposed land uses are described in the next section. The proposed updated CLUP of Mandaue City, which includes these land uses, is shown in Figure 6.5.6.



Source: JICA Project Team

Figure 6.5.6 Proposed Updated CLUP of Mandaue City

(2) Lapu-Lapu City and Municipality of Cordova

As shown in Figure 6.5.7, the proposed CLUP of Lapu-Lapu City has a conventional land use classification. Whereas the general residential zone is designated for residential use and commercial use is limited to neighborhood convenience stores (sari-sari stores), the General Commercial Zone includes all kinds of commercial facilities and limited residential facilities (commercial housing and commercial condominiums). Therefore, the following mixed-use areas were proposed in addition (see Figure 6.5.9) to TOD Mixed-use and Roadside Mixed-use.

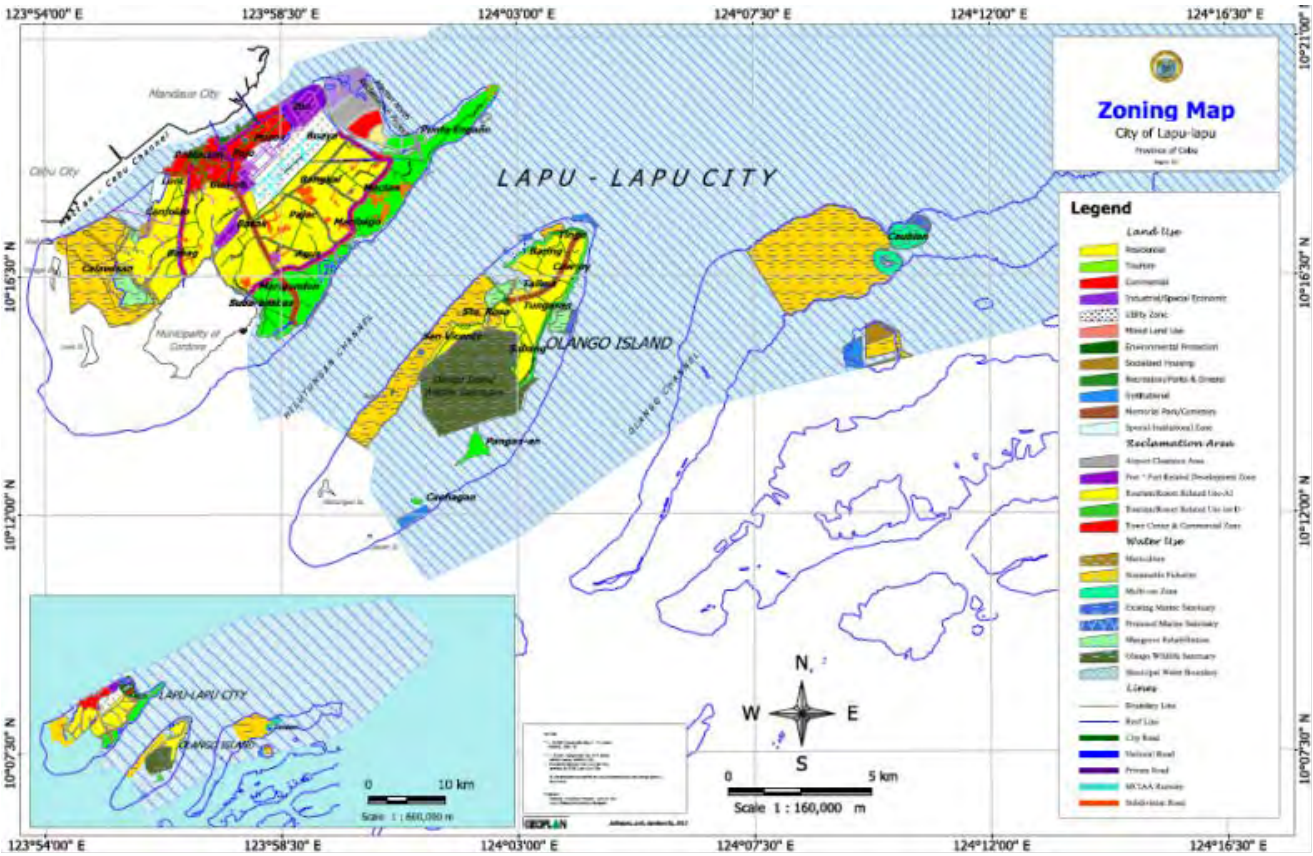
(i) Commercial-based Mixed-use

Commercial-based Mixed-use assumes the same zoning as C-2 and C-3 in the zoning classification of Mandaue City. This mixed-use aims to include a variety of residential types in the commercial areas to improve the quality of urban living environment.

(ii) Residential-based Mixed-use

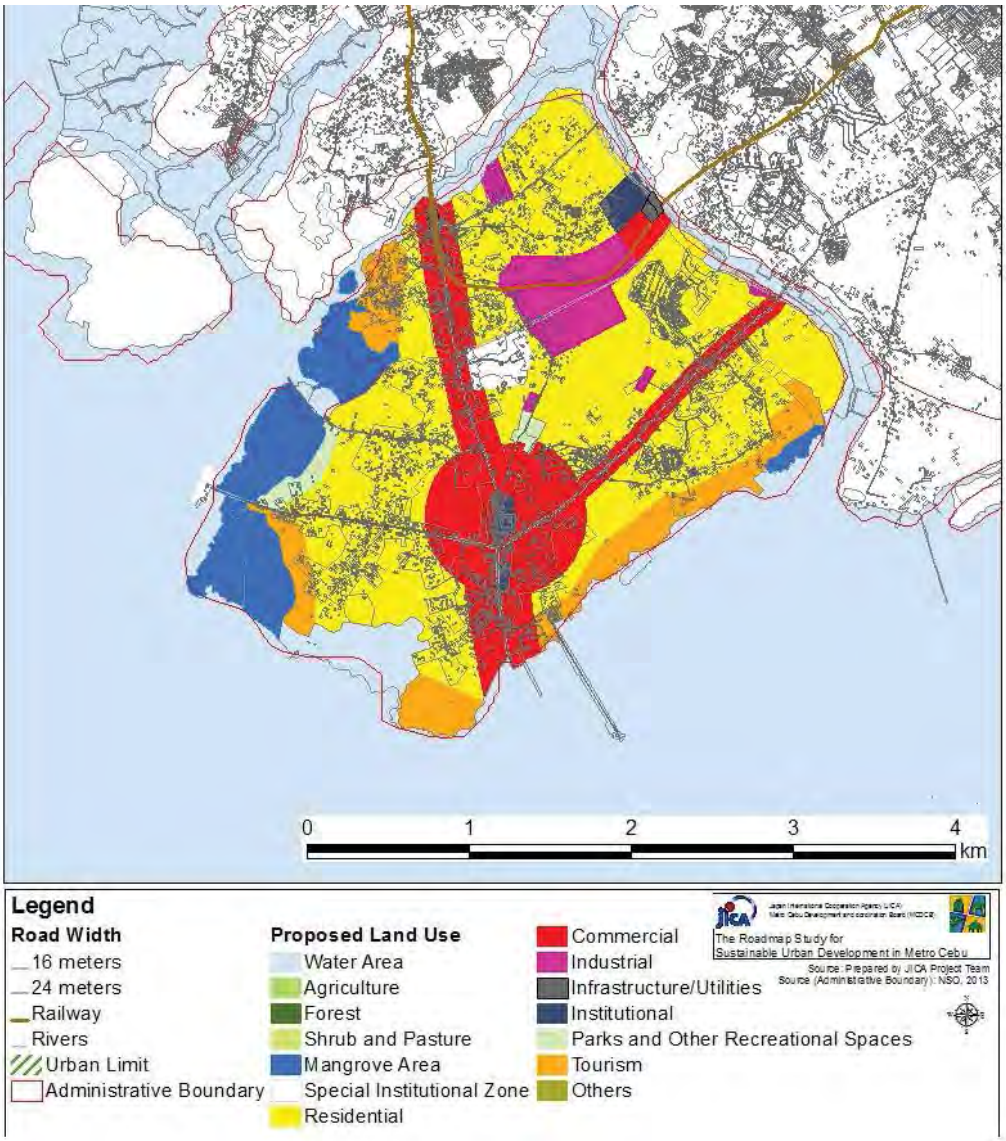
Residential-based Mixed-use assumes the same zoning as C-1 in the zoning classification of Mandaue City. This mixed-use aims for the integration of low-density residential and commercial uses to increase the convenience and attractiveness of the neighborhood.

Since the Municipality of Cordova's CLUP includes the descriptive proposed land use without a proposed zoning map, the spatial plan proposed by the Roadmap Study (Figure 6.5.8) has been updated in accordance with CLUP as shown in Figure 6.5.9.



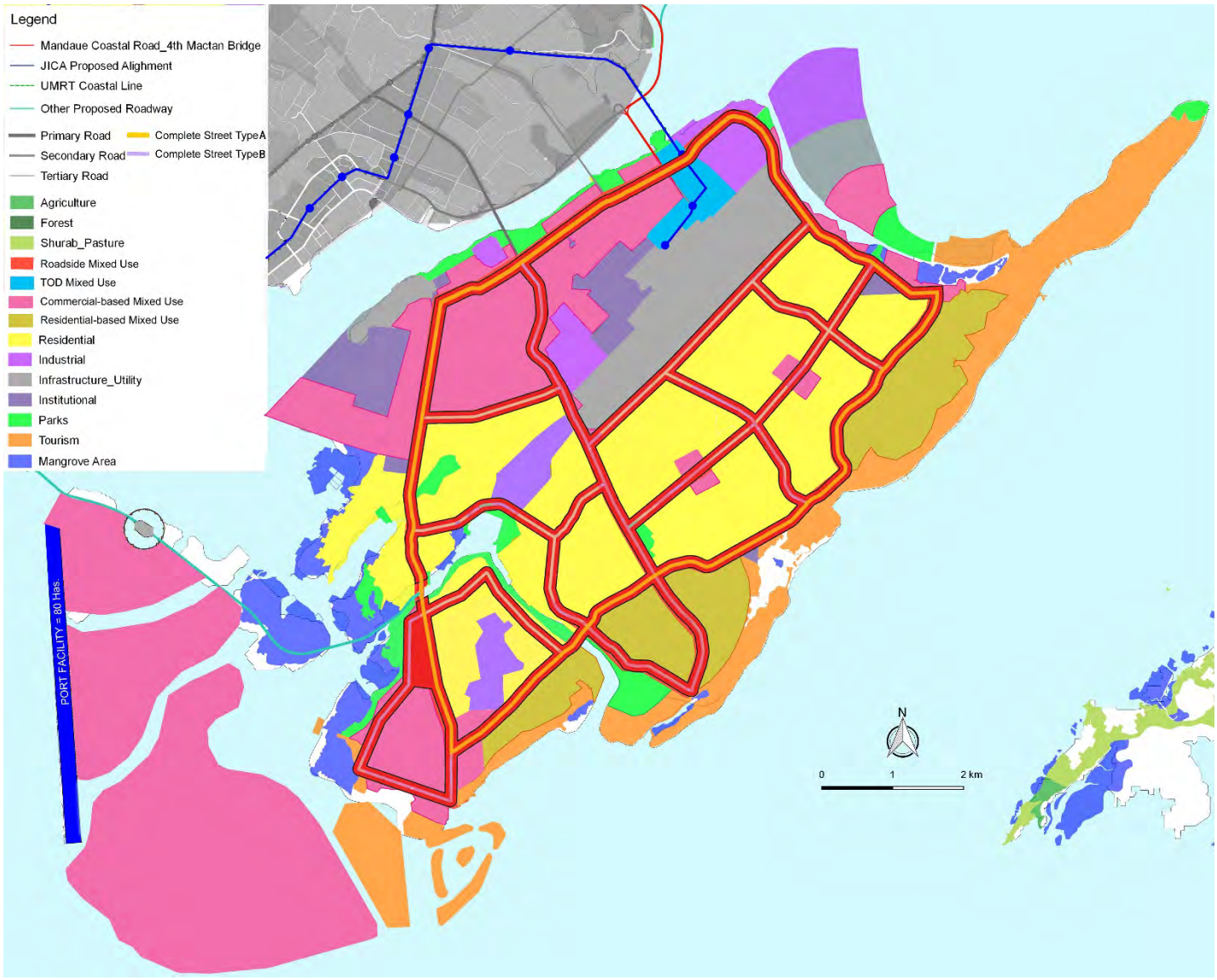
Source: Lapu-Lapu City

Figure 6.5.7 Proposed CLUP of Lapu-Lapu City



Source: The Roadmap Study

Figure 6.5.8 Spatial Plan of Municipality of Cordova Proposed by the Roadmap Study



Source: JICA Project Team

Figure 6.5.9 Proposed Updated CLUP of Lapu-Lapu City and Municipality of Cordova

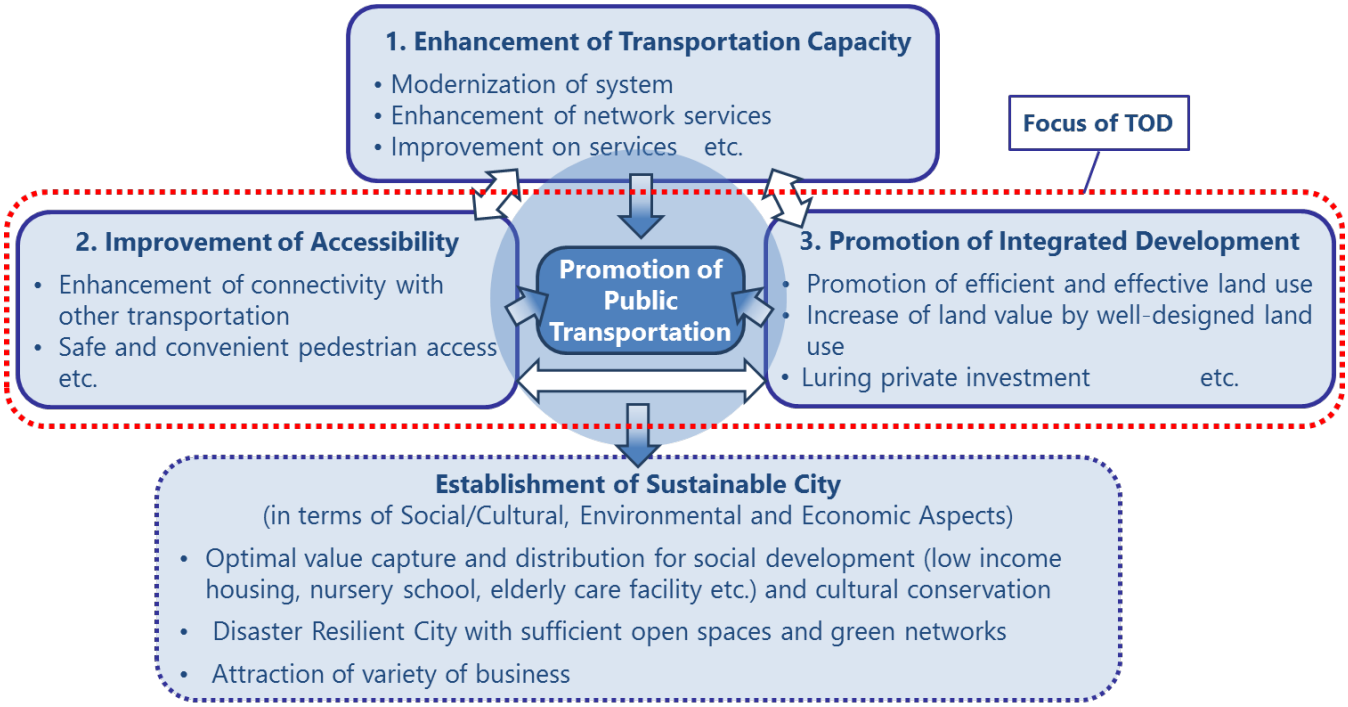
2) Design Guideline

As previously described, TOD Mixed-use and Roadside Mixed-use were proposed to enhance the integration of urban and transport development according to the guidelines as follows.

(1) TOD Mixed-use

(i) Concept

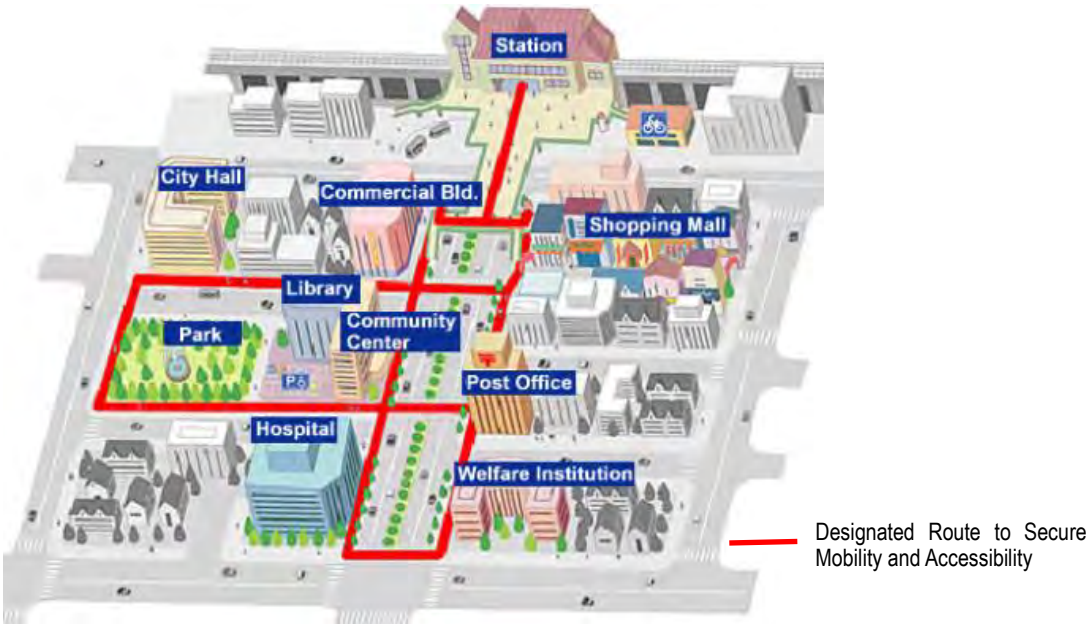
TOD aims to promote public transportation through improvement on accessibility and integrated urban and transport development as shown in Figure 6.5.10. Such integration enables to create a multi-functional, convenient, and vibrant space around the stations and to attract more passengers. Consequently, TOD stimulates the enhancement on public transportation network and contributes to sustainable growth of the local community in terms of social, economic, and environmental aspects.



Source: JICA Study Team

Figure 6.5.10 Concept of TOD

Regarding the normalization in mobility and accessibility (i.e. barrier-free design), while the National Building Code including Implementing Rules and Regulations as Amended of Batas Pambansa Biang 344 (Accessibility Law), stipulates the requirement for individual design elements such as slopes, sidewalks, etc., it does not secure the accessibility and mobility among the major facilities as shown in Figure 6.5.11. In Japan, the “Act on Promotion of Smooth Transportation etc. of Elderly and Disabled Persons etc.” has been enforced since 2006 to implement seamless accessibility and mobility among major public facilities that contributes to the improvement on accessibility and mobility in the entire community.



Source: Ministry of Land, Infrastructure, Transport and Tourism, Japan

Figure 6.5.11 Securing of Accessibility/ Mobility among Major Facilitates

Coordination and collaboration among stakeholders are essential to implement the holistic improvement on accessibility as well as integrated transport and urban development. Therefore, establishment of a TOD Committee that includes both public (DOTr, DPWH, LGUs, railway operator,[3] etc.) and private sectors (developer of TOD Mixed-use area, home and business owners' association, etc.) is necessary. A business improved district (BID) is one of the major bottom-up local operations and management systems led by property and business owners. BID tasks range from regular maintenance, such as cleaning and patrolling, to strategic marketing for attraction of business, capital investment, and visioning etc. as shown in Figure 6.5.12.



Source: Julie Grail. The Experiences of BID in the UK.

Figure 6.5.12 Hierarchy and Contents of BID Activity

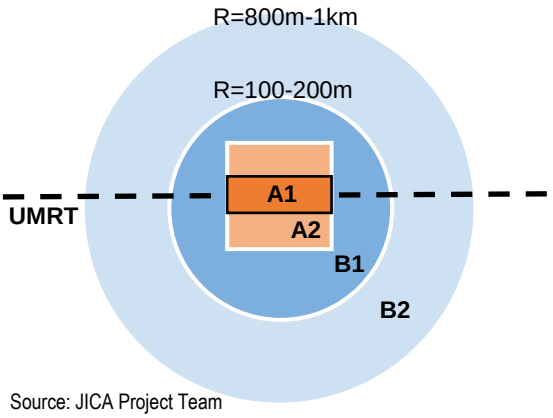
Since the BID can play a major role as a member of TOD Committee, establishment of BID is highly recommended based on the coordination and initiative by LGUs and local communities.

(ii) Allowable Use

Allowable land uses in the TOD Mixed-use Zone are the same as C-2 in accordance with the zoning code of Mandaue City as shown in Table 6.5.2. Some of the facilities listed in C-3 (except for regional shopping center) can be developed by project basis upon approval by the TOD Committee.

(iii) Zoning Regulations

TOD Mixed-use Zone consists of the following four sub-zones as shown in Figure 6.5.13. All structures in these zone are supposed to follow the National Building Code.



Station Zone	A1	Station Building Zone
	A2	Intermodal Facility Zone
Catchment Zone	B1	Primary Catchment Zone
	B2	Secondary Catchment Zone

Source: JICA Project Team

Figure 6.5.13 TOD Mixed-use Zone

[3] If UMRT is implemented by PPP, it can be a private company.

(a) Station Building Zone

The Station Building Zone covers station and consolidated building (if any) as well as their entry and exit points. It is supposed to be constructed and maintained by DOTr, railway operator, and/or commissioned private agency depending on the implementation structure of UMRT. If the station is consolidated as a station building, construction and maintenance cost can be shared by the private developer of the building. However, intensive coordination and negotiation would be required to reach an agreement and certain technical risks would be involved by combining the structures of railway and a mixed-use building.

Safe, comfortable, and convenient access to/from the ground floor needs to be secured since currently all UMRT stations are planned on the viaduct. The following facilities are required to be installed along the periphery of the station/ station building.

- Connection points to the pedestrian bridge/ deck in the Intermodal Facility Zone
- Elevators (minimum of one each on both sides of the station).
- Directional signage with consideration for universal design (e.g. audio guidance, braille signage, and description in multi-languages etc.).

(b) Intermodal Facility Zone

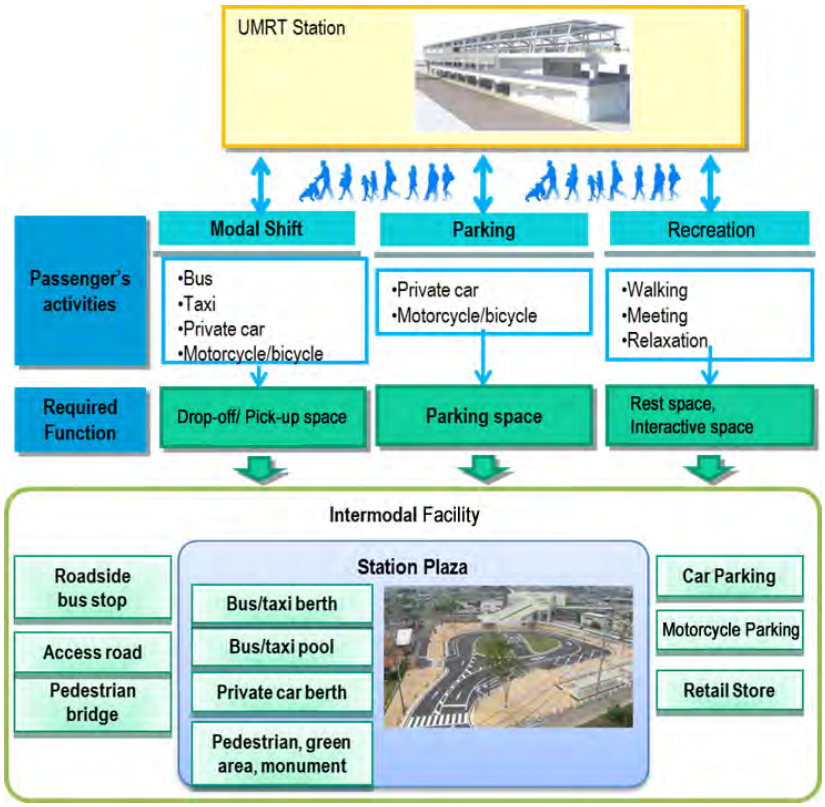
Intermodal Facility Zone is the area directly adjoining the station or station building where intermodal facility is planned to be developed. In other words, intermodal facility is the only facility to be developed in this zone. Intermodal facility is a key facility of TOD to implement a seamless transfer and creation of vibrant social space as shown in Figure 6.5.14. Main components of the intermodal facility are the station plaza and the pedestrian bridge/deck.

Pedestrian bridge/ deck should include the awnings as shown in Figure 6.5.15. It needs to be located on the both sides of the station for the safety, comfort, and convenience of pedestrian access. The size of the pedestrian bridge and deck should be designed based on the estimated numbers of peak-hour passengers to provide enough space for each passenger. There should also be consideration on the universal design (e.g. installation of detectable warning paving, elevators, etc.).

Station plaza includes elements such as a bus stop, taxi stand, drop-off/pick-up area, and rest area as shown in Figure 6.5.16. A sufficient open space should be secured not only for social interaction but also for evacuation in case of disaster.

Like the Station Building Zone, construction and maintenance costs can be shared between public and private sectors depending on the layout and contents of the adjacent buildings in the Primary Catchment Zone. For example, if the pedestrian bridge or deck is directly connected to the adjacent mixed-use building as shown in Figure 6.5.16, a part of (or full) construction and maintenance can be under the responsibility of the adjacent building's developer as it would encourage UMRT passengers to go to the building and stimulate business.

Since surface parking should be minimized in the Intermodal Facility Zone to establish a pedestrian friendly zone, parking facilities in the adjacent mixed-use buildings should be utilized for UMRT passengers as well.



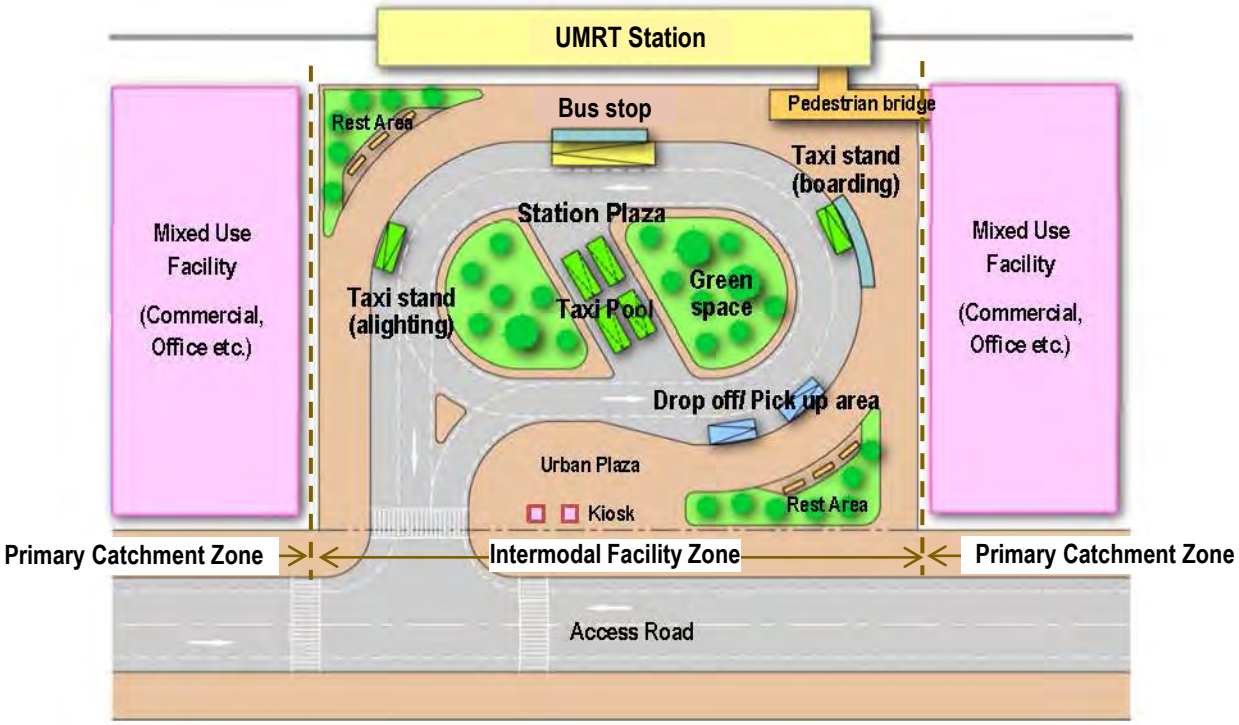
Source: JICA Comprehensive Study of the Urban Transport Development Program in Greater Yangon

Figure 6.5.14 Role and Function of Intermodal Facility

Pedestrian deck in the station plaza at Mizonokuchi Station, Kawasaki City	Pedestrian bridge crossing at the intersection, Shin Yokohama Station, Yokohama City
	

Source: JICA Comprehensive Study of the Urban Transport Development Program in Greater Yangon

Figure 6.5.15 Example of Pedestrian Bridge/Deck



Source: JICA Project Team

Figure 6.5.16 Typical Components of Station Plaza

(c) Primary Catchment Zone

A minimum of 10% of parking slots/ areas prescribed by National Building Code should be added to each building and allocated for UMRT passengers. Parking slots/ areas include the parking for motorcycle and bicycles. This requirement applies to the parking building as well if one is constructed in this zone.

Parking use is not allowed on the ground floor nor second floor as they have direct access for pedestrians and UMRT passengers, and potentially create a vibrant urban atmosphere. In order to maximize its potential to be a gateway area in the neighborhood, the use of the ground and second floors should either be commercial or office. Certain transparency should be situated to maintain visual connection between the inside and outside the building (e.g. glass wall to recognize the activity inside the building) on these floors.

Building setback required by National Building Code (see Table 6.5.3) should be fully-utilized for better pedestrian access. All setbacks that face the streets should be open to the public.

(d) Secondary Catchment Area

Same requirements for building setback would be applied for Primary Catchment Zone. In addition, a small urban plaza (Community Oasis) that includes feeder transport transfer facilities as shown in Figure 6.5.17 should be developed at the major corner of the street based on the coordination with the TOD Committee.



Source: City of Boston, JICA Project Team

Figure 6.5.17 Major Components of Community Oasis

(2) Roadside Mixed Use

(i) Concept

To maximize the benefits of arterial road widening as well as new construction of arterial roads, the integration with the adjacent property is essential. While the width of the sidewalks along proposed major arterials (Complete Streets) are limited (2.0–2.5 m) as shown in Figures 6.5.1 and 6.5.2, they can be expanded by utilizing the setback of the adjacent buildings.

The National Building Code prescribes the minimum setbacks for commercial, industrial, institutional, and recreational buildings as shown in Table 6.5.3.

Table 6.5.3 Setbacks for Commercial, Industrial, Institutional and Recreational Buildings

Width of ROW (m)	Front (m)	Side (m)	Rear (m)
30.0 or above	8.0	5.0	5.0
25.0–29.0	6.0	3.0	3.0
20.0–24.0	5.0	3.0	3.0
10.0–19.0	5.0	2.0	2.0
Below 10.0	5.0	2.0	2.0

Source: National Building Code

While many of the existing buildings do not comply with these requirements, the widening and construction of (new) arterial roads require reconstruction of the adjacent buildings. This would be the opportunity to introduce the setback in accordance with the code.

Usage of the ground floor should be carefully considered as it creates the image of the neighborhood. In other words, if the appropriate use was chosen, it would

induce multiplier effects for pedestrians and business and property owners of the ground floor, as well as for local community.

(ii) Allowable Use

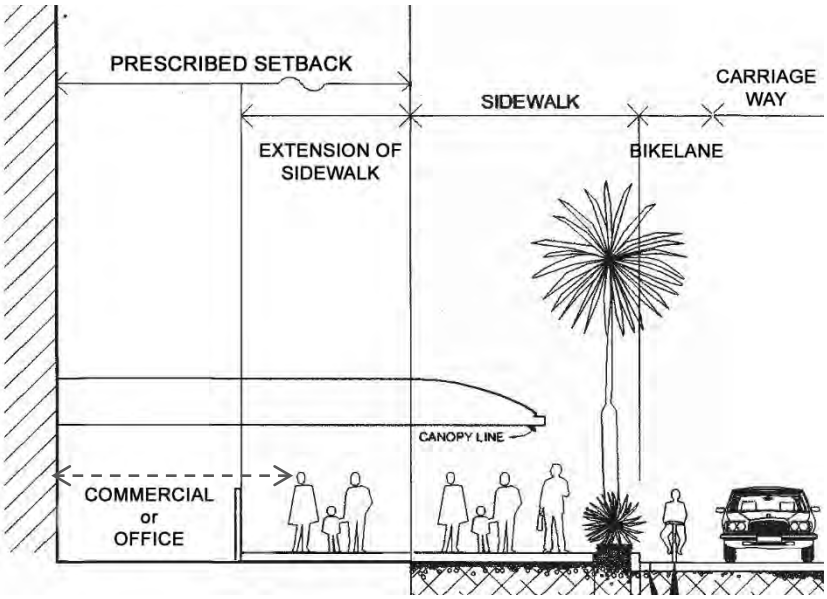
Since the Roadside Mixed-use Zone aims to enhance land use efficiency, a medium- to high-density mixed-use is desirable. Therefore, allowable land uses in this zone are the same as C-2 and C-3 in accordance with the zoning code of Mandaue City as shown in Table 6.5.2.

(iii) Zoning Regulation

A minimum of 50% of the required front setback as shown in Table 6.5.3 should be open to the public as an extension of the sidewalk area. Integration of the building frontage space with the sidewalk should be considered (e.g. extended awning from the shop to the sidewalk as shown in Figure 6.5.18).

Therefore, the use of ground floor should give a sense of welcoming for the pedestrians and could be either commercial or office. Certain transparency should be maintained on the ground floor to maintain visual connection between the inside and outside the building. Semi-open space use such as café with outdoor seating is recommended.

Setback width should be the same as the adjacent buildings to align the building façade.



Source: National Building Code (with edits by JICA Project Team)

Figure 6.5.18 Setback Requirements in Roadside Mixed-use Zone

7 BASIC POLICY AND ORIENTATIONS OF URBAN TRANSPORT DEVELOPMENT IN METRO CEBU

7.1 Review of Past Policy and Development as Planning Considerations

The existing spatial structure of Metro Cebu, as well as its state of transportation network, were influenced by past development initiatives and the greatest impact could be attributed to the Metro Cebu Land Use and Transport Study (MCLUTS). The MCLUTS Plan, which was released in early 1981, was supposed to guide the development of Metro Cebu until year 2000. However, it continued as a planning reference after year 2000 due to the absence of a successor plan. In 2015, a successor plan (the Roadmap Study) was completed with funding from JICA. In between, there had been other initiatives that provided significant guidance on how Metro Cebu should develop.

The MCLUTS, the Roadmap Study, and other planning initiatives are described in this section.

1) The MCLUTS

MCLUTS adopted a structural plan based on the concentration of development in Cebu City and Mandaue City, including the implementation of mainland reclamation. The plan (see Figure 7.1.1) was basically implemented by government authorities, albeit with one or two adjustments such as the construction of a bridge connecting the mainland and Mactan Island and the construction of the Tayud Link. The major components of the MCLUTS plan that were implemented included:

(i) Mandaue City Reclamation Project;

(ii) South Reclamation Project;

(iii) New roads built such as the connector road from M.J. Cuenco to P. Del Rosario Sts., by-pass road from H. Cortes to the reclamation area, and extension of F. Cabahug to H. Cortez Sts.;

(iv) Widening/Improvement of arterial roads;

(v) Construction southern bus terminal;

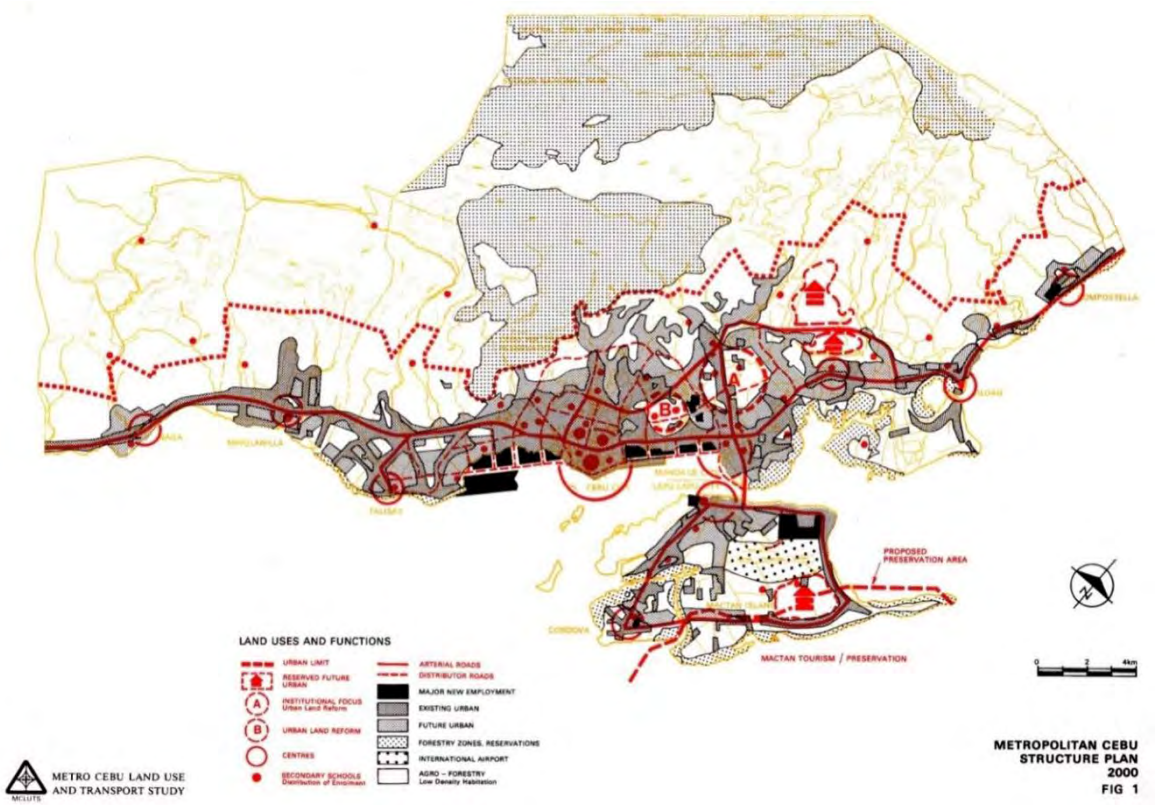
(vi) Installation of a modern traffic signal system;

(vii) Implementation of traffic management measures; and

(viii) Development of Mactan Tourism Site.

In terms of population distribution, Cebu City and Mandaue City accounted more than half of the population in 2000, basically, in support of the preferred concentrated form of development. Unfortunately, it can be argued that the traffic congestion that is now experienced in the urban core of Metro Cebu could be partly attributed to the type of spatial structure selected, i.e., a mono-centric form of development.

The Roadmap Study has recommended to break this trend and has adopted a polycentric form of development for Metro Cebu with Danao City in the north, City of Naga in the south, and Lapu-Lapu City in Mactan Island to be developed as growth poles.



Source: MCLUTS, 1981

Figure 7.1.1 MCLUTS Preferred Structure Plan

2) Roadmap Study for Sustainable Urban Development in Metro Cebu (The Roadmap Study)

The land use and transportation components of the Metro Cebu Roadmap could be considered as the successor plan of MCLUTS. Similar to MCLUTS, the Roadmap Study formulated a spatial strategy and its corresponding transportation network. It has departed from the monocentric form of development and has endorsed a polycentric one with other growth poles. While under MCLUTS, Cebu City and Mandaue City accommodated more than half of the metropolitan population. These cities would constitute less than 50% of metro population (in fact, 45.7% in 2030 and 41.5% in 2050 based on MCLUTS definition of Metro Cebu composition).

In terms of transportation network development, the Roadmap Study has taken into account existing proposals including those from MCLUTS that have not yet been implemented. The recommended program is shown in Table 7.1.1.

Table 7.1.1 Metro Cebu Roadmap Study Proposed Transportation Investment Program

Term	Projects
Short-term	• MP and FS on mass transit system (Bus Rapid Transit/ Light Rapid Transit/ Mass Rapid Transit (BRT/LRT/MRT)) development for Metro Cebu (2015–2017) • The Cebu City BRT (CBRT) Project, reorganization of PUV routes (2015–2017) • FS on Area Traffic Control (ATC) for Metro Cebu (2015–2017) • Synchronized signalization system covering major intersections by Traffic Control Center (TCC) (2018–2020) • Carcar Public Transport Terminal (2018–2020) • RROW widening with wide sidewalks and bicycle lanes (2018–2020) • A dual-mode bridge between Mandaue City and Mactan North (2017–2020)

Term	Projects
Medium-term	• Construction and operation of the Automated Guideway Transit – Cebu City, Mandaue City and Lapu-Lapu City Line (AGT – CML Line) (2018–2021) • Urban fringe roads (Metro Cebu Circumferential Road, Second Cebu South Road, and Second Cebu North Road) (2021–2030) • A new road bridge between Cebu City and Mactan South (2021–2030) • Continuous improvement of congested intersections (2021–2030) • Construction and operation of the MRT Central Line (2021–2030) • Revitalization of the abandoned PNR ROW for road and railway (2021–2030) • Completion of Mandaue's Scenic Coastal Road and Tayud Coastal Road (2021–2030) • Strengthening of Mactan Island Road Network (2021–2030) • Construction of secondary and collector roads in accordance with Metro Cebu Spatial Plan (2021–2030) • Introduction of ferry commuting service (when urban traffic is seriously clogged)
Long-term	• Completion of the remaining MRT lines (2031–2050) • Promotion of bus/minibus/jeepney and TOD around MRT/LRT stations (2031–2050) • Continuous construction of secondary and collector roads in accordance with Metro Cebu Spatial Plan (2031–2050) • Construction of toll skyway (when necessary)

Source: Roadmap Study, 2015

3) Other Initiatives

Two other projects with metro-wide coverage are (i) The Study of Master Plan on High Standard Highway Network Development in the Philippines of the JICA (HSH Study) in 2010 and (ii) The Development of Public Transportation Strategic Plan for Metro Cebu by DOTC (Metro Cebu Public Transport Study) in 2011. There are also a number of specific project proposals that have been considered in the Roadmap Study, including the World Bank-funded BRT Project and PPP Bridge Project connecting Cebu City and Municipality of Cordova.

The development objectives of the HSH Study for Metro Cebu were:

(i) To decongest traffic on arterial roads,

(ii) To achieve integration of socio-economic activities,

(iii) To enhance the tourism industry,

(iv) To recover international competitiveness of industries, and

(v) To promote sound urban expansion.

The proposed HSH network development for Metro Cebu is shown in Figure 7.1.2. It consists of the following proposals.

(i) North–South Corridor

  (a) Parallel road to the existing north-south road

(ii) Mactan Island

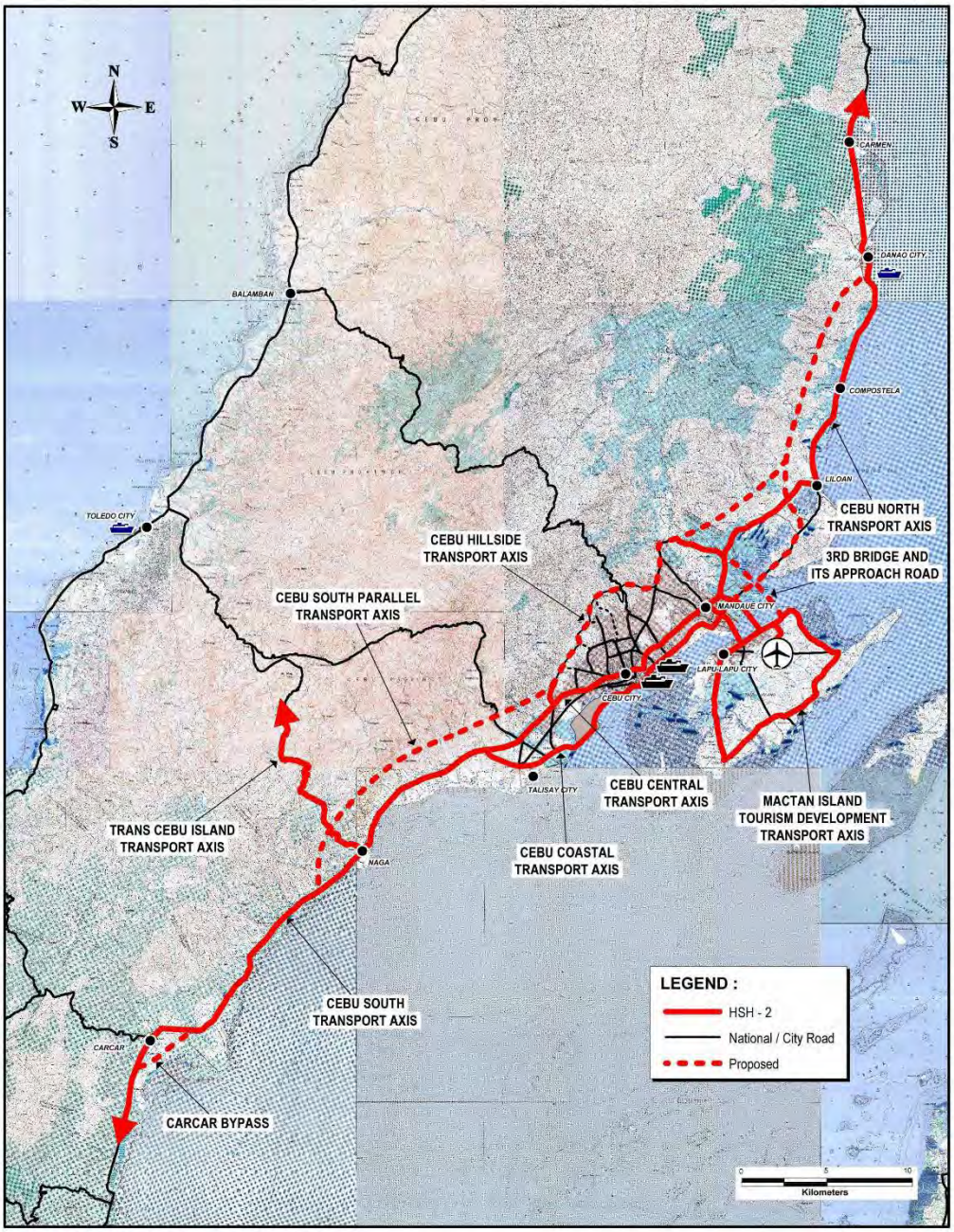
  (a) Mactan Island circumferential road

  (b) Strengthen connection between the mainland and Mactan Island

(iii) Highly Urbanized Areas

(a) Cebu Central Transport Axis

(b) Cebu Hillside Transport Axis



Source: HSH Study, 2010

Figure 7.1.2 Proposed HSH Network for Metro Cebu

In the case of Metro Cebu Public Transport Study, the strategic proposal is the BRT line with medium-capacity transit from City of Talisay to Mactan Cebu International Airport via south and north roads and City of Talisay to Mandaue City via Ayala Center.

7.2 Proposed Basic Policy and Development Targets

1) Basic Development Policy and Targets

Like many large urban cities in developing countries, Metro Cebu aspires to eradicate its paralyzing traffic congestion. The solutions provided constantly by many demand provision of new infrastructure (e.g., new roads, new interchange or underpass, new rail transit, etc.) if not the expansion of existing facilities. Many of them, even if valid from a network standpoint, would take time besides being non-sustainable in the long run. Cities cannot build roads ad infinitum and more roads that cater mainly for private cars is not sustainable.

The basic policy direction is to achieve sustainable mobility in future as well as accessibility. As stated in Chapter 6 and shown in Figure 6.3.5, sustainable transport should prioritize pedestrian accessibility and mobility based on the consideration for inclusive and universal design. The policy is consistent with the transport policies of other LGUs such as Cebu City.

Since transport network forms the framework of land use, it also has the potential to enhance land use through the improvements on mobility and accessibility. Objectives and specific development targets for Metro Cebu Urban Transport were proposed as follows.

(1) Objective of Accessibility and Mobility in Metro Cebu

(i) Preponderance of planned unit developments (compact mixed-use cluster developments with high densities) at various scales outside Cebu City, Mandaue City and Lapu-Lapu City where services and jobs are walkable or cyclable for residents.

(ii) Suburban nodes (evident in planned unit developments) are interconnected by an efficient public and mass transit system that enables accessibility to higher level amenities and services.

(iii) A seamless inter-modal public transportation system that enables to provide the access for all especially for people with disadvantages and/or under privileged whether they are in LGUs on the periphery (e.g., City of Carcar and Danao City) or in the urban heartland like Mandaue City and Lapu-Lapu City.

(iv) Availability of mobility substitutes such as telecommuting and on-line delivery of services that reduces the need to travel.

(v) Conversion of vehicles which provides comfortable travel and improves air quality.

(vi) Provision of accessibility for all users (including persons with disabilities, pedestrians and bicyclists) based on the consideration for environmental aspects, inclusive and universal design in the arterial roads through the implementation of Complete Street[1] introduced in Chapter 6.

As the baseline, present conditions of urban transport in Metro Cebu is represented by the indicators as shown in Table 7.2.1.

Table 7.2.1 Present Conditions of Urban Transport in Metro Cebu

Indicators		Present (2017)
Traffic Conditions	Average VCR	0.90
	Average Travel Speed (kph)	19.7
Transport Cost (PHP million/day)	Vehicle Operating Cost (VOC)	278
	Travel Time Cost (TTC)	270
	Total	548

Source: JICA Project Team

[1] Streets that are designed, used and operated for all users and maximize the functionality of the street.

(2) Target of Accessibility and Mobility in Metro Cebu

(i) Average travel speed from 30 to 40 k/h on major arterials. This will permit commute time to go down to 30 minutes within Cebu City, Mandaue City, and Lapu-Lapu City, and within 60 minutes from City of Carcar and Danao City to any point in the three previously mentioned cities.

(ii) Volume to capacity ratio on urban arterials is <90%.

(iii) Roadway level of service (LOS[2]) is equal to D or better.

2) Phased Development Strategy

The development targets for Metro Cebu Urban Transport by phase are proposed as follows.

(1) Short Term (up to 2022)

(i) Improvement of the road-based public transport system while having the basic features stipulated in the PUV Modernization Program (PUVMP) of DOTr.

(ii) Completion of the 1st phase of intersection improvement at critical intersections.

(iii) Completion of the on-going construction of the Cebu–Cordova Link Expressway (CCLEX) and its integration with the rest of the road network.

(iv) Construction of the 4th Mactan bridge (Lapu-Lapu City to Mandaue City) and Mandaue Coastal Road.

(v) Relocation of the Cebu International Container Port to Municipality of Consolacion.

(vi) Creation of a metro-wide mechanism for cooperation and collaboration in traffic engineering and management;

(vii) Establishment of a Metro Cebu Traffic Coordinating Council that will promote and monitor the implementation of the Master Plan including the relevant public transport regulations and metro-wide smart traffic management systems.

(viii) Establishment of a coordinated and smart traffic signaling system that cuts across political boundaries.

(2) Medium-Term (up to 2028 or 2040)

(i) Building (and operationalization) of its first UMRT (UMRT Central Line) along the corridor with highest demand such as Talisay–Cebu–Mandaue Corridor.

(ii) Construction of the second UMRT (UMRT Coastal Line) from Mactan to the CBDs on Cebu's urban heartland.

[2] A parameter used to describe the combination of road condition (surface roughness) and road capacity utilization measured in terms of traffic volume to capacity ratio (VCR). Surface roughness and VCR can only be brought together in qualitative terms (source: DPWH Enterprise Data Glossary). DPWH adopts American Association of State Highway and Transportation Officials (AASHTO) classification of LOS consisting of 6 levels (A: free flow, B: reasonable flow, C: stable flow, D: approaching unstable flow, E:unstable flow, and F: forced or breakdown flow).

(iii) Completion of the 4th Mactan bridge (Lapu-Lapu City to Mandaue City) and Mandaue Coastal Road.

(iv) Completion of the remaining phase of intersection improvement at critical intersections.

(v) Widening of major arterial roads with bicycle lane and construction of new diversion roads to bypass the congested road sections.

(vi) Completion of all three phases of the Metro Cebu Circumferential Road.

(vii) Construction of a Mactan circumferential road to provide a major artery to decongest Mactan island as well as to connect CCLEX and the 4th Mactan Bridge.

(viii) Commencement of traffic demand control (private vehicular control) through enhancement on promotion of public transport.

(3) Long-Term (up to 2050)

(i) Extension of the UMRT Central Line to the north (Danao City) and south (City of Carcar) and UMRT Coastal Line from Cebu City to City of Talisay.

(ii) Transformation of the entire public transportation into an inter-connected intelligent transport system.

(iii) Massive shift to electric and other LEVs starting with public transport.

(iv) Construction and completion of the Metro Cebu Coastal Road Expressway from Danao City to City of Carcar (elevated tollway).

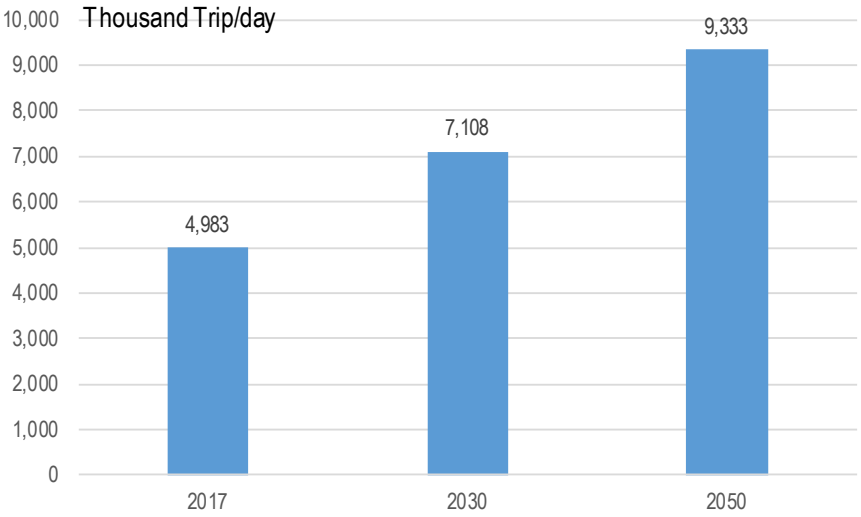
(v) Construction and completion of the Outer Metro Cebu Circumferential Expressway, traversing Talisay-Cebu-Mandaue (elevated tollway).

7.3 Future Traffic Demand Analysis

Future traffic demand was estimated based on the future socio-economic framework (future population, employment and school enrollment by traffic zone) and the models developed by the existing database of traffic demand and supply. The results and characteristics of the estimated future traffic demand are described in the following sections.

1) Total Generated Trip

The total generated trip in 2030 is estimated at 7,108 thousand trips/day based on trip production rate and the future population, which is almost 1.5 times the current condition. In 2050, the total generated trip is almost twice the current condition (see Figure 7.3.1).



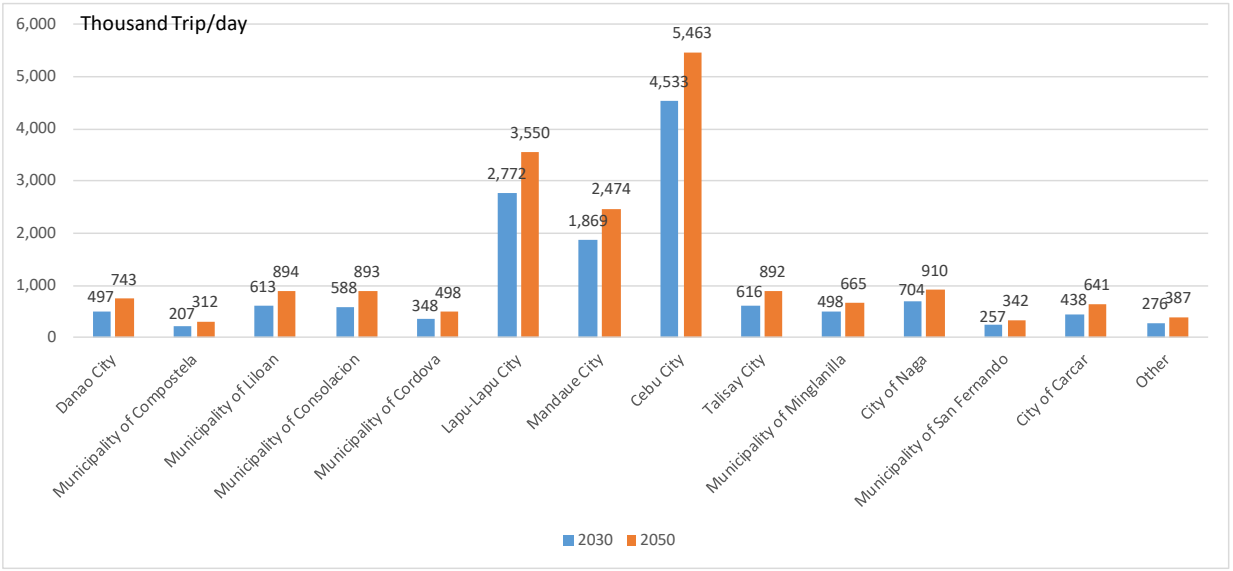
*The number of trips include external zone trip

Source: JICA Project Team

Figure 7.3.1 Total Generated Trip in the Future

2) Trip Generation and Attraction

Trip generation and attraction is estimated by vehicle ownership and by trip purpose using the correlated explanatory variables from the future socio-economic framework. Cebu City is the highest in regard to trip generation and attraction trip by LGU. The second highest is Lapu-Lapu City and third is Mandaue City. The trip generation and attraction trip of other LGUs is smaller compared with the mentioned cities (see Figure 7.3.2).



Source: JICA Project Team

Figure 7.3.2 Total Generation and Attraction in the Future

3) Trip Distribution

(1) Origin–Destination Trip

OD trip is estimated by applying the Frater method based on the present OD trips. Among the OD trips of LGUs in 2030 and 2050, the trip between Cebu City and Mandaue City is the highest except in the internal trip. Meanwhile, the trips between Cebu City and Lapu-

Lapu City, Mandaue City and Lapu–Lapu City, and Cebu City and City of Talisay are high (see Tables 7.3.1 and 7.3.2, and Figure 7.3.3).

Table 7.3.1 OD Table by LGU in 2030

Unit Thousand Trip/Day

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
1	168.1	3.3	3.9	3.3	0.7	10.8	13.1	21.1	1.0	0.3	2.1	1.0	0.3	12.2	241.1
2	3.7	50.3	9.6	1.3	0.4	11.9	9.3	10.9	0.8	0.2	0.5	0.2	0.2	2.2	101.4
3	4.5	10.7	150.8	16.1	1.0	26.0	33.0	38.8	2.0	1.6	2.4	0.8	1.1	1.3	289.9
4	3.0	1.4	25.0	136.6	0.4	22.9	52.7	34.0	1.2	0.2	0.6	0.8	0.3	5.0	284.0
5	2.0	0.1	1.8	0.4	71.4	58.4	13.3	25.1	1.2	0.1	0.3	0.3	0.2	0.1	174.7
6	14.5	10.4	40.6	34.5	57.3	918.3	79.4	130.3	23.0	20.9	22.8	11.0	19.5	9.8	1,392.1
7	17.0	15.5	36.6	58.7	11.8	109.2	461.9	183.0	20.1	14.5	19.8	7.2	12.4	28.8	996.6
8	23.6	11.3	41.0	45.5	26.9	139.3	144.9	1,545.7	86.7	51.9	68.8	27.8	27.7	39.1	2,280.2
9	1.3	0.8	2.2	2.2	1.1	15.9	9.7	75.9	137.0	16.8	19.7	3.0	6.8	6.2	298.7
10	0.4	0.2	3.2	0.4	0.3	14.0	15.4	47.1	16.3	116.2	25.7	2.8	0.4	4.5	246.7
11	2.5	0.6	2.3	1.0	1.0	17.4	11.2	45.6	17.1	19.8	188.0	14.2	3.3	4.5	328.5
12	0.6	0.2	1.5	0.8	0.4	10.8	6.1	30.1	2.7	2.0	13.8	53.5	4.2	1.4	128.1
13	0.4	0.2	1.8	0.3	0.3	14.0	7.8	20.2	1.5	0.3	3.5	5.4	134.2	17.6	207.7
14	14.7	0.9	2.8	2.8	0.1	11.2	14.5	45.3	6.8	6.2	7.3	1.2	20.2	4.8	138.7
Total	256.3	105.9	322.9	304.0	173.2	1,380.1	872.1	2,252.9	317.6	250.9	375.1	129.1	230.7	137.5	7,108.3

Source: JICA Project Team

Note: 1. Danao City, 2. Municipality of Compostela, 3. Municipality of Liloan, 4. Municipality of Consolacion, 5. Municipality of Cordova, 6. Lapu-Lapu City, 7. Mandaue City, 8.Cebu City, 9.City of Talisay, 10.Municipality of Minglanilla, 11.City of Naga, 12.Municipality of San Fernando, 13.City of Carcar, 14.Other : over 50,000 trips/day

Table 7.3.2 OD Table by LGU in 2050

Unit Thousand Trip/Day

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
1	255.4	5.7	6.2	4.4	1.4	15.6	22.8	26.8	1.8	0.4	3.7	1.2	0.4	19.4	365.2
2	5.3	83.3	11.4	1.9	0.8	15.6	12.9	13.3	1.2	0.3	0.6	0.4	0.3	3.1	150.3
3	6.5	13.5	236.2	21.3	2.0	35.7	43.9	52.3	3.3	2.6	3.5	1.0	1.8	1.7	425.3
4	3.6	1.7	34.5	237.6	1.0	32.0	69.2	47.3	2.2	0.3	0.9	1.1	0.3	6.9	438.9
5	2.8	0.3	4.0	0.8	112.4	80.4	18.3	39.1	2.9	0.2	0.5	0.4	0.2	0.1	262.4
6	19.1	15.8	56.8	45.6	65.2	1,160.9	106.5	166.2	34.0	25.9	31.6	15.7	25.8	15.5	1,784.7
7	25.3	21.3	49.3	76.1	14.7	132.3	633.4	219.8	27.6	17.2	26.3	8.6	15.0	40.8	1,307.7
8	30.0	15.6	51.0	55.8	31.8	175.2	177.4	1,830.2	108.5	59.4	82.9	35.9	31.4	53.3	2,738.2
9	1.9	1.7	3.4	3.4	2.1	24.1	14.3	94.7	212.4	25.6	28.7	3.8	10.3	8.4	434.7
10	0.6	0.3	4.8	0.4	0.6	17.0	16.7	52.4	24.5	169.9	30.0	3.9	0.5	6.1	327.7
11	4.7	1.0	3.1	1.6	2.4	22.8	13.5	53.1	23.0	24.2	248.7	16.0	3.7	6.2	423.8
12	0.9	0.3	2.0	1.1	0.7	15.3	7.2	42.3	3.7	2.1	15.5	74.1	4.6	1.9	171.9
13	0.8	0.4	2.6	0.4	0.8	19.8	10.1	26.0	2.5	0.6	3.7	6.6	210.2	24.0	308.6
14	20.8	1.2	3.8	3.9	0.1	18.4	20.2	61.7	9.2	8.5	10.0	1.6	27.6	6.5	193.4
Total	377.6	162.0	469.0	454.1	236.0	1,765.1	1,166.4	2,725.2	456.9	337.3	486.5	170.4	332.3	194.0	9,332.7

Source: JICA Project Team

Note: 1. Danao City, 2. Municipality of Compostela, 3. Municipality of Liloan, 4. Municipality of Consolacion, 5. Municipality of Cordova, 6. Lapu-Lapu City, 7. Mandaue City, 8.Cebu City, 9.City of Talisay, 10.Municipality of Minglanilla, 11.City of Naga, 12.Municipality of San Fernando, 13.City of Carcar, 14.Other : over 50,000 trips/day

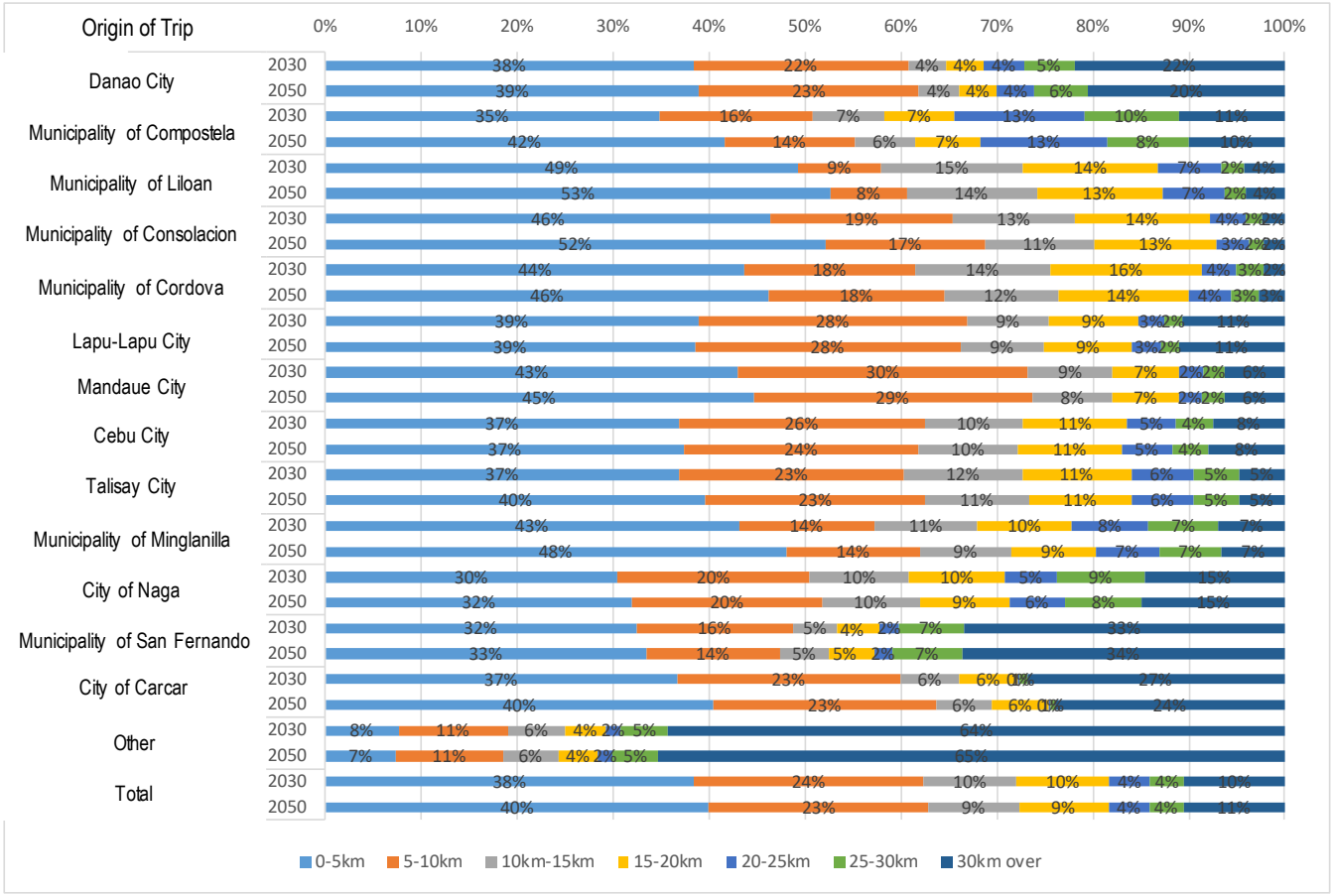


Source: JICA Project Team

Figure 7.3.3 Trip Destination by LGU

(2) Trip Length

More than 50% of trips are 0 to 15 km in each LGU. The share of more than 30 km trip is high in Danao City, Municipality of San Fernando, and City of Carcar compared with other LGUs (see Figure 7.3.4).

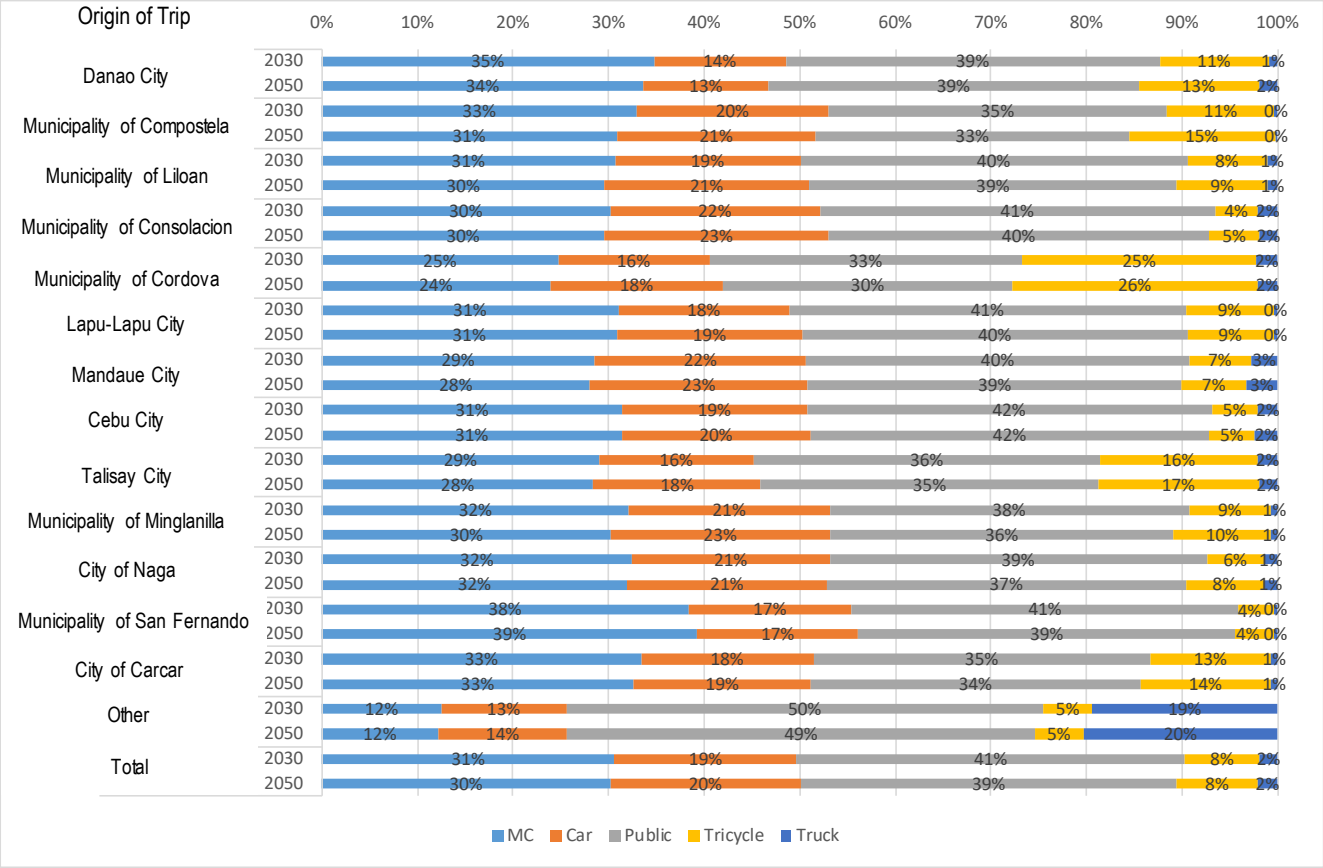


Source: JICA Project Team

Figure 7.3.4 Trip Length by LGU

4) Modal Share

Modal share is estimated by vehicle ownership group using binary choice model. The share of motorcycle is about 24% to 40% per LGU, while share of car is 14% to 23% (see Figure 7.3.5).



Source: JICA Project Team

Figure 7.3.5 Modal Share

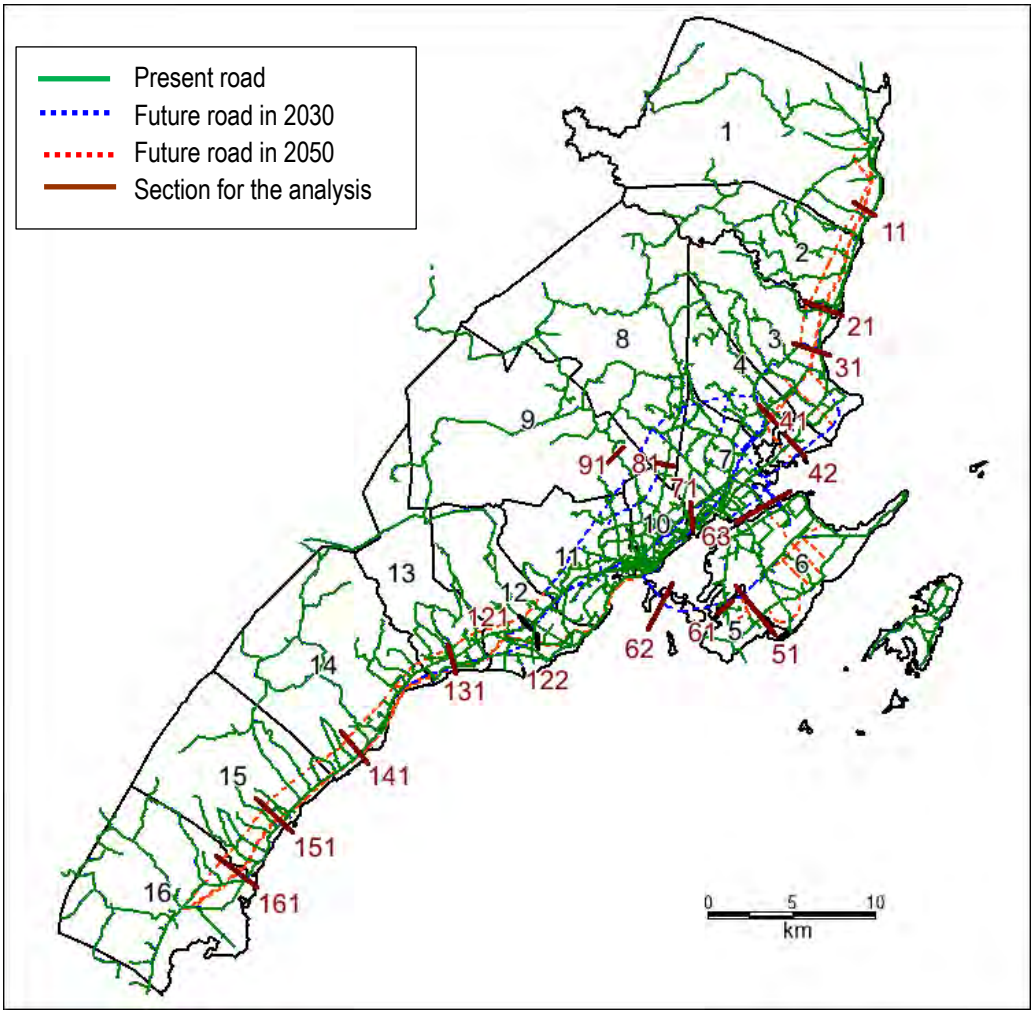
7.4 Demand–Supply Gap in Transport Network

In order to identify the urban transport network where is the future bottle neck, the existing and future traffic conditions are compared to the existing traffic capacity by zone and corridor. For this, the cases of “Do Committed Project” for 2030 and 2050 are analyzed by traffic demand forecast. In addition to the existing transport network, the “Do Committed Project” case includes the following ongoing and committed projects:

- Cebu-Cordova Link Expressway (CCLEX: The Third Mactan Bridge)
- Cebu BRT projects and traffic management improvement in the CBD Area (Cebu City and Mandaue City) assuming the increase of road capacity

1) Zoning and Section for Analysis

Figure 7.4.1 shows zoning and section for demand–supply gap analysis. The study area was divided into 16 zones and 17 sections were selected for the analysis.



Source: JICA Project Team

Figure 7.4.1 Zoning and Section for Demand Supply Gap Analysis in Transport Network

2) Demand Supply Gap Assessment by Zone

In the present case, V/C ratio in each LGU is not so high. Only the V/C ratios of Municipality of Cordova, Mandaue City, and Cebu City are greater than 1.0. In the "Do-Committed" case, the V/C ratio of LGUs are all greater than 1 in both years 2030 and 2050, and the V/C ratios in 2050 are all higher than those in 2030 (see Table 7.4.1).

Table 7.4.1 Demand Supply Gap Assessment by Zone

No.	LGU	Capacity	Present		Do Committed (2030)		Do Committed (2050)	
		(000 PCU-km)	Traffic (000 PCU-km)	V/C Ratio	Traffic (000 PCU-km)	V/C Ratio	Traffic (000 PCU-km)	V/C Ratio
1	Danao City	601	346	0.58	922	1.53	1,385	2.30
2	Municipality of Compostela	457	218	0.48	583	1.28	872	1.91
3	Municipality of Liloan	531	410	0.77	1,095	2.06	1,581	2.98
4	Municipality of Consolacion	437	396	0.91	910	2.08	1,323	3.03
5	Municipality of Cordova	104	138	1.33	323	2.17	456	3.06
6	Lapu-Lapu City	1,250	1,222	0.98	2,808	1.62	3,700	2.14
7	Mandaue City	1,370	1,720	1.26	3,493	2.41	4,862	3.36
8	Cebu City 1	802	648	0.81	919	1.14	1,135	1.41

9	Cebu City 2	498	599	1.20	1,221	2.45	1,624	3.26
10	Cebu City 3	1,510	1,559	1.03	2,607	1.59	3,434	2.09
11	Cebu City 4	1,585	1,748	1.10	2,979	1.78	3,745	2.24
12	City of Talisay	1,082	1,068	0.99	2,351	2.17	3,105	2.87
13	Municipality of Minglanilla	555	431	0.78	1,101	1.98	1,454	2.62
14	City of Naga	892	818	0.92	2,268	2.54	3,058	3.43
15	Municipality of San Fernando	509	302	0.59	948	1.86	1,285	2.53
16	City of Carcar	607	419	0.69	993	1.64	1,382	2.28
Total		12,791	12,044	0.94	25,521	1.87	34,401	2.53

: V/C>1.0 Note: Passenger Car Unit (PCU), Source: JICA Project Team

3) Demand Supply Gap Assessment by Section

The V/C ratio of most sections is over 1 at present. The situation becomes worse in 2030 as all sections' V/C ratio become greater than one and becomes worst in 2050 if the committed countermeasures would be done (see Table 7.4.2). Locations of the sections are indicated in Figure 7.4.1 under the same section numbers.

Table 7.4.2 Demand Supply Gap Assessment by Section

	Section	Capacity	Present		Do Committed (2030)		Do Committed (2050)	
		(000 PCU)	Traffic vol. (000 PCU)	V/C Ratio	Traffic vol. (000 PCU)	V/C Ratio	Traffic vol. (000 PCU)	V/C Ratio
11	Central Nautical Hwy	11.9	15.6	1.31	54.4	4.55	87.1	7.29
21	Central Nautical Hwy	11.9	19.4	1.62	78.2	6.54	119.5	10.00
31	Central Nautical Hwy	11.9	22.9	1.92	85.4	7.14	127.5	10.67
42	Cebu North Coastal Rd	10.1	25.1	2.48	42.0	4.15	64.5	6.37
41	Central Nautical Hwy	12.5	41.4	3.31	151.4	12.09	225.5	18.00
51	Babag II Rd	8.8	13.2	1.49	24.0	2.72	38.3	4.33
51	CCLEX Extension in Cordova	42.0	-	-	31.0	0.74	34.0	0.81
61	M.L. Quezon National Hwy	8.8	26.4	2.99	64.1	7.26	86.4	9.78
62	CCLEX	50.9	-	-	32.5	0.64	43.3	0.85
63	Osmena Bridge	17.1	45.3	2.66	104.3	6.11	138.1	8.09
63	Marcelo Ferman Bridge	50.9	48.3	0.95	117.0	2.30	170.1	3.34
71	Lopez Jaena St.	25.5	52.7	2.07	58.3	1.64	72.1	2.02
71	Quano Ave.	61.5	99.5	1.62	67.6	6.28	88.8	8.24
81	Gov. M. Curenco Ave	35.6	35.1	0.99	115.6	2.62	160.2	3.63
91	Cebu Transcentral Hwy	10.8	34.4	3.19	137.7	3.12	183.1	4.15
121	Cebu S Rd	44.1	38.4	0.87	188.2	4.48	254.6	6.06
122	CSCR	44.1	53.2	1.21	123.2	12.16	164.7	16.26
131	CSCR	42.0	60.4	1.44	83.3	8.23	115.0	11.35
141	CSCR	10.1	35.2	3.48	69.5	6.86	95.9	9.47
151	CSCR	10.1	27.4	2.71	54.4	4.55	87.1	7.29
161	CSCR	10.1	20.9	2.06	78.2	6.54	119.5	10.00

: V/C>1.0, Source: JICA Project Team

4) Required Development and Alternative Solutions

Based on the results of demand-supply gap analysis, the required transport capacity expansion and alternative solutions are identified as shown in Table 7.4.3.

Table 7.4.3 Required Development and Alternative Solutions by Zone

		Existing Road		Required Road		Possibility of Road Development		Alternative Solutions					
		No. of Roads	Total No. of Lanes	No of Lanes 1)		Widen-ing	New Road	Traffic Mgmt.		Arterial Road Development			UMRT
				2030	2050			Mgmt	TDM	Widening	New Road at grade	New Road elevated	
Danao City	11	1	2	3	5	B	A	B	C	B	A	B	B
Municipality of Compostela	21	1	2	5	8	B	A	B	C	B	A	B	B
Municipality of Liloan	31	1	2	5	8	B	A	B	C	B	A	B	B
Municipality of Consolacion 1	42	1	2	2	4	B	A	A	B	C	A	B	C
Municipality of Consolacion 2	41	1	2	10	15	B	B	A	B	B	B	B	A
Municipality of Cordova 1	51	1	2	1	2	B	B	A	B	B	B	C	C
Municipality of Cordova 2	51	-	-	0	0	-	-	-	-	-	-	-	-
Lapu-Lapu City 1	61	1	2	4	6	B	B	A	B	B	B	C	B
Lapu-Lapu City 2	62	-	-	0	0	-	-	-	-	-	-	-	-
Mandaue City	63	2	6	11	17	-	A	A	A	-	-	A	A
Cebu City 1	71	2	12	14	23	C	C	A	A	B	C	A	A
Cebu City 2	81	1	4	2	3	C	C	A	A	B	C	B	B
Cebu City 3	91	1	2	4	6	C	C	A	A	B	C	C	C
City of Talisay 1	121	1	4	5	8	B	B	A	B	B	B	B	A
City of Talisay 2	122	1	4	7	10	B	B	A	B	B	A	A	C
Municipality of Minglanilla	131	1	4	10	15	B	B	A	C	B	A	B	B
City of Naga	141	1	2	8	11	B	A	B	C	B	A	B	B
Municipality of San Fernando	151	1	2	5	7	B	A	B	C	B	A	B	B
City of Carcar	161	1	2	4	6	B	A	B	C	B	A	B	B

1) Standard capacity assumes 14,000PCU/day
2) Possibility of road development: A - possible, B - possible with some difficulty, C - difficult
3) Assessment of alternative A - recommended, B - for consideration, C - not recommended
Source: JICA Project Team

7.5 Review of Proposed Roadmap Transport Projects and Selection of Priority Projects

During the Roadmap Study, transport projects were proposed to enhance the mobility in terms of public transport, network, gateways, and management.

1) Updates on the Status of the Transport Projects Proposed by the Roadmap Study

Table 7.5.1 shows the current status of the proposed transport projects. It describes that several projects have been committed and commenced by the relevant agencies such as DPWH.

Table 7.5.1 Updates on the Status of the Roadmap Projects in Transport Sector

Project		Area	Length	Total Cost*	Implementing Agency	Implementing Schedule	Status/Notes
A.	Roads and Highways						
1	Mandaue–Lapu-Lapu Link Dual Mode Bridge	Mandaue Reclamation, Cansaga Bay and northern part of Lapu-Lapu City	3.42 km	15, 262	DPWH	2018–2022	The Dual Mode Bridge is included in the Public Investment Program (PIP). The PIP still has to be approved and finalized. The Scenic Coastal Road is included in the list of priority programs, activities, and projects (PAPs) of DPWH-7 for inclusion in the FY 2018 budget proposal of the DPWH Central Office, which was endorsed by the RDC per Resolution No. 9-A (s. 2017).
2	Area Traffic Control System in Metro Cebu	Metro Cebu	N/A	10,000	DOTr, DPWH, LGU	2015–2017	Commencement of F/S was endorsed by RDC to DOTr for inclusion in FY 2018 proposed budget per RDC Resolution No. 15 (s. 2017).
3	Synchronized Signalization System in Urban Areas	Replacement of 69 signals by MCDP and development of synchronized system with new ones	N/A	1,285	DPWH	2018–2020	The RDC passed Resolution No. 24 (s. 2015) endorsing the draft Memorandum of Agreement (MOA)/Framework Agreement on the Synchronized Traffic Signalization Project to the Road Board of the Philippines. MCDCB will resend the draft MOA to the Road Board for consideration.
4	Roads Widening	Arterial roads, mainly unimplemented from MCLUTs	54.15 km	21,604	DPWH	2018–2023	RDC passed Resolution No. 20 (s. 2015) endorsing to the DPWH the widening of ten road sections and geometric improvement/modification of fifteen road intersections for inclusion in its priority infrastructure program. Some of these roads were unimplemented road widening projects under the MCLUTS implemented in 1980 but terminated in 1995.
5	Metro Cebu Outer Circumferential Road	Talisay City to Municipality of Consolacion	21.0 km	40,215	DPWH	2018–2023	DPWH has conducted an F/S on the Metro Cebu Circumferential Road (Metro Cebu Expressway), which was completed on January 2015. DPWH plans to submit the F/S to the Investment Coordinating Committee (ICC) for evaluation and approval. This Metro Cebu Circumferential Road is Segment 1 of Talisay City to Municipality of Consolacion.

Project		Area	Length	Total Cost*	Implementing Agency	Implementing Schedule	Status/Notes
6	Second Cebu North Road	Cebu Circumferential Road (Segment 2)–Municipality of Consolacion, Liloan, Compostela and Danao City	34.8 km	21,525	DPWH	2018–2030	DPWH has conducted an F/S on the Metro Cebu Circumferential Road (Metro Cebu Expressway), which was completed in January 2015. DPWH plans to submit the F/S to the ICC for evaluation and approval.
7	Second Cebu South Road	Talisay City–Municipality of Minglanilla–City of Naga–Municipality of San Fernando–Carcar City	35.0 km	21,874	DPWH	2021–2030	DPWH has conducted an F/S on the Metro Cebu Circumferential Road (Metro Cebu Expressway), which was completed in January 2015. DPWH plans to submit the F/S to ICC for evaluation and approval. This Second Cebu South Road is Segment 3 of Talisay City to City of Carcar.
8	Cebu-Cordova Bridge (3rd Bridge)	Cebu City (C. Padilla) to Municipality of Cordova (part of Green Loop Corridor)	10.0 km	27,900	DPWH	2017–2022	The Cebu Cordova Link Expressway Project is to be implemented through a Joint Venture agreement between the City of Cebu and Municipality of Cordova. Concession Agreement was signed by the grantors (Metro Pacific Tollways Development Corporation) on 3 October 2016. The proponent is currently processing necessary approvals from various government agencies, e.g., EMB, CAAP, CPA, etc. Additional engineering studies and surveys are currently conducted. Project completion is scheduled in 2022.
9	Metro Cebu Intersection Improvements (Grade-separation)	20 Intersections at Cebu City and Mandaue City	8.31 km	14,581	DPWH	2021–2030	The construction of three underpasses/skyways along (i) Archbishop Reyes–Governor Cuenco Ave., Cebu City, (ii) Salinas Drive–J. Luna Ave, Cebu City, and (iii) Cardinal Rosales Ave.–F. Cabahug St., Cebu City (these are from the 20 identified intersections) were included in the list of PAP of DPWH 7 for inclusion in the FY 2018 budget proposal of the DPWH Central Office, which was endorsed by the RDC per Resolution No. 9-A (s. 2017).

Project		Area	Length	Total Cost*	Implementing Agency	Implementing Schedule	Status/Notes
10	Road Widening on the MRT Central Line and Its Access Roads	Imus Ave., MJ Cuenco Ave., Lopez Jaena St., MC Briones St., General Maxilom Ave., Pope John Paul II Ave.	7.3 km	5,915	DPWH	2021–2030	RDC passed Resolution No. 20 (s. 2015) endorsing to the DPWH the widening of ten road sections and geometric improvement/modification of fifteen road intersections for inclusion in its priority infrastructure program. Some of these roads were unimplemented road widening projects under the MCLUTS implemented in 1980 but terminated in 1995
11	Talisay-Naga Coastal Road (ex PNR)	Brgy. Lawaan, Talisay–Minglanilla New Center–Brgy. Colon, City of Naga	7.1 km	4,374	DPWH	2021–2030	RDC passed Resolution No. 13 (s. 2017) endorsing the Talisay–Minglanilla–Naga Bypass to DPWH. Portions of the bypass traverse along the same ex-PNR road.
12	Tayud Coastal Road with the Second Cansaga Bay Bridge	Mandaue–Brgy. Tayud, Municipality of Consolacion–Brgy. Poblacion, Municipality of Liloan	10.5 km	8,543	DPWH	2021–2030	RDC passed Resolution No. 58 (s. 2016) requesting the DPWH to conduct n F/S on the Mandaue–Consolacion–Liloan Bypass Project. The three proposed alignments were proposed to be constructed parallel to the Cansaga Bay Bridge. One alignment considered traverses along the Mandaue Scenic Coastal Road. This proposed bypass project is in support to the New Cebu International Container Port.
13	Rest of Mandaue Scenic Coastal Road (2 Sections)	Ouano Ave.–Second Bridge, Cebu North Road–Cansagay Bay Bridge	5.4 km	4,834	DPWH	2021–2030	DPWH is conducting an F/S for construction of Scenic Coastal Road from the second Mactan Bridge to Cuenco Ave.
14	Airport Underpass Road	Second Bridge-MCIA–Brgy. Pajak, Lapu-Lapu City	2.7 km	2,438	TBD	2021–2030	Neither DPWH Region VII nor NEDA Region VII offices have any updates.
15	Mactan MRT Avenue (incl. 1 bridge)	Brgy. Dapitan, Municipality of Cordova–Brgy. Mactan, Lapu-Lapu City	8.6 km	2,244	DPWH	2021–2030	Road widening has been proposed as a part of Mactan Circumferential Road Project.
16	Metro Cebu Coastal Expressway	Part of Coastal Line from Danao City to City of Carcar	79.0 km	149,310	PPP	2031–2050	Proposed by this MP as a long-term project that will be on the viaduct by utilizing the existing ROW.
B.	Public Transport/Mass Transit						
1	BRT Line	Cebu City (Talamban–Bulacao–SRP)	22 km	17,662	DOTr	2015–2021 (1st Phase)	NEDA approved the resumption of the project as well as it is revised schedule.

Project		Area	Length	Total Cost*	Implementing Agency	Implementing Schedule	Status/Notes
2	Master Plan and F/S on Metro Cebu Mass Transit System Development	Metro Cebu	N/A	Million USD 2.0	DOTr	2017–2018	Project on the Master Plan study and institutional development on urban transport system in Metro Cebu was commenced by JICA in July 2017 and will be complete in October 2018.
3	Public Transport Terminal	Carcar City Center	N/A	140	LGU	2017–2018	Construction of the terminal is presently at the bidding stage. The projected time of construction start is on the first quarter of 2018.
4	Public Transport Terminal (Second Phase)	Cebu North Terminal	N/A	118	LGU	2021–2030	The proposed second phase will no longer push through since there is an ongoing negotiation between the Mandaue City Government and Gatewalk Central. Mandaue City is planning to sell the lot to Ayala Land and Aboitiz Land, Inc.—developers of Gatewalk Central.
5	AGT-CML Line	Cebu City–Ouano Ave., Mandaue City–MCIA	19.2 km	Million USD 819	DOTr	2017–2021	Included in the Philippine Investment Program (PIP); PIP is still for approval.
6	MRT Lines						No major progress from involved public agencies except for some unsolicited proposals and studies from private entities.
	Central	Consolacion to Talisay	21.2 km	Million USD 1774	DOTr / Private	2021–2030	
	North	Danao City to Municipality of Liloan	24.7 km	Million USD 1369	DOTr / Private	2031–2050	
	South	Municipality of Minglanilla to City of Carcar	29.2 km	Million USD 1799	DOTr / Private	2031–2050	
	Mactan	Cebu City–Lapu-Lapu City	21.5 km	Million USD 1737	DOTr / Private	2031–2050	
C.	Others						
1	F/S on Consolacion New Port	Tayud, Municipality of Consolacion	N/A	Million USD 1.5	DOTr / Private	2015–2017	F/S for the project already complete. The New Cebu International Container Port (NCICP) was approved by the NEDA Board on 14 November 2016.
2	Consolacion New Port Construction and Revitalization of Cebu Port	Cebu City, Municipality of Consolacion	N/A	9,900	DOTr / Private	2018–2022	The NEDA Board-approved NCICP is in its pre-implementation phase. The revitalization of Cebu Port will be undertaken by the Cebu Ports Authority (CPA).

Project		Area	Length	Total Cost*	Implementing Agency	Implementing Schedule	Status/Notes
3	MCIA Development Project	MCIA	N/A	17,500	DOTr / Private	2015–2020	Construction of the second passenger terminal building of the Mactan–Cebu International Airport is ongoing and scheduled to be completed in July 2018. The GMR-Megawide Cebu Airport Corporation (GMCAC) currently operates and manages the terminal operations of the airport. RDC passed Resolution No. 15 (s. 2017) that endorses transfer of the CAAP Control Tower in MCIA for inclusion in its FY 2018 budget proposal to connect the existing terminal building and second terminal building, which is scheduled for completion in June 2018.

Note: *PHP millions unless it is stated
Source: JICA project Team

2) Evaluation Criteria

NEDA Region 7 office has put efforts on the integration of transport projects in the Roadmap Study with Research, Program, and Organizational Development (RPOD), which is currently under preparation. Therefore, evaluation criteria that NEDA adopts for RDIP as shown in Table 7.5.2 was referred to for the selection of priority projects in order to ensure the relevance and feasibility for implementation. Evaluation criteria of OECD-Development Assistance Committee (DAC) was also adopted as shown in Table 7.5.3 in order to evaluate based on the various perspectives.

Table 7.5.2 The Evaluation Criteria for RDIP

Criteria	Yes/No	Remarks
1. RELEVANCE		
Is the PAP supportive of the Central Visayas RDP 2017–2022? (Indicate in the remarks column the specific RDP objective/strategy.)		
Are the expected PAP outputs specified?		
2. IMPLEMENTATION FEASIBILITY		
Is the implementing agency specified? (State the implementing agency.)		
Is the PAP within the mandate/functions of the proposed implementing agency?		
Are there other offices/entities that will be involved in the implementation of the PAP? (State these offices.)		
3. RESOURCES		
Is the funding source specified? (Indicate the funding source.)		
Is the total funding requirement indicated? (State the total amount required.)		
Is the implementation schedule and annual funding requirement indicated? (Provide the information under remarks column.)		
4. ENVIRONMENTAL ACCEPTABILITY		
Are the environmental impacts of the PAP identified? (Enumerate them)		
Is the PAP located within an Environmentally Critical Area (ECA) or an Environmentally Critical Project (ECP)? (If yes, state whether it's in an ECA or an ECP.)		

Criteria	Yes/No	Remarks
For a PAP requiring Environmental Compliance Certificate (ECC), are activities undertaken or to be undertaken to secure an ECC outlined in the proposal/project profile?		
5. SOCIAL ACCEPTABILITY		
Does it have endorsement from the LDC? (State the LGU.)		
Would its implementation cause displacement of people?		
Is there actual or potential opposition from the community? (Discuss details under remarks column.)		
Are measures to address the issue identified? (Discuss details under remarks column.)		

Source: NEDA

3) Evaluation Results

According to the prepared evaluation table as previously described, evaluation was conducted, and the results were summarized in Table 7.5.3. As indicated, the following 5 projects were selected as the priority projects. Details of the priority projects are described in Chapter 8.

(i) Mandaue–Lapu Lapu Link Bridge (4th Mactan Bridge) with Mandaue Coastal Road

(ii) Metro Cebu Circumferential Road (Metro Cebu Ring Road)

(iii) UMRT Coastal Line (AGT-CML Line proposed by the Roadmap Study)

(iv) UMRT Central Line (MRT Central Link proposed by the Roadmap Study)

(v) ATC System in Metro Cebu

Table 7.5.3 Results of Evaluation for the Transport Projects of the Roadmap Study

No	Project	3: High/Well 2: Moderate 1: Low/Poor					1: High/Well 2: Moderate 3: Low/Poor		3: High/Well 2: Moderate 1: Low/Poor			Total Evaluation
		Relevance		Implementation Feasibility			Environmental Acceptability		Social Acceptability		Impact	
		Consistency with upper level planning	Potential for integration with the relevant urban development	Identification of proposed implementing agency and stakeholders	Identification of funding source and necessary amount of funds (incl. operation and maintenance)	Identification of potential environmental impact	Potential for the inclusion of ECA and/or ECP	Degree of the resettlement	Identification of the countermeasures for the social issues (e.g. opposition from the local community)	Number of expected beneficiaries	Degree of the quick positive impact on traffic congestion	
A. Roads and Highways												
1	Mandaue-Lapu-Lapu Link Dual-Mode Bridge	3	3	3	3	3	3	3	3	3	3	30
2	Area Traffic Control System in Metro Cebu	3	3	3	3	3	3	3	3	3	3	30
3	Synchronized Signalization System in Urban Areas	3	3	2	3	3	3	3	3	3	3	29
4	Roads Widening	3	3	3	2	2	2	1	3	3	2	24
5	Metro Cebu Outer Circumferential Road	3	3	3	3	3	2	2	3	3	3	28
6	Second Cebu North Road	3	3	3	3	3	2	2	3	3	2	27
7	Second Cebu South Road	3	3	3	3	3	2	1	3	3	2	26
8	Metro Cebu Intersection Improvements (Grade-separation)	3	3	3	3	3	2	2	3	3	3	28
9	Road Widening on the MRT Central Line and Its Access Roads	3	3	3	3	3	2	2	3	3	2	27
10	Talisay-Naga Coastal Road (ex PNR)	3	3	3	3	3	2	1	3	3	2	26
11	Tayud Coastal Road with the Second Cansaga Bay Bridge	3	3	3	3	3	2	2	3	3	3	28
12	Cebu North Coastal Road	3	3	3	3	3	2	1	3	2	3	26
13	Rest of Mandaue Scenic Coastal Road (2 Sections)	3	3	3	3	3	2	1	3	3	2	26
14	Airport Underpass Road	3	2	2	2	2	2	2	3	2	2	22
15	Mactan MRT Avenue (incl. 1 bridge)	3	2	3	2	2	2	1	3	2	2	22
16	Metro Cebu Coastal Expressway	3	3	2	2	3	3	3	3	3	2	27
B. Public Transport / Mass Transit												
1	Public Transport Terminal (Second Phase)	3	3	2	2	3	3	3	3	3	2	27
2	AGT-CML Line	3	3	3	3	3	2	2	3	3	3	28
3	MRT-Central	3	3	3	3	3	2	2	3	3	3	28
	MRT- North, South & Mactan	3	3	3	2	2	2	1	3	3	2	24

Source: JICA Project Team

8 PROPOSED URBAN TRANSPORT MASTER PLAN AND PROJECTS

8.1 Road Network Planning

1) Necessity for New Road Network in Metro Cebu

The existing traffic situation in Metro Cebu involves the serious congestions along arterial roads and major intersections, particularly in Cebu City and Mandaue City including the roads to Mactan Island (i.e., the first and second Mactan Bridges). Serious traffic congestion lowers the vehicle speed to less than 10 km/hour at certain identified roads. Urgent measures are necessary to eliminate bottlenecks in the central area of Metro Cebu. For example, being that the 1st and 2nd Mactan Bridges connect the city center of Cebu and Mactan Island, 2 lanes of the 1st Mactan Bridge is already over capacity at 45,000 PCU/day (against the 24,000 PCU/day capacity) and 4 lanes of the 2nd Mactan Bridge is almost over capacity at 48,000 PCU/day.

A total of 68 intersections in Metro Cebu were being signalized of which 65 are located within Cebu City. In 1993, all intersections and the Traffic Control Center were activated. The urban traffic control system adopted the Sydney Coordinated Adaptive Traffic System (SCATS). In spite of the introduction of the urban traffic control system, it has not been sufficient to control the traffic at the intersections due to the drastic increase of registered number of vehicles that doubled since 1993. This implies the need for further enhancement on traffic management as well as physical improvements at the intersections.

Majority of the current traffic issues stem from the road network including the following.

(i) Congestion is primarily caused by weak road network, particularly limited construction of new roads. The drastically increasing number of vehicles cannot be accommodated.

(ii) New roads are not adequately planned in accordance with the appropriate land use plan formulated under the long-term vision.

(iii) Inefficient use of roads by the current public transport system that requires higher capacity.

(iv) Many vehicles on the road are inadequately maintained, particularly buses, jeepneys, and trucks. These vehicles contribute to the deterioration of air quality because of poorly controlled emissions.

(v) In addition to the lack of infrastructure development, traffic management to utilize the existing infrastructure capacity to the maximum extent to mitigate traffic congestion is not sufficient.

In order to solve these issues, a series of studies, such as MCLUTS and Roadmap Study, has been conducted (as previously described). While some projects were implemented by DPWH, there are some differences between the proposed alignments from the previous studies and DPWH as described in the following sections.

2) Road Transport Network Plan for Medium-Term Toward Year 2030

The objectives of proposed road and bridge projects listed in Table 8.1.2 and intersection improvement projects listed in Table 8.1.3 are:

- To reduce through traffic from northern to southern area of Metro Cebu;
- To increase road network capacity and travel speed would be increase at 10km/h;
- To make an alternative route to prevent unnecessary intrusion to central Metro Cebu from northern and southern Metro Cebu;
- To provide safe, convenient, and comfortable access for pedestrians and bicyclists; and
- Smooth connection to and from Mactan Island through Mactan New Bridges including the proposed new bridges.

The basic concept of strategic urban road network plan in Metro Cebu is to establish an outer diversion road connecting to the coastal road at the central area of Metro Cebu that suffers from serious traffic congestion.

Metro Cebu Circumferential Road was proposed to connect the coastal road in Talisay City, Cebu City, and Mandaue City with a diversion road to make a ring road at central Metro Cebu, which connects to the north–south link from Danao to Carcar as well as to Mactan Island via the proposed Mandaue–Lapu-Lapu Link Bridge (4th Mactan Bridge) and 3rd Mactan Bridge. Alignment of segment 1 of the Metro Cebu Expressway proposed by DPWH does not form a loop at the central Metro Cebu, which is less efficient than the proposed road network by the project as shown in Figure 8.1.1. In addition, segment 1 alignment proposed by DPWH does not meet the high-standard highway design criteria as shown in Table 8.1.1. It will reduce the average travel speed to around 20 km/hour.

Table 8.1.1 Geometric Design Standard for Segment 1

	Proposed by the Project (High-Standard Highway)	Proposed by DPWH
Design Speed	80 km/hr.	40 km/hr.
Minimum Radius	300 m	35 m
Maximum Gradient	4%	12%

Source: JICA Project Team

While the locations suffering from the serious traffic congestion are concentrated in Cebu City, Mandaue City, Talisay City, and Lapu-Lapu City, the other Metro Cebu LGUs also began to face traffic congestion daily. Therefore, road capacity needs to be increased by widening of road and construction of bypass roads such as the Cebu Circumferential Road, etc. Future road network in Metro Cebu is shown in Figure 8.1.3.

As previously described in Chapter 6, road widening for the transformation of the existing arterials into Complete Street providing access to all users including pedestrians and bicyclists as well as maximizing its functionality should be strategically implemented prior to the construction of UMRT as it enables to secure the space for the viaduct of UMRT.

In addition to road widening and construction of the new road, improvements on the intersection are also effective to mitigate traffic congestion. Figure 8.1.4 indicates the intersections proposed for improvement. Since the intersection improvements range from traffic management such as signal control to geometric design (at-grade and grade separation), measures should be prioritized. Traffic management and at-grade geometric design improvements should be considered first including necessary capacity enhancement activities to minimize the construction cost as well as environmental and social impacts. Currently DPWH conducts feasibility study (F/S) for the improvements on intersections and majority of them match the ones listed in Table 8.1.3. However, as the F/S by DPWH does not include the improvements by traffic management, further holistic study is expected to clarify the priority and phased improvement plan.

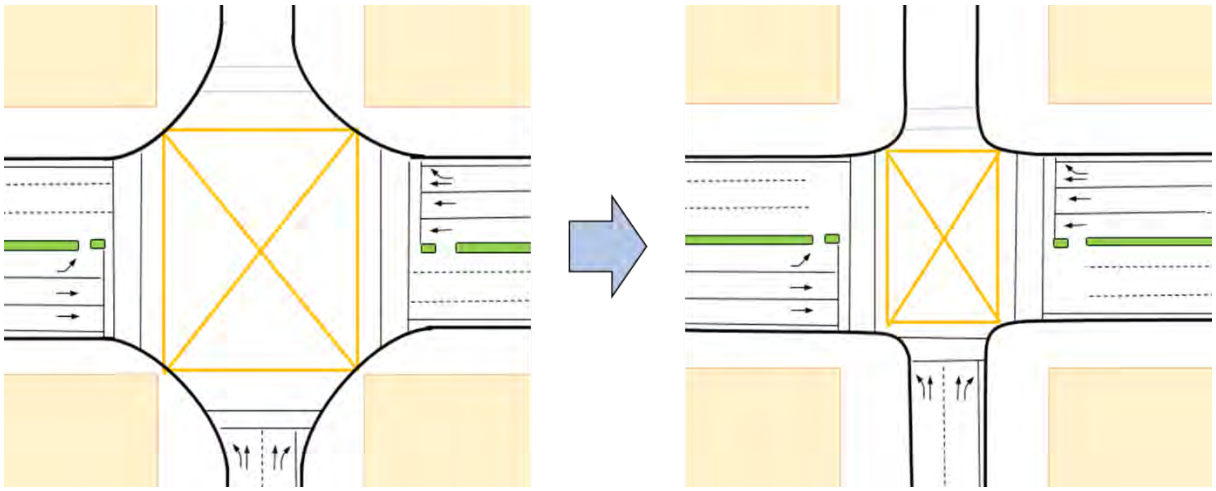
Followings are the major measures for the improvements on efficiency of road space

including at-grade geometric intersection improvements.

(1) Improvement of Geometric Condition at Intersections

There are various measures to manage traffic flows such as lane operation, parking management, and ensuring pedestrian safety. Fundamentally, improvement of intersection geometric condition is essential.

There are many wide intersections in Metro Cebu. This extends the travel time as well as cycle time of the signal to clear all vehicles entering the intersection. Measures such as adjustment of stop lines should be done to make an intersection compact as shown in Figure 8.1.1. Also, inappropriate location of exit and entrance near the intersection cause traffic congestion. For example, a vehicular entrance and exit gate of a sports facility is located at the intersection as shown in Figure 8.1.2. Relocation of the gate should be considered to mitigate the congestion at the intersection.



Source: JICA Project Team

Figure 8.1.1 Image of Improvement on Efficiency of Road Space



Source: JICA Project Team

Figure 8.1.2 Undesirable Condition at an Intersection (Gate of Sports Center at Del Rosario St. and Leon Kilat St.)

(2) Space Separation for People and Vehicle

Separate lanes for pedestrians and bicycles are essential to avoid physical conflict between people and vehicle. This will encourage people to walk or use non-motorized vehicles. Therefore, conversion of arterial streets to Complete Street, which includes

continuous safe and comfortable sidewalk and bicycle lane shaded by trees is proposed as the major roadway project as shown in Chapter 6.

Since Complete Street includes introduction of consistent and easy to recognize signage, improvement in travel flow would be expected as well.

(3) Improvement of Traffic regulations utilizing signs and markings

In addition to the improvement of geometric conditions of roads, the traffic regulations to utilize street signs and markings for restriction of on-street parking, speed limits, prohibition of turnings and lane switching, signage of where to slowdown, etc. also need improvements. At many intersections, drivers make a right turn when signal lights are red. This poses a conflict between turning vehicles and crossing pedestrians. One measure to improve the situation is the installation of signages for vehicles to slow down and be mindful of pedestrians crossing the streets.

(4) Optimization of Lane Allocation

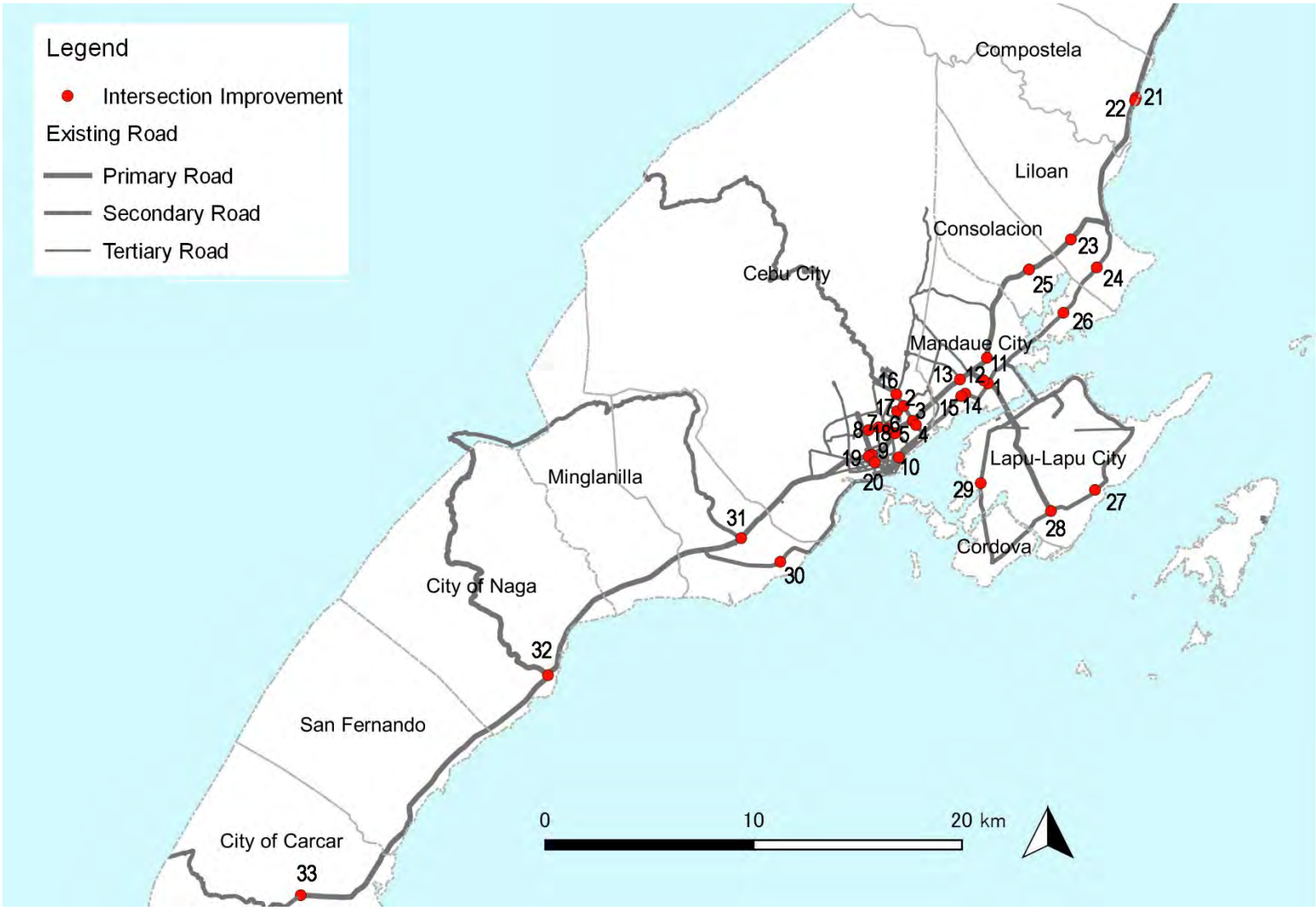
The width of artery road is relatively wide with enough space for three to four lanes, but traffic volume is relatively small in both outer lanes at some intersections. Proper lane assignment of the upward and downward of intersection is necessary. One reason of congestion is road usage imbalance—imbalance of routes and imbalance of lane usage. A countermeasure for congestion is to balance traffic density between lanes.

The regulation prohibiting left turn at some intersections might reduce conflicts between vehicles going straight, but travel distance could become long and road traffic at surrounding areas could become large. There could also be an issue with drivers' route choice. Even after availability of information gets improved by ITS, the utilization of road network might not improve.

Since there're many other intersections can be improved by at-grade geometric design improvements including traffic management, holistic F/S needs to be conducted in a short term as part of General Intersection Improvement Project listed in Table 8.1.3. Once all geometric design improvements including traffic management is completed, further study should be conducted to confirm the necessity for the grade separation.



Figure 8.1.3 Metro Cebu Future Urban Road Network



Source: JICA Project Team

Figure 8.1.4 Locations of Proposed Intersection Improvements

Table 8.1.2 List of Proposed Road and Bridge Projects

	Project Name	Location	Implementation	Length (km)	Proposed Lanes	Civil Work Cost (Million Peso)	ROW Cost (Million Peso)	TOTAL COST (Million Peso)
A. ROADS HIGHWAYS	1. Metro Cebu Circumferential Road （Segment 1）	Cebu, Mandaue, Talisay	New	24.72	2-2	17,398.27	19,001.85	36,400.12
	2. Metro Cebu Circumferential Road （Segment 2）	Consolacion, Liloan, Danao	New	29.80	2-2	13,808.60	15,480.00	29,288.60
	3. Metro Cebu Circumferential Road （Segment 3）	Minglanilla, Naga,	New	17.40	2-2	7,751.80	9240.00	16,991.80
	4. Talisay-Naga Diversion Road	Talisay, Naga, Minglanilla	New	7.70	2-2	3,686.90	6,030.00	9,716.90
	5. Mandaue-Liloan Diversion Road	Consolacion, Liloan	New-	10.10	2-2	4,963.80	7,740.00	12,703.80
	6. Cebu Arterial Road Widening Phase 1-1 Central Section (Complete Street Type A, 6 lanes))	Cebu, Mandaue	Upgrade	7.31	3-3	1,205.33	4,748.25	5,953.58
	7. Cebu Arterial Road Widening Phase 1-2 Central Section (Complete Street Type A, 4 lanes)	Cebu, Talisay	Upgrade	13.39	2-2	2,958.78	11,219.00	14,177.78
	8. Cebu Arterial Road Widening Phase 2-1 North Section (Complete Street Type A, 4 lanes)	Liloan, Consolacion Danao	Upgrade	16.00	2-2	2,941.62	5,909.20	8,850.82
	9. Cebu Arterial Road Widening Phase 2-2 South Section (Complete Street Type A, 4 lanes)	Talisay, Naga, Minglanilla, Carcar	Upgrade	28.50	2-2	4,797.21	9,618.60	14,415.81
	10. Cebu Coastal Road Widening Phase 1 (Complete Street Type A, 6 lanes)	Cebu, Mandaue	Upgrade	13.00	3-3	2,145.00	0.00	2,145.00
	11. Cebu Coastal Road Widening Phase 2 (Complete Street Type A, 6 lanes)	Cebu, Talisay	Upgrade	9.70	3-3	1,600.50	0.00	1,600.50
	12. Mactan Circumferential Road (Road Widening, Complete Street Type A, 4 and 6 lane)	Mactan Island	Upgrade	22.00	2-2/3-3	6,713.82	12,885.40	19,599.22
	13. Guadalupe–Lahug Diversion Road	Cebu	New	1.60	2-2	820.38	2,340.00	3,160.38
	14. Metro Cebu Intersection Improvement (Details are listed in Table 8.1.3)	Metro Cebu	Upgrade	-	-	7,817.62	2,571.46	10,389.08
B. BRIDGES	15. Cebu–Cordova Link Expressway Bridge	Cebu, Cordova	New On-going	3.23	2-2	27,900.00	0	27,900.00
	16. Mandaue Coastal Road (Viaduct)	Mandaue	New	6.20	2-2	11,254.80	915.00	12,169.80
	17. Mandaue–Lapu Lapu Link Bridge	Mandaue/ Lapu-Lapu	New	0.64	2-2	6,629.97	361.86	6,991.83
	18. 1st Matan Bridge Replacement	Mandaue/ Lapu-Lapu	Replacement	2.50	3-3	11,241.40	2,619.00	13,860.40
	TOTAL			**213.79**		**135,635.80**	**110,679.62**	**246,315.42**

Source: JICA Project Team

Table 8.1.3 List of Proposed Intersection Improvement Projects (Location Breakdown of Item No. 14 in Table 8.1.2 are shown in Figure 8.1.4)

No.	Location	Length (m)	Cost	ROW	Remarks
			(,000 PHP)	(,000 PHP)	
1	UN Ave cor. Plaridel Road	600.00	497,280.00	142,400.00	
2	Juan Luna Ave. cor. Cardinal Rosales Ave.	390.00	394,400.00	88,000.00	
3	M. J. Cuenco Ave. cor. Juan Luna Ave	475.00	374,240.00	139,800.00	
4	Juan Luna Ave. cor. A. Soriano Ave.	460.00	461,600.00	68,800.00	
5	Gen. Maxilom Ave. cor. M. J. Cuenco Ave	510.00	360,000.00	148,840.00	
6	Gen. Maxilom Ave. cor. Gorordo Ave.	930.00	952,800.00	88,000.00	**Combine No.6, 7, 18**
7	Gen. Maxilom Ave. cor. M. Gotianuy St.				
8	Gen. Maxilom Ave. cor. Juana Osmeña St.	410.00	413,600.00	88,000.00	
9	Osmeña Blvd. cor. N. Bacalso Ave	800.00	633,280.00	219,600.00	**Combine No.9 & 19**
10	V. Sotto St. cor. C. Arellano Blvd	480.00	357,120.00	141,520.00	
11	M. C. Briones St. cor. UN Ave	470.00	343,360.00	139,080.00	
12	A. C. Cortes Ave. cor. S. B. Cabahug	440.00	442,400.00	68,800.00	
13	M. C. Briones St. cor. A. S. Fortuna St	420.00	317,760.00	104,920.00	
14	Ouano Ave. cor. Conrado D. Seno	700.00	601,280.00	195,200.00	**Combine No.14 & 15**
15	Ouano Ave. cor. E. O. Perez St				
16	Archibishop Reyes Ave. cor. Juan Luna Ave	480.00	480,800.00	88,000.00	
17	Cardinal Rosales Ave. cor. Mindanao Ave	380.00	384,800.00	88,000.00	
18	Gen. Maxilom Ave. cor. Rahmann St	-	-	-	
19	Del Rosario cor. Leon Kilat St.	-	-	-	
20	Colon St. cor. Leon Kilat St	500.00	500,000.00	68,800.00	
	SUB TOTAL	**8,445.00**	**7,514,720.00**	**1,877,760.00**	

No.	Location	Form of Intersection	Cost (,000 PHP)	ROW (,000 PHP)	Remarks
21	Central Nautical Highway Near Conpostela Municipal Park	Trifurcated	4,900.00	30,100.00	
22	Central Nautical Highway Roger Canete St.	Trifurcated	4,900.00	30,100.00	
23	Central Nautical Highway Silot Draive Yati.	Crossroad	9,800.00	60,200.00	
24	Cebu North Coastal Road Bayong Yati Rd.	Crossroad	9,800.00	60,200.00	
25	Central Nautical Highway Near SM Consolacion	Crossroad	9,800.00	60,200.00	
26	Cebu North Coastal Road Laray Rd.	Crossroad	9,800.00	60,200.00	
27	ML Quezon National Highway Pajac Maribago Rd.	Trifurcated	4,900.00	30,100.00	
28	ML Quezon National Highway Basak Marigondon Rd.	Crossroad	9,800.00	60,200.00	
29	Babag II to Tiangue Rd. Road Segment Cordova	Trifurcated	4,900.00	30,100.00	
30	Cebu South Coastal Road Rafael Rabaya Rd.	Crossroad	9,800.00	91,000.00	
31	Cebu South Road Toledo Tabunok Rd. Rafael Rabaya Rd.	Crossroad	9,800.00	91,000.00	
32	Cebu South Road Naga Uling Rd.	Trifurcated	4,900.00	30,100.00	
33	Cebu South Road Liburon Rd. N. Bacalso National Highway	Crossroad	9,800.00	60,200.00	
34	General Intersection Improvement (approx. 120 intersections)	TBC	200,000.00	N/A	
	SUB TOTAL		**302,900.00**	**693,700.00**	

Source: JICA Project Team, DPWH

3) Implementation Schedule of Short- and Medium-Term Proposed Projects

Implementation schedule of the proposed short- and medium-term projects for roads are shown in Table 8.1.4 and bridges are in Table 8.1.5.

Table 8.1.4 Implementation Schedule for Metro Cebu Road Project

Project Name	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1. Metro Cebu Circumferential Road (Segment 1)													
2. Metro Cebu Circumferential Road (Segment 2)													
3. Metro Cebu Circumferential Road (Segment 3)													
4. Talisay–Naga Diversion Road													
5. Mandaue–Liloan Diversion Road													
6. Cebu Arterial Road Widening Phase 1-1 Central Section (6 lanes)													
7. Cebu Arterial Road Widening Phase 1-2 Central Section (4 lanes)													
8. Cebu Arterial Road Widening Phase 2-1 North Section													
9. Cebu Arterial Road Widening Phase 2-2 South Section													
10. Cebu Coastal Road Widening Phase 1													
11. Cebu Coastal Road Widening Phase 2													
12. Mactan Circumferential Road (Road Widening)													
13. Guadalupe–Lahug Diversion Road													
14. Metro Cebu Intersection Improvement (tentative)													

Source: JICA Project Team, DPWH

Table 8.1.5 Implementation Schedule for Metro Cebu Bridge Project

Project Name	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
15. Cebu–Cordova Link Expressway Bridge													
16. Mandaue Coastal Road (Viaduct)													
17. Mandaue–Lapu-Lapu Link Bridge													
18. Replacement of 1st Mactan Bridge													

Source: JICA Project Team, DPWH

4) Road Transport Network Plan for Long-Term Toward Year 2050

Considering the traffic volume in year 2050, which will increase further due to the economic growth in Metro Cebu, the road capacity both in width and length needs to be increased to meet the traffic demand.

Major projects for the enhancement of road network toward 2050 are expressway projects as described in Table 8.1.6 and their implementation schedules are shown in Table 8.1.7.

Table 8.1.6 Proposed Long-Term Metro Cebu Road Project Toward 2050

(Unit: Million Php)

	Project Name	Location	Length (km)	Proposed Lanes	Civil Work Cost	ROW Cost	TOTAL Cost
C. ROADS	C-1 Metro Cebu Coastal Road Expressway (Elevated highway along existing road)	Danao to Carcar	79.00	3-3	188,480.00	2,400.00	190,880.00
	C-2 Metro Cebu Circumferential Expressway (Elevated highway along Metro Cebu Circumferential Road)	Cebu, Mandaue Talisay	28.80	3-3	74,758.40	9,500.00	84,258.40
	TOTAL		107.80		**263,238.40**	**11,900.00**	**275,138.40**

Source: JICA Project Team

(5) Metro Cebu Coastal Expressway

The proposed Metro Cebu Coastal Expressway will be an elevated toll road from Danao through Metro Cebu North–South Coastal Road to Carcar using the existing road ROW. The proposed elevated road is approximately 79 km and has 6 lanes of roadway.

(6) Metro Cebu Circumferential Expressway

The proposed Metro Cebu Circumferential Expressway will be an elevated toll road using the same alignment of the proposed Metro Cebu Circumferential Road. No ROW is required. This expressway is approximately 28.80 km and has 6 lanes of roadway.

Table 8.1.7 Implementation Schedule for Proposed Metro Cebu Road Project

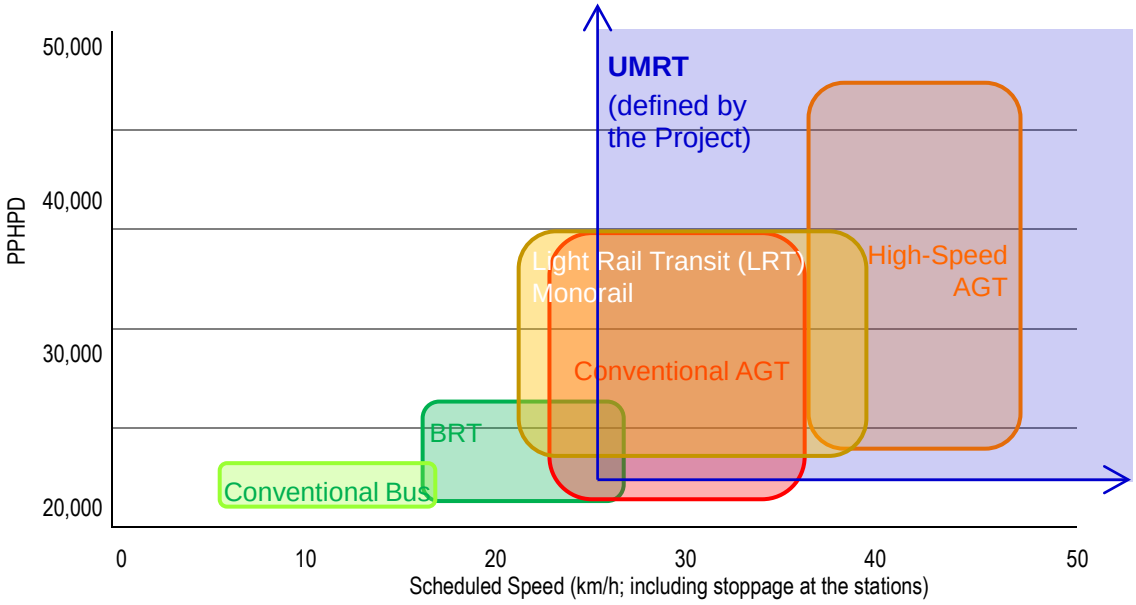
Project Name	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
1. Metro Cebu Coastal Road Expressway (Elevated Highway along existing road)						━	━	━	━	━			
2. Metro Cebu Circumferential Expressway (Elevated Highway along Metro Cebu Circumferential Road)	━	━	━	━	━								

Source: JICA Project Team

8.2 UMRT Network Planning

1) Principle of UMRT Planning

Among various transport modes, UMRT has high transport capacity that establishes the transport backbone in Metro Cebu. UMRT is a mass rapid transit that operates in urban areas. It has no clear definition; however, UMRT may refer to a system with capacity of more than 10,000 passengers per hour per direction (PPHPD) at a speed faster than a scheduled speed of 25 km/hr in the Project as shown in Figure 8.2.1.



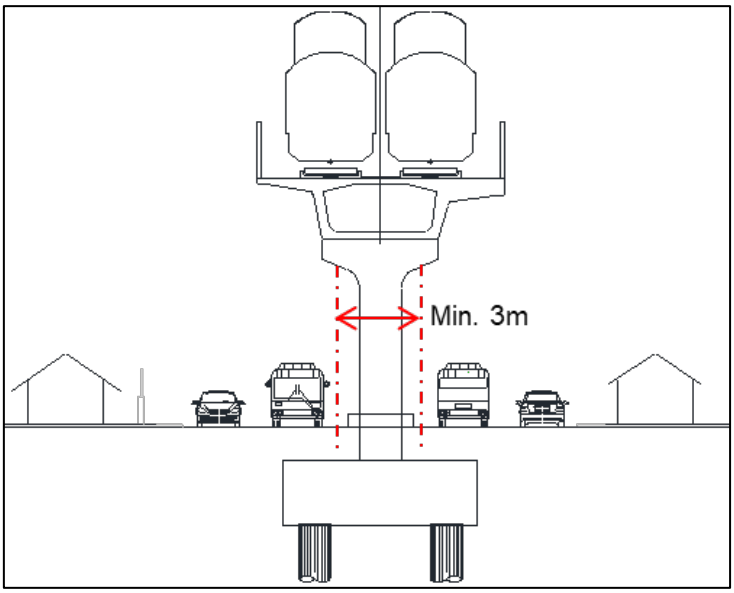
Source: JICA Project Team, Mitsubishi Heavy Industries Technical Review Vol. 52 No. 1

Figure 8.2.1 Public Transport Modes by Speed and Capacity

Construction cost is generally higher than the other transport modes especially in the urban area where UMRT has to be underground (in the tunnel) or above ground (on the viaduct as shown in Figure 8.2.2). Furthermore, UMRT requires an operation system such as signal, telecom and power supply as well as rolling stock. Such financial drawbacks should be mitigated by maximizing the benefits of the UMRT development and minimizing the social impact.

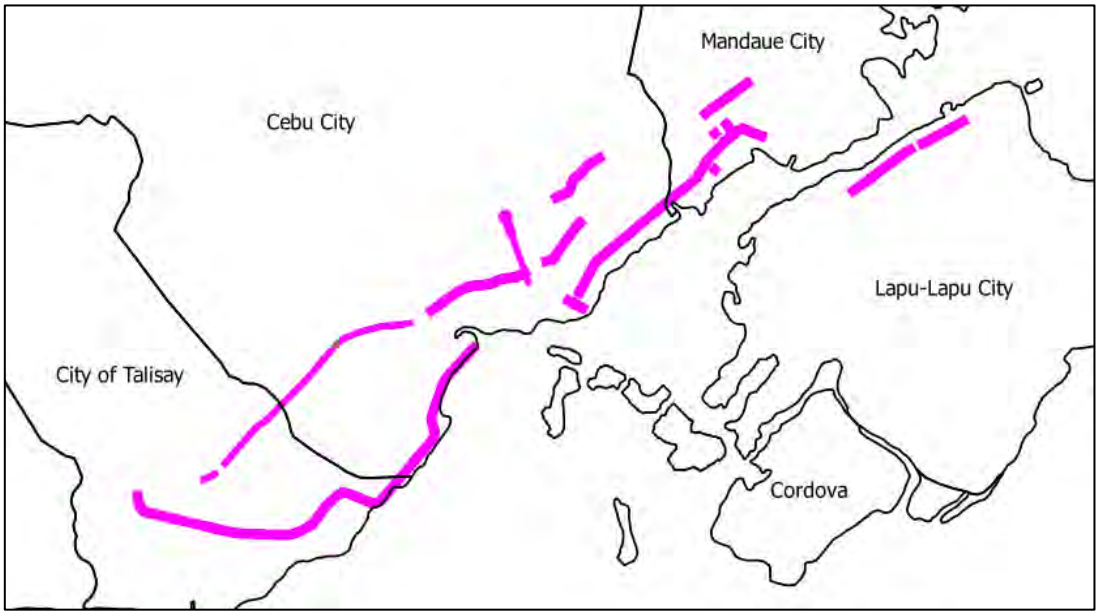
In order to maximize the benefits of the UMRT development, it should be located in the central urban area to link major urban development projects. As described in Chapter 2, large scale urban development projects that are both existing and planned are concentrated in central Metro Cebu such as Cebu City, Mandaue City, and Lapu-Lapu City. Trip generation and attraction are also concentrated in these 3 cities as previously indicated in this chapter.

Due to the limited land availability in the central Metro Cebu, the UMRT should be located on the viaduct which requires at least 3m width additional space in the center of the road as shown in Figure 8.2.2. Therefore, arterial roads with sufficient width to accommodate the viaduct should be selected as the candidate of UMRT corridor to minimize the social impact. The candidate arterial roads with the width of 20m or larger in the central Metro Cebu have been identified as seen in Figure 8.2.3.



Source: JICA Project Team

Figure 8.2.2 Typical Cross Section of Elevated UMRT Structure



Source: Prepared by JICA Project Team, RM Study

Figure 8.2.3 Candidate Arterial Roads with Sufficient Width for UMRT Alignment

The candidate roads are categorized in 2 corridors, namely Central Corridor and Coastal Corridor as shown below, that shape the alignment of UMRT Central Line and UMRT Coastal Line respectively.

Central Corridor:	Cebu South Rd., Natalio B. Bacalso Ave., Pantaleon Del Rosario St., Imus Ave., M.C. Briones St., and Cebu North Rd.
Coastal Corridor:	Cebu South Coastal Rd., Sergio Osmena Jr Blvd., and Ouano Ave.

2) Demand Forecast

In accordance with the UMRT planning principles, a series of demand forecast has been conducted in order to verify the necessity of UMRT development as well as to identify the priority of UMRT alignments.

In the demand forecast, 6 cases were studied by adding either UMRT Central Line or UMRT Coastal Line or adding both lines to the base line scenario (existing network) in the target years of 2030 and 2050 respectively. Results of the demand forecast are summarized in Tables 8.2.1 and 8.2.2.

Table 8.2.1 Case Summary of Demand Forecast for UMRT in Metro Cebu

Case No.	Target Year	Section of UMRT	With or Without		V/C	Travel Speed (km/h)	Vehicle Operating Cost (Php mil/day)	Travel Time Cost (Php mil/day)
			Central Line	Coastal Line				
1	2030	Central section of Central Line only	✓	-	1.35	14.3	736	2,131
2	2030	Central section of Coastal Line only	-	✓	1.48	14.1	773	2.212
3	2030	Central sections of Central and Coastal Lines	✓	✓	1.23	14.5	794	2,075
4	2050	Entire section (Danao-Carcar) of Central Line only	✓	-	1.26	14.4	914	5,740
5	2050	Entire section of Coastal Line only	-	✓	1.80	12.1	1,058	6,525
6	2050	Entire sections of Central and Coastal Lines	✓	✓	1.13	15.1	867	5,367

Source: JICA Project Team

Estimated number of passengers of each case is summarized in Table 8.2.2 below,

Table 8.2.2 Summary of Passenger Demand Forecast for UMRT in Metro Cebu

Case No	Target year	With or Without		Central Corridor		Coastal Corridor	
		Central Corridor	Coastal Corridor	Ridership (1000 pax)	PPHPD (pax/hr)	Ridership (1000 pax)	PPHPD (pax/hr)
1	2030	✓	-	822	16,900	-	-
2	2030	-	✓	-	-	398	10,300
3	2030	✓	✓	845	17,100	381	10,600
4	2050	✓	-	1,255	15,800	-	-
5	2050	-	✓	-	-	647	11,000
6	2050	✓	✓	1,466	17,000	665	11,000

Source: JICA Project Team

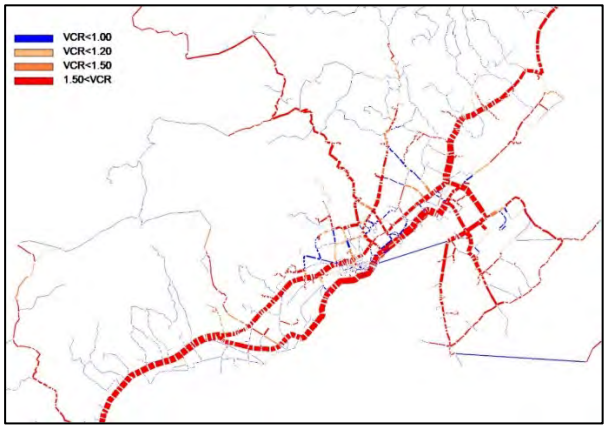
Traffic volume of baseline scenarios in 2030 and 2050 as well as the six case studies are shown in Figures 8.2.4 to 8.2.11.

The results of the demand forecast indicate that UMRT Central Line is more effective to mitigate the traffic congestion than UMRT Coastal Line in terms of traffic volume as well as travel speed. While it follows that UMRT Central Line should be developed as the first UMRT in Metro Cebu, the results also imply the necessity for the central section of both UMRT Central and Coastal Line by 2030 as the volume capacity ratio (VCR) will remain around 1.4–1.5 with either UMRT Central or Coastal Line in 2030, whereas development of both UMRT Central and Coastal Line of the central section in 2030 will reduce to around 1.2.

Due to the proximity of UMRT Central and Coastal Lines, competition between these lines can be assumed as the potential risk. However, the results show the multiplier effects on the ridership by the development of both lines. For example, passengers of UMRT Central Line under Cases 3 (2030) and 6 (2050) wherein both Central and Coastal lines will be developed are more than those of under Cases 1 (2030) and 4 (2050) wherein only the Central Line will be developed.

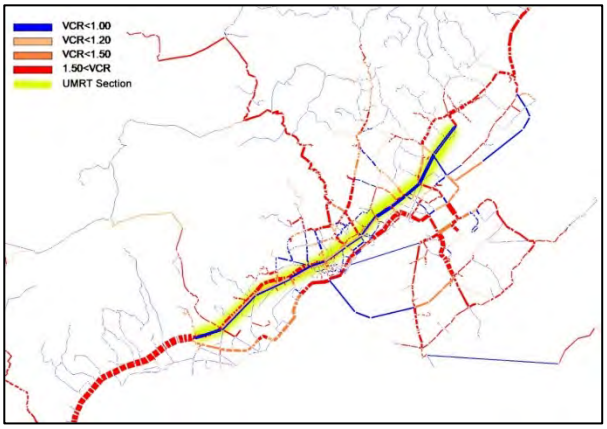
Therefore, analysis based on the demand forecast is summarized as follows;

- While the central section of UMRT Central Line should be developed first, the central section of UMRT Coastal Line also needs to be constructed by around 2030.
- UMRT Central Line and Costal Line will induce multiplier effects between them to increase both ridership rather than competing each other.



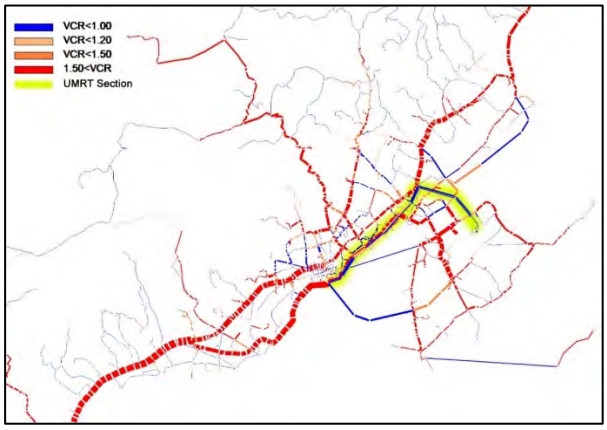
Source: JICA Project Team

Figure 8.2.4 Traffic Volume of Baseline (2030)



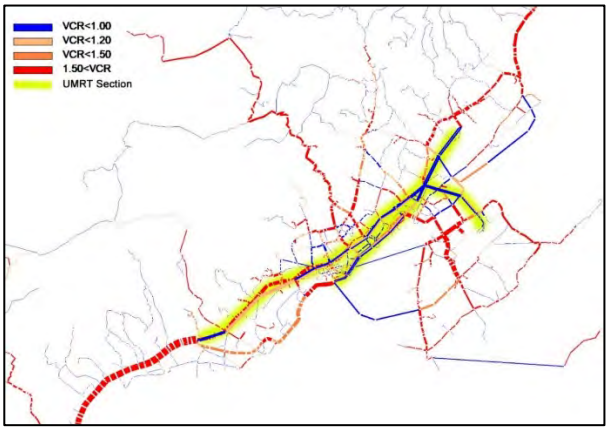
Source: JICA Project Team

Figure 8.2.5 Traffic Volume of Case 1 (2030)



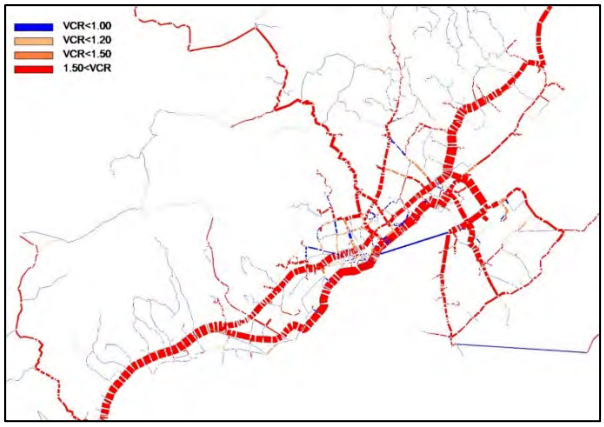
Source: JICA Project Team

Figure 8.2.6 Traffic Volume of Case 2 (2030)



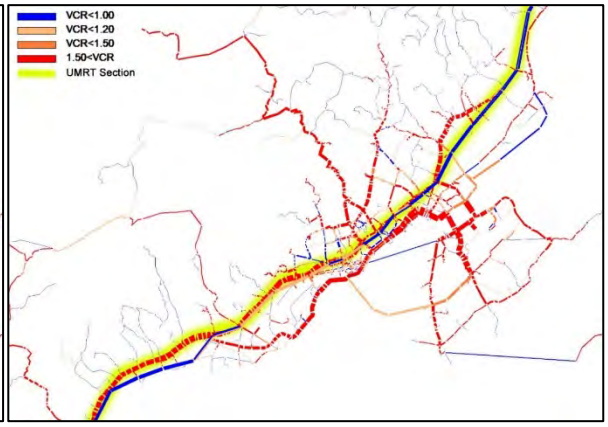
Source: JICA Project Team

Figure 8.2.7 Traffic Volume of Case 3 (2030)



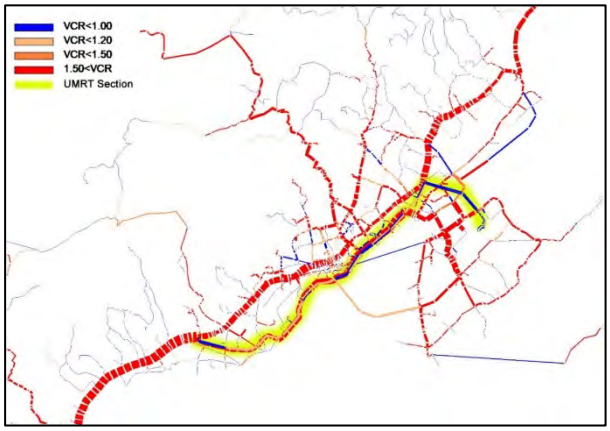
Source: JICA Project Team

Figure 8.2.8 Traffic Volume of Baseline (2050)



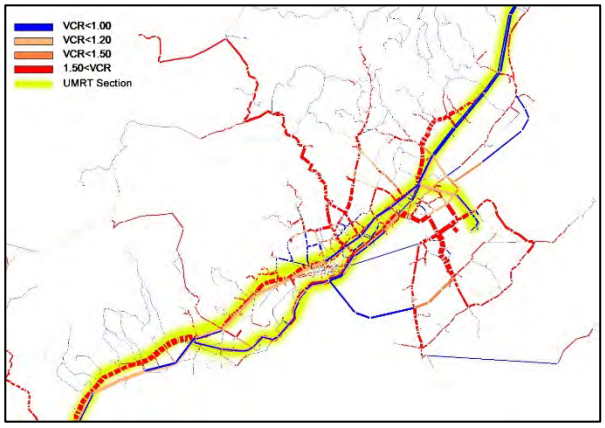
Source: JICA Project Team

Figure 8.2.9 Traffic Volume of Case 1 (2050)



Source: JICA Project Team

Figure 8.2.10 Traffic Volume of Case 2 (2050)



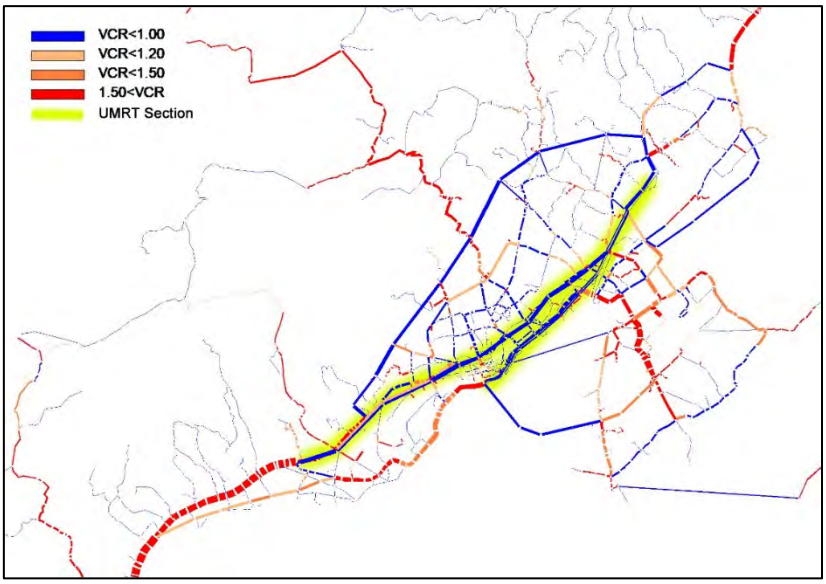
Source: JICA Project Team

Figure 8.2.11 Traffic Volume of Case 3 (2050)

Demand forecast was also conducted to verify the necessity for the railway connection by bridge between Cebu Mainland and Mactan Islands. Figure 8.2.11 shows the results of the case where all projects proposed in the future transport network are implemented except for the railway bridge between Cebu Mainland and Mactan Islands. By 2030, 2 more bridges (Cebu Cordova Link Bridge: 3rd Mactan Bridge and Mandaue-Lapu Lapu Link Bridge: 4th Mactan Bridge) are planned to be constructed between Cebu and Mactan Island. With these four bridges, traffic congestion between Mandaue City and Lapu-Lapu City cannot be solved as Figure 8.2.12 shows VCR of all the bridges exceed 1.0. Therefore, the railway bridge that has higher transport capacity than the roadway bridge will be necessary between Mandaue City and Lapu-Lapu City by 2030.

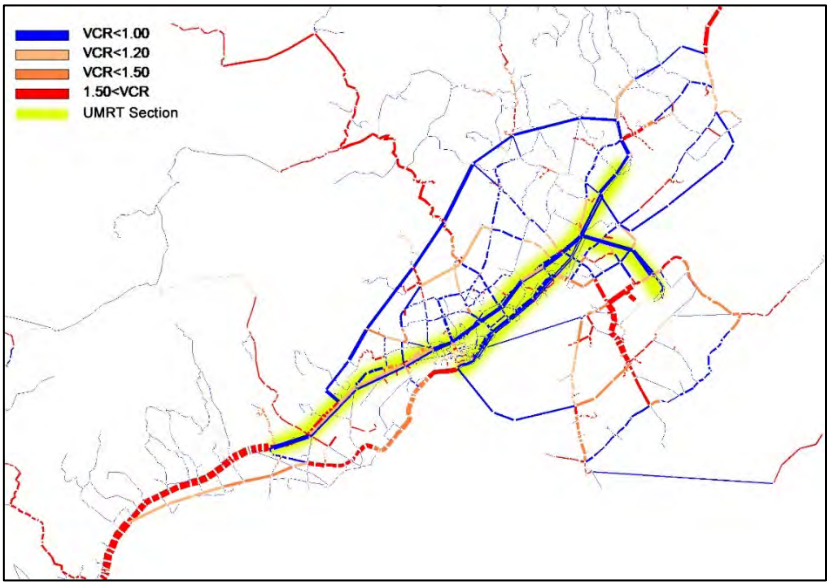
Figure 8.2.13 shows the results of the case with all the proposed projects are implemented including the railway bridge. The railway bridge between Mandaue City and Lapu-Lapu City will significantly mitigate the traffic congestion not only for the 4th Mactan Bridge but also for the existing 2nd Mactan Bridge.

Further analysis for the location of the railway bridge between Cebu and Mactan Island is conducted and described in the next section.



Source: JICA Project Team

Figure 8.2.12 Traffic Volume of Case of Do-All Projects (Excluding Railway Bridge: 2030)



Source: JICA Project Team

Figure 8.2.13 Traffic Volume of Case of Do-All Projects (2030)

3) Proposed UMRT Network in Metro Cebu

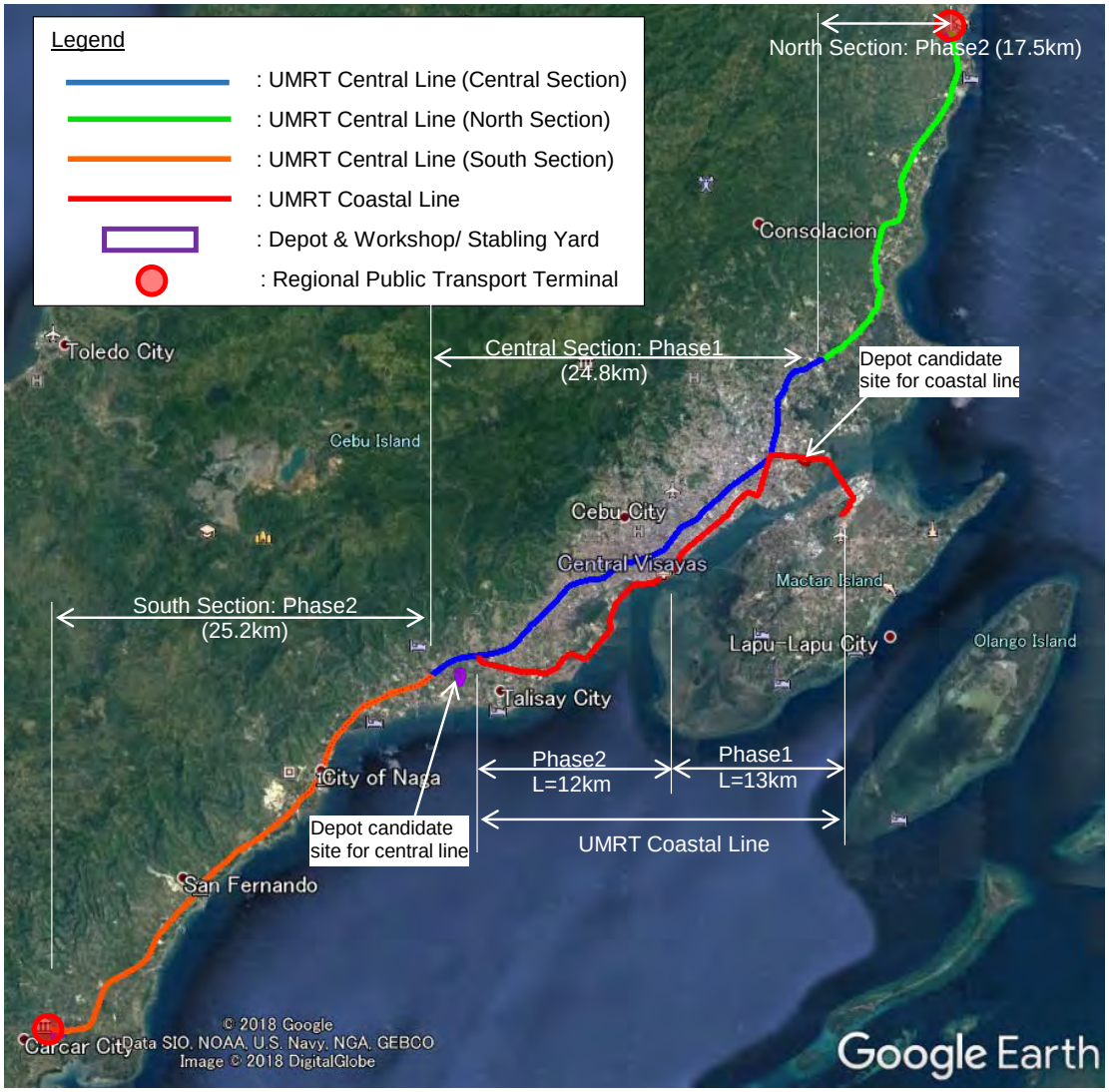
Proposed network of UMRT is shown in Figure 8.2.14 and implementation schedule is shown in Tables 8.2.3 to 8.2.7.

The following are the major conclusions based on the results of studies made for a railway network in Metro Cebu.

- UMRT Central Line should be developed along the central corridor prior to UMRT Coastal Line.

- Followed by the UMRT Central Line, UMRT Coastal Line should be developed along the coastal corridor.

- Railway bridge linking Mandaue City and MCIA should be constructed by 2030.



Source: JICA Project Team

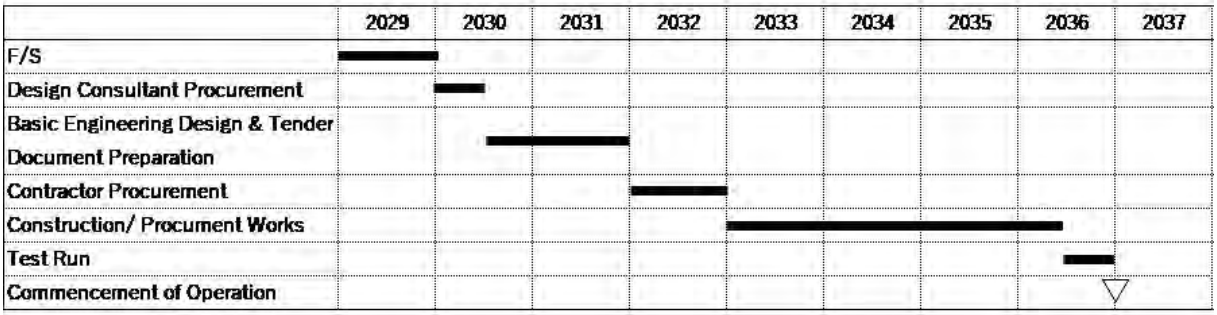
Figure 8.2.14 Proposed UMRT Network in Metro Cebu

Table 8.2.3 Implementation Schedule of UMRT Central Line (Central Section, Phase 1)

	2019	2020	2021	2022	2023	2024	2025	2026	2027
F/S									
Design Consultant Procurement									
Basic Engineering Design & Tender Document Preparation									
Contractor Procurement									
Construction/ Procument Works									
Test Run									
Commencement of Operation								▽	

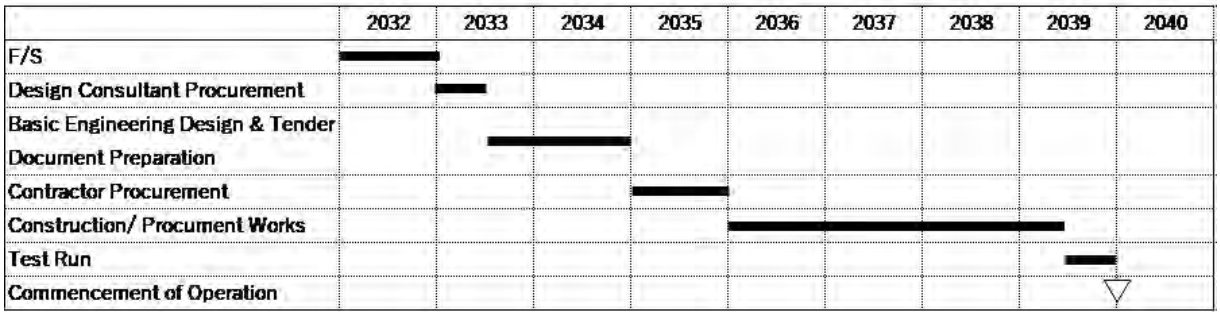
Source: JICA Project Team

Table 8.2.4 Implementation Schedule of UMRT Central Line (South Section, Phase 2)



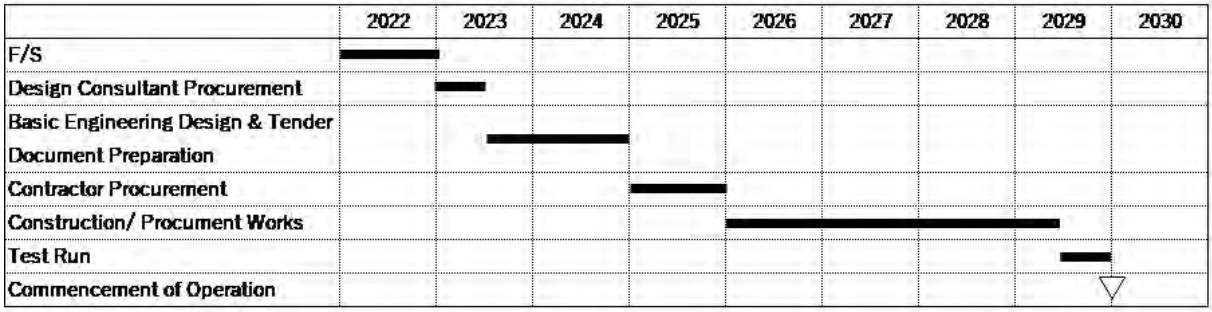
Source: JICA Project Team

Table 8.2.5 Implementation Schedule of UMRT Central Line (North Section, Phase 2)



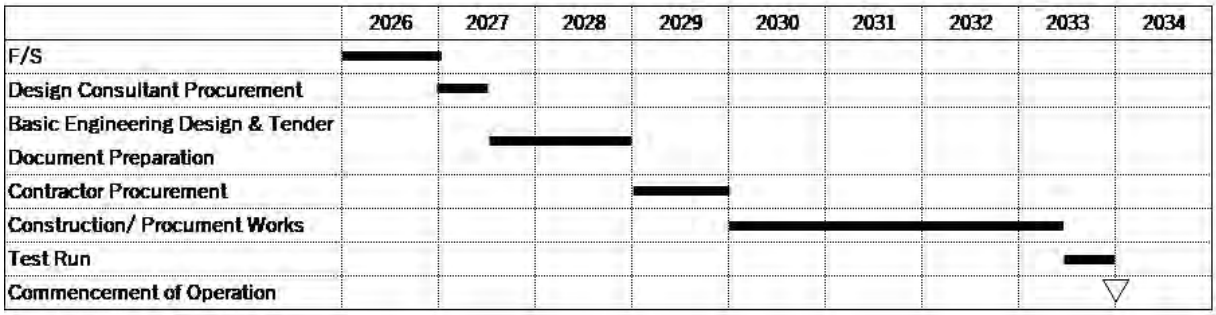
Source: JICA Project Team

Table 8.2.6 Implementation Schedule of UMRT Coastal Line (Phase 1)



Source: JICA Project Team

Table 8.2.7 Implementation Schedule of UMRT Coastal Line (Phase 2)



Source: JICA Project Team

Since the above are preliminary recommendations, minor changes might be added through F/S. For instance, higher priority on UMRT Central Line has been set from the perspective of effectiveness of railway development and mitigation of traffic congestion. However, since construction of UMRT Central Line will require more land acquisition and resettlement than

construction of UMRT Coastal Line, priority might change considering that land acquisition and resettlement will take a long time as described in the Roadmap Study. Flexible adjustments need to be made on the proposed railway network through F/S.

4) Railway Airport Access

Airport demand of MCIA shows robust growth in recent years. The actual airport users exceeded 10 million passengers per year in 2017.[1] The growth from 2016 reached as much as 14% (demand in 2016 is 8.8 million passengers). According to Airport Council International (ACI), the Philippines is ranked as the tenth fastest-growing country for airport demand around the world and a 5.7% yearly growth is expected from 2016 to 2040.[2] Provided that the demand of MCIA increased at the rate expected by ACI by 2030, the number of airport user will reach more than 20 million passengers per year in 2030.

In the meanwhile, the private operator of MCIA currently proposes to construct 2nd runway in the near future and central government is considering acceptance of the proposal. In the proposal, operation of 2nd runway will be commenced in 2040 and the airport capacity will be increased as many as 50 million passengers per year. This demand scale is similar to the neighboring international airports like Inchon in South Korea, Suvarnabhumi in Bangkok, Changi in Singapore, and Soekarno-Hatta in Jakarta, etc.

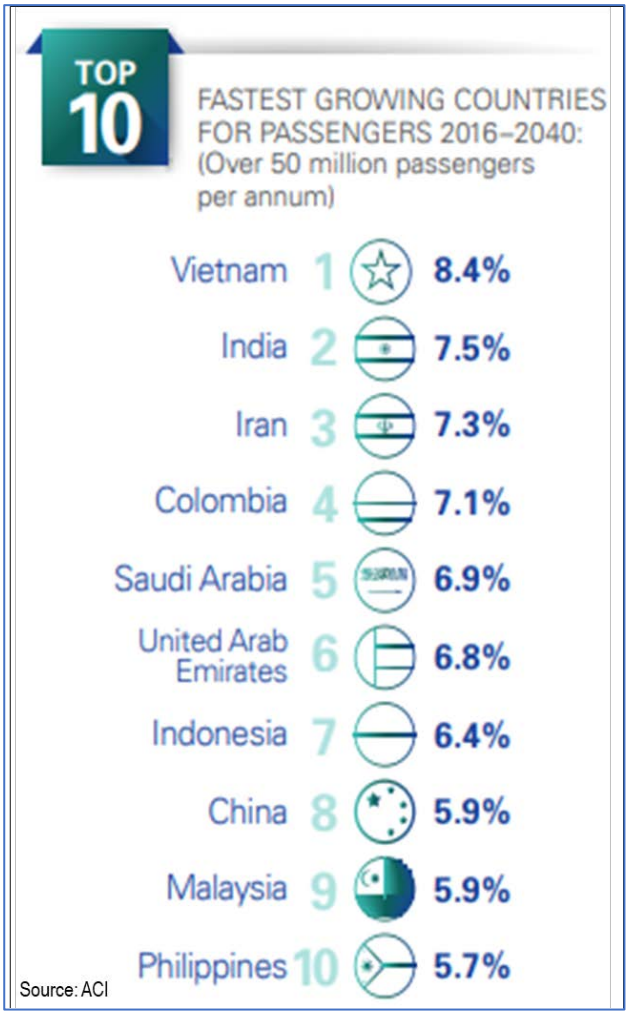


Figure 8.2.15 List of Fastest Growing Countries for Airport Passenger

It is common that railway airport access is developed as the airport demand expands. Railway airport access is usually developed as one of the strategies of urban cities to attract more foreigners. An increase in the accessibility to the urban city from the hub airport will also increase the competitiveness of the industries in the urban area around the airport and the entire urban area will be bustling with activities.

Looking at the railway access of the top 20 high demand airports among the top-50 high-demand airports around the world issued by ACI, all except Manila International airport have developed railway access. Even for the airports below the airport passenger demand of 20th, most already developed or started construction/ planning works of railway access except for a few airports. The passenger demand of these low-ranked international airport is slightly below 20 million to 40 million, which is close to the passenger demand of Mactan Cebu International airport in 2030. In this regard, Mactan Cebu International airport will be

[1] http://mciaa.gov.ph/index.php/statistics/
[2] http://www.aci.aero/media/9d12ed0c-e36b-48da-9b9f-8ec4640d5821/iM0Zyg /Statistics%20and%20Data /Infographics/Infographic_ACI_World_Airport_Traffic_Forecasts%202017%E2%80%932040.pdf

large enough to be equipped with railway access. Considering the importance of Cebu (being the second largest city in Philippines) and that is one of the most famous tourist sites in the country, which is expected to attract more tourists in the future, it is recommended to develop railway access to MCIA by 2030 when demand is expected to reach more than 20 million passengers per year.

The city center and MCIA can be linked in 23 minutes from Fort San Pedro and 19 minutes from SM City Mall with the preliminary operation plan. The airport where 20 million passengers use every year has to equip the service level which provides rapid accessibility and punctual access to the airport.

Table 8.2.8 Airport Demand of Existence of Railway Access of Top 20 to 50 International Airports

Rank	Airport	City	Country	Total	Existance of Railway Access		
				Nos of Passengers	Developed	Under Construction	Planning
21	Hamad International Airport	Doha	Qatar	37,322,843		○	
22	Xi'an Xianyang International Airport	Xi'an	China, People's Republic of	36,994,300		○	
23	Chongqing Jiangbei International Airport	Chongqing (Chungking)	China, People's Republic of	35,888,800	○		
24	Don Mueang International Airport	Bangkok SGD	Thailand	35,203,757	○		
25	Tan Son Nhat International Airport	Ho Chi Minh City (Saigon)	Vietnam	32,486,537			○
26	Hangzhou Xiaoshan International Airport	Hangzhou	China, People's Republic of	31,595,000			○
27	King Abdulaziz International Airport	Jeddah	Saudi Arabia	31,003,000		○	
28	Jeju International Airport	Jeju	Republic of Korea	29,707,364			
29	Abu Dhabi International Airport	Abu Dhabi	United Arab Emirates	25,964,178			○
30	Kansai International Airport	Greater Osaka Area	Japan	25,232,279	○		
31	Gimpo International Airport	Seoul	Republic of Korea	25,043,088	○		
32	King Khalid International Airport	Riyadh	Saudi Arabia	23,400,000		○	
33	Xiamen Gaoqi International Airport	Xiamen	China, People's Republic of	22,737,000		○	
34	Nanjing Lukou International Airport	Nanjing	China, People's Republic of	22,358,100	○		
35	Kempegowda International Airport	Bangalore	India	22,187,841			○
36	Changsha Huanghua International Airport	Changsha	China, People's Republic of	21,296,700	○		
37	Fukuoka Airport	Fukuoka	Japan	20,968,463	○		
38	Wuhan Tianhe International Airport	Wuhan	China, People's Republic of	20,771,000	○		
39	Zhengzhou Xinzheng International Airport	Zhengzhou	China, People's Republic of	20,760,000	○		
40	Qingdao Liuting International Airport	Qingdao	China, People's Republic of	20,660,000			○
41	Noi Bai International Airport	Hanoi	Vietnam	20,596,632			○
42	New Chitose Airport	Sapporo	Japan	20,461,531	○		
43	Ürümqi Diwopu International Airport	Ürümqi	China, People's Republic of	20,200,800			○
44	Ngurah Rai International Airport	Denpasar	Indonesia	19,986,415	△（BRT）		
45	Juanda International Airport	Surabaya	Indonesia	19,483,844			
46	Haikou Meilan International Airport	Haikou	China, People's Republic of	18,803,800	○		
47	Naha Airport	Naha	Japan	18,336,030	○		
48	Ben Gurion Airport	Central District	Israel	17,936,810	○		
49	Chennai International Airport	Chennai	India	17,733,375	○		
50	Sanya Phoenix International Airport	Sanya	China, People's Republic of	17,370,000			

Source: JICA Project Team, ACI

5) Location of Railway Bridge

While the optimal alignment and system of UMRT need to be identified through F/S, preliminary study was conducted to compare the potential locations of the railway bridge. While the optimal alignment and system of UMRT need to be identified through F/S, preliminary study was conducted to compare the potential locations of the railway bridge. In order to compare the travel time from Cebu Island to Mactan Island, routes from Fort San Pedro to MCIA via alternative railway bridges were identified as shown in Figure 8.2.16.



Source: JICA Project Team

Figure 8.2.16 Alternative Routes of Railway Bridge between Cebu Mainland and Mactan Island

Although connection point of Alternative 1 on Cebu Island side is in Cebu City, it's close to the central area of Cebu City as well as the border of Mandaue City and provides the convenient and fastest service to the airport from Fort San Pedro. However, this option requires significant initial cost due to the length of the bridge which is more or nearly double the other alternatives.

A bridge at Alternative 2 could be constructed at a minimum cost due to its shortest length; however, cost and time for the resettlement could be an issue as more affected people is expected compared to the other options.

While route of Alternative 3 takes the longest travel time, its difference with Alternative 1 is 4 minutes, which can be negligible when compared to the advantages in other evaluation factors. Since the number of affected households is expected to be the minimum and it will have a connection with UMRT Central Line, Alternative 3 would be the preferred option. Preliminary evaluation of each criteria is summarized in Table 8.2.9. Since these results are preliminary, they need to be verified and revised as necessary through F/S.

Table 8.2.9 Summary of Preliminary Evaluation for Alternative Locations and Routes of Railway Bridge

Item	Alternative 1		Alternative 2		Alternative 3	
Bridge Length (m)	1,800m		500m		900m	
Route Length (travel time)	10.8 km (19 min)	◎	11.5km (20 min)	○	13.5km (23 min)	×
Bridge cost	×		◎		○	
Passenger Demand /Catchment Area	×		○		◎	
Land Acquisition/ Resettlement	Approx. 20 houses to be affected.	○	Approx. 40 houses and 1 factory to be affected.	×	Approx. 10 houses to be affected.	◎
Preliminary Evaluation	Not Recommended				Recommended	

Source: JICA Project Team

6) Possible 2nd Runway Construction in MCIA

Although Alternative 3, which goes through Mactan Economic Processing Zone (MEPZ) 1 area, was recommended in the previous section, there is a plan for Mactan-Cebu International Airport to build 2nd runway in the area where currently occupied by MEZ1. According to the 3D conceptual drawing disclosed in the news website,[3] the 2nd runway is seen in the northeast side of the existing airport property and almost all the MEZ1 area are gone (see Figure 8.2.17). This indicates that a second runway may be constructed in the area where many factories and warehouses are currently built by demolishing such existing facilities and buildings in the area. Such large-scale demolition works could not be possible considering the legal aspect of the impact; however, if this plan is realized, the proposed route of Alternative 3 is no longer possible. Further studies for alternative route for railway bridge may then be required in case a second runway at MCIA is implemented. Close attention to the second runway project at MCIA is entailed.



Source: Cebu Provincial Government

Figure 8.2.17 Proposed 2nd Runway in Mactan-Cebu International Airport

[3] http://www.bworldonline.com/content.php?section=Nation&title=underground-train-linking-terminals-included-in-proposed-mactan-cebu-airport-expansion&id=148228

7) System of UMRT Coastal Line

As shown in Table 8.2.2, PPHPD of UMRT Coastal Line is estimated at around 11,000 in 2050. Therefore, a special guideway system as shown in Table 8.2.10 should be adopted rather than conventional MRT with a heavy rail due to its effectiveness on cost as well as the areas to be disturbed by the construction and operation. For example, while conventional heavy rail system has a limit of 3% slope in operation, a special guideway system can operate up to 6% slope as shown in Table 8.2.10. This makes difference in the constructions cost by shortening the length of the bridge over the channel between Cebu and Mactan Islands.

Table 8.2.10 Comparison of Alternative Urban Railway Guided System

	Monorail		AGT		Linear Metro		MRT(reference)
Image (Outline)	 Straddle on a single concrete beam.		 Rubber tier on flat concrete surface.		 Driven by linear motor. Steel wheel on rail.		 Traditional steel wheel railway system.
Capacity (PPHPD)	10,000-20,000 pax/hr/direction	△	10,000-20,000 pax/hr/direction	△	20,000-30,000 pax/hr/direction	◎	~60,000 pax/hr/direction
Alignment conditions	Max slope: 6% Min curve: 60m	△	Max slope:6% Min curve:30m	◎	Max slope:6% Min curve:100m	△	3.5% 200m
Initial cost (per km)	USD4~5billion (elevated)	△	USD 3~4billion(elevated)	◎	USD6~7billion (elevated)	×	USD 15billion (elevated)
Speed	Max speed: 80km/h Scheduled speed: 35~40km/h	△	Max speed: 60km/h Scheduled speed: 25~35km/h	×	Max speed: 80km/h Scheduled speed: 30~40km/h	◎	80 ㎞/h 30~40km/h
Safety in Emergency	No evacuation route secured.	×	Flat surface can be used for evacuation route.	◎	Track can be used for evacuation route.	△	Track can be used for evacuation route.
Environment/ Landscape	Simple structure with 2 concrete beams. Less noise due to rubber tire operation.	◎	Mass solid structure required in the air. Less noise due to rubber tire operation.	△	Mass solid structure required in the air. Noise generated between wheel and rail.	△	Noise
Competitiveness	A few suppliers only.	×	Several suppliers around the world.	△	Several suppliers around the world.	×	Many suppliers around the world.
Maintenance	Regular tire change required. Many tires are used for one vehicle.	△	Regular tire change required.	△	Reaction plates are very expensive. More energy consumption required.	×	Easy to maintain.

Source: JICA Project Team

Amongst the above systems, linear metro runs with steel wheel on steel rail same as traditional MRT, while AGT and monorail run with rubber tire on concrete surface. Below is a description of each factor of the urban railway systems.

(i) Capacity

Traditional MRT carries more passengers than any other urban railway systems. Car capacity of an MRT rolling stock is approximately 250 passengers. A 10-car train can transport 50,000 passengers per hour if operated every 3 minutes.

Car capacity of monorail is approximately 100 passengers. Monorail with a 6-car train (same as Tokyo Monorail operation) can transport 12,000 passengers per hour if operated every 3 minutes.

Car capacity of Japanese standard AGT is around 80 passengers. An AGT with 6-car train (same as Yurikamome Operation) can transport 9,600 passengers if

operated every 3 minutes. Large-size AGT car by a Japanese manufacturer carries 100 passengers per car, which is the same figure with monorail.

Ooedo line in Tokyo is one of the major linear metros in Japan. Its car capacity is around 100 passengers and it can transport 16,000 passengers per hour if operated every 3 minutes with 8-car train.

It is noted that all the figures above are from the existing railway systems in Japan. Capacity of each system changes depending on the size of rolling stock and number of car per train.

(ii) Alignment Flexibility

There are strict conditions on MRT alignment design since rapid transit is the basic policy for MRT operation. Max slope is 3.5% for MRT while all the other modes proposed above can operate with a max slope of 6%. Minimum curve for AGT is 30 m, which is the smallest among the others. Monorail follows with 60 m for minimum curve. Minimum curve for linear metro can be as small as 100 m although it depends on the size of rolling stock.

(iii) Initial Investment Cost

Initial investment cost for AGT is the lowest since civil structure is simple and light, though it depends on the competitive environment. Monorail requires high accuracy in beam construction that is slightly costlier than AGT. Linear metro tends to be applied at underground section since it requires less section area than MRT as no power supply cable is required. However, the cost for elevated structure for linear metro is slightly lower than MRT though it is depending on the size of car.

(iv) Speed

MRT and linear metro provides the fastest railway operation, although it depends on the alignment conditions. Monorail can run as fast as 80 km/h, which is same as MRT. Standard AGT runs at the maximum speed of 60 km/h that is slightly lower than any other system.

(v) Safety in Emergency

Track way can be used as evacuation route in case of MRT, linear metro and AGT. However, there are some difficulties in walking on the track way of MRT and linear metro due to structures on the track such as sleepers and rails. Track surface of AGT is flat so no difficulties walking on track way is expected. On the other hand, evacuation route cannot be secured with monorail as passengers cannot walk on a thin concrete beam installed up in the air. If evacuation facility such as catwalk is separately constructed, initial cost becomes slightly higher. If evacuation facility is not constructed, prompt evacuation cannot be achieved. Passengers need to wait for aerial track with escape chute to arrive at the site.

(vi) Environment (Landscape)

All railway systems except monorail require solid concrete slab with side wall up in the air, which can disturb landscape along the elevated structure. In case of monorail, only two thin concreate beam are seen in the air, so it has less impact against the landscape.

(vii) Competitiveness in Price

Since MRT is a traditional railway system and the most common, there are many suppliers and manufacturers all around the world. There are several suppliers even in Japan. But when it comes to other railway systems, the number of supplier is significantly smaller than MRT. In the case of monorail, the number of major supplier is limited to three or four in the world. There is only one supplier in Japan. There are more suppliers for AGT than monorail although the number of suppliers is also limited. In Japan, several suppliers have produced rolling stock and railway system, however, most of those suppliers deliver rolling stock and railway system only to domestic market except for one supplier.

(viii) Maintenance Cost

As discussed in the previous clause, procurement of MRT spare parts is the easiest as there are multiple suppliers. Since the number of suppliers of other railway systems is limited, the availability of spare parts is also limited. Regular tire replacement is required for monorail and AGT. In addition to limited suppliers, as the cost for reaction plate for linear metro system is relatively much more expensive than other system, maintenance cost for linear metro could be higher than other alternative systems.

Considering the pros and cons described above, a proper railway mode to satisfy the requirement of this project shall be selected. Based on the comparison table, the characteristics of each railway mod can be described as below,

Monorail	Monorail is good for landscape as its structure is very simple; however, safe evacuation in emergency cannot be achieved. In addition, the number of suppliers is the lowest.
AGT	AGT's biggest advantage against other systems is the flexibility of alignment design, but it fails in rapidness.
Linear metro	Linear metro system is closer to traditional railway system; however, high technical capability is required since the clearance between reaction plate and motor has to be kept very close each other (a few centimeters). The maintenance cost will be the highest.

The length of south corridor is approximately 23 km. Railway system which can provide the schedule speed of 40 km/h linked the entire route in 35 minutes, while AGT can transport in 39 min.[4] There is only a 4-minute difference in operation time. This difference is not significant since the route length is relatively shorter, meaning, rapidness of the system will not be a big advantage in this project. In addition, land acquisition and resettlement shall be minimized in this project since the first urban transportation system to be developed in Metro Cebu is expected to commence operation as soon as possible considering the seriousness of existing traffic conditions in the area. In this regard, the alignment of the selected system shall follow ROW of existing road as much as possible. Considering the specific requirement of the project, AGT with the most flexible alignment, is currently recommended for south corridor based on the results of the preliminary study. However, further analysis should be conducted through F/S for the selection of the optimal mode of UMRT Coastal Line.

[4] 23km /40 x 60min = 35 minutes, 23km /35 x 60min = 39minutes.

8.3 Public Transport System Planning

1) Objectives of System Planning

When an urban commuter can take a ride within reasonable walking distance (~500 m) to a public transport route and gets to his destination in less than an hour (whether a person comes from Carcar City or City of Danao and goes to Cebu City, Lapu-Lapu City, or Mandaue City), then Metro Cebu can be deemed to a have a good public transport system.

It becomes a great system when other desirable features are present, such as (i) use of one ticket, preferably electronic, if the trip involves a transfer; (ii) the conveyance is comfortable and safe (the current public utility vehicles [PUV] are not); (iii) transfer is seamless, even if it involves road and ferry, or different service providers; (iv) waiting time for a ride is short (<10 minutes); and (v) comfortable waiting area especially if it entails more than 10 minutes waiting time.

However, a significant gap still exists between the abovementioned and the current conditions of public transport in Metro Cebu. All LGUs in Metro Cebu and Cebu Province struggle to make their public transport system effective and efficient for commuters. Even if they realized that the cities' growth cannot be sustained by relying on private cars, neither strategies nor indicators to evaluate the strategies have not been well established. To manage the improvements on public transport system, there are performance standards and benchmarks that have gained wide acceptance. These are summarized in Table 8.3.1.

Table 8.3.1 Indicators of Public Transport Services

Policy Goal	Performance Indicator	Significance	Desirable Level (tentative)
Efficient service delivery	Transport expenditures as % of household income per month	Affordability	<10%
	Fares per pax-km		
Service quality	Headways or frequency	Reflects waiting time	<5 minutes, at peak
	% Breakdowns	Measures reliability	<20 minutes, off-peak
	% Trips requiring transfers	Network connectivity & responsiveness to need	<8%
Safety	Accident per 100,000 bus-km		<3
Accessibility	Time to PUV stop	Indicators coverage and proximity to user	1.5 to 3.0
Environment quality	Bus emission standard	Emissions from PT	10 minutes
Operating frequency	Revenue-to-cost ratio	Financial viability	
	Vehicle (km/day)	Asset productivity	
	% Fleet in service	Maintenance effectives	
	Pax/day/ "Crush" capacity	Adequacy of capacity	1,000–2,000 (regular bus)

Source: JICA Project Team

Road congestion is usually expressed in volume-to-capacity ratio—the number of vehicles using a road in relation to the designed capacity of the road (maximum 2,000 pcu per lane per hour is the norm for limited access expressway; lower than 1,000 for urban roads with many at-grade intersections). For a sustainable transport system, the metric has shifted to the number of passengers per lane per hour in lieu of cars per lane per hour. This new metric implies a preferential policy for public transport vehicles in the use of scarce road spaces. The modal share of public transport (rail, bus, minibus, tricycles, and ferry) in the commuting market must be kept above 70%.

The achievement of these objectives is almost impossible without public transport planning that is metro-wide in focus and multi- and inter-modal in orientation. The fact that all transport service providers is private is a good thing, in the sense that no public subsidy is involved. The downside, however, is the fragmentation or lack of integration in the routes and in the services. In order to establish a consolidated public transport system in a holistic manner, proactive and close intervention among national, provincial government, and LGUs is necessary.

2) Road-Based Public Transport

There was no clear direction on what next steps to take especially on the future of public transport system in Metro Cebu. Decision-makers have become bold in their respective recommendations on public transport systems for their localities, while other elected officials became dependent on what the national government agencies have proposed for their local areas.

The private sector, on the other hand, has grown more active in providing the supply especially in road-based public transport as an answer to the demand for more public transport modes to cater to the increasing population in areas where there is urban growth. The LTFRB, which is mandated to regulate and control the issuance of franchises for the PUVs, can no longer determine the number of PUV units needed in each LGU. So, in 17 November 2003, LTFRB issued Memorandum Circular No. 2003-028 that declares the "nationwide moratorium on the acceptance of new applications and petitions for the issuance of a certificate of public convenience except trucks-for-hire service."

In September 2009, the Department of Transportation (DOTr; was formerly called Department of Transportation and Communication) commissioned a study entitled "Development of Public Transportation Strategic Plan for Metro Cebu." Then in 2010, the pre-F/S for the CBRT was undertaken and completed in August 2012.

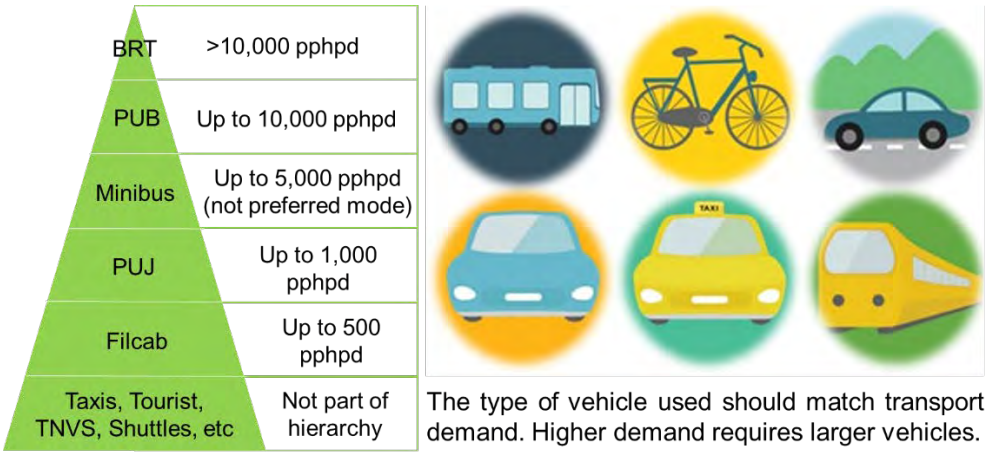
In mid-2017, DOTr laid down the framework for the modernization of road-based PT under DOTr Order No. 2017-011 entitled "Omnibus Guidelines on the Planning and Identification of Public Road Transportation Services and Franchise Issuance (OFG)". Its desired outcomes are as follows:

- Replacement of existing PUVs (numbering more than 12,000 in Metro Cebu) with a modern fleet that is compliant with the new vehicle technical standards (design suited for urban operations and low-carbon) for class 2 and 3 vehicles.

- Transformation of the existing fragmented (mostly one-vehicle one-owner) operation into a coordinated delivery of services, preferably under a cooperative set-up backed up by an omnibus franchise.

- Formulation of the LPTRP by LGUs rather than by LTFRB.

- Hierarchy of public transport modes, whereby low-capacity micro-buses give way to higher-capacity standard buses as demand grows (following the principle of less vehicle-to-road density and more passenger throughput per lane of road).



Source: DOTr

Figure 8.3.1 Hierarchy of Public Transport Modes (per DOTr Guidelines)

For Metro Cebu, this guideline requires 13 LGUs to draw up PUV routes that will be the basis for franchise issuance by LTFRB. DOTr currently carries out activities related to the national government's PUVMP program, such as providing capacity building seminars/workshops to the LGUs in the formulation of its respective LPTRP. Eventually, route rationalization of PUVs will be prepared in its entirety for Metro Cebu and the rest of the country to improve the coordination and role-sharing among relevant agencies.

LTFRB acts as the regulatory agency that franchises public transport service providers, but they do not define the desired public transport network before granting permit or franchise. The routes and service areas of jeepneys, buses, and taxis are largely driven by the market.

When a private entity wants to enter a market, he applies for an authority to operate a public transport by defining (and defending) his preferred route(s). Opponents from existing operators may arise as they are invited by LTFRB and the issue of market entry is resolved via quasi-judicial hearings. In some instances, LTFRB would rely on the evaluation of the DOTr-Road Planning Division that relies on a concept called route measured capacity (RMC). RMC is supposed to determine the number of PUVs adequate to meet demands except that the survey data to support such an estimation is rarely available. In a process heavy on legalistic arguments, an integrated public transport network can only happen by accident.

On its own, a large fleet operator would necessarily plan for its success but would limit itself to a small niche of the overall network. In Metro Cebu, there is no large fleet operator who has the resources or incentive to do system-wide planning. The current state of public transport, with approximately 600 overlapping routes, is simply the product of a fragmented industry structure (more than 12,000 operators deploy 12,788 units in competition with each other).

Most cities in developed countries take it upon themselves to provide good public transport system as a basic service obligation to its residents. This is not the case in the Philippines. LGUs face the difficulty to fully commit themselves in public transport services due to the limited territorial jurisdictions and lack of coordination with the relevant national government agencies. Only the regulation of tricycles was devolved to LGUs by virtue of the Local Government Code of 1992. Even at this moment, very few LGUs have risen to the challenge of planning their operations.

Things could change with the issuance by DILG and DOTr of Joint Memorandum Circular No. 001 dated 19 June 2017 that requires LGUs to formulate their respective public

transport as a prerequisite for the issuance of a franchise by LTFRB. The delegation of responsibilities stated in the circular is shown on Table 8.3.2

Table 8.3.2 New Roles for LGUs in Public Transport Planning

Level ➔	City/Municipality	Province	DOTr
Task ➔	Public transport route within the city or municipality (Intra-LGU)	PT route that has an origin in one LGU and a destination in another LGU (inter-LGU)	Inter-province or region; Between and among independent cities; Metro Manila
Implications to Metro Cebu ➔	11 LGUs: Carcar, San Fernando, Naga, Minglanilla, Talisay, Mandaue, Cordova, Consolacion, Liloan, Compostela, Danao,	All intra-LGUs (11); exceptions are those with points in Lapulapu & Cebu City	2 LGUs: Lapulapu City and Cebu City are independent cities. Routes between these 2 LGUs
Existing PT Routes ➔	Only 3 of 11 have intra-routes, viz. Naga, Danao, and Cordova.	About ¼ of the 600 routes	Many intra-city routes in Cebu City; a handful within Lapulapu

Source: JICA Project Team

The delineation according to the above table leaves out some important routes. The province is prevented from including routes from any of the 11 LGUs that terminates in or originates from Cebu City and Lapu-Lapu City. It would also be left out of the DOTr's responsibility, because DOTr is limited to intra- and inter-city for the two cities. Ideally, public transport system planning should not be constrained by political boundaries.

As for the road network where these PUVs traverse, most of the Metro Cebu LGUs have limited available roads for public transport. Most of the time, the national highway functions as an arterial and as a collector as well. In highly urbanized cities, there are city streets used by the PUJs according to what has been stipulated in their respective local ordinance on "travel lines." These travel lines are city streets provided by the LGU as PUJ routes. However, these city streets now experience congestion as well with the increase of private vehicle usage coming from the emerging residential buildings and commercial establishments at the urban areas in Metro Cebu.

At the same time, PUV terminals cannot provide enough space for PUV units to wait for passengers. These terminals are operated by the private sector and accredited by the LGUs. Another scenario that can be observed in a PUV terminal is the very long queue of passengers waiting for a jeepney. During peak hours, the turnaround time of PUVs become longer due to the occurrence of congestion in some areas along the PUJ route. Hence, the buildup of passenger queues has become a normal scenario. LGUs should start to look into these PUV terminals to determine how to improve them and to plan for their future.

On the other hand, PUJs have been trip-cutting in some routes as reported by the LGUs, especially at areas where a high number of commuters were observed waiting along the road for PUJs. It is evident that the LGUs have not thought about any planning activities in relation to the terminal facilities made available for the Cebuano road users. At the same time, the LGUs must strictly enforce the designated "PUJ Stop" areas. PUJs that load and unload commuters whenever and wherever along their route is an obstruction to the vehicle/s behind them. A concerted effort is needed to be done by the LGUs to stop trip-cutting and loading/unloading of passengers not on designated PUJ stops.

In Metro Cebu, since UMRT will be introduced from Danao to Carcar by 2040, a regional transport terminal that provides multi-modal transfer will be required at the terminal stations to connect with northern and southern LGUs in Cebu Province. The Municipality of Carcar is planning to develop its first consolidated public transport terminal as a part of its new urban center including the new city hall that was completed in 2017 and cultural sports complex, etc. A similar approach to develop a public transport terminal through the integrated transport and urban development should be done in Danao City.

Increase in transport capacity of public transport is also essential to achieve the desired level of service previously described. Due to the limited developable areas and rapid population growth in Metro Cebu, space for public transport should be used in an effective and efficient manner. Therefore, the way forward in public transport is a gradual reduction of PUJs (with capacities of 16–20) and simultaneously adding more buses (with capacity of more than 50). The standard for Class 2 PUV (defined as a vehicle that can carry more than 22 passengers, both seated and standing) should be "relaxed." Urban transit requires more spaces for standees rather than seated passengers. As discussed earlier, many PT routes in Metro Cebu have a level of demand that exceeds the carrying capacity of PUJ, but the roads are not wide enough to accommodate a standard bus. A new PUV that has space for standees could carry as much as 30 pax (instead of 22 pax). This would also yield higher revenue per unit and encourage the shift.

It is worth restating the recommendation of the 2015 Roadmap Study: "… Metro Cebu to launch and implement two initiatives for the immediate improvement of the overall public transport system. This entails updating the route structures of PUVs and adopting color-coding by route corridors, re-numbering, and management by route association following a successful program of Olongapo City in the early 1980s."

"The second is to introduce buses into the intra-urban routes, starting with the proposed lines identified in the BRT Feasibility Study (2012) as well as in the Metro Cebu Public Transport Improvement Plan (2011) and in the light of the SM most recent proposal."

The SM proposal has become a reality with MyBus already plying on selected routes between Mactan, Mandaue, and Cebu City. The launch of the DOTr's PUVM program in Metro Cebu is a late answer to the first recommendation.

Many of the PUJ routes in 2017 that will be re-structured over the next 10 years under the PUVM program will be inadequate by 2030. Bigger buses (BRT, standard bus, and minibus) need to be brought in (to replace the microbus) to meet the capacity requirements.

Regarding BRT, NEDA approved the resumption of the project as well as its revised schedule. The alignment of BRT is planned from Bulacao to Ayala Mall via Cebu South Road, Osmena Boulevard, and N. Escario Street. A total of 16-km alignment consists of three phases; phase 1 will be operational from Ayala Mall to SRP according to the revised schedule.

Transport regulatory reform, which is one of the components of PUVM, is also necessary for the implementation of sustainable public transport system.

The most critical reform to accelerate the modernization of PUVs on the road is to introduce higher capital subsidy (greater than the current offer of Php80,000) and this can be complemented by a more liberal tariff, such as the adoption of flat fare (equal or more than Php10 per ride). Combination of these measures would incentivize private operators to convert early. A flat fare regime would also simplify fare collections and, simultaneously, differentiate the higher level of service. Public opposition will be muted as new services will be concurrent with the old.

Another aspect of reform is consolidation of operators. This master plan recommends a new type of consolidation called "virtual" consolidation that is the use of a digital platform to

connect small and independent PUV providers. In effect, it is an Uber-type fleet management system for fixed routes that pools and re-distributes revenues according to output and dispatches vehicles according to demand and time of day. This leads to higher productivity in the deployment of public transport assets and, therefore, less PUVs for the same passenger volume. It also entails less demand on LTFRB or LGUs.

As previously mentioned, the allocation of responsibilities among different levels of LGUs need to be revised. In the planning of PT routes that crosses two or more LGUs, the OFG envisages a role for the province. This should be amended to allow each LGU to modify the route segment that passes through its territory as long as it does not disrupt the continuity of the route path across LGU boundaries. This would prevent the need, for example, for Mandaue City to wait for the province to act on PT routes coming from the northern LGUs (Liloan, Consolacion, Compostela, or Danao). Through the PUVM, DOTr should eventually lead to the devolution of franchising to LGUs—beyond local public transport planning. This devolution should include other transportation modes as well.

Given the experiences in planning and implementation of PUVM in the selected LGUs (Mandaue, Cordova, and Lapu-Lapu) for the pilot project of this master plan, a more realistic timetable for the 13 LGUs of Metro Cebu is shown in Table 8.3.3. The delayed implementation for Cebu City is due to the BRT project; it assumes that the restructure of PUVs would occur only after completion of the former.

Table 8.3.3 Implementation Schedule of PUVM in Metro Cebu

ACTIVITIES	2018	2019	2020	2021	2022
Pilot LGUs:					
Route planning & re-design					
Approval & adoption of route plans					
Issuance of omnibus franchises					
Fleet replacement & industry consolidation					
Outlying LGUs: north & south					
Route planning & re-design					
Approval & adoption of revised routes					
Issuance of Omnibus Franchise					
Fleet replacement & industry consolidation					
Implementation for Cebu City					

Source: JICA Project Team

The medium- to long-term scenarios can take off from the preceding timetable as shown in Table 8.3.4.

Table 8.3.4 Indicative Roadmap for Road-Based Public Transport

Aspects	Present Situation	Target Situation 2030	Target Situation 2050
Route Coverage & Configuration	Cebu City-centric route structure; dominated by PUVs with some inter-urban buses. Tricycles as feeder service in Lapu-Lapu, Cordova, and outlying LGUs. Many areas are not covered by the PT routes.	UMRT line under Phase 1 in operation, functioning as the backbone of the PT system. Buses and minibuses on other trunk routes. Microbuses (PUJ) re-deployed to secondary routes.	A hierarchical route network with rail, bus, and PUVs that operate as a family of transit modes. No areas in Metro Cebu is 500-m away from a PT route.

Operating Business Model	Atomized and fragmented. PUVs compete. Drivers hired by "boundary system." No coordination on dispatching.	Coordinated deployment by corridor or groups of PUV operators under the Omnibus Franchising Guidelines.	Bus and PUV operators are paid on service delivered (per vehicle-km). Common e-ticketing system & system-wide scheduling.
Key Success Factors	Many enterprising small-scale investors willing to navigate under soft rules. Weak institution unable to plan and impose logical routes.	Establishment of a Metro Cebu Traffic Management Coordination Board with reduced role for LTFRB. Routes are planned and designed by LGUs in cooperation with provincial and national Government.	A sustainable transit system (rail+bus+ microbus) enabled by smart technologies, and clear funding support. Fares set according to the value-proposition of services.

Source: JICA Project Team PT: Public Transport

The preceding scenario can be translated into specific projects to be undertaken as shown in Table 8.3.5.

Table 8.3.5 Key Projects of PUVM

Short-Term (up to 2022)	Medium-Term	Long-Term
Route restructuring for 3 LGUs. Fleet replacement (3,480 units). Consolidation of 267 operators into 4–5 groups. Add P2P bus services from Northern & Southern LGUs.	Route re-structuring for the 9 remaining LGUs starting with Cebu City. Fleet replacement involving ~8,500 units. Consolidation into <10 groups. Phase 2 of PT Route restructuring to be triggered by completion of MRT Line and 3rd Mactan Bridge.	All PT operators operate under a common e-ticketing system. Smart PT system across all PT operators.
Conversion of PUV fleet into electric vehicles. Expansion of bus network.		

Source: JICA Project Team

3) Water Transport

While water transport services are valuable, there is still a need for a planning process in order to come up with harmonized objectives for the water transport system. To be able to provide for a seamless transfer of the passengers in their everyday commute from one transport mode to the other will mean shorter travel time and, hopefully, savings on their costs on transportation. Eventually, the provision of another option for public transport may alleviate the congestion experienced along the arterials and collector roads.

4) Aerial Ropeway Transit

Aerial ropeway transit (ART) is an aerial public transit technology in which cabins (also called carriers, vehicles, or cars) are suspended and propelled from above by cables. The underlying technology of ART has been around for more than a century; it has been applied mostly in terrain-challenged recreational contexts (e.g., gondolas in ski resorts) to transport skiers and tourists to-and-from mountain tops. In recent years, however, the same technologies that have been used in these resorts have been adopted and implemented as a mode of transit in non-alpine but geographically constrained urban regions where conventional transit service was deemed very difficult or unfeasible to implement. ART can be thought of as a member of the broader cable-propelled transit technology (CPT), which also includes rail-supported cable cars. CPT can be defined as a transit technology that moves people in motor-less/engine-less vehicles propelled by a steel cable.[5] Characteristics of a major ART system are summarized in Table 8.3.6.



Source: Doppelmayr.com

Figure 8.3.2 Example of ART

Table 8.3.6 Characteristics of Major ART System

System Characteristics	Traditional Aerial Tramway	Dual-Haul Aerial Tramway	Monocable Detachable Gondola (MDG)	Bicable Detachable Gondola (BDG)	Tricable Detachable Gondola (TDG)
Cable Configuration	Cabins are suspended from one or more fixed cable (called "track ropes") and are pulled by another cable (called a "haulage rope").	Cabins are suspended from two fixed cables and are pulled by another cable.	Cabins are suspended and pulled by the same cable (a moving loop of cable).	Cabins are suspended from one fixed cable and are pulled by another cable.	Cabins are suspended from two fixed cables and are pulled by another cable.
Detachability	The two cabins cannot be detached from the moving cable (the movement of the two cabins is synchronized).	Cabins can't be detached from the moving cable (each cabin operate independently).	Cabins are at regular-speed intervals and they detach from the cable at the terminal for unloading and loading.	Same as MDG	Same as MDG
Maximum No. of Passenger Cabins	2 cabins	2 cabins	Depends on line length and headway; can have 100+ cabins.	Same as MDG	Same as MDG
Max No. of Stations	3 stations	3 stations	Can have multiple stations.	Same as MDG	Same as MDG
Max Distance between Towers	Less than 1,000 m	Less than 1,001 m	350 m	700 m	3,000 m
Cabin Capacity	High capacity (up to 200 passengers/cabin)	High capacity (more than 100 passengers/cabin)	Low capacity (up to 15 passengers/cabin)	Low capacity (up to 16 passengers/cabin)	Medium capacity (up to 35 passengers/cabin)

[5] Journal of Transportation Engineering © ASCE / March 2012, p. 253–258

Maximum Transport Capacity	2,000 pass/h	2,800 pass/h	3,600 pass/h	3,600 pass/h	6,000 pass/h
Speed	Up to 43.2 km/h	Up to 29 km/h	Up to 21.6 km/h	Up to 21.6 km/h	Up to 30.6 km/h

Source Journal of Urban Planning and Development, March 2014

While ART is still a new concept in the Philippines, in other countries like Bolivia, ART has been catering to the mobility requirements of its citizens. The advantages of ART, as seen by the users of the system, are the following:

- Independent transport relief (suitable for hilly areas).
- Powered by electricity.
- No CO_2 emissions if renewable energy is used for electricity.
- No exhaust emissions.
- Significantly-reduced noise emissions.
- No need of surfaces for transport.
- High level of traffic safety.
- Comfortable transport in the air by rope (vibrations occur only when vehicles pass over the roller batteries).
- No need for the additional weight of a drive mechanism and fuel in the vehicle.
- Overcomes the lack of corridor space for infrastructure needed by LRTs and MRTs.
- Avoids land acquisition excepts the ART station.
- Helps alleviate congestion on the roads.
- Shortens trip distances.
- Short construction time and small cost.
- Significantly reduces operating and maintenance costs.

On the other hand, the disadvantages of ART are the following:

- Speed limited to 12 m/s or 43.2 km/hr.
- Capacity limited to 4,000 persons/hr.
- Suitable only for distances up to 7 km (gondolas with intermediate stations).
- Wind resistance of normally up to 18 m/s (65 km/h) and bi-cable systems at 90 km/hr.
- Extensive maintenance and controls.
- Difficult to rescue people from aerial cable cars.
- Expensive infrastructure (for faster detachable cable cars).
- No heating or air conditioning in cabins.
- Potential negative visual impacts of cable cars.

- Heavy initial investment.[6]

Considering the limited capacity and high initial investment cost, the most suitable areas for ART operation in Metro Cebu would be the hilly areas. However, as described in Chapter 2, they're not that suitable for residential development. Therefore, ART is not recommended to consider for daily transportation. It could also encourage people to live in disaster-prone areas. For other purposes such as tourism, ART is worthwhile to study as it is recognized as a green transport mode and attractive for tourists. An F/S should be conducted to identify the appropriate potential use and routes.

8.4 Traffic Management Planning

1) Traffic Management Strategy

(1) Issues concerning traffic management

Issues that should be handled by traffic management are summarized as follows. The details are shown with the countermeasures in latter part of this section.

Traffic management can be one of the useful solutions for traffic issues. The advantage of the traffic management is relatively low cost and have a short project period compared with large-scale construction project such as bypass road, expressway, etc. However, the effect of traffic management is only limited. There are few fundamental effects and some measures need people's acceptance, which often takes much time. Therefore, traffic management should be coordinated and harmonized with other transport master plan projects to ensure appropriate effect.

(i) Traffic congestion

Serious traffic congestion recurrently occurs at major routes and intersections in Cebu City, Mandaue City, and roads between Cebu and Mactan Island (i.e., first and second Mactan bridges). The fundamental reason is weak road network. From the view of utilization of existing infrastructure, there are some causes that deteriorate road capacity such as bad drivers' behavior, PUV operation, and signal control etc. Those issues can be solved or improved in the field of traffic management. Considering the limited space left for new roads, much is expected of traffic management.

(ii) Traffic accident

The number of traffic accidents in 3 cities, i.e., Cebu, Mandaue, and Lapu-Lapu, is over a thousand cases per year. When there's an increase in demand, the situation could worsen. Generally speaking, the more congested a road becomes, more accidents can occur. Moreover, accidents cause congestion. Metro Cebu is in an undesirable situation that both risks are high.

(iii) Bad driving manner and traffic violation

Dangerous driving behaviors that may cause accidents are often seen. Examples are switching lanes before intersection, motorcycles running on sidewalks, and pedestrians crossing very busy roads. These behaviors might not be traffic violations,

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but might cause traffic accidents or deteriorate road capacity leading to traffic congestion. Those behaviors should be improved, not only for traffic safety, but also to reduce congestion.

(iv) Environmental pollution

Some of the causes in deterioration of air quality are heavy traffic congestion and poor emission control of vehicles, which are inadequately managed, particularly buses and jeepneys. In some areas, sidewalks are undeveloped and cars pass right in front of houses. Residents in those houses are exposed to emission gases (see Figures 8.4.1 and 8.4.2).



Source: JICA Project Team

Figure 8.4.1 Deterioration of Air Quality Caused by Poorly Maintained Jeepneys



Source: JICA Project Team

Figure 8.4.2 Houses Exposed to Emission Gases

A major solution is congestion reduction. Fuel efficiency of public transit can be higher than private car. Therefore, appropriate regulation and operation are important as well as an appropriate and secure space for cars and pedestrians.

(2) Policies for Traffic Management

In order to solve the traffic issues in Metro Cebu, 5 policies to represent and realize the vision were set. Table 8.4.1 shows which policies can cover which issues.

Traffic flow is greatly affected by social demands for traffic and geographic conditions of roads. Traffic management is related to each urban and transportation field such as land use, road network, public transport service, etc. If there is some change of urban transport situation, traffic behavior also changes. Therefore, traffic

management field has to consider several conditions and situation affected by traffic movement.

Table 8.4.1 Relationship Between Policies and Issues Concerning Traffic

		Issues concerning Traffic Management			
		(a) Traffic Congestion	(b) Traffic accident	(c) Bad driving manner and traffic violation	(d) Environmental pollution
Policies	(a) Realization of secure and pleasant road space	✓	✓	✓	✓
	(b) Effective utilization of existing road network	✓			✓
	(c) Improvement of traffic safety	✓	✓	✓	
	(d) Quick and proper traffic management	✓	✓	✓	
	(e) Appropriately controlled traffic demand	✓			✓

Source: JICA Project Team

(i) Realization of secure and pleasant road space

Safe and comfortable road space should be created, which gives the maximum road capacity. This is possible through improvement of road alignment at intersection, space separation for people and vehicle, distinct street signages and road markings, and others. Proper traffic operation that allows smooth traffic and removes obstacles are also necessary. These measures will contribute to the improvement of traffic safety and congestion reduction (see Figure 8.4.3).



Source: JICA Project Team

Figure 8.4.3 Example of Unsecured Road Space Caused by Works

(ii) Effective utilization of existing road network

Making the most of the existing road network is the most basic and important policy. Measures to consider for this to be realized are to guide drivers to less congested route by proper information provision and harmonization of neighboring signals.

(iii) Improvement of traffic safety

Both road environmental development and drivers' behavior improvements are necessary to realize improvement traffic safety improvement. Accident is caused by

various factors. The 2 viewpoints relating to time when considering traffic accidents are (i) countermeasure before accident, i.e., prevention, and (ii) accident-handling right after occurrence of accident. For example, improvement of sidewalk is a countermeasure for pedestrians. An effective example countermeasure for better accident handling is enhancement of function of traffic control center. In this manner, it is efficient to plan countermeasures in both fields comprehensively (see Figure 8.4.4).



Source: JICA Project Team

Figure 8.4.4 Example of Sidewalk to be Improved

(iv) Quick and proper traffic management

Quick and proper traffic operation contributes to congestion mitigation and accident prevention. After an accident occurs, damage minimization and secondary accident prevention are important. To achieve this, a system that supports enforcers to handle the accident should be made. Education of traffic engineers is also important for continuous improvement of traffic safety as traffic situation changes.

(v) Appropriately controlled traffic demand

It is expected that the traffic situation in Metro Cebu will be more serious without any project. But road network in metropolitan area is close to overcapacity because the urban area of Cebu City and Mandaue City are already dense and land acquisition for new road construction is difficult and costly. Therefore, traffic demand management needs to be considered as one possible tool option. However, attention is needed in the implementation of traffic demand management so as not to economic development and activity. There are some measures on traffic demand management such as time-oriented, area-oriented, and method-oriented. In Metro Cebu, PUV is very popular and people is used to using public transit; therefore, upgrading of public transit is reasonable method as a tool for traffic demand management.

(3) Field and Method

Fields and methods that put policies into practice are shown in Table 8.4.2. Table 8.4.3 shows the relationship among policies and fields. Details of each method are shown in the following sections.

Table 8.4.2 Fields and Methods Concerning Traffic Management

Fields	Methods	Remark
(1) Traffic Signal Optimization	(i) Optimization of cycle time	Synchronized Signalization System
	(ii) Optimization of Signal phases	
	(iii) Harmonization with adjacent intersections	
(2) Traffic Control Center	(i) Installation of traffic control center	ATC System: Priority project
	(ii) Area traffic control management	
(3) Proper Traffic Operation	(i) Traffic operation considering traffic demand	
	(ii) PUV management	
	(iii) Truck management	
	(iv) Education of traffic engineer	
(4) Traffic Information Provision	(i) Installation of variable message signboards	
	(ii) Information provision for Cebu-Mactan bridges	
(5) Efficient road asset management	(i) Introduction of efficient road asset management system	
	(ii) Enforcement on overloaded trucks	
(6) Improvement of traffic behavior	(i) Activity for traffic safety enlightenment	
(7) Use promotion of public transit	(i) Convenience enhancement of PUV	
	(ii) Utilization of ITS technology for public transit	
(8) Others	(i) Standardization of ETC specification	

Source: JICA Project Team
Notes: (2) Traffic Signal Optimization and (3) Traffic Control Center are proposed transport projects of the Roadmap Study and are described as "Synchronized Signalization System in Urban Areas" and "Area Traffic Control System in Metro Cebu," respectively, in Chapter 6 of this report.

Table 8.4.3 Relationship Among Policies and Fields

Policies for traffic management	(1) Traffic Signal Optimization	(2) Traffic Control Center	(3) Proper Traffic Operation	(4) Traffic Information Provision	(5) Efficient road asset management	(6) Improvement of traffic behavior	(7) Use promotion of public transit	(8) Others
(A) Realization of secure and pleasant road space	✓		✓		✓			
(B) Effective use of existing road network	✓	✓	✓	✓				✓
(C) Improvement of traffic safety	✓	✓	✓	✓	✓	✓		
(D) Quick and proper traffic management		✓	✓			✓		
(E) Appropriately controlled traffic demand				✓			✓	

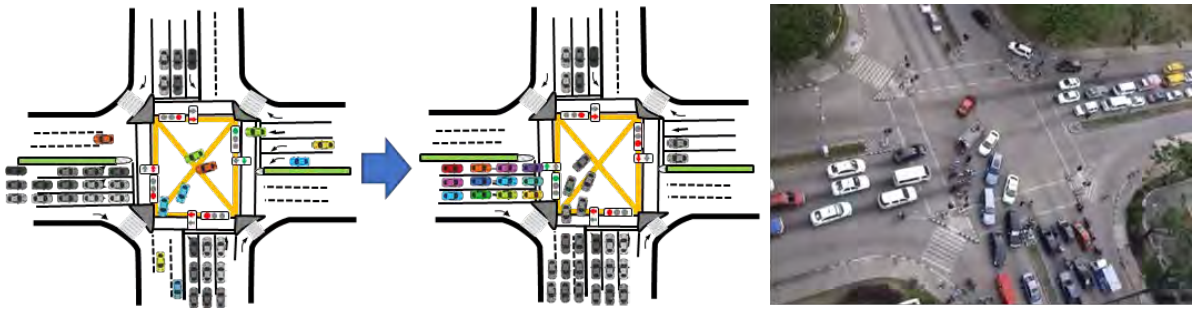
Source: JICA Project Team

2) Traffic Signal Optimization

(1) Optimization of Cycle Time

The cycle time of traffic signals are longer than the optimum time and the phase order is fixed independently at each intersection. As such, there are instances when long green time is observed even when traffic volume is low. Also, the number of vehicles that cross an intersection is extraordinarily small at the latter part of the green time. This indicates the condition of unnecessary long green time while the waiting queues of other vehicles approaching the intersection become long. This situation seems to affect behavior of drivers to beat the red light, which is a reckless driving behavior.

Another common occurrence is when drivers enter an intersection then get stuck because of congested onward flow of traffic especially when the signal light turns red. This results to having an obstacle for other directional traffic flows. This situation is caused by long cycle time of signals where vehicles from the downward intersection get to join up with the traffic at the next intersections (see Figure 8.4.5).



Source: JICA Project Team

Figure 8.4.5 Example of Blocked Traffic Flow by Queue (at Car. Rosales Ave. and Luzon Ave.)

(2) Optimization of Signal Phases

There are 3 or 4-phase patterns adopted mainly in Metro Cebu. The 2-phase pattern where directions of major stream changes alternately is rarely seen. One of the reasons for the long cycle time is the many phases. Judging from the types of conflicts that happen at many intersections, the 4-phase pattern seem ineffective.

(3) Harmonization with Adjacent Intersections

Harmonized signal control is not apparent at many intersections in Metro Cebu. The harmonization of signals at adjacent intersections that will avoid long cycle time are definitely important to address congestion.

3) Traffic Control Center (TCC)

(1) Installation of TCC

A TCC should be developed and functional. It has been noted that TCCs in some cities lack facilities. The creation of a TCC is one way of realizing safe and smooth traffic flow. The following functions are handled by the center:

(i) To provide control and monitor traffic information;

(ii) To provide information of traffic obstacles such as accidents, broken-down vehicles, and fallen objects then address with necessary actions;

(iii) To collect and provide information about abnormal circumstances such as weather then take measures; and

(iv) To communicate and coordinate with concerned parties, such as the police, fire department, traffic patrol, traffic information provider, etc., and regulate traffic.

To effectively realize (c), the TCC should be connected with the disaster monitoring center as there are events that need both to work together such as in cases of floods where motorists need to be informed about flooded areas/roads, providing priority passage for emergency vehicles, etc.

(2) Area Traffic Control (ATC) Management

ATC is a system often applied in big cities. The traffic operator controls the signals efficiently and intensively by monitoring traffic situation through CCTVs and graphical displays where there are traffic congestions. A traffic control center not only collects traffic data and processes it, but also provides traffic information on the internet or on various signboards on streets. This helps drivers' route choice.

The road network stretches beyond the local area boundary. As such, traffic management is effective when done from a wider point of view with a grasp of traffic flow from both micro and macro level. For example, in a traffic congestion, attention should be paid to the bottleneck site and wider road network such as collision at the periphery of a congestion, detour route information provision to on-coming drivers, travel time information provision to all drivers that might take congested route, etc. In this light, an ATC is necessary for better traffic management. The traffic control system of each local area becomes more effective when they are connected with each other and are able to exchange information real-time. This makes it possible to provide a comprehensive road network information to drivers and traffic officers alike. For example, provision of information on the Cebu–Mactan Bridge to drivers in Cebu City or Talisay City would be very useful.

When introducing an ATC in Metro Cebu, a variety of services and adjustment of traffic regulation policy among LGUs (e.g., truck route management) will be an issue. As mentioned above, wider area management is necessary for effective and efficient traffic control. An arrangement of administrative organization, which can control traffic over LGU boundary, should be considered (details of institutional arrangement are described in Chapter 12). Therefore, before implementation, a F/S is necessary and a list of commitments of LGUs are required. Based on the required commitments of LGUs, capacity enhancement should be conducted to acquire the necessary skills to establish and manage ATC system in Metro Cebu.

4) Proper Traffic Operation

(1) Traffic Operation Considering Traffic Demand

Traffic control by enforcers is done in almost all congested intersections and management seems to have improved. Enforcers mainly pay attention to vehicles entering the intersection. The main concept of traffic control at an intersection is to give priority passage corresponding to traffic demand. Therefore, besides understanding traffic conditions based on sight, it is also important to understand the traffic around the intersection.

There are various causes of decrease in road capacity such as illegal parking, abrupt lane change before the intersection, PUJ passengers getting on and off near intersections, etc. Motorcycle drivers often don't stay on their lane as per regulation. These illegal acts should be strictly managed by police. Some intersections have road works done during daytime on a weekday that further aggravate traffic congestion. To reduce influence of road works, schedules need to be carefully planned by application of sectional separation of work and scheduling on weekends.

(2) PUV management

Passenger loading/unloading locations are not well designated in Metro Cebu. The behavior of drivers that stop anywhere even in the middle of the road to load and unload contributes to the disturbance of traffic flow.

To set appropriate locations for PUV loading/unloading bays and restrict random loading/unloading activities at other locations will require a lot of effort, but initial steps to implement this measure are necessary. One step is a regulation for PUVs to use bays, designated loading/unloading areas, and outside lanes.

(3) Truck management

As urban development continues, the number of vehicles that transport goods increase. Large vehicles, such as trucks and trailers, can cause traffic congestion; therefore, operation of trucks is very important. Currently, the establishment of the Metro Cebu Truck Corridor is being promoted in Metro Cebu. The benefit is highly expected in Metro Cebu area.

(4) Education of traffic engineer

It is deemed necessary for some traffic engineers to operate traffic signals for a more responsive control of the traffic situation. Traffic conditions in Metro Cebu continuously change by time of day and season. Therefore, development of human resources is very important.

Duties of the traffic engineers include advice for road work schedule based on congestion forecast, proper road traffic information provision, traffic data management used as a basis for various measures, etc.

5) Traffic Information Provision

(1) Installation of Variable Message Signboards

Spatial traffic demand management is important as one of the countermeasures against congestion. One tool to apply is the provision and dissemination of traffic information that provide routes encouraging drivers to take the less congested road/s to their destinations. Provision of best route and estimated travel time are most ideal. But each driver's destination is different, so provision of useful information can be difficult. The most common information such as an estimated travel time to major destinations is a possible method.

The metropolis extends in a long and narrow coastal strip. With the current road network, traffic demand along the longitudinal direction is very high and there are limited options for route choice or detour routes to avoid bottlenecks. Hence, road network improvement of more major roads along the longitudinal and transverse directions are necessary. Motorists will require traffic information dissemination once road network is improved.

(2) Information Provision for Cebu–Mactan Bridges

In near future, as the 1st Mactan Bridge will be closed for maintenance works, traffic on Cebu–Mactan bridges needs to be controlled. In this time, traffic information provision is necessary. Some points to consider are as follows.

(i) To ascertain existence of proper detour routes for the two bridges and their capacities;

(ii) To understand situation of utilization especially focusing on the difference between two bridges; and

(iii) To ascertain matching of route guidance policy by LGUs.

6) Efficient road asset management

(1) Introduction of Efficient Road Asset Management System

Road surface defects such as potholes and undulating pavements are seen in Metro Cebu. Surface defects not only disrupts comfortable driving, but also cause traffic congestion. In consideration of the age of the Cebu–Mactan bridge structures and the construction rush of flyovers and underpasses, structure maintenance will occupy a lot of the LGUs' work. Introduction of an efficient road asset management system will help reduce unnecessary road or lane closures.

(2) Enforcement on Overloaded Trucks

One reason for road surface deterioration is the increasing road use of overloaded trucks. Although details of the regulation on weights and sanctions for violation have yet to be examined, the traffic volume of trucks in Metro Cebu is increasing especially on the arterial roads. The regulation on controlling loads will also contribute to the management of road assets. To cite, trucks are not allowed on the Osmeña Bridge due to its age, but they are allowed on the M. Fernan Bridge. As such, the use of an axle load measuring device near the Cebu–Mactan Bridge would be one way to determine whether trucks are overloaded or not.

7) Improvement of traffic behavior

(1) Activity for Traffic Safety Enlightenment

Improvement of drivers' behavior is important especially in the reduction of traffic accidents. Traffic accidents are caused by three components of vehicle, road, and human; meaning, if every single person drives a car appropriately and in a smart and relaxed manner, the number of traffic accidents will decrease. Improvement of traffic behavior is necessary not only for traffic safety, but also for effective utilization of road. Pedestrians can be seen to ignore traffic lights everywhere in the metropolis. One reason for this is the long cycle time. Hence, proper setting of acceptable cycle length will contribute to the improvement of pedestrians' behavior. Another safety issue that needs to be addressed is when bicycles and taxis are caught in traffic at intersections, they become obstacles for pedestrians to cross the street. One more case often seen is when people get tired to wait for jeep that they start to crowd on the roadside and occupy the vehicle lane. These are the issues on safety and effective utilization of road (see Figure 8.4.6).



Source: JICA Project Team

Figure 8.4.6 Example of Behavior to be Controlled (Sitting on Cargo Bed)

As mentioned above, traffic safety education is important. However, improving the mind-set on traffic through education promotion and the like will take some time. To provide incentive to driver is one example of measure. Preparation of material for traffic safety education, such as booklet, sticker for children, student, adult, aged person, etc. is also another. Also, conducting promotion campaign to follow traffic rules and information dissemination on traffic problem is effective.

8) Use promotion of public transit

(1) Convenience enhancement of PUV

PUV in Metro Cebu is very popular and widely used by many people. Generally, utilization of public transit is desirable to decrease the number of cars on road because of the high transport efficiency.

(2) Utilization of Intelligent Transport System (ITS) technology for BRT system

The implementation of a BRT system in Metro Cebu is currently underway. ITS technology can contribute to the improvement of utilization, for example, in the field of operation management, toll collection, information provision, etc.

9) Others

(1) Introduction of Efficient Road Asset Management System

Road surface defects such as potholes and undulating pavements are seen in Metro Cebu. Surface defects not only disrupts comfortable driving, but also cause traffic congestion. In consideration of the age of the Cebu–Mactan bridge structures and the construction of flyovers and underpasses, structure maintenance will occupy a lot of the LGUs' work. Therefore, introduction of an efficient road asset management system will help reduce unnecessary road or lane closures.

(2) Standardization of Electronic Toll Collection (ETC) Specification

There is a plan led by a private company to build a bridge between Cebu and Cordova. As a method of toll collection, the introduction of an ETC would be desirable for smooth traffic flow and convenience. Specifications of the ETC will be from the operation company. There are other road projects such as Metro Cebu Expressway Project by DPWH that might operate as a toll road. With the future possibility of more implementation of toll roads, the ETC specification should be standardized and made common to all expressways. It will be much convenient for drivers to use the same type of on-board unit or card. In order to realize this, the Toll Regulatory Board may have to set specifications.

(3) Utilization of ITS Technology for BRT System

The implementation of a BRT system in Cebu is currently underway. An ITS technology can contribute to the improvement of utilization, for example, in the field of operation management, toll collecting, information provision, etc.

10) Implementation Plan for Traffic Management Project

Measures in regard to traffic management are summarized in Table 8.4.4. All these measures include the relevant necessary capacity enhancement and awareness rising

activities.

Once transport infrastructure is developed to certain level including the first phase of UMRT, demand control should be considered to control the private vehicular and promote public transportation.

Table 8.4.4 Measures in regard to Traffic Management

Project	Schedule ~ 2022	~ 2028	~ 2040	~ 2050	Cost (PHP Million)	Quantity
1. Traffic Signal Optimization					150	100 intersections
2. Traffic Control Center					9,000	
3. Proper Traffic Operation					N/A	
4. Traffic Information Provision					1,000	50 locations (VMS) etc.
5. Efficient road asset management					N/A	-
6. Improvement of traffic behavior					N/A	-
7. Use promotion of public transit					N/A	-
8. Others					N/A	

Source: JICA Project Team

8.5 Performance of the Proposed Future Urban Transport Network in Metro Cebu

If all the priority projects listed above were implemented together with the existing arterial road widening and the intersection improvements in Metro Cebu, traffic condition would drastically improve by 2030. While the average VCR would be 1.86 in 2030 under the scenario being same as the current condition without any projects including 3rd bridge (Do Nothing Scenario), it would become 0.94 if all proposed projects were implemented (Do Master Plan Scenario).

Average traffic speed and the required time by the vehicle at peak hour from Cebu City Municipal Office to Mactan International Airport (about 15 km) is simulated and results are shown in Table 8.5.1. Results show the effectiveness of 4th Mactan Bridge and Mandaue Coastal Road, which reduces travel time by about 10 minutes from the baseline scenario in 2030.

Table 8.5.1 Result of Traffic Simulation for the Required Time by the Vehicle from Cebu Municipal Office at Cebu Center to Mactan International Airport (about 15-km distance)

Description	Year 2017	Year 2030		
		Do Nothing	Do Nothing Network + 4th Mactan Bridge and Mandaue Coastal Road	Do MP
Required Time (Average speed)	38 min. (25 kph)	55 min. (17 kph)	45 min. (20 kph)	37 min. (26 kph)

Source: JICA Project Team (Draft of Traffic Demand Forecast as of May 2018)

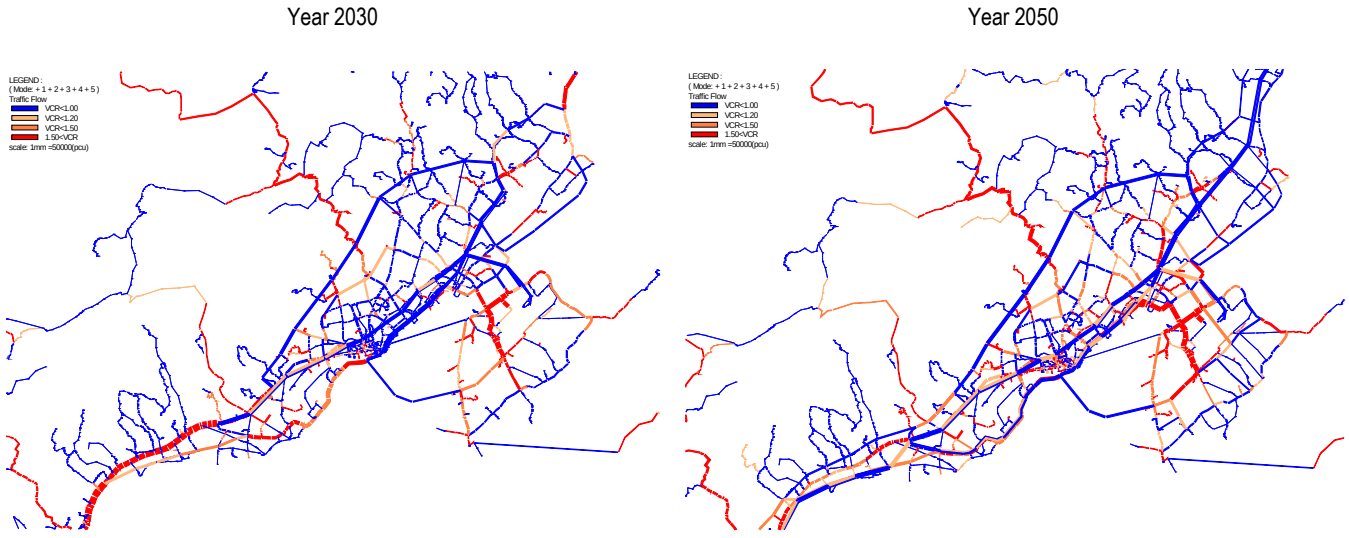
Based on the proposed future urban transport network described in the previous sections, its performance to improve the traffic situation was analyzed using traffic demand forecast. As shown in Table 8.5.2 and Figure 8.5.1, traffic situation will be slightly improved although transport cost will increase due to increase of total traffic demand.

The analysis of demand-supply gap for the future urban transport network was also conducted by zone and corridor section in Metro Cebu. The results (see Tables 8.5.3 and 8.5.4) show that traffic conditions of most zones and corridor sections have significantly improved and VCR ratio has become less than 1.0. However, further improvement in terms of transport infrastructure and traffic management are still required for some areas and corridor sections.

Table 8.5.2 Performance of Future Urban Transport Network

Indicator		2017	2030		2050	
			Do Committed	Do MP	Do Committed	Do MP
Congestion Ratio (VCR)		0.90	1.80	0.94	2.43	0.84
Average Travel Speed (km/h)		19.7	13.0	20.1	10.9	20.1
Transport Cost (Php million/day)	VOC	278	767	536	1,152	683
	TTC	270	737	477	1,102	599
	Total	548	1,501	1,013	2,254	1,282
CO2 (tons/day)		21.8	70.6	50.7	98.4	56.7

Source: JICA Project Team



Source: JICA Project Team

Figure 8.5.1 Traffic Volume on the Future Urban Transport Network (2030 and 2050)

Table 8.5.3 Demand Supply Gap on Future Urban Transport Network by Area

No	LGU	Do all projects in 2030			Do all projects in 2050		
		Capacity (000 PCU-km)	Traffic (000 PCU-km)	V/C Ratio	Capacity (000 PCU-km)	Traffic (000 PCU-km)	V/C Ratio
1	Danao City	913	893	0.98	1,240	1,050	0.85
2	Municipality of Compostela	629	561	0.89	901	549	0.61
3	Municipality of Liloan	1,177	1,056	0.90	1,565	926	0.59
4	Municipality of Consolacion	1,978	1,351	0.68	2,120	1,709	0.81
5	Municipality of Cordova	297	355	1.19	454	486	1.07
6	Lapu-Lapu City	2,642	2,957	1.12	3,136	3,677	1.17
7	Mandaue City	4,174	3,000	0.72	3,164	3,500	1.11
8	Cebu City 1	1,378	1,135	0.82	1,378	1,364	0.99
9	Cebu City 2	734	1,235	1.68	734	1,613	2.20
10	Cebu City 3	3,211	2,080	0.65	2,545	2,399	0.94
11	Cebu City 4	3,554	3,124	0.88	14,945	9,116	0.61
12	Talisay City	1,864	2,216	1.19	2,113	2,398	1.13
13	Municipality of Minglanilla	727	1,026	1.41	939	909	0.97
14	City of Naga	1,114	2,122	1.91	1,581	1,904	1.20
15	Municipality of San Fernando	808	907	1.12	1,245	592	0.48
16	City of Carcar	981	933	0.95	1,126	929	0.83
Total		26,182	24,953	0.95	39,186	33,120	0.85

Note: Location of Areas is referred to the Figure 7.4.1 : V/C>1.0

Source: JICA Project Team

Table 8.5.4 Demand Supply Gap on Future Urban Transport Network by Section

	Capacity (000 PCU)	Do all projects in 2030		Do all projects in 2050	
		Traffic vol. (000 PCU)	V/C Ratio	Traffic vol. (000 PCU)	V/C Ratio
11	184.1	52.4	0.28	81.4	0.44
21	184.1	76.9	0.42	115.6	0.63
31	184.1	84.1	0.46	126.6	0.69
42	52.2	62.1	1.19	57.7	1.11
41	142.0	85.8	0.60	167.3	1.18
51	77.7	82.5	1.06	101.1	1.30
61	35.6	57.5	1.61	46.3	1.30
62	50.9	40.8	0.80	50.6	0.99
63	118.9	154.1	1.29	247.1	2.08
71	285.8	252.8	0.88	323.3	1.13
81	35.6	35.6	1.00	38.4	1.08
91	10.8	57.9	5.37	75.5	7.01
121	186.1	163.8	0.88	194.4	1.04
122	108.1	80.4	0.74	136.5	1.26
131	226.1	180.9	0.80	243.0	1.07
141	184.1	120.4	0.65	178.4	0.97
151	184.1	79.8	0.43	108.8	0.59
161	184.1	65.8	0.36	89.9	0.49

Note: Location of Sections is referred to the Figure 7.4.1 : V/C>1.0

Source: JICA Project Team

8.6 Investment Plan

Based on the schedule of each proposed projects, the investment schedule of master plan projects is summarized in the tables below by sub-sector.

Table 8.6.1 Investment Schedule for Road and Bridge Projects (tentative)

Project Name	IA*	Status	Length (km)	Total Const. Cost (Million Peso)	Implementation Period			
					2022	2028	2040	2050
A. Road and Bridge								
1. Metro Cebu Circumferential Road (Segment 1)	DPWH	New	24.72	36,400	▬			
2. Metro Cebu Circumferential Road (Segment 2)	DPWH	New	29.80	29,289		▬		
3. Metro Cebu Circumferential Road (Segment 3)	DPWH	New	17.40	16,992	▬			
4. Talisay–Naga Diversion Road	DPWH	New	7.70	9,717	▬			
5. Mandaue–Liloan Diversion Road	DPWH	New	10.10	12,704	▬			
6. Cebu Arterial Road Widening Phase 1-1 Central Section (Complete Street Type A, 6 lanes)	DPWH	Upgrade	7.31	5,954	▬			
7. Cebu Arterial Road Widening Phase 1-2 Central Section (Complete Street Type A, 4 lanes)	DPWH	Upgrade	13.39	14,178		▬		
8. Cebu Arterial Road Widening Phase 2-1 North Section (Complete Street Type A, 4 lanes)	DPWH	Upgrade	16.00	8,851		▬		
9. Cebu Arterial Road Widening Phase 2-2 South Section (Complete Street Type A, 4 lanes)	DPWH	Upgrade	28.50	14,416		▬		
10. Cebu Coastal Road Widening Phase 1 (Complete Street Type A, 6 lanes)	DPWH	Upgrade	13.00	2,145	▬			
11. Cebu Coastal Road Widening Phase 2 (Complete Street Type A, 6 lanes)	DPWH	Upgrade	9.70	1,601		▬		
12. Mactan Circumferential Road (Road Widening)	DPWH	Upgrade	22.00	19,599		▬		
13. Guadalupe–Lahug Diversion Road	DPWH	New	1.60	3,160	▬			
14. Metro Cebu Intersection Improvement	DPWH	Upgrade, Improvement	-	10,189	▬	▬	▬	▬
15. Cebu–Cordova Link Expressway Bridge	Joint Venture	New On-going	3.23	27,900	▬			
16. Mandaue Coastal Road (Viaduct)	DPWH	New	6.20	12,170	▬			
17. Mandaue–Lapu Lapu Link Bridge	DPWH	New	0.64	6,992	▬			
18. 1st Mactan Bridge Replacement	DPWH	Replacement	2.50	13,860		▬		
19. Metro Cebu Coastal Expressway (elevated highway along existing coastal road)	DPWH	New	79.00	190,880			▬	▬
20. Metro Cebu Circumferential Expressway (elevated highway along Metro Cebu Circumferential Road)	DPWH	New	28.80	84,258			▬	
TOTAL			**321.59**	**521.255**				

*IA=Implementing Agency

Source: JICA Project Team

Table 8.6.2 Investment Schedule for UMRT Projects (tentative)

Project Name	IA*	Status	Length (km)	Total Const. Cost (Million Peso)	Implementation Period			
					2022	2028	2040	2050
B. Urban Mass Rapid Transit (UMRT)								
1. UMRT Central Line (Central Section)	DOTr	New	24.8	77,908	▬	▬		
2. UMRT Central Line (North Section)	DOTr	New	17.5	50,833			▬	
3. UMRT Central Line (South Section)	DOTr	New	25.2	71,500			▬	
4. UMRT Coastal Line (Phase 1)	DOTr	New	13.0	44,287	▬	▬		
5. UMRT Coastal Line (Phase 2)	DOTr	New	12.0	31,980		▬	▬	
TOTAL			**92.5**	**276,508**				

*IA=Implementing Agency

Source: JICA Project Team

Table 8.6.3 Investment Schedule for Other Project Components (tentative)

Project Name	IA*	Status		Total Cost (Million Peso)	Implementation Period			
					2022	2028	2040	2050
C. Traffic Management								
1. Metro Cebu Area Traffic Control (ATC) System (Control center, detectors, CCTV, traffic information provision, etc.)	DPWH/ LGUs	New		10,000	▬	▬		
2. Traffic signal optimization with intersection improvement	DPWH/ LGUs	Upgrade		350	▬			
3. Other traffic management and safety measures (traffic enforcement, asset management, traffic education, promotion of public transport, etc.)	DPWH/ LGUs	Upgrade		N/A	▬	▬	▬	▬
D. Public Transport								
1. PUV Modernization Program/ PUV Route Plan	DOTr/ LGUs	On-going		N/A	▬			
2. Public Transport Terminals	DOTr/ LGUs	On-going		N/A	▬			
3. BRT	DOTr	On-going		N/A	▬			
4. Water Transport	DOTr	On-going		N/A	▬	▬	▬	▬
TOTAL				**10,350**				

*IA=Implementing Agency

Source: JICA Project Team

8.7 Priority Projects

In order to mitigate the serious traffic congestion in Metro Cebu, a combination of improved road network and urban mass rapid transit (UMRT) network is necessary. Among the various projects previously introduced, the following 5 projects were identified as priority as shown in the figure below.

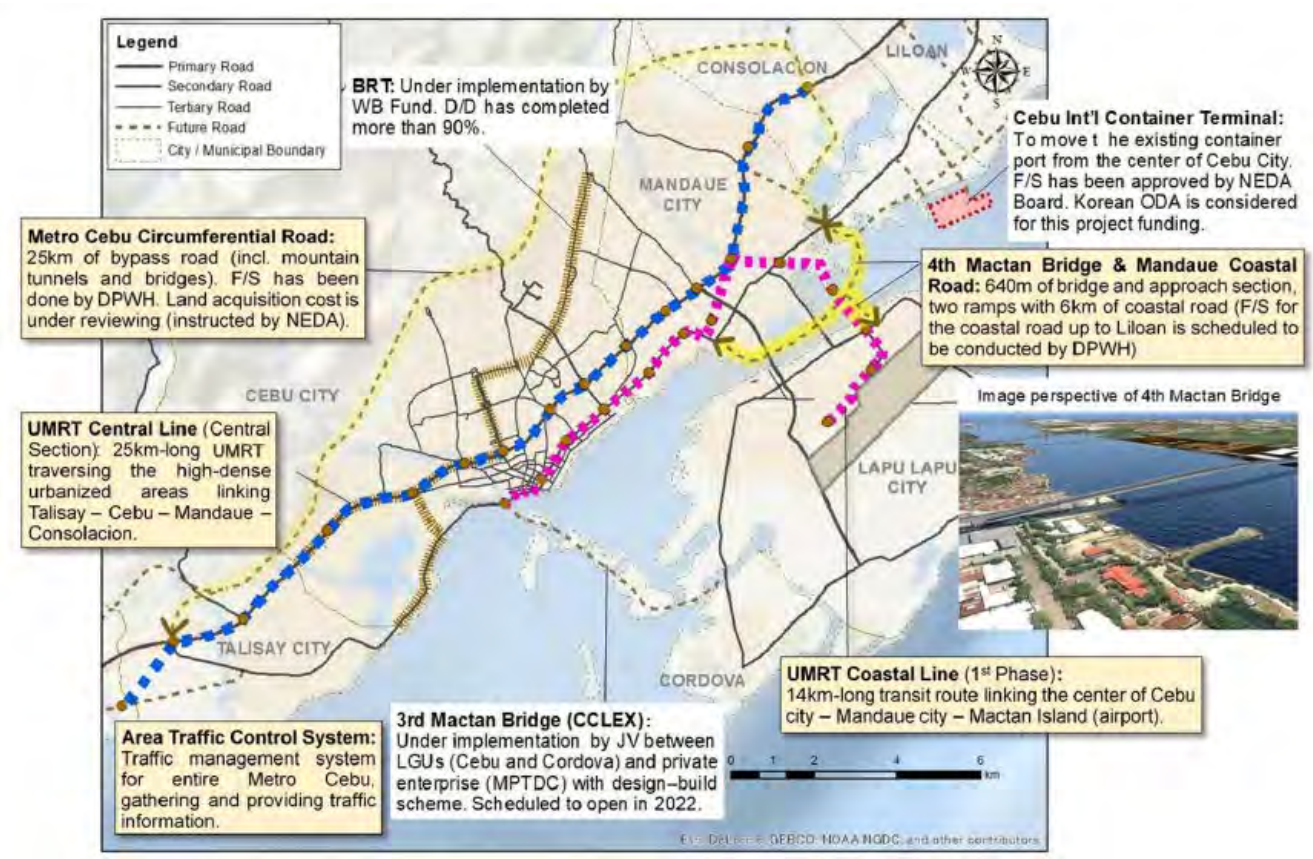
(i) Mandaue–Lapu Lapu Link Bridge (4th Mactan Bridge) with Mandaue Coastal Road

(ii) Metro Cebu Circumferential Road (Segment 1)

(iii) UMRT Central Line (Phase 1: Central Section)

(iv) UMRT Coastal Line (Phase 1)

(v) Mero Cebu Area Traffic Control (ATC) System



Source: JICA Project Team

Figure 8.7.1 Future Transport Network and Major Priority Projects in Metro Cebu

1) Mandaue–Lapu Lapu Link Bridge (4th Mactan Bridge) with Mandaue Coastal Road

(1) Background and Rationale

The existing 2 bridges between Cebu mainland and Mactan Island are vital links to sustain the economic growth in Metro Cebu. The First Mandaue–Mactan Bridge was built in 1972 with a single 2-lane carriageway. In 1990, one vessel accidentally hit the bridge during Typhoon Ruping. The accident damaged the structure of the bridge that made it only passable by vehicles of less than 5 tons. In 1993, the Philippine government decided to build the second bridge through Japanese ODA loan. The Second Mandaue–Mactan Bridge (Marcelo Fernan Bridge) was opened in 1999 with dual 2-lane carriageways (4 lanes in total).

The traffic survey in October 2017 showed that the traffic on the second bridge is larger than that of the first bridge, i.e., 59,100 vehicles and 56,500 vehicles, respectively. The first bridge shows a daily traffic congestion of less than 10 km per hour, particularly in the afternoon from Mandaue City to Lapu-Lapu City. After several years, both bridges will be more congested due to population growth and increased airport passengers generated by Cebu's booming industry and tourism. A new bridge (4th Mactan Bridge) will be necessary in addition to the Cebu Cordova Link Bridge (3rd Mactan bridge) currently under construction to sustain the economic growth in the heart of Metro Cebu. More details on this new bridge later on.

In 2016, Mactan Cebu International Airport (MCIA) handled 6.4 million passengers at the domestic terminal and 2.4 million passengers at the international terminal. MCIA will construct a new terminal under a PPP scheme and the existing and new terminals will handle over 10 million passengers in 2020. Cebu is a convenient destination by seaways as well as sea-cum-roads or vehicles on RORO ships at short seaways. Airport use is deemed more affordable for time-conscious people. The 4th Mactan Bridge will provide better access for the airport passengers as well as a bypass from Danao to Mactan, and reduce traffic congestion in Mandaue City.

In order to strengthen road network around Cansaga Bay and Mactan Strait, Mandaue City proposes the Mandaue Coastal Road. DPWH also proposed the Mandaue Liloan Diversion Road. Mandaue Coastal Road is a part of this diversion road. Along the road, the city intends to promote reclamation with urban development and preserve mangrove forests as water parks. The section between the Second Mandaue–Mactan Bridge and the Cansaga Bay Bridge of the Mandaue Coastal Road can offer a diversion route between North Cebu Province and Mactan Island, particularly between the new Consolacion International Container Port and Mactan EPZ I & II. This can also mitigate road traffic congestion at the center area of Mandaue City. Therefore, Mandaue Coastal Road is considered as an important access road to new bridges.

(2) Project Objectives

As previously described, the objective of the 4th Mactan Bridge with Mandaue Coastal Road Construction project aims to maximize the economic growth by securing sufficient traffic capacity between main Cebu and Mactan Islands as well as the social and ecological benefits through the reduction of travel time and CO_2 emissions.

(3) Project Description

The project includes the following roadway components.

(i) Construction of a new 4-lane road for 4th Mactan Bridge, and 4-lane road viaduct and access road for Mandaue Coastal Road.

(ii) Construction of the Mandaue–Lapu-Lapu Link Main Bridge Structures with 2 interchange (connecting ramp for Mandaue Coastal Road and connecting ramp for M.L. Quezon National Highway in Lapu-Lapu City).

(iii) Construction of Mandaue Coastal Road Viaduct that is part of Mandaue–Liloan Diversion Road.

(4) Project Cost and Financing

Preliminary construction and project costs for the 4th Mactan Bridge and Mandaue Costal Road are estimated in the tables below. Estimated breakdown of cost based on the implementation schedule under the fast track scheme will be shown later on.

Routine maintenance cost is applied with 0.2% of civil work cost per year and periodic maintenance cost is applied with 5% of civil work cost every 10 years.

The Special Terms for Economic Partnership (STEP) of Japanese Official Development Assistance (ODA) would be one of the possible funding sources of the project. Analysis on economic evaluation and financing options are described in Chapter 10.

Table 8.7.1 Estimated Construction Cost of 4th Mactan Bridge

Location	Length (m)	Cost (,000 PHP)	ROW Cost (,000 PHP)	Total (,000 PHP)
Viaduct Construction	100.00	339,000.00	361,860.00	700,860.00
Long Span Bridge Construction	540.00	5,735,880.00		5,735,880.00
Ramp Construction	(2 ramps)	555,090.00		555,090.00
TOTAL	640.00	6,629,970.00	361,860.00	6,991,830.00

Source: JICA Project Team

Table 8.7.2 Estimated Construction Cost of Mandaue Coastal Road

Location	Length (m)	Cost (,000 PHP)	ROW Cost (,000 PHP)	Total
Road Construction	800.00	271,200.00	915,000.00	
Viaduct Construction	5,400.00	10,983,600.00		
TOTAL	6,200.00	11,254,800.00	915,000.00	12,169,800.00

Source: JICA Project Team

Table 8.7.3 Estimated Project Cost of 4th Mactan Bridge

Category	Foreign Currency (million yen)	Local Currency (million PHP) <Tax>	Total Amount (million JPY)
1. Civil Works	12,962	265 <729>	15,248
2. Price Escalation	1,027	35 <95>	1,326
3. Contingency	648	13 <36>	761
4. Engineering Services	700	355 <24>	1,572

5. Land Acquisition	0	362 <0>	833
6. Administrative Cost	0	133 <0>	306
Total	15,337	1,163 <884>	20,046

Note: JPY is Japanese Yen, PHP is Philippine Pesos

Source: JICA Project Team

Table 8.7.4 Estimated Project Cost of Mandaue Costal Road

Category	Foreign Currency (million JPY)	Local Currency (million PHP) <Tax>	Total Amount (million JPY)
1. Civil Works	22,003	450 <1,238>	25,884
2. Price Escalation	1,138	38 <104>	1,464
3. Contingency	1,100	23 <62>	1,296
4. Engineering Services	1,159	579 <40>	2,583
5. Land Acquisition	0	915 <0>	2,105
6. Administrative Cost	0	225 <0>	518
Total	25,400	2,230 <1,445>	33,850

Source: JICA Project Team

(5) Institutional Arrangements

DPWH will be a project proponent.

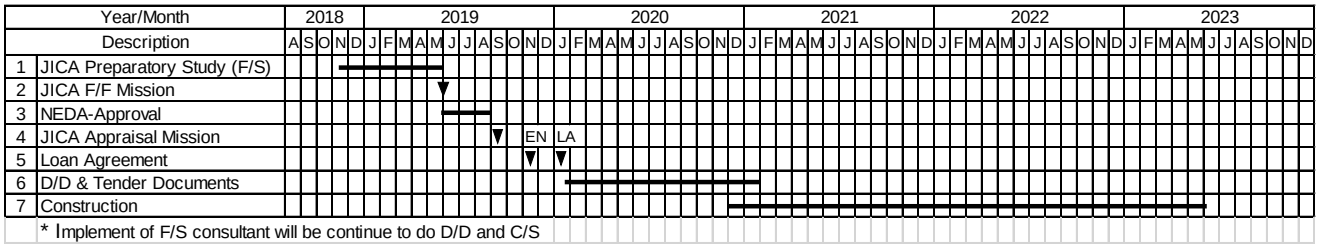
(6) Project Implementation Schedule

JICA Preparatory Study (F/S) was planned to be commenced around the end of 2018. Two cases of project implementation schedule for Metro Cebu Circumferential Road were examined.

Case-1 (fast track schedule): Procurement of consultant is only F/S phase and consultant will continue to the implementation of D/D and C/S. Duration of F/S, D/D, and C/S can be reduced around 2 years. This scheme is recommended for this project. Completion year of this case is 2023.

Case-2 (normal procedure): Consultant is to be procured during F/S, D/D, and C/S.

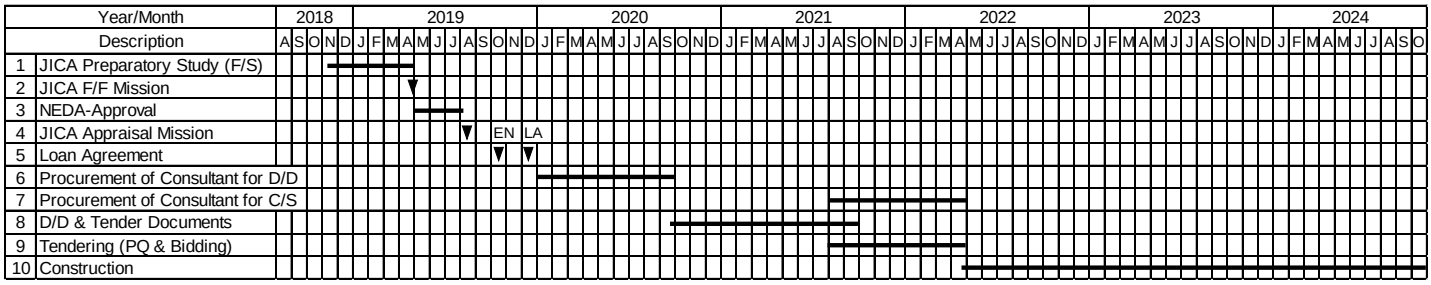
Table 8.7.5 Project Implementation Schedule for 4th Mactan Bridge and Mandaue Coastal Road (Fast Track Procedure)



Note: *Implement of F/S consultant will be continued to do D/D and C/S

Source: JICA Project Team

Table 8.7.6 Project Implementation Schedule for 4th Mactan Bridge and Mandaue Coastal Road (Normal Procedure)



Source: JICA Project Team

(7) Preliminary Scoping on Natural and Social Environments

Preliminary scoping of the Mandaue–Lapu Lapu Link Bridge (4th Mactan Bridge) with Mandaue Coastal Road project was conducted based on existing data and information.

The alignment of Mandaue Coastal Road is nearly close to what the city government has planned for a reclamation project and it is already included in its CLUP; thus, given that situation, it is presumed that no major considerations for natural and social environments shall be taken into account for the coastal road project. However, it shall be pointed out that a mangrove community exists near Cansaga Bay bridge that is not designated as preserved or protected area by law of the national government and the Mandaue City Government. According to the CLUP and its zoning ordinance CY2014, the mangrove zone is characterized as “a community of intertidal plants including all species of trees, shrubs, vines and herbs found on coasts, swamps or border of swamps” and its allowable uses and/or activities are mangrove plantations and a portion for an ecological park and fisherman’s wharf, which the city government is planning for after reclamation of the designated area. The zoning ordinance also specifies that zone has building regulations, which are for conservation of mangrove forests and not for permanent buildings or structures. Any improvement (e.g., ecological part) should observe minimal disturbance of biodiversity and terrain.

Based on the actual alignment of the coastal road, the City Planning and Development Office (CPDO) of Mandaue City Government mentioned it may change the zoning ordinance to let pillars be built if they do not disturb the mangrove community and after public consultation regarding the change.

According to “The State of Cebu Biodiversity” published in 2015 with the support of the Department of Environmental and Natural Resources (DENR), Foundation for the Philippine Environment (FPE) and other founders, and Bird Life International, the areas of Mactan, Kalawisan, and Cansaga Bay were identified through an internationally agreed set of criteria for the conservation of bird populations as an important bird and biodiversity area. The area was identified as migration hotspot of the “Chinese Egret Egretta Eulophotes” as well as in countries like Japan, China, and Taiwan. In Mactan Island’s case, the main migrating area is Olango Island. Provincial Environment & Natural Resources Office (PENRO) and City Environment & Natural Resources Office (CENRO) of the City of Mandaue and City of Lapu-Lapu have confirmed that not either the central government or LGUs has designated Mactan Channel and Consaga Bay area as protected areas for the said species. Further study is suggested since the last reconnaissance survey was conducted in early 2000.

There is a need to update the baseline information on marine environment component since the only available secondary data as source for information on the marine environment in the area is published in 2002. Given that the 4th Mactan Bridge and the coastal road are predominantly offshore, the baseline shall look into the marine life, such as algae, seagrass, mangrove community, corals and other benthic invertebrates, and marginal fishing.

Involuntary resettlement of affected households is most unlikely foreseen, but there might be a negative affect or disturbance to the businesses to the commercial buildings and/or factory in Lapu-Lapu side during the construction and after the completion of the bridge.

Table 8.7.7 Preliminary Scoping of Mandaue–Lapu Lapu Link Bridge (4th Mactan Bridge) with Mandaue Coastal Road Project

	Impact Item	Degree of Impact		Description
		Const.	O&M	
Pollution	Air Quality	B^-	B^+	Construction Phase: Exhaust fume and dust caused by construction vehicles and equipment may temporally deteriorate air quality around the construction site. Operation Phase: Decrease of exhaust fume and dust because of construction completion. Decrease of traffic congestion on the access roads to two existing bridges may reduce exhaust fume of idling vehicles.
	Water Quality	B^-	C^-	Construction Phase: Soil erosion from the construction works and waste water from the site or material yards may temporally affect seashore water quality. Operation Phase: Insignificant impact is expected to affect water quality, but periodical monitoring is suggested.
Pollution	Soil Contamination	B^-	D	Construction Phase: Fuel, oil, or any other machinery chemicals or other substances spilled out from storage or wrongly leaked at construction site may contaminate soil. Operation Phase: No impact is expected.
	Waste	B^-	D	Construction Phase: Not only construction waste, but also significant amount of general waste will be generated at construction site. Operation Phase: No impact is expected.
	Noise & Vibration	B^-	B^-	Construction Phase: Construction vehicles and equipment may cause noise and vibration at and around the construction site. Operation Phase: No impact is expected to be affected by the bridge, but the residents living along the access roads may be affected because of increased volume of traffic.
	Ground Subsidence	D	D	No impact is expected.
	Offensive Odor	B^-	D	Construction Phase: Due to the deterioration of air quality, offensive odor may be expected. Operation Phase: Less negative impact is expected because of exhaust fume of increased volume of traffic.
	Bottom Sediment	C	D	Construction Phase: Extent of impact is unknown In the bottom of the sea (the channel). Operation Phase: No or less impact is expected.
Natural	Protected Areas	B^-	B^-	Construction Phase: Protected mangrove area is located not very far away from the construction site in Mandaue side, so it should be underlined that the construction will not disturb that area. Operation Phase: Less impact is expected, but periodical inspection is recommended.

	Impact Item	Degree of Impact		Description
		Const.	O&M	
	Flora, Fauna and Biodiversity	B^-	D	Construction Phase: Endangered plant and animal species are not identified in the Metro Cebu area. However, Mandaue City identified the mangroves to be protected species of the city, which is located not very far away from the construction site. It should be emphasized that the construction will not disturb that area. Operation Phase: No or less impact is expected.
	Hydrological Situation	D	D	Construction Phase: No or less impact is expected. Operation Phase: No or less impact is expected.
	Topography & Geographical Feature	D	D	Construction Phase: No or less impact is expected. Operation Phase: No or less impact is expected.
Social Environment	Involuntary Resettlement	B^-	D	Construction Phase: Although informal setters were identified in the Roadmap Study report, the area where the bridge piers were planned to be built is already cleared by a private company for its redevelopment; therefore, involuntary resettlement will not be a problem. However, quite number of informal settlers who will not be the target of involuntary resettlement still reside near the project area in Lapu-Lapu City. Operation Phase: No impact is expected.
	The poor & Vulnerable Group	D	D	Construction Phase: The poor and/or vulnerable group are not identified at the project site, so no impact is expected. Operation Phase: No impact is expected.
	Indigenous & Ethnic People	D	D	Construction Phase: Indigenous and ethnic people are not identified in Metro Cebu area, so no impact is expected. Operation Phase; Same as above.
Social Environment	Local Economy (Employment, Livelihood, etc.)	$B^{+/-}$	$B^{+/-}$	Construction Phase: Construction may generate local job opportunities, while lots of workers' inflow may disturb local livelihood. Businesses near construction site may be disrupted due to increased heavy vehicles and/or temporary closure or roads. Operation Phase: Less traffic congestion near the project site may contribute to improve business environment
	Land-use & Utilization of Local Resources	D	D	Construction Phase: The project is already illustrated in the land-use plan of Mandaue and planned in Lapu-Lapu, so it does not affect land-use plans. Operation Phase: Same as above.
	Water Usage or Water Rights and Rights of Common	N/A	N/A	
	Existing Social Infrastructures and Services	D	D	Construction Phase: The project does not disturb social infrastructures and services during the construction phase since such facilities are not located nearby.
	Social Institutions (Split of Communities, etc.)	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Misdistribution of Benefit & Damage	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Local Conflicts of Interest	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Cultural Heritage	D	D	Construction Phase: No specific cultural and historical heritage needed to be conserved are identified in this area. Operation Phase: Same as above.

	Impact Item	Degree of Impact		Description
		Const.	O&M	
	Landscape	B^-	D	Construction Phase: The project may cause landscape disturbance during the construction phase because of fences and construction machineries. Operation Phase: No or less impact is expected.
	Gender	B^-	D	Construction Phase: Construction workers may cause disturbances to women near the project site due to the potential emergence of a sex industry. Operation Phase: No or less impact is expected.
	Children's Rights	N/A	N/A	
	Hazards (Risks), Infectious Diseases (HIV/AIDS)	B^-	D	Construction Phase: Construction workers from outside may cause disturbances and even bring infectious diseases. Operation Phase: No or less impact is expected.
	Working Conditions	$B^{+/-}$	D	Construction Phase: Accidents involving workers may occur if safety measures are not taken care of properly and seriously. A construction takes health care and precautions seriously, so workers may benefit from such provisions. Operation Phase: No or less impact is expected.
Others	Accidents	B^-	D	Construction Phase: Accidents involving workers and traffic accidents involving pedestrians walking near the project site may occur. Operation Phase: No or less impact is expected. Traffic accidents caused by general reasons such as reckless driving may be expected.
	Global Warming	D	B^+	Construction Phase: Although increased exhaust fume will be temporarily observed due to heavy vehicles and construction machineries, it would not significantly affect global warming. Operation Phase: Decreased traffic congestion because of better access may reduce CO_2 emissions, which cause the global warming.

A: Significant positive/negative impact is expected + Positive impacts - Negative /Adverse impacts

B: Moderate positive/negative impact is expected.

C: Extent of positive/negative impact is unknown (Examination is needed)

D: No or less positive/negative impact is expected.

Source: JICA Project Team

2) Metro Cebu Circumferential Road

(1) Background and Rationale

The Metro Cebu Road Network Plan has been studied and discussed since 1976 by the World Bank, Overseas Economic Cooperation Fund (OECF), Australia Aid, and JICA; however, few of the recommended projects were implemented. Only the Second Cebu Mactan Bridge, Cebu South Coastal Road, and Cansaga Bay Bridge as a part of Cebu North Coastal Road were implemented as major road networks.

One of the strategic road networks in Metro Cebu is to establish a circumferential road connecting with the coastal road in Talisay City and Mandaue City to form a ring road in the center of Metro Cebu, and continuously link to North Bypass from Danao City and South Bypass from City of Carcar. Therefore, the circumferential road was proposed in the Roadmap Study to mitigate the traffic congestion in the center of Metro Cebu.

Based on this, DPWH conducted an F/S for Cebu Circumferential Road in January 2015. However, the proposed DPWH alignment is different from proposed JICA Roadmap alignment. Also, the alignment of Segment 1 is not high-standard highway design criteria, but like a secondary road alignment.

This circumferential road is now called Metro Cebu Expressway by DPWH with a total length of 73.8 km starting from City of Naga to Danao City. This expressway is divided into 3 segments.

- Segment 1. Talisay City–Cebu City–Mandaue City that is 26.8 km length and with 6 lanes road including 2-km tunnels expected to be developed under ODA Loan. This alignment is basically similar with Metro Cebu Circumferential Road Alignment. However, this alignment should be revised based on high standard road criteria. Number of lanes will be analyzed based on traffic demand forecast. The tunnel will be 2 lanes for each direction.

- Segment 2. Municipality of Consolacion–Municipality of Liloan–Municipality of Compostela-Danao City that is 29.8 km in length with 4-lane road to be developed under local fund.

- Segment 3. City of Naga–Municipality of Minglanilla that is 17.2 km in length with 4-lane road to be developed under local fund.

The study was already completed on January 2015 by a local consultant. Construction of Segment 3 is expected to start in 2018 using national fund.

(2) Project Objectives

The proposed Metro Cebu Circumferential Road (similar alignment of Segment 1 of Metro Cebu Expressway) is one of the important projects of Metro Cebu Road Network Plan to reduce traffic congestion in the urban area.

Objectives for this proposed circumferential road are:

- To reduce through traffic from northern area to southern area of Metro Cebu;

- To make the buffer zone enter the developed center of Metro Cebu, Cebu City, Talisay City, and Mandaue City and away from outside traffic; and

- To provide smooth connection from Mactan Island through Mactan Bridges including the proposed new bridges.

(3) Project Description

The road alignment would traverse from Pardo in Cebu City starting from Cebu South Road then will connect Tisa, Banawa, Guadalupe, Banilad, and Talamban to Paknaan at Cebu North Coastal Road near Cansaga Bay Bridge. Its total length is 24.72 km with 4 lanes roadway and 40-m width right-of-way (ROW). Preliminary project description is as follows:

- At grade 4 lanes (cut and fill): 18.10 km (ROW = 40 m)

- Tunnel 4 lanes 2 cell: Total 2.30 km (ROW = only entrance)

- Bridges 4 lanes: total 4.32 km (ROW = 21 m, 50%)

(4) Project Cost and Financing

Preliminary construction and project costs for the Metro Cebu Circumferential Road are estimated in the tables below. Estimated Breakdown of cost based on the implementation schedule under fast track scheme would be described later.

Routine maintenance cost is applied with 0.2% of civil work cost every year and periodic maintenance cost is applied with 5% of civil work cost every 10 years.

ODA would be one of possible funding sources of the project. Analysis on economic evaluation and financing options are described in Chapter 10.

Table 8.7.8 Estimated Construction Cost of Mero Cebu Circumferential Road

Description	Length (km)	Project Cost (Million Pesos)	ROW Cost (Million Pesos)	TOTAL (Million Pesos)
At grade (cut & fill)	18.10	6,134.88	19,001.85	25,136.73
Tunnel 4 lanes 2 Cell	2.30	5,496.00	Including at grade	5,496.00
Bridge 4 lanes	4.32	5,467.39		5,467.39
2-On/Off ramp		300.00		300.00
TOTAL	24.72	17,398.27	19,001.85	36,400.12

Source: JICA Project Team

Table 8.7.9 Estimated Project Cost of Mero Cebu Circumferential Road

Category	Foreign Currency (million yen)	Local Currency (million pesos) <Tax>	Total Amount (million yen)
1. Civil Works	34,014	696 <1,914>	40,016
2. Price Escalation	1,968	66 <181>	2,536
3. Contingency	1,701	35 <96>	2,002
4. Engineering Services	1,800	901 <62>	4,015
5. Land Acquisition	0	19,002 <0>	43,704
6. Administrative Cost	0	348 <0>	800
Total	39,483	21,048 <2,253>	93,074

Source: JICA Project Team

(5) Institutional Arrangements

DPWH will be the project proponent.

(6) Project Implementation Schedule

Two cases of project implementation schedule for the Metro Cebu Circumferential Road were examined. They are described and shown in the tables that follow.

Case-1 (fast track schedule). Procurement of consultant is only in the F/S phase and this consultant will continue to the implementation of D/D and C/S. Duration of F/S, D/D and C/S can be reduced around 2 years. This scheme is recommended for this project.

Completion year of this case is 2023.

Case-2 (normal procedure). A consultant is procured at each phase of F/S, D/D, and C/S.

Table 8.7.10 Project Implementation Schedule for Metro Cebu Circumferential Road (Fast Track Procedure)

	Year/Month	2018	2019	2020	2021	2022	2023
	Description	A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
1	F/S						
2	F/F Mission						
3	NEDA-Approval						
4	Appraisal Mission			EN	LA		
5	Loan Agreement						
6	D/D & Tender Documents						
7	Construction						

* Implement of F/S consultant will be continue to do D/D and C/S

Note: *Implement of F/S consultant will be continued to do D/D and C/S

Source: JICA Project Team

Table 8.7.11 Project Implementation Schedule for Metro Cebu Circumferential Road (Normal Procedure)

	Year/Month	2018	2019	2020	2021	2022	2023	2024
	Description	A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O
1	F/S							
2	F/F Mission							
3	NEDA-Approval							
4	Appraisal Mission							
5	Loan Agreement			EN	LA			
6	Procurement of Consultant for D/D							
7	Procurement of Consultant for C/S							
8	D/D & Tender Documents							
9	Tendering (PQ & Bidding)							
10	Construction							

Source: JICA Project Team

(7) Preliminary Scoping on Natural and Social Environments

Preliminary scoping of the Metro Cebu Circumferential Road project was conducted based on desk research on existing data and information.

The number of affected buildings was counted through Google Earth as they can only be distinguished through satellite images, such as through the footnote of buildings. Actual number of to-be-affected buildings, road facilities, and trees shall be categorized and inventoried during F/S.

The affected will be 2,132 houses and 33 commercial buildings. More than 8,500 involuntary resettlements are foreseen in this project being the average number of household members in Metro Cebu is four persons. Nonetheless, the presence of ethnic minorities and indigenous peoples in the area has not been reported. The existence of cultural heritage that should be taken into consideration is not reported in any documents of LGUs. It was suggested to scrutinize further the historical buildings and vegetation that has cultural value in the locality.

Some areas of the alignment were designated as low-medium-high risk of landslides especially the mountain areas of Cebu City where landslides that likely to occur are highly dangerous. It shall be also emphasized that there are national designated reserves near the planned construction route, which are the Central Cebu Protected Landscape (29,062 ha), Buhisan Watershed Reserve, and Kotkot-Lusaran Watershed Forest Reserve. In those reserves, rare species of fish and plants exist that can only be seen in Cebu Island.

Deforestation and expansion of the road development were also foreseen that may lead to expansion of agricultural land conversion, and obstruction free movement of wildlife animals and residents of people.

Table 8.7.12 Preliminary Scoping of the Metro Cebu Circumferential Road Project

	Impact Item	Degree of Impact		Description
		Const.	O&M	
Pollution	Air Quality	B^-	$B^{+/-}$	Construction Phase: Exhaust fume and dust caused by construction vehicles and equipment may temporarily deteriorate air quality around the construction site. Operation Phase: Decrease of exhaust fume and dust because of the construction completed, yet those from traffic will then cause air pollution when it did not occur before.
	Water Quality	B^-	C^-	Construction Phase: Soil erosion from the construction works and wastewater from the site or material yards may temporarily affect water quality near construction site. Operation Phase: Insignificant impact is expected to affect water quality unless proper drainage measures are not taken.
Pollution	Soil Contamination	B^-	D	Construction Phase: Fuel, oil, or any other machinery chemicals or other substances may spill from storage or accidentally leak from construction site that may contaminate soil. Operation Phase: No or insignificant impact is expected.
	Waste	B^-	D	Construction Phase: Not only construction waste, but also significant amount of general waste will be generated at construction site. Operation Phase: No or insignificant impact is expected.
Pollution	Noise & Vibration	B^-	B^-	Construction Phase: Construction vehicles and equipment may cause noise and vibration at and around the construction site. Operation Phase: Noise and vibration from rail are expected, particularly to the buildings near and located along the road. Mitigation measures for noise and vibration, such as noise barriers and shades to protect privacy, shall be taken into consideration, particularly for schools, hospitals and nurseries.
	Ground Subsidence	D	D	No impact is expected.
	Offensive Odor	B^-	C^-	Construction Phase: Due to the deterioration of air quality, offensive odor may be expected. Operation Phase: Decrease of exhaust fume and dust because of construction completion, yet exhaust fume and dust from increased traffic will cause air pollution where such did not exist before due to much less traffic volume.
	Bottom Sediment	C	D	Construction Phase: Extent of impact is unknown on the bottom of the sea (the channel). Operation Phase: No or less impact is expected.
Natural Environment	Protected Areas	C	C	Construction Phase: There are no protected or designated preservation areas classified by the LGUs along the alignment. Operation Phase: Less impact is expected, but periodical inspection is recommended.
	Flora, Fauna and Biodiversity	C	D	Construction Phase: Endangered plant and animal species are not identified in the Metro Cebu area, but further consultation with LGUs and related stakeholders are recommended. Operation Phase: No or less impact is expected.
	Hydrological Situation	D	D	Construction Phase: No or less impact is expected. Operation Phase: No or less impact is expected.
	Topography & Geographical Feature	D	D	Construction Phase: No or less impact is expected. Operation Phase: No or less impact is expected.

	Impact Item	Degree of Impact		Description
		Const.	O&M	
Social Environment	Involuntary Resettlement	B^-	D	Construction Phase: Almost 2,200 buildings of which 2,132 are houses and 33 commercial buildings will be affected. It is unknown how many informal settlers are included in those numbers, yet it is said that nearly or more than 40–50% of urban households are informal setters mostly living on the hillside of urbanized areas. Operation Phase: No impact is expected.
	The poor & Vulnerable Group	C	C	Construction Phase: The number and degree of the poor in the project area is unknown. Operation Phase: The number and degree of the poor in the project area is unknown.
	Indigenous & Ethnic People	D	D	Construction Phase: Indigenous and ethnic people are not identified in Metro Cebu area, so no impact is expected. Operation Phase; Same as above.
	Local Economy (Employment, Livelihood, etc.)	$B^{+/-}$	D	Construction Phase: Construction may generate local job opportunities, while lots of workers' inflow may disturb local livelihood. Business near the construction site may be disrupted due to increased heavy vehicles and/or temporary closure of roads. Operation Phase: Insignificant impact is expected.
Social Environment	Land-use & Utilization of Local Resources	C	C	Construction Phase: LGUs have not incorporated the alignment into their land-use and no development plans along the road are taken into consideration, so the impacts to their CLUP and CDP are unknown. Operation Phase: No or less impact is expected.
	Water Usage or Water Rights and Rights of Common	N/A	N/A	
	Existing Social Infrastructures and Services	B^-	D	Construction Phase: Social infrastructure such as roads, power transmission line, water, and roads will be affected during construction. Particularly, heavy traffic congestion on access roads to the project sites will be anticipated. Operation Phase: No or less impact is expected.
	Social Institutions (Split of Communities, etc.)	C^-	C^-	Construction Phase: It may cause social intuitions depending on the design of the road and provision of access roads to cross the circumferential road. Operation Phase: It may cause social intuitions depending on the design of the road and provision of access roads to cross the circumferential road.
	Misdistribution of Benefit & Damage	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Local Conflicts of Interest	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Cultural Heritage	D	D	Construction Phase: No specific cultural and historical heritage needed to be conserved are identified in this area. Operation Phase: No specific impact is expected.
	Landscape	B^-	C^-	Construction Phase: The project may cause landscape disturbance during the construction phase because of fences and construction machineries. Operation Phase: Landscape will be disturbed by and may obstruct the view from houses and commercial buildings along the road.

	Impact Item	Degree of Impact		Description
		Const.	O&M	
	Gender	B^-	D	Construction Phase: Construction workers may cause disturbances to women near the project site due to the potential emergence of a sex industry. Operation Phase: No or less impact is expected.
	Children's Rights	N/A	N/A	
	Hazards (Risks), Infectious Diseases (HIV/AIDS)	B^-	D	Construction Phase: Construction workers from outside may cause disturbances and even bring infectious diseases. Operation Phase: No or less impact is expected.
	Working Conditions	$B^{+/-}$	D	Construction Phase: Accidents involving workers may occur if safety measures are not taken care of properly and seriously. A construction takes health care and precautions seriously, so workers may benefit from such provisions. Operation Phase: No or less impact is expected.
Others	Accidents	B^-	D	Construction Phase: Accidents involving workers and traffic accidents involving pedestrians walking near the project site may occur. Operation Phase: No or less impact is expected. Traffic accidents caused by general reasons, such as reckless driving may be expected.
	Global Warming	D	B^+	Construction Phase: Although increased exhaust fume will be temporarily observed due to heavy vehicles and construction machineries, it would not significantly affect global warming. Operation Phase: Decreased traffic congestion because of better access may reduce CO_2 emissions, which is one cause of global warming.

A: Significant positive/negative impact is expected + Positive impacts - Negative /Adverse impacts

B: Moderate positive/negative impact is expected.

C: Extent of positive/negative impact is unknown (Examination is needed)

D: No or less positive/negative impact is expected.

Source: JICA Project Team

3) UMRT Central Line

(1) Background and Rationale

The population of Metro Cebu has reached 2.55 million as of 2010. Although the introduction of UMRT has been discussed since the 1990s, no mass transport system has been introduced and jeepney is still the leading public transport mode in Metro Cebu. However, as previously identified, a UMRT network should be developed as a transport backbone in Metro Cebu.

(2) Project Objectives

UMRT should be developed as a backbone public transport in the north–south axis in Metro Cebu where traffic demand is concentrated.

(3) Project Description

The UMRT Central Line is divided into sub-lines Central Section, North Section, and South Section. The outline of each section is summarized in the table below.

Table 8.7.13 The Outline of UMRT Central Line

Item	Specification		
Section	Central Section	North Section	South Section
	Talisay City–Liloan	Liloan–Danao City	Carcar City–Talisay City
Length	24 km/800 m	17 km/500 m	25 km/200 m
Structure Type	Elevated	Elevated	Elevated
No. of Stations	24	17	25
No. of Train Cars	179	130	182

Source: JICA Project Team

(4) Project Cost and Financing

Preliminary construction and project costs are estimated for each sub-line as shown in the following tables. Funding source has not been determined yet. Analysis on economic and financial evaluation as well as financing options are described in Chapter 10.

Table 8.7.14 Estimated Construction Cost of UMRT Central Line (Central Section)

Location	Unit	Qty	FC (million JPY)	LC (million PHP)	Total Cost (million JPY)
Civil Works	L.S	1	39,005	16,407	73,132
E&M Works	L.S	1	66,101	2,970	72,280
Rolling Stock	L.S	1	30,195	2,680	35,769
TOTAL			135,301	22,058	181,181

Source: JICA Project Team

Table 8.7.15 Estimated Construction Cost of UMRT Central Line (North Section)

Location	Unit	Qty	FC (million JPY)	LC (million PHP)	Total Cost (million JPY)
Civil Works	L.S	1	26,967	11,489	50,864
E&M Works	L.S	1	37,764	1,694	41,287
Rolling Stock	L.S	1	22,004	1,953	26,066
TOTAL			86,734	15,136	118,217

Source: JICA Project Team

Table 8.7.16 Estimated Construction Cost of UMRT Central Line (South Section)

Location	Unit	Qty	FC (million JPY)	LC (million PHP)	Total Cost (million JPY)
Civil Works	L.S	1	38,515	16,588	73,018
E&M Works	L.S	1	51,870	2,417	56,896
Rolling Stock	L.S	1	30,696	2,725	36,363
TOTAL			121,080	21,730	166,278

Source: JICA Project Team

The project cost generally includes construction cost (civil works), procurement cost (railway system & rolling stock), consultant cost (design and construction supervision), and other necessary costs, such as administration cost, taxes, price escalation and contingencies, etc. Land acquisition cost is covered by the road widening projects for the UMRT corridor.

Table 8.7.17 Estimated Project Cost of UMRT Central Line (Central Section)

Category	Foreign Currency (million JPY)
1. Construction and Procurement Works	181,181
2. Engineering Services	13,589
3. Other cost (incl Admin cost, contingency, price escalation, etc.) Assumed to be 30% of items 1 and 2 above.	58,431
Total	253,200

Source: JICA Project Team

Table 8.7.18 Estimated Project Cost of UMRT Central Line (North Section)

Category	Foreign Currency (million JPY)
1. Construction and Procurement Works	118,217
2. Engineering Services	8,866
3. Other cost (including administration cost, contingency, price escalation, etc.) Assumed to be 30% of items 1 and 2 above.	38,125
Total	165,209

Source: JICA Project Team

Table 8.7.19 Estimated Project Cost of UMRT Central Line (South Section)

Category	Foreign Currency (million JPY)
1. Construction and Procurement Works	166,278
2. Engineering Services	12,471
3. Other cost (including administrative costs, contingency, price escalation, etc.) Assumed to be 30% of the above items 1 and 2.	53,625
Total	232,373

Source: JICA Project Team

(5) Institutional Arrangements

Institutional arrangements have not been discussed yet.

(6) Implementation Schedule

As discussed in the previous section, the Central Section of UMRT Central Line has priority and shall commence operation by 2030 and that two other sub-lines shall commence operation in years 2030s and 2040s consecutively.

Table 8.7.20 Project Implementation Schedule for UMRT Central Line (tentative)

Central Line

	2019	2020	2021	2022	2023	2024	2025	2026	2027
F/S									
Design Consultant Procurement									
Basic Engineering Design & Tender Document Preparation									
Contractor Procurement									
Construction/ Procument Works									
Test Run									
Commencement of Operation									

Central Line South Extension

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
F/S																			
Design Consultant Procurement																			
Basic Engineering Design & Tender Document Preparation																			
Contractor Procurement																			
Construction/ Procument Works																			
Test Run																			
Commencement of Operation																			

Central Line North Extension

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
F/S																						
Design Consultant Procurement																						
Basic Engineering Design & Tender Document Preparation																						
Contractor Procurement																						
Construction/ Procument Works																						
Test Run																						
Commencement of Operation																						

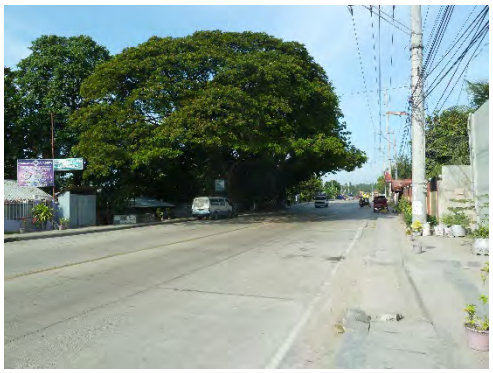
Source: JICA Project Team

(7) Preliminary Scoping on Natural and Social Environments

Ecologically important habitants are not reported in the planned area and there are no areas designated as national reserves or conservation areas. The UMRT central line is planned to be constructed on the national highway as an elevated structure; therefore, there are possible natural and social issues to be taken into consideration.

(a) Some segments of national highway in Compostela, San Fernando, and Carcar are still one lane per way being that DPWH has encountered difficulty acquiring ROW. At the stakeholders' meeting in Danao, the difficulty of land acquisition was raised as the LGU's major issue on road network development.

(b) Trees—mostly Acacia trees—stand and hang over along the national highway and obstruct its widening. The trees are preserved by residents and authority. Considering the residents and pro-environment groups' movement against cutting and/or relocating street trees along the planned BRT route, public consultations to local stakeholders is suggested to be conducted ahead of time before the planning stage to avoid unnecessary conflicts during construction.





Source: JICA Project Team

Figure 8.7.2 Trees Blocking National Highway in San Fernando

Review of the master plan of the Comprehensive Study for a Metro Cebu Integrated Flood and Drainage System Master Plan (DPWH, July 2017) is necessary when the UMRT Central Line proceeds to the next step because there are areas where flood damage is likely to happen in the urban areas of Talisay, Cebu City, Mandaue, and Consolacion if no countermeasures are taken.

Preliminary study of social impact shows hundreds of houses and commercial buildings that will be affected by the project. The social impacts will be seen where road widening is required and land acquisition for ROW is needed or the structure of UMRT will somehow affect houses and buildings along the planned alignment such as by noise and vibration. Closed structure of the UMRT to alongside building, although the acquirement of the ROW is not necessary.

The number of those affected buildings was counted through Google Earth, which can be distinguished from the satellite images only, such as through a footnote of buildings. Actual number of to-be-affected buildings and road facilities and trees shall be categorized and inventoried at the time of feasibility study.

Almost 700 buildings in total, of which 551 are houses and 139 are commercial buildings, will be affected. Being the average number of household members in Metro Cebu is four persons, more than 2,000 involuntary resettlers are foreseen. The presence of ethnic minorities and indigenous peoples in the area has not been reported. The existence of cultural heritage that should have been taken into consideration is not reported in any documents of LGUs. Further scrutiny about historical buildings and vegetation with cultural value for the locality is suggested.

Preliminary scoping of the Central Line project was conducted based on the desk research on existing data and information.

Table 8.7.21 Preliminary Scoping of the Central Line Project

	Impact Item	Degree of Impact		Description
		Const.	O&M	
Pollution	Air Quality	B^-	B^+	Construction Phase: Exhaust fume and dust caused by construction vehicles and equipment may temporarily deteriorate air quality around the construction site. Operation Phase: Decrease of exhaust fume and dust because of construction completion. Decrease of traffic congestion on the national highway may reduce exhaust fume of idling vehicles.
	Water Quality	B^-	D	Construction Phase: Soil erosion from the construction works and waste water from the site or material yards may temporarily affect water quality near construction site. Operation Phase: No or insignificant impact is expected to affect water quality.
Pollution	Soil Contamination	B^-	D	Construction Phase: Fuel, oil, or any other machinery chemicals or other substances may spill from storage or accidentally leak at construction site, and soil may be contaminated. Operation Phase: No or insignificant impact is expected.
	Waste	B^-	D	Construction Phase: Not only construction waste, but also significant amount of general waste will be generated at construction site. Operation Phase: No or insignificant impact is expected.
	Noise & Vibration	B^-	B^-	Construction Phase: Construction vehicles and equipment may cause noise and vibration at and around the construction site. Operation Phase: Noise and vibration from rail are expected, particularly to the buildings nearly located along the UMRT line. Since a train will run on an elevated structure, it will pass the height of a house of about two to three stories. Not only noise and vibration but also privacy is compromised by passengers of the UMRT. Mitigation measures for noise and vibration, such as railway noise barriers and shades for protecting privacy, shall be taken into consideration, particularly along schools, hospitals, and nurseries.
	Ground Subsidence	D	D	No impact is expected.
	Offensive Odor	B^-	D	Construction Phase: Due to the deterioration of air quality, offensive odor may be expected. Operation Phase: Less negative impact is expected because of exhaust fume of decreased volume of automotive vehicle traffic.
	Bottom Sediment	C	D	Construction Phase: Extent of impact is unknown on the bottom of the sea (the channel). Operation Phase: No or less impact is expected.
Natural Environment	Protected Areas	C	C	Construction Phase: There are no protected or designated preservation areas classified by the LGUs along the alignment. Operation Phase: Less impact is expected, but periodical inspection is recommended.
	Flora, Fauna and Biodiversity	C	D	Construction Phase: Endangered plant and animal species are not identified in the Metro Cebu area, but further consultation with LGUs and related stakeholders are recommended. Operation Phase: No or less impact is expected.
	Hydrological Situation	D	D	Construction Phase: No or less impact is expected. Operation Phase: No or less impact is expected.
	Topography & Geographical Feature	D	D	Construction Phase: No or less impact is expected. Operation Phase: No or less impact is expected.

	Impact Item	Degree of Impact		Description
		Const.	O&M	
Social Environment	Involuntary Resettlement	B^-	D	Construction Phase: Almost 700 buildings in total of which 551 are houses and 139 are commercial buildings will be affected. It is unknown how many informal settlers are included in those numbers, yet it is said that nearly or more than 40–50% of urban households are informal setters, but mostly living on the hillside of urbanized areas. Operation Phase: No impact is expected.
	The poor & Vulnerable Group	D	D	Construction Phase: The poor and/or vulnerable group are not identified at the project site, so no impact or insignificant impact is expected. Operation Phase: No impact is expected.
	Indigenous & Ethnic People	D	D	Construction Phase: Indigenous and ethnic people are not identified in Metro Cebu area, so no impact is expected. Operation Phase; Same as above.
Social Environment	Local Economy (Employment, Livelihood, etc.)	$B^{+/-}$	$B^{+/-}$	Construction Phase: Construction may generate local job opportunities, while lots of workers' inflow may disturb local livelihood. Business near the construction site may be disrupted due to increased heavy vehicles and/or temporary closure of roads. The business of street vendors, small shops, and housing business will also be affected because of the change of flow of people during the construction phase and once operations starts. Operation Phase: Less traffic congestion near the project site may contribute to improve business environment, but also the change of flow of people will negatively affect business environment, except around the planned station areas.
	Land-use & Utilization of Local Resources	C	C	Construction Phase: LGUs have not incorporate the alignment into their land-use and no development plans along the UMRT are taken into consideration, so the impacts to their CLUP and CDP are unknown. Operation Phase: No or less impact is expected.
	Water Usage or Water Rights and Rights of Common	N/A	N/A	
	Existing Social Infrastructures and Services	B^-	D	Construction Phase: Social infrastructure such as roads, power transmission line, water, and roads will be affected in the time of the construction. Particularly, heavy traffic congestion on national highway will be anticipated. Operation Phase: No or less impact is expected.
	Social Institutions (Split of Communities, etc.)	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Misdistribution of Benefit & Damage	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Local Conflicts of Interest	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Cultural Heritage	D	D	Construction Phase: No specific cultural and historical heritage needed to be conserved are identified in this area. Operation Phase: No specific impact is expected.

	Impact Item	Degree of Impact		Description
		Const.	O&M	
Social Environment	Landscape	B^-	D	Construction Phase: The project may cause landscape disturbance during the construction phase because of fences and construction machineries. Operation Phase: Landscape will be disturbed by the elevated structure and may obstruct the view from houses and commercial buildings along the UMRT Line.
	Gender	B^-	D	Construction Phase: Construction workers may cause disturbances to women near the project site due to the potential emergence of a sex industry. Operation Phase: No or less impact is expected.
	Children's Rights	N/A	N/A	
	Hazards (Risks), Infectious Diseases (HIV/AIDS)	B^-	D	Construction Phase: Construction workers from outside may cause disturbances and be a cause to bring infectious diseases. Operation Phase: No or less impact is expected.
	Working Conditions	$B^{+/-}$	D	Construction Phase: Accidents involving workers may occur if safety measures are not taken care of properly and seriously. A construction takes health care and precautions seriously, so workers may benefit from such provisions. Operation Phase: No or less impact is expected.
Others	Accidents	B^-	D	Construction Phase: Accidents involving workers and traffic accidents involving pedestrians walking near the project site may occur. Operation Phase: No or less impact is expected. Traffic accidents caused by general reasons, such as reckless driving because of pillars built on the median of roadway, may be expected.
	Global Warming	D	B^+	Construction Phase: Although increased exhaust fume will be temporarily observed due to heavy vehicles and construction machineries, it would not significantly affect global warming. Operation Phase: Decreased traffic congestion because of better access may reduce CO_2 emissions, which is one cause of global warming.

A: Significant positive/negative impact is expected + Positive impacts - Negative /Adverse impacts

B: Moderate positive/negative impact is expected.

C: Extent of positive/negative impact is unknown (Examination is needed)

D: No or less positive/negative impact is expected.

Source: JICA Project Team

4) UMRT Coastal Line

(1) Background and Rationale

More than half of the Metro Cebu's population is concentrated in Cebu City, Mandaue City, and Lapu-Lapu City. Most of the chronic traffic congestion are generated in these cities, so development of a railway-based efficient public transport is important. However, since almost all the land in these cities have already been well-developed being urban city centers, the land that can be utilized for railway-base public transport is very limited. Under these circumstances, a UMRT line has been proposed that connects Cebu City, Mandaue City, and Lapu-Lapu City.

(2) Project Objectives

UMRT line is expected reduce traffic congestions in Cebu City, Mandaue City, and Lapu-Lapu City.

(3) Project Description

The UMRT Coastal Line is divided into two phases. The outline of each phase is summarized in the table below.

Table 8.7.22 The Outline of UMRT Coastal Line

Item	Specification	
Phase	Phase 1	Phase 2
Section	Fort San Pedro–Mactan Airport	Cebu South Coastal Road (Talisay)–Fort San Pedro
Length	13 km	12 km
Structure Type	Elevated and long span bridge	Elevated
No. of Stations	13	12
No. of Train Cars	168	128

Source: JICA Project Team

(4) Project Cost and Financing

Preliminary construction and project costs are estimated for each phase as shown in the following tables. Funding source has not been determined yet. Analysis on economic and financial evaluations as well as financing options are described in Chapter 10.

Table 8.7.23 Estimated Construction Cost of UMRT Coastal Line (Phase 1)

Location	Unit	Qty	FC (million JPY)	LC (million PHP)	Total Cost (million JPY)
Civil Works	L.S	1	24,965	10,213	46,209
E&M Works	L.S	1	19,157	2,182	23,695
Rolling Stock	L.S	1	28,896	2,016	33,089
TOTAL			73,017	14,411	102,993

Source: JICA Project Team

Table 8.7.24 Estimated Construction Cost of UMRT Coastal Line (Phase 2)

Location	Unit	Qty	FC (million JPY)	LC (million PHP)	Total Cost (million JPY)
Civil Works	L.S	1	12,695	7,542	28,382
E&M Works	L.S	1	16,656	1,982	20,779
Rolling Stock	L.S	1	22,016	1,536	25,211
TOTAL			51,366	11,060	74,372

Source: JICA Project Team

The project cost generally includes construction cost (civil works), procurement cost (railway system and rolling stock), consultant cost (design and construction supervision), and other necessary costs such as administration cost, taxes, price escalation and contingencies etc. Land acquisition cost is covered by the road widening projects for the UMRT corridor.

Table 8.7.25 Estimated Project Cost of UMRT Coastal Line (Phase 1)

Category	Foreign Currency (million JPY)
1. Construction and Procurement Works	102,993
2. Engineering Services	7,724
3. Other cost (including administration cost, contingency, price escalation, etc.) Assumed to be 30% of items 1 and 2 above.	33,215
Total	143,933

Source: JICA Project Team

Table 8.7.26 Estimated Project Cost of UMRT Coastal Line (Phase 2)

Category	Foreign Currency (million JPY)
1. Construction and Procurement Works	74,372
2. Engineering Services	5,578
4. Other cost (including administration cost, contingency, price escalation, etc.) Assumed to be 30% of items 1 and 2 above.	23,985
Total	103,934

Source: JICA Project Team

(5) Institutional Arrangements

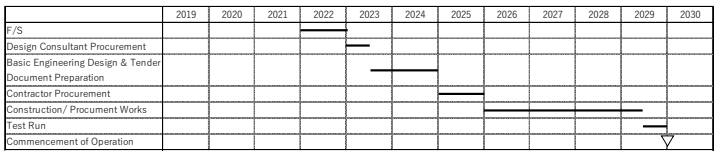
Institutional arrangements have not been discussed yet.

(6) Implementation Schedule

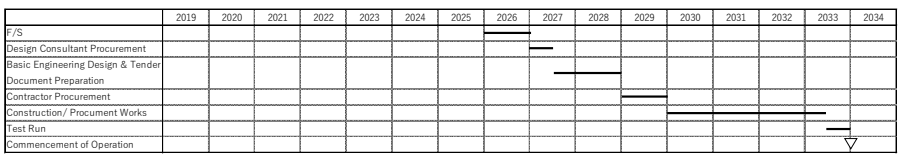
As discussed in the previous section, Phase 1 of UMRT Coastal Line is a priority and should commence operations by 2030, while Phase 2 should commence by 2034.

Table 8.7.27 Project Implementation Schedule for UMRT Central Line (tentative)

Coastal Line (Phase 1)



Coastal Line (Phase 2)



Source: JICA Project Team

(7) Preliminary Scoping on Natural and Social Environment

Ecologically important habitants are not reported in the planned area and there are no areas designated as national reserves or conservation areas. The UMRT Coastal Line is planned to be constructed on the national highway as an elevated structure. In such a case like this, there are possible natural and social issues to be taken into consideration.

As mentioned in the Central Line, vegetation (street trees) shall not be lightly taken, considering the experience of the BRT project in Cebu City. Although there was an advance information dissemination at every barangay, there was still a strong protest against cutting street trees once the local communities were aware and the media has intensively published about cutting them. The people appealed to the city government to take necessary actions to preserve and/or replant trees. Most part of the alignment of the coastal line will be built at the median of the existing national highway and, except for some segments in SRP, different kinds of vegetation will be planted; however, there are no tall trees or just trees classified as preserved. But it is safe to say that an inventory of trees shall be conducted during feasibility study to see if relocation or replant shall be needed or not.

Review of the master plan of the Comprehensive Study for a Metro Cebu Integrated Flood and Drainage System Master Plan (DPWH, July 2017) is necessary when the UMRT Costal Line proceeds to next step, because there are areas where flood damage is likely to happen, such as in Talisay, Cebu City, and Mandau, if there are no countermeasures taken.

Butuanon River basin in Mandaue City was designated as a non-build area that is 25 m from the center of the river for both sides, so the buffer zone will be 50 m wide. However, the CPDO of Mandaue City has already included the route that does not invade the buffer zone in the land-use plan.

There are 54 houses and 1 commercial building—a total of 50 buildings—that will be affected by the project.

The presence of ethnic minorities and indigenous peoples in the area have not been reported and the existence of cultural heritage that should be taken into consideration is not reported in any documents of the LGUs. Further scrutiny about historical buildings and vegetation with cultural value for the locality is suggested.

Preliminary scoping of the Coastal Line project was conducted based on the desk research on existing data and information.

Table 8.7.28 Preliminary Scoping of the Coastal Line Project

	Impact Item	Degree of Impact		Description
		Const.	O&M	
Pollution	Air Quality	B^-	B^+	Construction Phase: Exhaust fume and dust caused by construction vehicles and equipment may temporally deteriorate air quality around the construction site. Operation Phase: Decrease of exhaust fume and dust because of construction completion. Decrease of traffic congestion on the national highway may reduce exhaust fume of idling vehicles.
	Water Quality	B^-	D	Construction Phase: Soil erosion from the construction works and waste water from the site or material yards may temporarily affect water quality near construction site. Operation Phase: No or insignificant impact is expected to affect water quality.

	Impact Item	Degree of Impact		Description
		Const.	O&M	
Pollution	Soil Contamination	B-	D	Construction Phase: Fuel, oil, or any other machinery chemicals or substances spilled out from storage or wrongly leaked at construction site may contaminate soil. Operation Phase: No or insignificant impact is expected.
	Waste	B-	D	Construction Phase: Not only construction waste, but also a significant amount of general waste will be generated at construction site. Operation Phase: No or insignificant impact is expected.
	Noise & Vibration	B-	B-	Construction Phase: Construction vehicles and equipment may cause noise and vibration at and around the construction site. Operation Phase: Noise and vibration from rail are expected, particularly to the buildings nearly located along the UMRT line. Since the train will run on the elevated structure, it will pass the height of a house of about two to three stories. Not only noise and vibration, but privacy is also compromised by passengers of the UMRT. Mitigation measures for noise and vibration, such as railway noise barriers and shades for privacy protection, shall be taken into consideration, particularly along schools, hospitals, and nurseries.
	Ground Subsidence	D	D	No impact is expected.
	Offensive Odor	B-	D	Construction Phase: Due to the deterioration of air quality, offensive odor may be expected. Operation Phase: Less negative impact is expected because of exhaust fume of decreased volume of automotive vehicle traffic.
	Bottom Sediment	C	D	Construction Phase: Extent of impact is unknown on the bottom of the sea (the channel). Operation Phase: No or less impact is expected.
Natural Environment	Protected Areas	C	C	Construction Phase: There are no protected or designated preservation areas classified by the LGUs along the alignment. Operation Phase: Less impact is expected, but periodical inspection is recommended.
	Flora, Fauna and Biodiversity	C	D	Construction Phase: Endangered plant and animal species are not identified in the Metro Cebu area, but further consultation with LGUs and related stakeholders are recommended. Operation Phase: No or less impact is expected.
	Hydrological Situation	D	D	Construction Phase: No or less impact is expected. Operation Phase: No or less impact is expected.
	Topography & Geographical Feature	D	D	Construction Phase: No or less impact is expected. Operation Phase: No or less impact is expected.
Social Environment	Involuntary Resettlement	B-	D	Construction Phase: Almost 700 buildings in total of which 551 are houses and 139 are commercial buildings will be affected. It is unknown how many informal settlers are included in above numbers, yet it is said that nearly or more than 40–50% of urban households are informal setters, but mostly living on the hillside of urbanized areas. Operation Phase: No impact is expected.
	The poor & Vulnerable Group	D	D	Construction Phase: The poor and/or vulnerable group are not identified at the project site, so no impact or insignificant impact is expected. Operation Phase: No impact is expected.

	Impact Item	Degree of Impact		Description
		Const.	O&M	
	Indigenous & Ethnic People	D	D	Construction Phase: Indigenous and ethnic people are not identified in Metro Cebu area, so no impact is expected. Operation Phase; Same as above.
Social Environment	Local Economy (Employment, Livelihood, etc.)	$B^{+/-}$	$B^{+/-}$	Construction Phase: Construction may generate local job opportunities, while lots of workers' inflow may disturb local livelihood. Businesses near the construction site may be disrupted due to increased heavy vehicles and/or temporary closure of roads. The business of street vendors, small shops, and housing business will also be affected because of the change of flow of people during the construction phase and when the operations starts. Operation Phase: Less traffic congestion near the project site may contribute to improve business environment, but also the change of flow of people will negatively affect business environment, except around the planned station areas.
	Land-use & Utilization of Local Resources	C	C	Construction Phase: LGUs have not incorporate the alignment into their land-use and no development plans along the UMRT are taken into consideration, so the impacts to their CLUP and CDP are unknown. Operation Phase: No or less impact is expected.
	Water Usage or Water Rights and Rights of Common	N/A	N/A	
	Existing Social Infrastructures and Services	B^{-}	D	Construction Phase: Social infrastructure such as roads, power transmission line, water, and roads will be affected during construction. Particularly, heavy traffic congestion on national highway will be anticipated. Operation Phase: No or less impact is expected.
	Social Institutions (Split of Communities, etc.)	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Misdistribution of Benefit & Damage	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Local Conflicts of Interest	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Cultural Heritage	D	D	Construction Phase: No specific cultural and historical heritage needed to be conserved are identified in this area. Operation Phase: No specific impact is expected.
	Landscape	B^{-}	D	Construction Phase: The project may cause landscape disturbance during the construction phase because of fences and construction machineries. Operation Phase: Landscape will be disturbed by the elevated structure and may obstruct the view from houses and commercial buildings along the UMRT Line.
	Gender	B^{-}	D	Construction Phase: Construction workers may cause disturbances to women near the project site due to the potential emergence of a sex industry.. Operation Phase: No or less impact is expected.
	Children's Rights	N/A	N/A	
	Hazards (Risks), Infectious Diseases (HIV/AIDS)	B^{-}	D	Construction Phase: Construction workers from outside may cause disturbances and be a cause to bring infectious diseases. Operation Phase: No or less impact is expected.

	Impact Item	Degree of Impact		Description
		Const.	O&M	
	Working Conditions	$B^{+/-}$	D	Construction Phase: Accidents involving workers may occur if safety measures are not taken care of properly and seriously. A construction takes health care and precautions seriously, so workers may benefit from such provisions. Operation Phase: No or less impact is expected.
Others	Accidents	B^{-}	D	Construction Phase: Accidents involving workers and traffic accidents involving pedestrians walking near the project site may occur. Operation Phase: No or less impact is expected. Traffic accidents caused by general reasons, such as reckless driving because of pillars built on the median of roadway, may be expected.
	Global Warming	D	B^{+}	Construction Phase: Although increased exhaust fume will be temporarily observed due to heavy vehicles and construction machineries, it would not significantly affect global warming. Operation Phase: Decreased traffic congestion because of better access may reduce CO^2 emissions which cause the global warming.

A: Significant positive/negative impact is expected + Positive impacts - Negative /Adverse impacts

B: Moderate positive/negative impact is expected.

C: Extent of positive/negative impact is unknown (Examination is needed)

D: No or less positive/negative impact is expected.

Source: JICA Project Team

5) Mero Cebu ATC System

(1) Background and Rationale

The number of road crash fatalities in Central Visayas, which is composed largely of Mega Cebu, according to the Philippine Statistics Authority is rising steadily from 486 in 2006 to 531 in 2013. In Cebu City alone, the Cebu City Transportation Office reports an average of 10,000 road crashes each year of which at least 50 are fatalities.

There are traffic signals at 70 intersections in Cebu City. The system was built in 1993 and renewed in 1999 and doesn't have CCTV. There are 649 detectors in Cebu City, but now only 200 function and the rest don't.

Mandaue City built a TCC in 2013. There are traffic signals at 21 intersections and CCTVs at 17 intersections.

In Lapu-Lapu City, the city controls traffic mainly by dispatching enforcers at a few major intersections. CCTVs are in 42 locations including intersections. There is a plan to install signals at 10 intersections, 3 of which has already been done, and the rest by the end of 2018.

(2) Project Objectives

The objectives are to realize safe and comfortable traffic through the following:

- Provision, control, and monitoring traffic information.
- Provision of information of traffic obstacles such as accidents, broken-down vehicles and fallen objects, and measures to undertake.

- Collection and provision of information about abnormal circumstances such as weather and measures to undertake.

- Communication and coordination with concerned parties and traffic regulation.

The project contributes to congestion mitigation, reduction of traffic accident, and better level of service on road traffic.

For traffic management, it is important to understand traffic condition at both micro and macro levels. In a traffic congestion, for example, traffic operators should pay attention to all road networks other than bottlenecks and take care of various issues, such as collision at a tail of congestion, detour route information to drivers heading upward, and travel time updates to all drivers that might take the congested routes.

(3) Project Description

An area traffic control is a system often applied in a big city. A traffic operator controls signals efficiently and intensively by monitoring the traffic situation through CCTV and display showing the congested locations graphically. The traffic control center does not only collect traffic data and processes it, but also provides traffic information on internet or on variable message signboards on streets and helps drivers' route choice.

(4) Project Cost and Financing

The total cost for implementation is estimated to be PHP 10 billion. Costs of each components are as follows.

- Data collection system including detectors and CCTV: PHP 4 billion

- Data processing system including Central Processing Unit (CPU), telecommunication network, control room: PHP 5 billion

- Data provision system including variable message signboard: PHP 1 billion

Analysis on economic evaluation and financing options are described in Chapter 10.

(5) Institutional Arrangements

Institutional arrangements have not been discussed yet.

(6) Project Implementation Schedule

The total duration of implementation will be 3 years after completion of schematic design. The implementation schedule expected is listed below.

- Detail design: 12 months

- Construction: 18 months

- Trial operation: 6 months

(7) Preliminary Scoping on Natural and Social Environment

The ATC System project does not carry out geometric design improvement of intersections or widen roads approaching intersections, but only lay down detectors under roadway or put up CCTV and variable message signboards along or over roads. It is presumed that

there would be no major impacts on natural and social environments except minor impacts on street trees, i.e., cut down trees to put up traffic facilities.

Preliminary scoping of the ATC System project was conducted based on the desk research on existing data and information.

Table 8.7.29 Preliminary Scoping of the ATC System Project

	Impact Item	Degree of Impact		Description
		Const.	O&M	
Pollution	Air Quality	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Water Quality	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
Pollution	Soil Contamination	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Waste	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Noise & Vibration	B-	D	Construction Phase: Construction vehicles and equipment may cause noise and vibration at and around the construction site. Operation Phase: No or insignificant impact is expected.
	Ground Subsidence	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Offensive Odor	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Bottom Sediment	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
Natural Environment	Protected Areas	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Flora, Fauna and Biodiversity	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Hydrological Situation	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Topography & Geographical Feature	D	D	Construction Phase: No or less impact is expected. Operation Phase: No or less impact is expected.
Social Environment	Involuntary Resettlement	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	The poor & Vulnerable Group	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Indigenous & Ethnic People	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
Social Environment	Local Economy (Employment, Livelihood, etc.)	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Land-use & Utilization of Local Resources	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Water Usage or Water Rights and Rights of Common	N/A	N/A	
	Existing Social Infrastructures and Services	B-	D	Construction Phase: Social infrastructure such as roads, power transmission line, water supply, and roads will be affected in the time of the construction. Operation Phase: No or less impact is expected.

	Impact Item	Degree of Impact		Description
		Const.	O&M	
	Social Institutions (Split of Communities, etc.)	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Misdistribution of Benefit & Damage	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
Social Environment	Local Conflicts of Interest	D	D	Construction Phase: No specific impact is expected. Operation Phase: No specific impact is expected.
	Cultural Heritage	D	D	Construction Phase: No specific cultural and historical heritage needed to be conserved are identified in this area. Operation Phase: No specific impact is expected.
	Landscape	B^-	D	Construction Phase: The project may cause landscape disturbance during the construction phase because of fences and construction machineries. Operation Phase: No or insignificant impact is expected.
	Gender	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Children's Rights	N/A	N/A	
	Hazards (Risks), Infectious Diseases (HIV/AIDS)	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.
	Working Conditions	$B^{+/-}$	D	Construction Phase: Accidents involving workers may occur if safety measures are not taken care of properly and seriously. A construction takes health care and precautions seriously, so workers may benefit from such provisions. Operation Phase: No or less impact is expected.
Others	Accidents	B^-	D	Construction Phase: Accidents involving workers and traffic accidents involving pedestrians walking near the project site may occur. Operation Phase: No or less impact is expected.
	Global Warming	D	D	Construction Phase: No or insignificant impact is expected. Operation Phase: No or insignificant impact is expected.

A: Significant positive/negative impact is expected + Positive impacts - Negative /Adverse impacts

B: Moderate positive/negative impact is expected.

C: Extent of positive/negative impact is unknown (Examination is needed)

D: No or less positive/negative impact is expected.

Source: JICA Project Team

9 PRELIMINARY FEASIBILITY STUDY ON MANDAUE–LAPU-LAPU BRIDGE (4th MACTAN BRIDGE) AND MANDAUE COASTAL ROAD PROJECT

9.1 Project Background and Scope

1) Project Background

General project background is described in Chapter 8.7.

The 4th Mactan Bridge with Mandaue Coastal Road is included in the Philippine Investment Program (PIP), which still needs to be approved and finalized. The Scenic Coastal Road is included in the list of priority programs, activities, and projects (PAPs) of DPWH 7 for inclusion in the FY 2018 budget proposal of the DPWH Central Office, which was endorsed by RDC per Resolution No. 9-A (S. 2017). DPWH Strategic Infrastructure Programs in 2017 is including the implementation of Mandaue Coastal Road, i.e. Mandaue Coastal Road is part of Mandaue–Liloan Diversion Road Plan by DPWH.



Source: JICA Project Team

Figure 9.1.1 Road Network Plan at Mandaue-Mactan Link Bridge

2) Objectives

The objective of the 4th Mactan Bridge with Mandaue Coastal Road Construction project aims to maximize the economic growth by securing sufficient traffic capacity between main Cebu Island and Mactan Island as well as the social and ecological benefits through the reduction of travel time and CO_2 emissions.

3) Scope of the Project

The Project includes the following roadway components.

(i) Construction of a new 4-lane road for 4th Mactan Bridge and 4-lane road viaduct and access road for Mandaue Coastal Road.

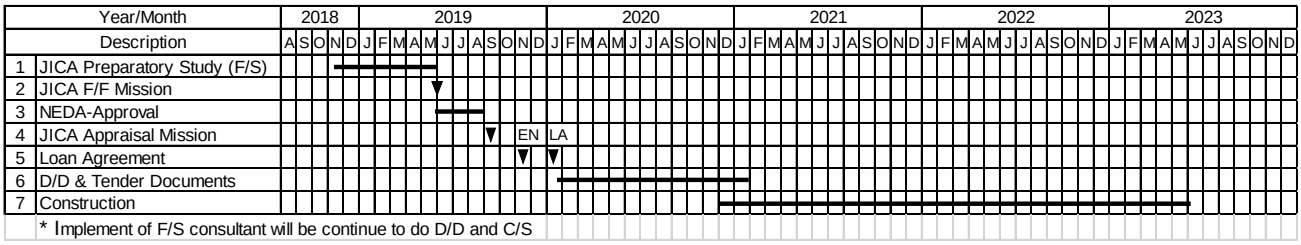
(ii) Construction of the Mandaue–Lapu-Lapu Link main bridge structures with two interchange (connecting ramp for Mandaue Coastal Road and Connecting Ramp for M.L. Quezon National Highway in Lapu Lapu City).

(iii) Construction of Mandaue Coastal Road Viaduct, which is part of Mandaue-Liloan Diversion Road.

4) Evaluation of Dual Mode Bridge and Separated Bridges of Road and UMRT

In order to construct the rail and road bridges together as a dual mode bridge, the details of each bridge, such as construction specifications, implementation scheme and schedule etc., need to be determined in advance with close coordination with the DOTr, DPWH, and LGUs. As previously described in Chapter 3, according to the future road network analysis, the 4th Mactan Bridge needs to be constructed at the earliest opportunity following the schedule as shown in Table 9.1.1 to mitigate the current serious traffic congestion.

Table 9.1.1 Implementation Schedule of the 4th Mactan Bridge (Fast Track: tentative)



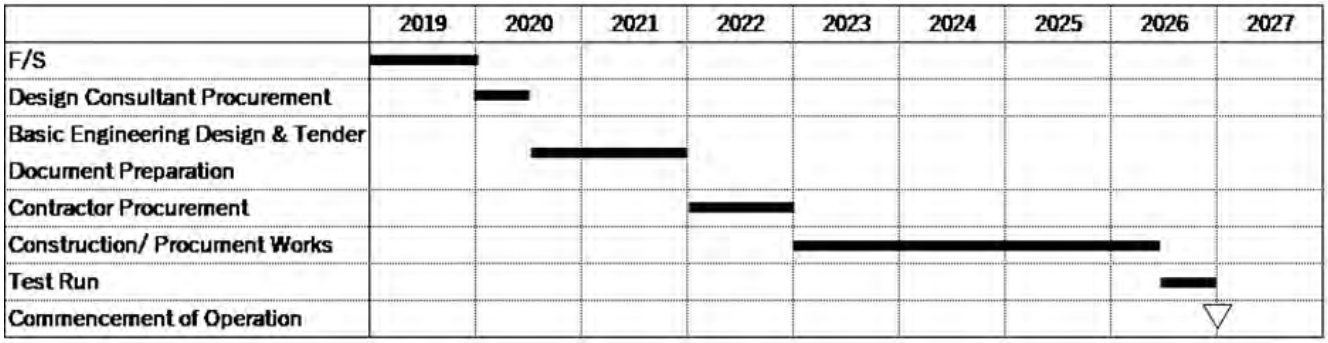
Source: JICA Project Team

While future UMRT network analysis indicates the necessity of the rail bridge, which will be a part of UMRT Coastal Line by around 2030, the UMRT Central Line has higher priority for the implementation according to the future UMRT network analysis previously described. Tables 9.1.2 and 9.1.3 show the tentative implementation schedule of UMRT Central Line and Coastal Line, respectively.

A comparison of those tables show a 7-year gap that will occur between the implementation years of the 4th Mactan Bridge and UMRT Coastal Line including the rail bridge. Although a dual-mode bridge could be less expensive (approximately PHP 9.45 billion[1]) than construction of separate road and rail bridges (approximately PHP 10.62 billion[1]), this difference could be offset by the interest earnings of the capital cost of the rail bridge. If a 5.5% interest rate that is the 5-year yield curve for the Philippine Treasuries were applied, interest earnings would exceed the savings (PHP 1.17 billion) from the 7th year. In other words, financial advantage of the dual mode bridge would diminish if the construction of railway were delayed more than 7 years after completion of the bridge in this estimation.

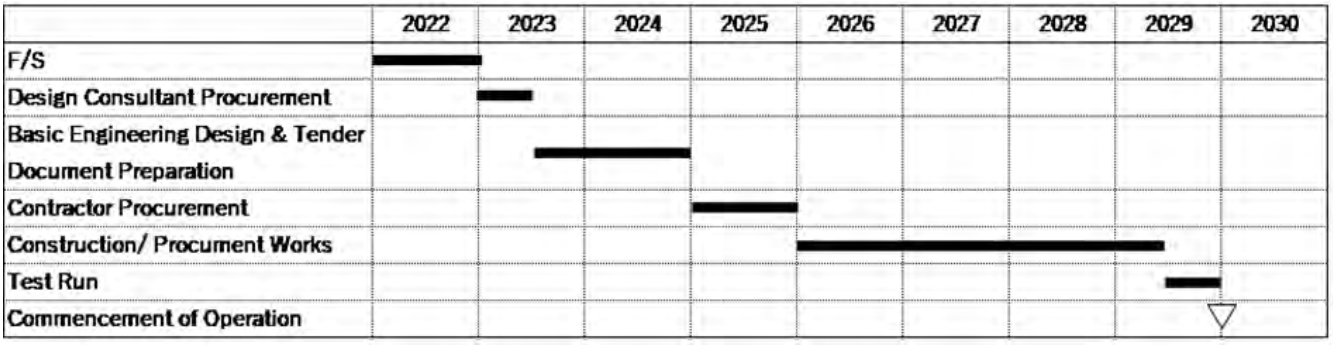
[1] According to the preliminary cost estimates as of May 2018.

Table 9.1.2 Implementation Schedule of UMRT Central Line (Central Section, Phase 1: tentative)



Source: JICA Project Team

Table 9.1.3 Implementation Schedule of UMRT Coastal Line (Phase 1: tentative)



Source: JICA Project Team

As previously described, specifications of the railway system needs to be determined prior to the commencement of detailed design to construct the dual mode bridge since it is not practical and feasible to change the railway system including the guided system after the completion of base structure. The railway system of UMRT Coastal Line has to be determined based on the agreement between DOTr and DPWH by 2019 prior to the commencement of the detail design of the 4th Mactan Bridge, whereas if the railway bridge were constructed separately, railway system could be studied until the end of 2022 as shown in Table 9.1.3. Since selection of the railway system requires intensive study and coordination among stakeholders even for the regular railway construction project, feasibility for such significant decision making about 3 years ahead based on the consensus of stakeholders needs to be carefully examined and confirmed.

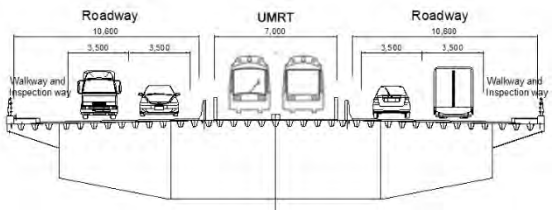
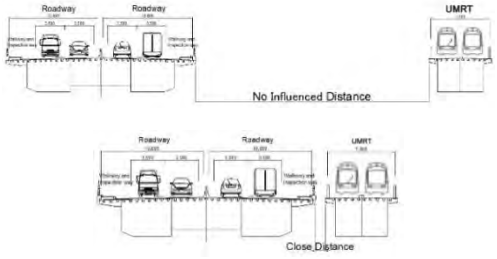
Moreover, due to the number of unsolicited proposals for railway projects from the private sector, such as Guangzhou Metro China; Guangzhou Metro & Design Institute China; Anhui Shengyun Environmental Protection Group Co (China); Guangdong Hydropower Co., Ltd. (China); Harvest Global Investments Limited (Singapore); and Sinophile Sheng Yun Management Inc. (Philippines), coordination for establishment of the railway system in Metro Cebu has become complicated. According to the newspaper articles, the private sector is working with DOTr since last quarter of 2017 for the construction of elevated and underground LRT that connects Cebu and Mactan Islands. This Cebu LRT project will be funded by One Belt One Road Program of Chinese Government. The article says that the construction may start immediately in early 2019 and target for completion by 2022.

While supplemental LRT system will be necessary for future Metro Cebu, the Project has identified the significant importance of UMRT Central Line with sufficient capacity to connect entire Metro Cebu as well as UMRT Coastal Line. Consequently, implementation process and approach for these projects will be continuously studied in the Project to reflect on the transport master plan. On the other hand, in order to mitigate the serious traffic congestion issues between Cebu and Mactan Islands in the most prompt manner, the 4th

Mactan Bridge is recommended to construct as a road bridge and its feasibility study should be commenced as soon as possible to meet the schedule shown in Table 9.1.1.

Evaluation for options (i) dual mode bridge (ii) separate rail and road bridge, and (iii) road bridge only is summarized in Table 9.1.4.

Table 9.1.4 Technical Evaluation for Bridge Type of Road and Rail Bridge

	Type-1 Dual Mode Bridge	Type-2 Separated Bridge
Cross section	 Dual mode bridge	 Independent rail bridge and road bridge
Construction cost	(i) In the case that rail and road service start simultaneously • Cost effective because foundation and a part of superstructure can be shared by road and train. • Implementation of Coastal Line earlier than the original schedule could delay the completion of Central Line due to the limited financial and human resources.	• Less cost-effective due to two foundations and two superstructures • Construction period of use of marine for will be twice. • Rail and Road bridges are able to be constructed under separate schedule in response to the traffic demand in Metro Cebu.
	○ Good	
	In the case that railway service starts later or no service • Advantage of construction cost could be offset if railway were constructed several years later the completion of the roadway. • If railway development failed, additional investment for railway would be in vain.	
	× Poor	○ Good
Flexibility in change of railway mode and system	• Railway guided system and other relevant systems need to be determined by when detailed design of roadway is completed and cannot be changed later.	• Railway guided system and other relevant systems are supposed to be determined in accordance with the implementation schedule of the railway bridge irrelevant to the roadway bridge.
	△ Fair	◎ Excellent
Construction period and commencement of service	(i) In the case that rail and road service start simultaneously • As detailed design and construction include both road and railway, construction period will be longer than other cases and commencement of roadway service will be delayed comparing to the other cases.	• Roadway service will start earlier than Type 1 due to the shorter construction period for the independent roadway bridge comparing to the dual mode bridge. • Railway service will be able to start in accordance with the preferred railway development schedule (after the completion of UMRT Central Line).
	× Poor	
	In the case that railway service starts later or no service • Roadway service will be limited during the construction of railway. • Total periods for the construction of rail and road parts will be longer than the case above.	
	△ Fair	◎ Excellent
Uncertain risks towards the implementation of	• Following aspects includes risks due to the lack of precedent. Maintenance and operation by multiple government agencies Determination of railway system earlier than the detailed design period for the regular (single mode) rail bridge. Coordination between the purely public funded road portion and railway portion which involves the possibility	• No issues in terms of coordination of roadway and railway development due to their independent structure

roadway and railway bridge	for the inclusion of private fund through PPP. Traffic management of roadway during the construction of railway (in the case that railway service will start later than roadway service).	
	× Poor	◎ Excellent
Maintenance and management	• Role and cost sharing need to be clarified between DOTr and DPWTH prior to the completion including the division in charge (i.e. management division of road and train administrator). • If PPP were adopted in railway development the role and cost sharing need to be clarified including the private sector. • Future modification and repair work might influence other functions. • Overall maintenance and its cost could be less due to the less exposure of the structure comparing to the total exposed areas of independent rail and road bridges.	• Role and cost sharing are clear including the management division of road and rail bridges. • Future modification and repair work will not influence each other. • Overall maintenance and its cost could be higher than a dual mode bridge due to the larger exposed areas of rail and road bridges.
	△ Fair	○ Good
Technical issues	• Less impact of ROW acquisition than Type2 (minimum width for securing both railway and roadway functions). • Wind stability will be secured by additional elements such as horizontal plate according to past experience.	• More impact of ROW acquisition than Type 1. • Wind stability will be secured by additional elements such as horizontal plate according to the past experience for road bridge. Detailed study of wind stability for rail bridge needs to be conducted with consideration due to its narrow width.
Technical innovation	• The bridge will be the longest steel box girder bridge in the Philippines. • The bridge is the first dual mode bridge in the Philippines. • The bridge will contribute to the development of Philippine bridge technology.	• The bridge will be the longest steel box girder bridge in the Philippines. • The bridge will contribute to the development of Philippine bridge technology.
	◎ Excellent	◎ Excellent
Evaluation	**NOT Recommend**	**◎Recommend**

Source: JICA Project Team

9.2 Selection of Alternative Route

1) Selection of Alternative Route for Mandaue Coastal Road

Mandaue Coastal Road is part of the Mandaue–Liloan Diversion Road and its F/S is under implementation.

Several alternative routes were selected by DPWH and currently studied. Basically, the final route alignment adopts the alignment based on the future road network recommended by JICA Project Team. This route alignment has also been accepted by Mandaue City.

Since the alignment proposed by DPWH is located along the coastal residential and industrial areas in Mandaue City, many houses and factories will be affected. JICA Project Team has then chosen an alternative route (see Figure 9.2.1) among the options DPWH proposed in order to minimize the impact.

While Mandaue-Lapu Lapu Link Bridge will be connected with the proposed Mandaue Coastal Road, connection with the existing bridges should be studied through the F/S which is currently underway.



Source: JICA Project Team

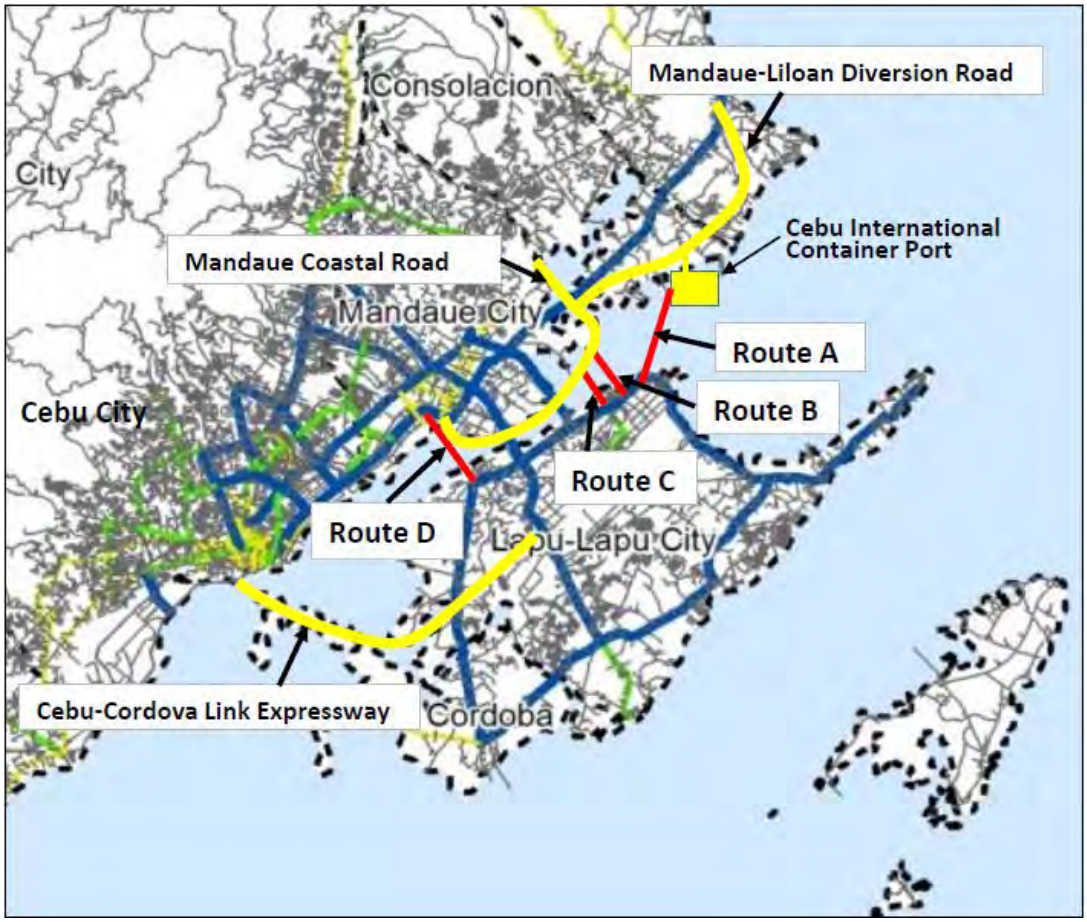
Figure 9.2.1 Alternative Route for Mandaue–Liloan Diversion Road

2) Selection for Alternative Route Location of 4th Mactan Bridge with Bridge Structure Type

(1) Selection of Alternative Route Location

Four alternative locations have been proposed for the 4th Mactan Bridge as well as the routes associated with the bridges at the alternative locations as shown in Figure 9.2.2.

- **Alternative Route A.** From New Cebu International Container Port in Consolacion to Quezon National Highway at Northern side of MEPZ-1 at the north of Lapu-Lapu City.
- **Alternative Route B.** From Mandaue Coastal Road in Mandaue City to Quezon National Highway running at northern side of MEPZ-1 in Lapu-Lapu City.
- **Alternative Route C**. From Mandaue Coastal Road in Mandaue City to Quezon National Highway and Airport Road at Mactan Cebu International Airport in Lapu Lapu City.
- **Alternative Route D.** From Ouano Avenue in Mandaue City to S. Osmena Rd. at Plobacion in Lapu-Lapu City Mactan Center.



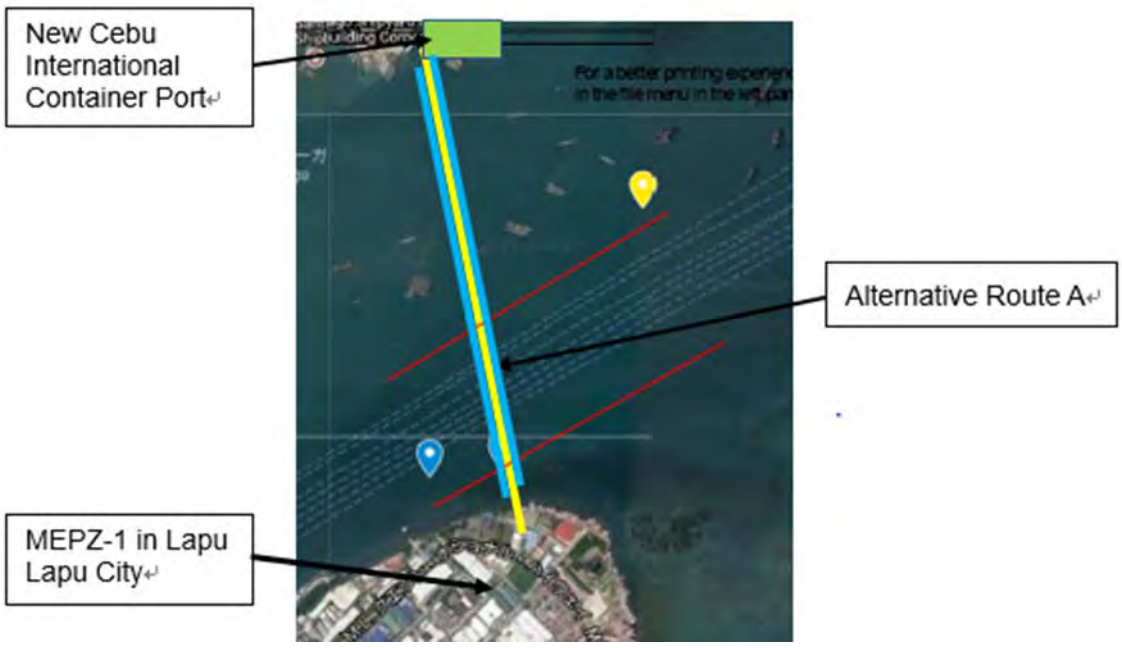
Source: JICA Project Team

Figure 9.2.2 Location Map of Alternative Route

(2) Route Alignment for Each Alternative Route

(i) Alternative Route A

Alternative Route A has direct connection to New Cebu International Container Port located at Consolacion. Route plan for Alternative Route A is shown in Figure 9.2.3.



Source: JICA Project Team

Figure 9.2.3 Alignment for Alternative Route A (1)

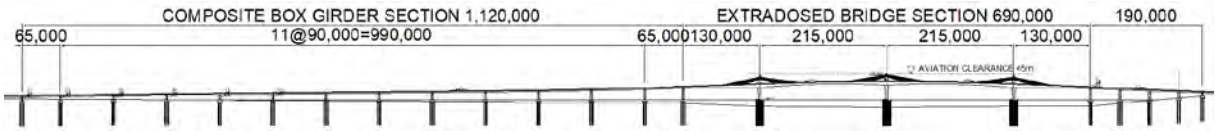
Main navigation width is estimated around 430 m due to the location of navigation safety facility owned by CPA. Furthermore, the bridge has to secure the safety of navigation to the shipyard in Consolacion. Navigation width for Alternative A is shown in Figure 9.2.4.



Source: JICA Project Team

Figure 9.2.4 Alignment for Alternative Route A (2)

There is no bridge type that supports main span with 430 m length and bridge height less than the aviation clearance of 45 m. Therefore, the bridge with two main spans with 215 m length, which has two divided navigation routes, has been proposed. The bridge types in accordance with this navigation width and aviation clearance are (i) extra-dosed Bridge, (ii) steel truss bridge and (iii) steel box girder bridge, among others. Considering the existing conditions, a continuous extra-dozed bridge is recommended. General view of bridge type for Alternative A is shown in Figure 9.2.5.



Source: JICA Project Team
Note: (Main Span 130+215+215+130m, 4-span continuous extra-dosed bridge)

Figure 9.2.5 Bridge Type for Alternative Route A

(ii) Alternative Route B

Alternative Route B connects from Mandaue Coastal Road in Mandaue City to MEPZ-1 in Lapu-Lapu City through Quezon National Highway. The route plan for Alternative Route B is shown in Figure 9.2.8.

Minimum span length is 260 m under conditions of not installing a structure in the navigation route and navigation safety facility. Aviation clearance is 45 m. The bridge types in accordance with this navigation width and aviation clearance are (i) steel box girder bridge and (ii) steel truss bridge. Suspended structure is not suitable for the low aviation clearance.

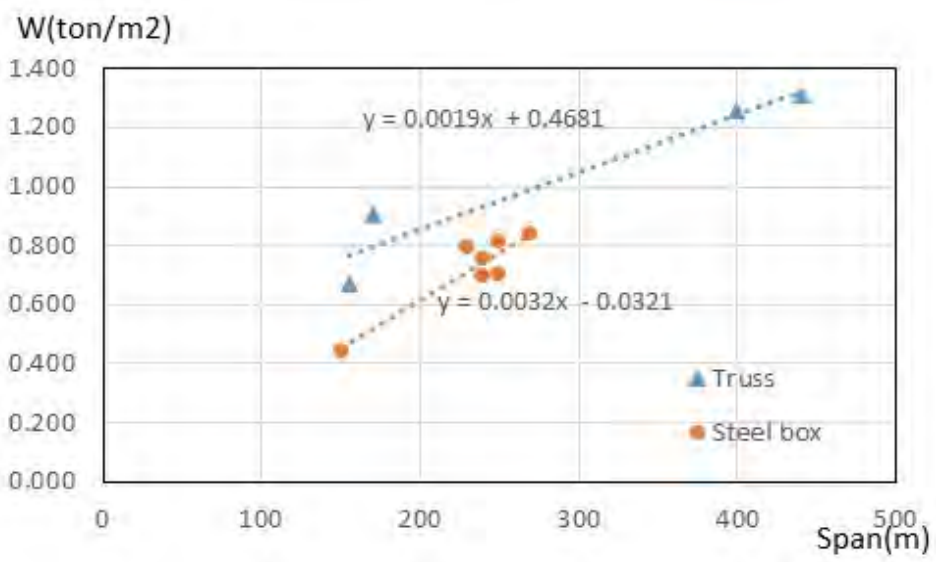
As a bridge type crossing a strait between Cebu and Mactan Island, a truss type was recommended by a JICA survey in 2015 and extra-dozed type was recommended by an IDI survey in 2014. These bridge types are the same type with the Osmeña bridge (1st Mactan bridge) and Marcelo Ferman Bridge (2nd Mactan bridge), and both bridge forms may give the same impression to people. The 3rd Mactan Bridge that is still under planning is a cable-stayed bridge.

Considering the iconic characteristics and roles expected of the new bridge and its high technical innovation and economic efficiency, the bridge types were restudied. For routes B, C, and D, which cross the strait, a steel box girder bridge that is economical and give an innovative impression is recommended. Comparison of bridge type is shown in Table 9.2.1 and general view of bridge type for Alternative B is shown in Figure 9.2.7.

Table 9.2.1 Comparison of Bridge Type

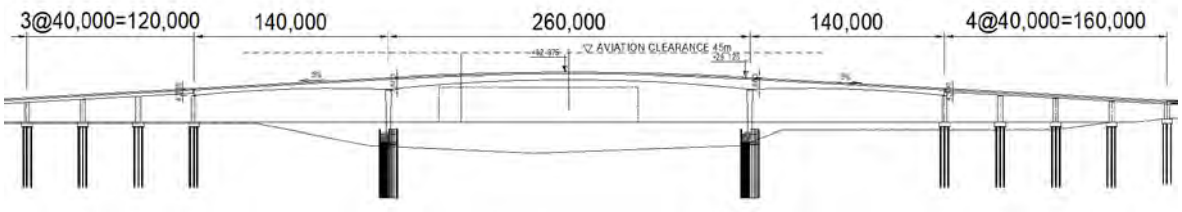
	Truss bridge	Steel Box girder bridge
Steel weight	14700ton (1.23)	12000ton (1.00)
	○ Good	◎ Excellent
Technical Innovation	High performance steel, Steel pipe sheet pile foundation	High performance steel, Steel pipe sheet pile foundation 7th long span in the world
	◎ Excellent	◎ Excellent
Aesthetic	The form is characteristic and it is suitable for a gate of metro Cebu. However, this is the same form as the first Mactan bridge, and is less individuality.	The form give beautiful slender line and elegant. It is suitable for a gate of metro Cebu.
	○ Good	◎ Excellent
Maintenance	More time and effort will be needed for much components.	Less maintenance cost since components and exposure area decrease
	○ Good	◎ Excellent
Total	Small deformation by high rigidity structure but less cost, maintenance and individuality in metro Cebu.	World class bridge with economical and suitable for a gate of metro Cebu
	2nd	◎ Recommended (1st)

Source: JICA Project Team



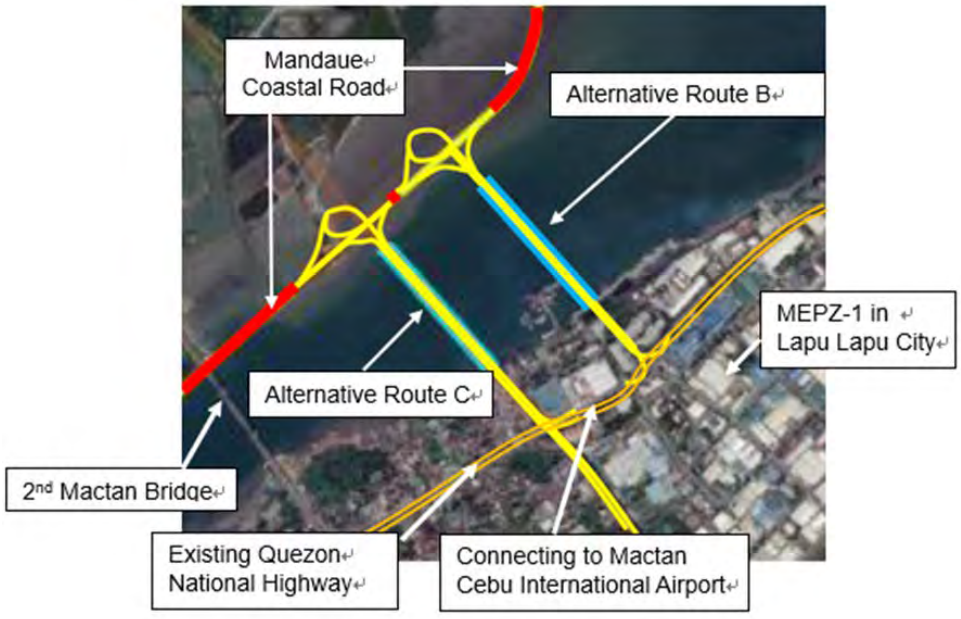
Source: JICA Project Team

Figure 9.2.6 Steel Weight of Truss Bridge and Steel Box Girder Bridge



Source: JICA Project Team
Note: 140m+260m+140m Steel Box Girder Bridge

Figure 9.2.7 Bridge Type for Alternative Route B



Source: JICA Project Team

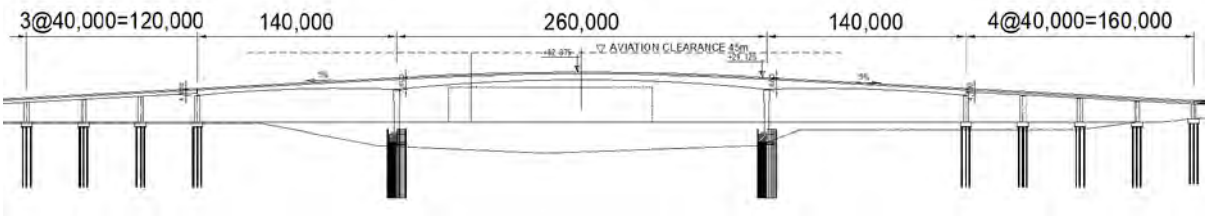
Figure 9.2.8 Alignment for Alternative Route B and C

(iii) Alternative Route C

Alternative Route C connects from Mandaue Coastal Road in Mandaue City to MEPZ-1 in Lapu-Lapu City through Quezon National Highway. The route plan for Alternative Route C is shown in Figure 5.2.8.

Minimum span length is 260 m under conditions of not installing a structure in the navigation route and navigation safety facility. Aviation clearance is 45 m. The bridge types that satisfy this navigation width and aviation clearance is (i) steel box girder bridge and (ii) steel truss bridge. Process for selection of bridge type for Alternative Route C is same as Alternative Route B.

Steel Box Girder Bridge for Alternative C is recommended being economical and gives an innovative impression. The general view of this bridge type is shown in Figure 9.2.9.



Source: JICA Project Team
Note: 140m+260m+140m Steel Box Girder Bridge

Figure 9.2.9 Bridge Type for Alternative Route C

(iv) Alternative Route D

Alignment of Alternative D connects from Ouano Avenue at Mandaue New Development Area in Mandaue City to S. Osmena Rd. at Barangay Poblacion in Lapu-Lapu City. The route plan for Alternative Route D is shown in Figure 9.2.10.



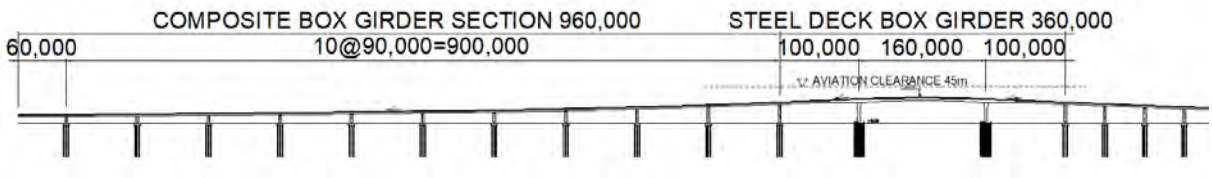
Source: JICA Project Team

Figure 9.2.10 Alignment for Alternative Route D

The navigation width of Route D is the same as Osmeña Bridge at 120 m. There are port facilities located on the west side from the main route. It is not desirable to install many piers that could disturb cruise of a vessel.

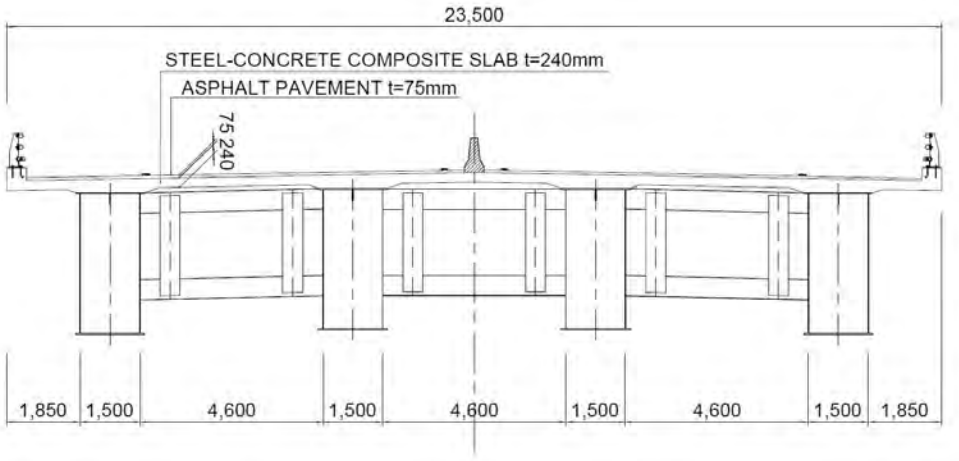
Bridge types that satisfy this navigation width and aviation clearance are (i) extra-dosed bridge, (ii) steel truss bridge, (iii) steel box girder bridge and (iv) PC-box girder, among others.

Steel box girder bridge of 100+160+100m is recommended for main bridge being economical and gives an innovative impression. The span length of an approach bridge shall be 90 m so as not to disturb cruise in port, and the composite girder bridge with narrow box is recommended. General view of bridge type for Alternative D is shown in Figure 9.2.11.



Source: JICA Project Team
Note: 60+10@90; Composite girder and 100+160+100m; Steel Box Girder Bridge

Figure 9.2.11 Bridge Type for Alternative Route D



Source: JICA Project Team

Figure 9.2.12 Composite Girder Bridge with Narrow Box Girder Type

(v) Summary of Bridge Type for Each Alternative Route

The summary of bridge type for each alternative route based on the above study is summarized in Table 9.2.2.

Table 9.2.2 Summary of Bridge Type of Each Alternative Route

Alternative Route	Bridge length over water	Inviolable Navigation by safety facilities (Design Navigation Clearance)	Aviation Clearance limit	Navigation Clearance Limit	Bridge over water	Recommended bridge type
Route A	2000m	430m (unclear)	45m	24.38m (80ft.) at MLLW	65+11@90+65 (West approach; Composite girder) 130+215+215+130m (Extra-dosed), 190m (East approach; PC-girder)	Extra-dosed bridge +Composite girder
Route B	720m	260m (140 x 23m)	45m	24.38m (80ft.) at MLLW	140+260+140 (Steel box girder) 180m (East approach; PC-girder)	Steel box girder
Route C	640m	260m (140 x 23m)	45m	24.38m (80ft.) at MLLW	140+260+140 (Steel box girder) 100m (East approach; PC-girder)	Steel box girder
Route D	1230m	160m (120 x 23m)	45m	24.38m (80ft.) at MLLW	60+9@90(West approach; Composite girder) 100+160+100(Steel box girder),	Steel box girder +Composite girder

Source: JICA Project Team

(3) Traffic Demand Forecast in Year 2030 for Each Alternative Route

Results of the traffic demand forecast in year 2030 for each alternative route are summarized in Table 9.2.3. The cases shown in that table include development of UMRT Central and Coastal Line according to the schedule shown in Tables 9.1.2 and 9.1.3.

Traffic demand forecast of the 3rd Mactan Bridge (Cebu–Cordova Link Bridge) would not be influenced by the 4th Mactan Bridge as long as it is located at north side of the 2nd Mactan Bridge (i.e. alternative routes A–C). While the 4th Mactan Bridge in alternative route D reduces the traffic of the 3rd and 1st Mactan Bridge, traffic volume of the 4th Mactan Bridge significantly exceeds its capacity (50,900 PCU/day, V/C=1.6).

On the other hand, traffic volume distribution in the alternative routes B and C are well-balanced. It means that Alternatives B or C are the preferred locations in the future urban transport network.

Table 9.2.3 Traffic Demand Forecast for Each Alternative Route in Year 2030

Unit: PCU/day

Alternative Route	1st Mactan Bridge	2nd Mactan Bridge	3rd Mactan Bridge	4th Mactan Bridge
A	65,392	55,704	39,213	37,967
B	68,713	50,702	38,208	42,943
C	66,574	48,117	39,224	43,737
D	22,593	61,088	30,873	83,698

Source: JICA Project Team

9.3 Navigation and Aviation Restriction for Each Alternative Route

1) Navigation Clearance

(1) Location

On the east coast of the Cebu Island at the northern end of the Cebu strait.

(2) Port Limits

Cebu Harbor is part of the Strait between Mactan Island and the island of Cebu.

(3) Marine Navigation Restrictions

- Foreign ships are not allowed to pass the North Channel due to the bridge between Mandaue and Opon. However, ships of 24.38 m vertical height from Mean Lower Low Water and length of 91.44 m may pass with utmost care.
- Draft limitation of 12.19 m for Cebu Channel while port established berthing space vary from 3.05 to 9.14 m.
- Ballast and oil are prohibited to be discharged within the Cebu Harbor and Philippine waters.
- The Mandaue–Mactan Bridge and the Marcelo Fernan Bridge crossing the North Channel are open to traffic with a clearance of 23.16 m (76 ft.) at MLLW and 24.38 m (80ft.) at MLLW.

(4) Fairway

Vessels can enter the harbor through the narrow strait either from the northeast or from the south. With the 25.3 m vertical clearance of Cebu–Mactan Bridge, large ocean-going vessels and some inter-island vessels have to take the south entrance. The northeast channel is narrow. It has a navigable width of at least 50 m and a controlling depth of 8.8 m. It is comparatively straight and properly marked with beacons, buoys, and lights for navigational guides. The channel from the southern approach is wider at 805 m or 0.5 miles wide at the narrowest point.

To achieve maximum safety to sea navigation, the port is equipped with the following safety facilities.

- **Cebu North Channel.** Black Buoy No. 1, Red Buoy No. 2, Bantolino Beacon No. 3, and White Beacon fronting Pier No. 1.
- **Cebu South Channel.** Lawis Lighthouse and Red Buoy C No. 3, Black Buoy C No. 1, Red Buoy C, Beacon No. 2, Capitol Light, Ludo Wharf, San Nicolas Church red-lighted cross, and Compania Maritima Building.



Source: JICA Project Team

Figure 9.3.1 Location of Navigation Buoy

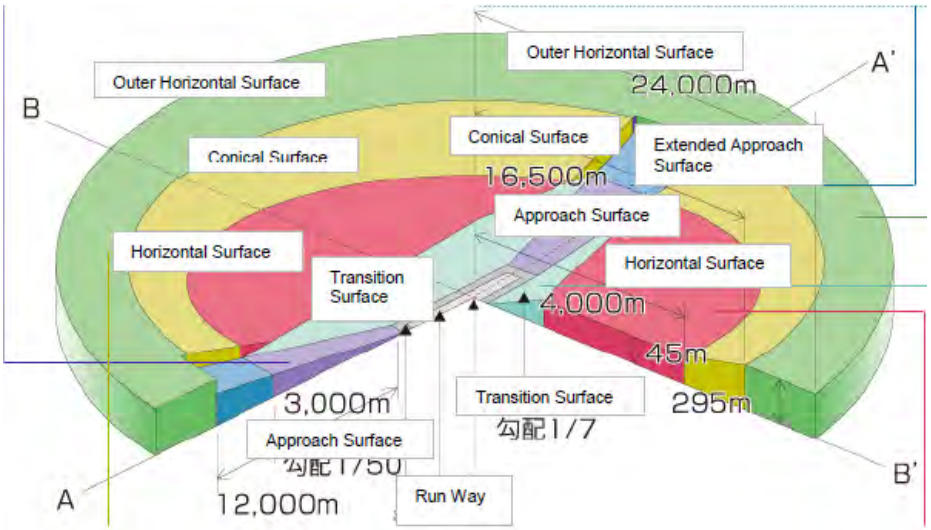
2) Aviation Clearance

(1) Location

Cebu International Airport at Lapu-Lapu City in Mactan Island.

(2) Aviation Height Restriction

Aviation clearance height restriction for any structure height limit at a 4-km area is H=45 m and all alternative routes are within 4 km area. Aviation clearance area and height is shown in Figure 9.3.2 and Figure 9.3.3.



Source: JICA Project Team

Figure 9.3.2 Schematic for Aviation Height Restriction



Source: JICA Project Team

Figure 9.3.3 Aviation Height Restriction Area for 4 km

9.4 Natural and Social Environmental Condition for Each Alternative Route

A comprehensive social and environmental study was performed to determine potential adverse impacts of the construction and operation of the Project. While there are inherent social concerns and environmental risks, these could be addressed and mitigated with the corresponding and effective measures during construction of the project to ensure that the social and environmental conditions "without the Project" could be preserved and also improved "with the Project."

1) Natural Environmental Condition

There are no any affected mangrove or other natural impact in all alternative routes.

2) Social Environmental Condition

Many informal settlers exist along the coastal area of Mandaue City and Lapu-Lapu City, but all alternative routes do not.

Table 9.4.1 shows the number of affected houses and factory in each alternative route.

Table 9.4.1 Number of Affected House and Factory for Each Alternative Route

Alternative Route	Location	Affected House	Affected Factory	Remarks
A	Consolacion Side	0	0	
	Lapu-Lapu Side	0	2	East Asia Utilities Corp. Phil-Union Frozen Foods, Inc.
B	Mandaue Side	0	0	
	Lapu-Lapu Side	0	1	First Glory Phils. Inc.
C	Mandaue Side	0	0	
	Lapu-Lapu Side	0	1	Muramoto Audio-Visual Phils., Inc.
D	Mandaue Side	0	0	
	Lapu-Lapu Side	90	3	School, market, factory, etc.

Source: JICA Project Team

Route D needs widening at G.Y. Serna Street. A total of 90 houses including a market and three factories would be affected in this alternative route.

9.5 Preliminary Project Cost for Each Alternative Route

1) Preliminary Cost Estimate

The construction cost estimates were derived in part of the approved budgets of recent DPWH projects from proposals, from private sector proponents of related projects, and from recent feasibility studies. The building of a superstructure on Mactan Strait using big barges with special crane was considered in the costing and temporary crane was also considered at sea near the island. Construction of sub-structure using steel pipe sheet pile well foundations was also considered.

Unit costs for the construction items are in Table 9.5.1 and the summary of the unit cost for the items associated with ROW are in Table 9.5.2.

Project costs (construction cost and ROW acquisition cost) of each alternative routes were

estimated based on the unit costs shown in Tables 9.5.1 and 9.5.2 and summarized in the next section.

Table 9.5.1 Unit Cost for each case of Bridge/Viaduct construction

Item	Unit Cost * (PHP/m²); ** (PHP/ramp)	Note
4 Lane At-Grade	15,000 *	With calculation based on other sample Project in Philippines
4 Lane Bridge Over River	56,000 *	With calculation based on other sample Project in Philippines
Viaduct: Second Level (over water)	90,000 *	With calculation based on other sample Project in Philippines
Viaduct: Second Level (over sea)	150,000 *	With calculation based on other sample Project in Philippines. This cost is additional cost to account for crane way in the sea and election from barges and soft ground conditions.
Long Span Bridge: Forth level (over Mactan straight)	470,000 *	With calculation based on other sample Project in Philippines. This cost is additional cost to account for crane way in Mactan straight and election for superstructure from big barges with special crane and sub-structure need special method.
On/off Ramp: Second level	150,000,000 **	Assuming 6.0 m width, 250.0 m long ramp
On/off Ramp: Third level	300,000,000 **	Assuming 6.0 m width, 500.0 m long ramp
Tunnel	1,200,000,000 **	2 lanes Tunnel with Tunnel Facilities per km

Source: JICA Project Team

Table 9.5.2 Unit Cost for ROW acquisition and land improvement

Item	Unit Cost (PHP/m²)	Note
ROW Acquisition (Cebu City)	50,000	Market price assumption only.
ROW Acquisition (Mandaue City)	50,000	Market price assumption only.
ROW Acquisition (all other LGU)	30,000	Market price assumption only.
Land Improvement Cost	22,000	With reference to average values assumed in DPWH comparative study.

Source: JICA Project Team

2) Preliminary Project Cost Estimate for Each Alternative Route

(1) Alternative Route A

Alternative Route A construction cost is indicated in Table 9.5.3 and its ROW acquisition and land improvement cost estimate is in Table 9.5.4.

Table 9.5.3 Construction Cost Estimate for Alternative Route A

Item	Quantity		Unit Cost (PHP/m2)	Cost (PHP)	Note
4 lane at-grade	3,390	m²	15,000	50,850,000	
Viaduct second level (over sea)	29,606	m²	150,000	4,440,900,000	
Long span bridge: forth level (over Mactan straight)	15,594	m²	470,000	7,329,180,000	
On/Off ramp: second level	1	ramp	150,000,000	150,000,000	Lapu-Lapu side
On/Off ramp: third level	1	ramp	300,000,000	300,000,000	Mactan side
Total				12,270,930,000	

Source: JICA Project Team

Table 9.5.4 ROW Cost Estimate for Alternative Route A

Item	Quantity		Unit Cost (PHP/m^2)	Cost (PHP)	Note
ROW Acquisition (Cebu City)	0	m^2	50,000	0	
ROW Acquisition (Mandaue City)	0	m^2	50,000	0	
ROW Acquisition (All other LGU)	4,890	m^2	30,000	146,700,000	Lapu-Lapu
Land Improvement	8,500	m^2	22,000	187,000,000	
Total				333,700,000	

Source: JICA Project Team

(2) Alternative Route B

The estimated construction cost of Alternative Route B is indicated in Table 9.5.5 and its ROW acquisition and land improvement cost estimate is indicated in Table 9.5.6.

Table 9.5.5 Construction Cost Estimate for Alternative Route B

Item	Quantity		Unit Cost (PHP/m^2)	Cost (PHP)	Note
4 lane at-grade	6,328	m^2	15,000	94,920,000	
Viaduct second level (over sea)	4,068	m^2	150,000	610,200,000	
Long span bridge: forth level (over Mactan straight)	12,204	m^2	470,000	5,735,880,000	
On/Off ramp: second level	1	ramp	150,000,000	150,000,000	Lapu-Lapu side
On/Off ramp: third level	1	ramp	300,000,000	300,000,000	Mactan side
Total				6,891,000,000	

Source: JICA Project Team

Table 9.5.6 ROW Cost Estimate for Alternative Route B

Item	Quantity		Unit Cost (PHP/m^2)	Cost (PHP)	Note
ROW Acquisition (Cebu City)	0	m^2	50,000	0	
ROW Acquisition (Mandaue City)	0	m^2	50,000	0	
ROW Acquisition (All other LGU)	9,780	m^2	30,000	293,400,000	Lapu-Lapu
Land Improvement	9,000	m^2	22,000	198,000,000	
Total				491,400,000	

Source: JICA Project Team

(3) Alternative Route C

The estimated construction cost of Alternative Route C is shown in Table 9.5.7 and the ROW acquisition and land improvement cost estimate is indicated in Table 9.5.8.

Table 9.5.7 Construction Cost Estimate for Alternative Route C

Item	Quantity		Unit Cost (PHP/m^2)	Cost (PHP)	Note
4 lane at-grade	7,006	m^2	15,000	105,090,000	
Viaduct second level (over sea)	2,260	m^2	150,000	339,000,000	
Long span bridge: forth level (over Macton straight)	12,204	m^2	470,000	5,735,880,000	
On/Off ramp: second level	1	ramp	150,000,000	150,000,000	Lapu-Lapu side
On/Off ramp: third level	1	ramp	300,000,000	300,000,000	Macton side
Total				6,629,970,000	

Source: JICA Project Team

Table 9.5.8 ROW Cost Estimate for Alternative Route C

Item	Quantity		Unit Cost (PHP/m^2)	Cost (PHP)	Note
ROW Acquisition (Cebu City)	0	m^2	50,000	0	
ROW Acquisition (Mandaue City)	0	m^2	50,000	0	
ROW Acquisition (All other LGU)	4,890	m^2	30,000	146,700,000	Lapu-Lapu
Land Improvement	8,000	m^2	22,000	176,000,000	
Total				322,700,000	

Source: JICA Project Team

(4) Alternative Route D

The construction cost estimate of Alternative Route D is shown in Table 9.5.9, and the ROW acquisition and land improvement cost estimate are in Table 9.5.10.

Table 9.5.9 Construction Cost Estimate for Alternative Route D

Item	Quantity		Unit Cost (PHP/m^2)	Cost (PHP)	Note
4 lane at-grade	45,652	m^2	15,000	684,780,000	
Viaduct second level (over sea)	19,662	m^2	150,000	2,949,300,000	
Long span bridge: forth level (over Mactan straight)	8,136	m^2	470,000	3,823,920,000	
On/Off ramp: second level	2	ramp	150,000,000	300,000,000	Lapu-Lapu side
On/Off ramp: third level	0	ramp	300,000,000	0	Macton side
Total				7,758,000,000	

Source: JICA Project Team

Table 9.5.10 ROW Cost Estimate for Alternative Route D

Item	Quantity		Unit Cost (PHP/m^2)	Cost (PHP)	Note
ROW Acquisition (Cebu City)	0	m^2	50,000	0	
ROW Acquisition (Mandaue City)	3,500	m^2	50,000	175,000,000	
ROW Acquisition (All other LGU)	35,268	m^2	30,000	1,058,040,000	Lapu-Lapu
Land Improvement	66,178	m^2	22,000	1,455,916,000	
Total				2,688,956,000	

Source: JICA Project Team

9.6 Comparison Study for Each Alternative Route

1) Route Selection Criteria

The various alternative routes of the 4th Mactan Bridge pass through Cebu Strait and connect to MEPZ and Cebu International Air Port. This situation requires an alignment selection criteria that provides emphasis or considerations to evaluation items based on special conditions/situations.

The evaluation items for the selection criteria based on special conditions/situations of the project are shown in Table 9.6.1.

Table 9.6.1 Alignment Selection Criteria

Selection Criteria	Points
Construction Cost and ROW Acquisition Cost	40
Construction Cost	30
ROW Cost	10
Social Environmental Considerations	20
Number of Houses affected by the project	20
Natural Environmental Considerations	10
Roadside Air pollution Impact	5
Roadside Noise Impact	5
Construction Aspect	10
Construction duration	3
Requirement for special construction equipment, materials and methods	1
Accessibility to the construction site	2
Availability of temporary construction yard and necessity of big scale of temporary work and/or temporary detour road	2
Scale and difficulty of traffic management	2
Road Network with Traffic Impact	20
Distribution of Traffic Flow by Traffic Demand Forecast	12
Distance to/from MEPZ-1	4
Distance to/from Cebu International Air Port	4

Source: JICA Project Team

(1) Roadside Air Pollution Impact

Roadside air pollution levels will depend on the emission of gaseous pollutants from vehicles. Traffic volume of Route D is the biggest among the other three alternative routes and passes through a populated residential area. Impacts of air pollutants on human health will be significant along roadside in populated residential areas. Traffic volume and average running speed may not be different among the other three alternatives and not passing through populated residential areas.

(2) Roadside Noise Impact

Increase of roadside noise levels will depend on the projected future traffic volume and running speed of vehicles. Traffic volume of Route D is biggest among the other three alternatives. Route D passes through residential and sensitive areas (schools and hospitals). Noise impact on roadside residences will be significant, while traffic volume and average running speed may not be different among the other three alternatives and when not passing through populated residential areas.

2) Comparative Study for Route Selection of 4th Mactan Bridge

The four alternative routes were proposed for comparison study to select the most appropriate route of bridge for each alternative based on route selection criteria.

The comparative study for the four routes of 4th Mactan Bridge is presented in Table 9.7.1.

Results of the comparative evaluation indicate that Alternative Route C garnered the highest rating at 91 points and is the most appropriate route of bridge. Second place is Alternative Route B at 86 points, third place is Alternative Route D at 74 points, and the last is Alternative Route A with the lowest rating at 61 points.

Rating for Route A was affected by highest construction cost and rating for Route D was affected by highest ROW cost.

9.7 Recommendations

The recommended bridge type for 4th Mactan Bridge is Single Mode Bridge Type (Road Bridge), while the most appropriate alternative route is Route C.

Table 9.7.1 Comparison of Alternative Route for 4th Mactan Bridge

Selection Criteria	Points	Alignment Route A		Alignment Route B		Alignment Route C		Alignment Route D	
1. **Construction Cost and ROW Acquisition Cost**									
Construction Cost	30	PHP 12,271 M (1.851)	16	PHP 6,891 M (1.039)	29	PHP 6,630 M (1.090)	30	PHP 7,758 M (1.170)	26
ROW Cost	10	PHP 334 M (1.003)	10	PHP 491 M (1.520)	7	PHP 323 M (1.250)	10	PHP 2,689 M (8.325)	1
Subtotal	40		26		35		40		27
2. **Number of Affected Houses**									
Project Affected Houses or Factory	20	2 factories	10	1 factory	20	1 factory	20	93 (90 houses and 3 factories)	1
Subtotal	20		10		20		20		1
3. **Construction Aspect**									
Construction duration	3	48 months	2	36 months	3	36 months	3	48 months	2
Requirement for special construction equipment, materials and methods	1	Required	0	Required	0	Required	0	Required	0
Accessibility to the construction site	2	Existing roads	2	Existing roads and reclamation area	2	Existing roads and reclamation area	2	Existing roads	2
Availability of temporary construction yard and necessity of big scale of temporary work and/or temporary detour road	2	Mandaue side	2	Mandaue side	2	Mandaue side	2	Consolacion side but not big area	1
Scale and difficulty of traffic management	2	Crucial	1	Lass	2	Less	2	Significant	0
Subtotal	10		7		9		9		5
4. **Natural Environmental Considerations**									
Air pollution	5	Small	1	Small	1	Small	1	Most significant	0
Noise level	5	Small	1	Small	1	Small	1	Most significant	0
Subtotal	10		2		2		2		0

Selection Criteria	Points	Alignment Route A		Alignment Route B		Alignment Route C		Alignment Route D	
5. **Road Alignment and Network and Traffic Impact**									
Distribution of Traffic Flow by Traffic Demand Forecast	12	Affect to 1st & 2nd Mactan Bridge	10	Balanced	12	Balanced	12	Traffic flow is intensively Go to this Bridge & 2nd Mactan Bridge	6
Distance to/from MEPZ-1	4	Very near	3	Very near	4	Very near	4	Very Far	1
Distance to/from Cebu International Air Port	4	Little bit far	3	Near	4	Very Near	4	Very Far	1
Subtotal	20		16		20		20		8
Total	**100**		**61**		**86**		**91**		**74**
		△		○		◎ **Recommended Most Appropriate Route**		△	

Source: JICA Project Team

1) Project Description for Recommended Route of Route C for 4th Mactan Bridge with Mandaue Coastal Road Project

The proposed bridge and approach length is approximately 580 m Main Bridge (Center Span 260 m) + 6.2 km (Approach Viaduct and Mandaue Coastal Road Viaduct) and will have a four-lane roadway. Summary of project description is shown in Table 9.7.2.

The main span length of 4th Mactan Bridge shall be 260 m considering the existing Black Buoy No.1, Red Buoy No. 2, Bantolino Beacon No. 3, and White Beacon fronting Pier No.1 and not becoming an obstacle for cruise vessels. Slender steel box girder was recommended as bridge type from the restriction of structure height by aviation and for its navigation, cost effectiveness, efficiency, and aesthetic. Perspective image of the bridge is shown in Figure 9.7.1 and location of the bridge is in Figure 9.7.2.

The final alignment will be fixed based on the results of detailed topographic and geotechnical surveys during the F/S stage.

Table 9.7.2 Summary Project Description of 4th Mactan Bridge Project

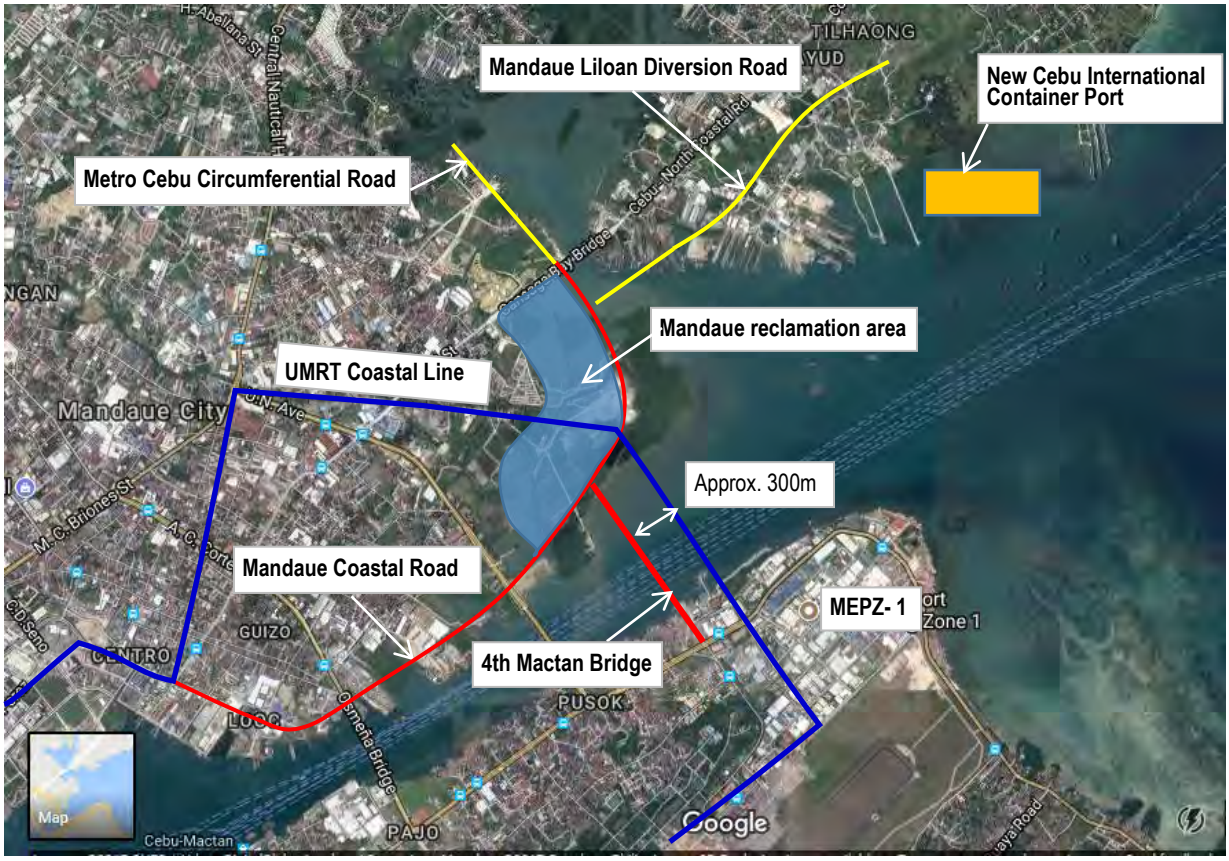
Total Length	6.78 km
➢ 4th Mactan Bridge (Main Bridge 0.14 + 0.26 + 0.14 + 0.04)	0.58 km
➢ Mandaue Coastal Road (Phase-1, 2)	6.20 km
Starting Point	Lapu-Lapu City
Ending Point	Mandaue City
No. of Lanes for Main Bridge	4 Lanes
No. of lanes for Viaduct	4 Lanes
Roadway Width	22.2 m
Right of Way	30 m
Median Island	1.0 meters
Interchanges	2
Viaduct Length	5.70 km
Implementation Period	3 Years
Detailed Engineering Design	16 months
Land Acquisition	Start 2019
Civil Works Construction	36 months
Target Start of Operation	2023

Source: JICA Project Team



Source: JICA Project Team

Figure 9.7.1 Perspective Image of 4th Mactan Bridge



Source: JICA Project Team

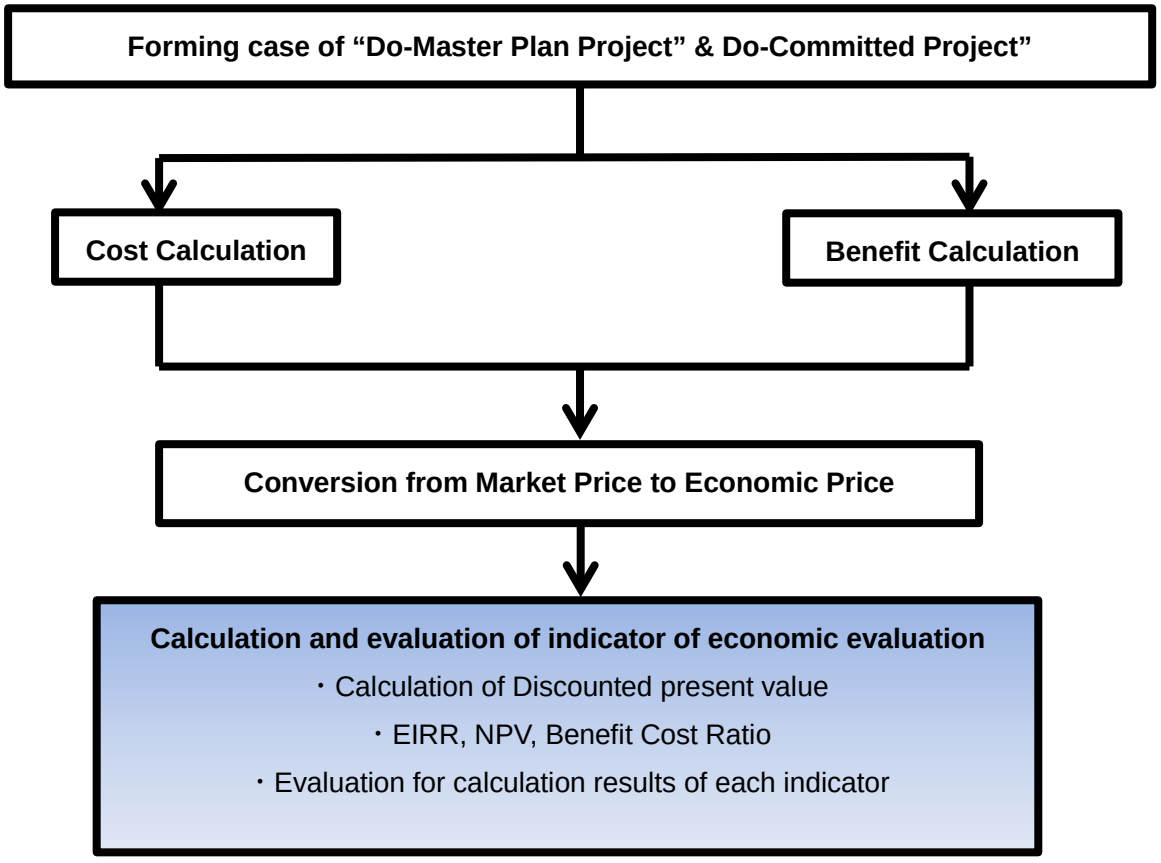
Figure 9.7.2 Location of 4th Mactan Bridge

10 EVALUATION OF URBAN TRANSPORT MASTER PLAN

10.1 Economic Evaluation for Proposed Master Plan

1) Methodology of Economic Evaluation for Master Plan

The JICA Project Team conducted an incremental discounted cash-flow analysis to evaluate the economic viability of the proposed master plan. The economic internal rates of return (EIRRs) and economic net present value (ENPVs) were calculated to determine the viability of the proposed plan. The analysis focused on the assessment of the "Do-Master Plan Project" and "Do-Committed Project" scenarios to measure the incremental impact of the project. Project duration was assumed to be present to target year 2050 of the master plan. Analysis is conducted based on the following Figure 10.1.1.



Source: JICA Project Team

Figure 10.1.1 Analysis Process

2) Proposed Urban Transport Network and System Planning in Master Plan

Proposed projects in the master plan are as follows:

(1) Road Transport Network Plan toward Year 2050

Basic concept of strategic urban road network plan in Metro Cebu is to establish an outer diversion road connecting to the coastal road at the central area of Metro Cebu that suffers

from serious traffic congestion. A list of proposed road and bridge projects in the master plan toward year 2050 is shown in Table 10.1.1.

Table 10.1.1 List for Proposed Road and Bridge Projects

Project Name	Location	Implementation	Length (km)
1. Metro Cebu Circumferential Road (Segment 1)	Cebu, Mandaue, Talisay	New	24.72
2. Metro Cebu Circumferential Road (Segment 2)	Consolacion, Liloan, Danao	New	29.80
3. Metro Cebu Circumferential Road (Segment 3)	Naga, Minglanila	New	17.40
4. Talisay–Naga Diversion Road	Talisay, Naga, Minglanila	New	7.70
5. Mandaue–Liloan Diversion Road	Consolacion, Liloan	New	10.10
6. Cebu Arterial Road Widening Phase 1 Central Section (Complete Street Type A,6 lanes)	Cebu, Mandaue, Consilacion	Upgrade	7.31
7. Cebu Arterial road Widening Phase 2 Central Section (Complete Street Type A, 4 lanes)	Cebu, Tailsay	Upgrade	13.39
8. Cebu Arterial road Widening Phase 3 North Section (Complete Street Type A, 4 lanes)	Liloan, Danao, Consolacion	Upgrade	16.00
9. Cebu Arterial road Widening Phase 4 South Section (Complete Street Type A, 4 lanes)	Talisay, Naga, Minglanila, Carcar	Upgrade	28.50
10. Cebu Coastal Road Widening Phase 1 Central Section (Complete Street Type A, 6 lanes)	Cebu, Mandaue	Upgrade	13.00
11. Cebu Coastal Road Widening Phase 2 Central Section (Complete Street Type A, 6 lanes)	Cebu Tailsay	Upgrade	9.70
12. Mactan Circumferential Road (Road Widening, Complete Street Type A, 4 and 6 lanes)	Mactan island	Upgrade	24.50
13. Guadalupe–Lahug Diversion Road	Cebu City	New	1.60
14. Metro–Cebu Intersection Improvement	Metro Cebu	Upgrade	-
15. Cebu–Cordova Link Expressway Bridge	Cebu City, Cordova	New On–going	3.23
16. Mandaue Coastal Road (Viaduct)	Mandaue	New	6.20
17. Mandaue–Lapu-Lapu Link Bridge	Mandaue, Lapu–Lapu	New	0.64
18. 1st Mactan Bridge Replacement	Mandaue, Lapu-Lapu	Upgrade	2.50
Total			216.29

Source: JICA Project Team

(2) UMRT Network Planning toward Year 2050

Proposed projects for UMRT network planning in the master plan are shown in Table 10.1.2.

Table 10.1.2 List for Proposed UMRT Projects

Project Name	Location	Length (km)
1. UMRT Central Line (Central Section)	Talisay City–Liloan	24.8
2. UMRT Central Line (North Extension)	Liloan–Danao City	17.5
3. UNRT Central Line (South Extension)	Carcar City–Talisay City	25.2
4. UMRT Coastal Line (1st Phase)	Fort San Pedro–Mactan Airport	13.0
5. UMRT Coastal Line (2nd Phase)	Cebu South Coastal Road–Fort San Pedro	12.0

Source: JICA Project Team

(3) Traffic Management Planning

The area traffic control system is the proposed traffic management system for the entire Metro Cebu to gather and provide traffic information.

3) Comparison of Benefits and Costs

(1) Economic Costs of the Project

The economic costs were determined by deducting all taxes included in the financial cost and by applying the shadow wage rate to the unskilled labor component of investment cost. Economic costs were estimated to be equivalent to about 85% of financial cost. The conversion factor applied to the operations and maintenance (O&M) costs were also 85%. Details and basis for calculation of project cost and O&M cost are described in the following sections.

(2) Economic Benefits of Project

The main economic benefits of this master plan are the savings owing to the reduction in vehicle operating cost (VOC) and travel time cost (TTC). The implementation of the proposed projects in the master plan is expected to reduce traffic volume, which in turn will result in shorter travel times and faster vehicle operating velocity. The shorter travel time translates into lower travelling time costs, while the faster vehicle velocity implies lower operating costs. The values of these economic benefits will be based on the willingness to pay for time cost and VOC per trip. Reduction in CO_2 emission is included for additional benefits of mentioned above benefits. Negative benefits of traffic congestion during construction period are not considered in this study.

Calculating the core benefits of the project, the unit VOCs and TTCs were then estimated. The unit VOCs were based on the average operating costs of a representative set of vehicles (Table 10.1.3). The cost items that were considered in the computation were (i) fuel, (ii) lubricant, (iii) tire, (iv) repair, (v) depreciation, (vi) capital opportunity, (vii) overhead, and (viii) crew. The results of the computation were consolidated and expressed as a function of travel speed.

Table 10.1.3 Unit VOC in Cebu, 2018

(in PHP per 1,000 kilometer)

	Speed (km/hour)	Motor Cycle	Car	Public	Tricycle	Truck
Economic Cost	5	10,353	27,333	44,244	20,706	178,178
	10	6,038	16,746	25,742,	12,076	99,240
	20	3,803	11,145	16,308	7,606	59,533
	30	3,038	9,188	13,361	6,076	43,107
	40	2,625	8,182	11,663	5,250	35,274
	50	2,437	7,658	11,658	4,874	31,702
	60	2,421	7,744	12,580	4,842	29,762
	70	2,473	8,024	13,973	4,946	29,308
	80	2,581	8,454	15,527	5,162	30,423
	90	2,756	9,083	16,854	5,512	32,533

Source: JICA Project Team

The estimates of unit TTCs were based on the mode of transportation across household income groups. The monthly TTC per mode of transportation is the weighted average of household income with percentage of vehicle ownership as weights (Table 10.1.4). However, these values represent the value of time while working and not the travel time cost. The average value of travel time per mode of transportation is the product of value of time per hour and the share of business trip and “to work” trip.

Table 10.1.4 Present Time Value of Passengers

(in PHP per 1,000 kilometer)

Motor Cycle	53.6
Car	104.7
Public	54.7
Tricycle	47.9
Truck	64.7

Source: JICA Project Team

The estimates of unit cost of CO2 were based on the following table issued by “Policy Research Institute for land infrastructure, Transport and Tourism”. Estimated CO2 cost in Japan is used for the calculation of benefits in this analysis.

Table 10.1.5 CO2 Cost Used for Evaluation of Transportation Project

USD/tCO2	Approach adopted	2010	2020	2030	2040	2050
France	Abatement Cost	39	123	295	Grows at 4.5% p.a.	
UK(non-traded)	Abatement Cost	40-122	47-142	55-164	106-319	158-473
Norway	Abatement Cost	Before 2015:24		2015-2030:interpolated		After 2030:91
The Netherlands	Abatement Cost	12.6 to 194.90				
Germany	Damage Cost	2010:54-161		2030:94-288		2050:174-523
U.S.	Damage Cost	12-97	13-140	18-174	23-209	28-241
New Zealand	Damage Cost	34.4				
Japan	Damage Cost	25.7				
Sweden	Fuel tax on CO2	For investment <10 years: 128			For investments>10 years:172	

Notes:

1. Carbon values are sourced from a preliminary OECD survey of monetary carbon value in selected member countries.
2. All carbon values were first inflated to 2013 prices in domestic currency using GDP deflator and then converted to USD using PPP conversion factors. GDP deflators and PPP data are sourced from OECD Statistics.
3. A conversion factor of 3.67 is used to convert tCO2 (for Japan)

4) Result of Cost Benefit Analysis

The results of the economic analysis for the master plan are shown in Table 10.1.5. Calculation conditions are as follows:

- Price and cost: Constant price in 2018 was used.
- Computation period: 32 years (27 years starting from operation).
- VAT are not considered.
- Social discount rate is 10%.

The proposed master plan yielded an EIRR of 21.6%, so it is larger than 10% of social discount rate set by NEDA. Thus, this proposed “Master Plan” brings about positive economic effects for national economy of Philippine.

Table 10.1.6 Cost-Benefit Analysis of Urban Transport Master Plan

EIRR		21.6%						
B/C		2.01	(at discounted rate of					10%
NPV	(Million Php)	428,485	(at discounted rate of					10%
								(Php Million)
	Cost			Benefit				Net Cash Flow
	Investment Cost including O&M Cost		Total Cost	VOC	TTC	CO2	Total Benefit	
2019	48,508		48,508					-48,508
2020	20,210		20,210					-20,210
2021	31,984		31,984					-31,984
2022	66,622		66,622					-66,622
2023	54,087		54,087					-54,087
2024	64,837		64,837	39,704	47,711	5.15	87,419	22,582
2025	57,478		57,478	42,776	50,809	5.57	93,591	36,112
2026	43,954		43,954	45,849	53,907	5.99	99,762	55,808
2027	51,014		51,014	48,922	57,005	6.41	105,933	54,919
2028	33,602		33,602	51,995	60,104	6.83	112,105	78,503
2029	10,154		10,154	55,067	63,202	7.25	118,276	108,122
2030	17,291		17,291	58,140	66,300	7.67	124,448	107,157
2031	31,888		31,888	61,213	69,398	8.09	130,619	98,732
2032	35,692		35,692	64,286	72,497	8.51	136,791	101,098
2033	45,281		45,281	67,358	75,595	8.93	142,962	97,681
2034	54,340		54,340	70,431	78,693	9.35	149,133	94,793
2035	65,908		65,908	73,504	81,791	9.77	155,305	89,397
2036	44,488		44,488	76,577	84,890	10.19	161,476	116,988
2037	47,190		47,190	79,649	87,988	10.61	167,648	120,458
2038	50,525		50,525	82,722	91,086	11.03	173,819	123,294
2039	58,911		58,911	85,795	94,184	11.45	179,990	121,080
2040	26,749		26,749	88,868	97,282	11.87	186,162	159,412
2041	4,605		4,605	91,940	100,381	12.29	192,333	187,729
2042	4,605		4,605	95,013	103,479	12.71	198,505	193,900
2043	7,604		7,604	98,086	106,577	13.13	204,676	197,072
2044	4,605		4,605	101,159	109,676	13.55	210,848	206,243
2045	4,605		4,605	104,231	112,774	13.97	217,019	212,414
2046	4,605		4,605	107,304	115,872	14.39	223,190	218,586
2047	4,605		4,605	110,377	118,970	14.81	229,362	224,757
2048	7,604		7,604	113,450	122,069	15.23	235,533	227,930
2049	4,605		4,605	116,522	125,167	15.66	241,705	237,100
2050	4,605		4,605	119,595	128,265	16.08	247,876	243,271
Total	1,012,760		1,012,760	2,150,530	2,375,669	286.5	4,526,486	3,513,725

Source: JICA Project Team

10.2 Economic and Financial Evaluation for Priority Projects

In order to mitigate the serious traffic congestion in Metro Cebu, implementing this proposed "Master Plan" brings about a positive and big economic effect in terms of national economy in the Philippines. Particularly, the combination of improved road network and UMRT network from the proposed "Master Plan" is necessary. Among the various projects previously introduced, the following projects were identified as priority. Economic evaluation was conducted for the five projects and financial evaluation was conducted only to (iii) and (iv) to verify economic and financial viability.

(i) Mandaue–Lapu Lapu Link Bridge (4th Mactan Bridge) with Mandaue Coastal Road

(ii) Metro Cebu Circumferential Road (Segment 1)

(iii) UMRT Central Line (Central Section)

(iv) UMRT Coastal Line (Phase-I)

(v) Metro Cebu Area Traffic Control (ATC) System

1) Economic Evaluation for Priority Projects

(1) Mandaue–Lapu Lapu Link Bridge (4th Mactan Bridge) with Mandaue Coastal Road

The JPT conducted incremental discounted cash flow analysis to assess the economic viability of the proposed "Mandaue–Lapu Lapu Link Bridge (4th Mactan Bridge) with Mandaue Coastal Road". EIRRs and ENPVs were calculated to determine the viability of the proposed this project. The analysis focused on the assessment of the "with-project" and "without-project" scenarios to measure the incremental impact of the project. The duration of the project was assumed to be 32 years, including a construction period of 5 years and an operating period 27 years.

A sensitivity analysis was also carried out to assess the responsiveness of the viability indicators to changes in critical variables such as economic costs and economic benefits.

(i) Economic Costs of the Project

The economic costs were determined by deducing all taxes and price escalation included in the financial cost and by applying the shadow wage rate to the unskilled labor component of investment cost. Economic costs were estimated to be equivalent to about 85% of financial cost. The conversion factor applied to the O&M costs were also 85%. And regarding the detail and basis for calculation of project cost and O&M cost, please refer to the corresponding to the page of this report.

(ii) Economic Benefits of Project

The main economic benefits are the savings because of the reduction in VOC and TTC. A reduction in traffic volume would be expected after project completion, which in turn will result in shorter travel times and faster vehicle operating velocity. The shorter travel time translates into lower travel time costs, while the faster vehicle velocity implies lower operation costs. The values of these economic benefits will be based on the willingness to pay for time cost and VOC per trip. Any additional economic benefits that may be included, e.g., reduction in CO_2 emission, and negative benefits of traffic congestion during construction period are not considered in this study.

In the process of calculating the core benefits of the project, the unit VOCs and TTCs were estimated. The unit VOCs were based on the average operating costs of a representative set of vehicles (Table 10.1.3). The cost items that were considered in the computation were (i) fuel cost, (ii) lubricant cost, (iii) tire cost, (iv) repair cost, (v) depreciation cost, (vi) capital opportunity cost, (vii) overhead cost, and (viii) crew cost. The results of the computation were consolidated and expressed as a function of travel speed.

(iii) Result of Cost Benefit Analysis

The results of the economic analysis for the "4th Mactan Bridge with Mandaue Coastal Road" are shown in Table 10.2.1. Calculation condition are:

- Price and cost: Constant price in 2018 is used.
- Computation period: 32 years (27 years starting from operation).
- VAT are not considered.
- Social discount rate is 10%.

Proposed "4th Mactan Bridge with Mandaue Coastal Road" yielded EIRR 13.0 %, so it is larger than the 10% social discount rate set by NEDA. Thus, this proposed project brings about positive economic effects for national economy of Philippine.

Table 10.2.1 Cost-Benefit Analysis of "Mandaue–Lapu Lapu Link Bridge (4th Mactan Bridge) with Mandaue Coastal Road"

EIRR		13.0%					
B/C		1.35	(at discounted rate of				10%
NPV	(Million Php)	6,320.12	(at discounted rate of				10%
							(Php Million)
	Cost			Benefit			Net Cash
	Investment Cost	O/M Costs	Total Cost	VOC	TTC	Total Benefit	Flow
2019	1,411		1,411			0	-1,411
2020	3,405		3,405			0	-3,405
2021	4,779		4,779			0	-4,779
2022	6,433		6,433			0	-6,433
2023	1,599		1,599			0	-1,599
2024		304	304	291	364	656	352
2025		304	304	583	729	1,311	1,007
2026		304	304	874	1,093	1,967	1,663
2027		304	304	1,166	1,457	2,623	2,319
2028		1,824	1,824	1,457	1,821	3,279	1,454
2029		304	304	1,749	2,186	3,934	3,630
2030		304	304	2,040	2,550	4,590	4,286
2031		304	304	2,066	2,639	4,705	4,401
2032		304	304	2,091	2,729	4,820	4,515
2033		1,824	1,824	2,117	2,818	4,934	3,110
2034		304	304	2,142	2,907	5,049	4,745
2035		304	304	2,168	2,996	5,164	4,860
2036		304	304	2,193	3,086	5,279	4,974
2037		304	304	2,219	3,175	5,393	5,089
2038		1,824	1,824	2,244	3,264	5,508	3,684
2039		304	304	2,270	3,353	5,623	5,319
2040		304	304	2,295	3,443	5,738	5,433
2041		304	304	2,321	3,532	5,852	5,548
2042		304	304	2,346	3,621	5,967	5,663
2043		1,824	1,824	2,372	3,710	6,082	4,258
2044		304	304	2,397	3,800	6,197	5,892
2045		304	304	2,423	3,889	6,311	6,007
2046		304	304	2,448	3,978	6,426	6,122
2047		304	304	2,474	4,067	6,541	6,237
2048		1,824	1,824	2,499	4,157	6,656	4,831
2049		304	304	2,525	4,246	6,770	6,466
2050		304	304	2,550	4,335	6,885	6,581
Total	17,627	15,810	33,437	53,441	78,850	134,258	100,820

Source: JICA Project Team

(iv) Sensitivity Analysis

A sensitivity analysis was carried out to verify the sensitivity of EIRR in accordance with the change of cost and benefit as shown in Table 10.2.2. All cases show that it is economically viable in terms of national economy.

Table 10.2.2 Sensitivity Analysis of "Mandaue–Lapu Lapu Link Bridge (4th Mactan Bridge) with Mandaue Coastal Road"

Case	EIRR (%)
Benefit is more than 10% and cost is less than 10% than base case	15.2%
Benefit is more than 10% than base case	14.0%
Cost is less than 10% than base case	14.1%
Base Case	13.0%
Benefit is less than 10% than base case	12.0%
Cost is more than 10% than base case	12.1%
Benefit is less than 10% and cost is more than 10% than base case	11.0%

Source: JICA Project Team

(2) Metro Cebu Circumferential Road (Segment 1)

The JPT conducted an incremental discounted cash flow analysis to assess the economic viability of the proposed "Metro Cebu Circumferential Road." EIRRs and ENPVs were calculated to determine the viability of the proposed this project. The analysis focused on the assessment of the "with-project" and "without-project" scenarios to measure the incremental impact of the project. The duration of the project was assumed to be 32 years, including a construction period of 5 years and an operating period 27 years.

A sensitivity analysis was also carried out to assess the responsiveness of the viability indicators to changes in critical variables such as economic costs and economic benefits.

(i) Economic Costs of the Project

The economic costs were determined by deducing all taxes and price escalation included in the financial cost and by applying the shadow wage rate to the unskilled labor component of investment cost. Economic costs were estimated to be equivalent to about 85% of financial cost. The conversion factor applied to the O&M costs were also 85%. Details and basis for calculation of project cost and O&M cost are described in the following sections.

(ii) Economic Benefits of Project

The main economic benefits are the savings owing to the reduction in VOC and TTC. The construction of this project is expected to reduce traffic volume, which in turn will result in shorter travel times and faster vehicle operating velocity. The shorter travel time translates into lower travelling time costs, while the faster vehicle velocity implies lower operating costs. The values of these economic benefits will be based on the willingness to pay for time cost and VOC per trip.

And additional economic benefits that may be included, e.g., reduction in CO2 emission and negative benefits of traffic congestion during construction period, are not considered in this study.

In the process of calculating the core benefits of the project, the unit VOCs and TTCs were estimated. The unit VOCs were based on the average operating costs of a representative set of vehicles (Table 10.1.3). The cost items that were considered in

the computation were: (1) fuel cost, (2) lubricant cost, (3) tire cost, (4) repair cost, (5) depreciation cost, (6) capital opportunity cost, (7) overhead cost, and (8) crew cost. The results of the computation were consolidated and expressed as a function of travel speed.

(iii) Result of Cost benefit Analysis

The results of the economic analysis for "Metro Cebu Circumferential Road" are shown in Table 10.2.3. Calculation condition is as follows:

- Price and cost: Constant price in 2018 is used.
- Computation period: 32 years (27 years starting from operation)
- VAT are not considered
- Social discount rate is 10%

Proposed "Metro Cebu Circumferential Road" yielded EIRR 18.9%, so it is larger than 10% social discount rate set by the NEDA. Thus, this proposed project" brings about positive economic effects for national economy of Philippine.

Table 10.2.3 Cost-Benefit Analysis of "Metro Cebu Circumferential Road"

EIRR		18.9%					
B/C		2.56	(at discounted rate of				10%
NPV	(Million Php)	49,851.15	(at discounted rate of				10%
							(Php Million)
	Cost			Benefit			Net Cash Flow
	Investment Cost	O/M Costs	Total Cost	VOC	TTC	Total Benefit	
2019	10,008		10,008			0	-10,008
2020	9,802		9,802			0	-9,802
2021	5,414		5,414			0	-5,414
2022	5,454		5,454			0	-5,454
2023	1,599		1,599			0	-1,599
2024		296	296	801	1,457	2,259	1,963
2025		296	296	1,603	2,914	4,517	4,221
2026		296	296	2,404	4,371	6,776	6,480
2027		296	296	3,206	5,829	9,034	8,739
2028		1,775	1,775	4,007	7,286	11,293	9,518
2029		296	296	4,809	8,743	13,551	13,256
2030		296	296	5,610	10,200	15,810	15,514
2031		296	296	5,750	10,391	16,142	15,846
2032		296	296	5,891	10,583	16,473	16,177
2033		1,775	1,775	6,031	10,774	16,805	15,030
2034		296	296	6,171	10,965	17,136	16,840
2035		296	296	6,311	11,156	17,468	17,172
2036		296	296	6,452	11,348	17,799	17,503
2037		296	296	6,592	11,539	18,131	17,835
2038		1,775	1,775	6,732	11,730	18,462	16,687
2039		296	296	6,872	11,921	18,794	18,498
2040		296	296	7,013	12,113	19,125	18,829
2041		296	296	7,153	12,304	19,457	19,161
2042		296	296	7,293	12,495	19,788	19,492
2043		1,775	1,775	7,433	12,686	20,120	18,345
2044		296	296	7,574	12,878	20,451	20,155
2045		296	296	7,714	13,069	20,783	20,487
2046		296	296	7,854	13,260	21,114	20,818
2047		296	296	7,994	13,451	21,446	21,150
2048		1,775	1,775	8,135	13,643	21,777	20,002
2049		296	296	8,275	13,834	22,109	21,813
2050		296	296	8,415	14,025	22,440	22,144
Total	32,277	15,380	47,657	161,688	280,591	449,055	401,398

Source: JICA Project Team

(iv) Sensitivity Analysis

A sensitivity analysis was carried out to verify the sensitivity of EIRR in accordance with the change of cost and benefit as shown in Table 10.2.4. All cases show that it is economically viable in terms of national economy.

Table 10.2.4 Sensitivity Analysis of "Metro Cebu Circumferential Road"

Case	EIRR (%)
Benefit is more than 10% and cost is less than 10% than base case	21.1%
Benefit is more than 10% than base case	19.9%
Cost is less than 10% than base case	20.1%
Base Case	18.9%
Benefit is less than 10% than base case	17.8%
Cost is more than 10% than base case	17.9%
Benefit is less than 10% and cost is more than 10% than base case	16.8%

Source: JICA Project Team

(3) UMRT Central Line (Central Section)

The JICA Project Team conducted incremental discounted cash flow analysis to assess the economic viability of the proposed "UMRT Central Line (Central Section)". The EIRRs and ENPVs were calculated to determine the viability of the proposed this project. The analysis focused on the assessment of the "with-project" and "without-project" scenarios to measure the incremental impact of the project. The duration of the project was assumed to be 32 years, including a construction period of 7 years and an operating period 25 years.

A sensitivity analysis was also carried out to assess the responsiveness of the viability indicators to changes in critical variables such as economic costs and economic benefits.

(i) Economic Costs of the Project

The economic costs were determined by deducing all taxes and price escalation included in the financial cost and by applying the shadow wage rate to the unskilled labor component of investment cost. Economic costs were estimated to be equivalent to about 85% of financial cost. The conversion factor applied to the O&M costs were also 85%. Details and basis for calculation of project and O&M costs are described in the following sections.

(ii) Economic Benefits of Project

The main economic benefits are the savings owing to the reduction in VOC and TTC. The construction of this project is expected to reduce traffic volume, which in turn will result in shorter travel times and faster vehicle operating velocity. The shorter travel time translates into lower travelling time costs, while the faster vehicle velocity implies lower operating costs. The values of these economic benefits will be based on the willingness to pay for time cost and VOC per trip. And additional economic benefits that may be included, e.g., reduction in CO2 emission and negative benefits of traffic congestion during construction period, are not considered in this study.

In the process of calculating the core benefits of the project, the unit VOCs and TTCs were estimated. The unit VOCs were based on the average operating costs of a representative set of vehicles (Table 10.1.3). The cost items that were considered in the computation were (i) fuel, (ii) lubricant, (iii) tire, (iv) repair, (v) depreciation, (vi) capital opportunity, (vii) overhead, and (viii) crew. The results of the computation were consolidated and expressed as a function of travel speed.

(iii) Result of Cost Benefit Analysis

The results of the economic analysis for "UMRT Central Line (Central Section)" are shown in Table 10.2.5. Calculation conditions are as follows:

- Cost: Constant price in 2018 was used.
- Computation period: 32 years (25 years starting from operation).
- VAT are not considered.
- Social discount rate is 10%.

The proposed "UMRT Central Line (Central Section)" yielded EIRR 14.2%, so it is larger than the 10% social discount rate set by NEDA. Thus, this proposed project brings about positive economic effects for national economy of the Philippines.

Table 10.2.5 Cost-Benefit Analysis of "UMRT Central Line (Central Section)"

EIRR		14.2%					
B/C		1.58	(at discounted rate of				10%
NPV	(Million Php)	42,684.35	(at discounted rate of				10%
							(Php Million)
	Cost			Benefit			Net Cash Flow
	Investment Cost	O/M Costs	Total Cost	VOC	TTC	Total Benefit	
2019	592		592			0	-592
2020	820		820			0	-820
2021	5,572		5,572			0	-5,572
2022	12,493		12,493			0	-12,493
2023	24,061		24,061			0	-24,061
2024	37,484		37,484			0	-37,484
2025	21,011		21,011			0	-21,011
2026		1,226	1,226	1,734	1,836	3,570	2,344
2027		1,226	1,226	3,468	3,672	7,140	5,914
2028		1,226	1,226	5,202	5,508	10,710	9,484
2029		1,226	1,226	6,936	7,344	14,280	13,054
2030		1,226	1,226	8,670	9,180	17,850	16,624
2031		1,226	1,226	9,614	10,073	19,686	18,460
2032		1,226	1,226	10,557	10,965	21,522	20,296
2033		1,226	1,226	11,501	11,858	23,358	22,132
2034		1,226	1,226	12,444	12,750	25,194	23,968
2035		1,226	1,226	13,388	13,643	27,030	25,804
2036		1,226	1,226	14,331	14,535	28,866	27,640
2037		1,226	1,226	15,275	15,428	30,702	29,476
2038		1,226	1,226	16,218	16,320	32,538	31,312
2039		1,226	1,226	17,162	17,213	34,374	33,148
2040		1,226	1,226	18,105	18,105	36,210	34,984
2041		1,226	1,226	19,049	18,998	38,046	36,820
2042		1,226	1,226	19,992	19,890	39,882	38,656
2043		1,226	1,226	20,936	20,783	41,718	40,492
2044		1,226	1,226	21,879	21,675	43,554	42,328
2045		1,226	1,226	22,823	22,568	45,390	44,164
2046		1,226	1,226	23,766	23,460	47,226	46,000
2047		1,226	1,226	24,710	24,353	49,062	47,836
2048		1,226	1,226	25,653	25,245	50,898	49,672
2049		1,226	1,226	26,597	26,138	52,734	51,508
2050		1,226	1,226	27,540	27,030	54,570	53,344
Total	102,034	30,649	132,683	397,545	398,565	796,110	663,427

Source: JICA Project Team

(iv) Sensitivity Analysis

A sensitivity analysis was carried out to verify the sensitivity of EIRR in accordance with the change of cost and benefit as shown in Table 10.2.6. All cases show that it is economically viable in terms of national economy.

Table 10.2.6 Sensitivity Analysis of "UMRT Central Line (Central Section)"

Case	EIRR (%)
Benefit is more than 10% and cost is less than 10% than base case	16.2%
Benefit is more than 10% than base case	15.1%
Cost is less than 10% than base case	15.2%
Base Case	14.2%
Benefit is less than 10% than base case	13.2%
Cost is more than 10% than base case	13.3%
Benefit is less than 10% and cost is more than 10% than base case	12.3%

Source: JICA Project Team

(4) UMRT Coastal Line (Phase-I)

The project team conducted an incremental discounted cash flow analysis to assess the economic viability of the proposed "UMRT Coastal Line (Phase-I)." The EIRRs and ENPVs were calculated to determine the viability of the proposed this project. The analysis focused on the assessment of the "with-project" and "without-project" scenarios to measure the incremental impact of the project. The duration of the project was assumed to be 29 years, including a construction period of 7 years and an operating period 22 years.

A sensitivity analysis was also carried out to assess the responsiveness of the viability indicators to changes in critical variables such as economic costs and economic benefits.

(i) Economic Costs of the Project

The economic costs were determined by deducing all taxes and price escalation included in the financial cost and by applying the shadow wage rate to the unskilled labor component of investment cost. Economic costs were estimated to be equivalent to about 85% of financial cost. The conversion factor applied to the O&M costs was also 85%. Regarding the detail and basis for calculation of project and O&M costs, please refer to the corresponding to the page of this report.

(ii) Economic Benefits of Project

The main economic benefits are the savings because of the reduction in VOC and TTC. A reduction in traffic volume would be expected after project completion, which in turn would result in shorter travel times and faster vehicle operating velocity. The shorter travel time translates into lower travel time costs, while the faster vehicle velocity implies lower operating costs. The values of these economic benefits will be based on the willingness to pay for time cost and VOC per trip. Any additional economic benefits that may be included, e.g., reduction in CO_2 emission, and negative benefits of traffic congestion during construction period are not considered in this study.

In the process of calculating the core benefits of the project, the unit VOCs and TTCs were estimated. The unit VOCs were based on the average operating costs of a representative set of vehicles (Table 10.1.3). The cost items that were considered in the computation were (i) fuel, (ii) lubricant, (iii) tire, (iv) repair, (v) depreciation, (vi)

capital opportunity, (vii) overhead, and (viii) crew. The results of the computation were consolidated and expressed as a function of travel speed.

(iii) Result of Cost Benefit Analysis

The results of the economic analysis for "UMRT Coastal Line (Phase-I)" are shown in Table 10.2.7 Calculation conditions are as follows:

- Cost: Constant price in 2018 was used.
- Computation period: 29 years (22 years starting from operation).
- VAT are not considered.
- Social discount rate is 10%.

The proposed "UMRT Coastal Line (Phase-I)" yielded EIRR 9.6% that is smaller than the 10% social discount rate set by NEDA. Thus, this proposed "UMRT Coastal Line (Phase-I)" does not bring about economic effects for the national economy of the Philippines. However, if additional economic benefits, e.g. reduction in CO_2 emission, were added, the value of EIRR would be up to nearly 10%.

Table 10.2.7 Cost-Benefit Analysis of "UMRT Coastal Line (Phase-I)"

EIRR		9.6%					
B/C		0.97	(at discounted rate of				10%
NPV	(Million Php)	-1,331.28	(at discounted rate of				10%
							(Php Million)
	Cost			Benefit			Net
	Investment Cost	O/M Costs	Total Cost	VOC	TTC	Total Benefit	Cash Flow
2022	337		337			0	-337
2023	337		337			0	-337
2024	3,167		3,167			0	-3,167
2025	7,225		7,225			0	-7,225
2026	13,924		13,924			0	-13,924
2027	21,185		21,185			0	-21,185
2028	11,698		11,698			0	-11,698
2029		613	613	1,785	1,913	3,698	3,085
2030		613	613	3,570	3,825	7,395	6,782
2031		613	613	3,672	3,889	7,561	6,948
2032		613	613	3,774	3,953	7,727	7,114
2033		613	613	3,876	4,016	7,892	7,279
2034		613	613	3,978	4,080	8,058	7,445
2035		613	613	4,080	4,144	8,224	7,611
2036		613	613	4,182	4,208	8,390	7,777
2037		613	613	4,284	4,271	8,555	7,942
2038		613	613	4,386	4,335	8,721	8,108
2039		613	613	4,488	4,399	8,887	8,274
2040		613	613	4,590	4,463	9,053	8,440
2041		613	613	4,692	4,526	9,218	8,605
2042		613	613	4,794	4,590	9,384	8,771
2043		613	613	4,896	4,654	9,550	8,937
2044		613	613	4,998	4,718	9,716	9,103
2045		613	613	5,100	4,781	9,881	9,268
2046		613	613	5,202	4,845	10,047	9,434
2047		613	613	5,304	4,909	10,213	9,600
2048		613	613	5,406	4,973	10,379	9,766
2049		613	613	5,508	5,036	10,544	9,931
2050		613	613	5,610	5,100	10,710	10,097
Total	57,873	13,486	71,358	98,175.00	95,625	193,800	122,442

Source: JICA Project Team

(iv) Sensitivity Analysis

A sensitivity analysis was carried out to verify the sensitivity of EIRR in accordance with the change of cost and benefit as shown in Table 10.2.8. All cases show that it is economically viable in terms of national economy.

Table 10.2.8 Sensitivity Analysis of "UMRT Coastal Line (Phase-I)"

Case	EIRR (%)
Benefit is more than 10% and cost is less than 10% than base case	11.9%
Benefit is more than 10% than base case	10.7%
Cost is less than 10% than base case	10.8%
Base Case	9.6%
Benefit is less than 10% than base case	8.5%
Cost is more than 10% than base case	8.6%
Benefit is less than 10% and cost is more than 10% than base case	7.5%

Source: JICA Project Team

(5) Metro Cebu ATC System

The project team conducted an incremental discounted cash flow analysis to assess the economic viability of the proposed "Metro Cebu ATC System." The EIRRs and ENPVs were calculated to determine the viability of the proposed this project. The analysis focused on the assessment of the "with-project" and "without-project" scenarios to measure the incremental impact of the project. The duration of the project was assumed to be 24 years, including a construction period of 4 years and an operating period 20 years.

A sensitivity analysis was also carried out to assess the responsiveness of the viability indicators to changes in critical variables such as economic costs and economic benefits.

(i) Economic Costs of the Project

The economic costs were determined by deducing all taxes and price escalation included in the financial cost and by applying the shadow wage rate to the unskilled labor component of investment cost. Economic costs were estimated to be equivalent to about 85% of financial cost. The conversion factor applied to the O&M costs was also 85%. Details and basis for calculation of project and O&M costs are described in the following sections.

(ii) Economic Benefits of Project

The main economic benefits are the savings because of the reduction in VOC and TTC. The construction of this project is expected to reduce traffic volume by h providing the effective traffic information, which in turn will result in shorter travel times and faster vehicle operating velocity. The shorter travel time translates into lower travelling time costs, while the faster vehicle velocity implies lower operating costs. The values of these economic benefits will be based on the willingness to pay for time cost and VOC per trip.

In the process of calculating the core benefits of the project, the unit VOCs and TTCs were estimated. The unit VOCs were based on the average operating costs of a representative set of vehicles (Table 10.1.3). The cost items that were considered in the computation were (i) fuel, (ii) lubricant, (iii) tire, (iv) repair, (v) depreciation, (vi) capital opportunity, (vii) overhead, and (viii) crew. The results of the computation were consolidated and expressed as a function of travel speed.

(iii) Result of Cost Benefit Analysis

The results of the economic analysis for "Metro Cebu ATC System" are shown in Table 10.2.9. Calculation conditions are:

- Cost: Constant price in 2018 was used.
- Computation period: 24 years (20 years starting from operation).
- VAT are not considered.
- Social discount rate is 10%.

The proposed "Metro Cebu ATC System" yielded EIRR 11.3% that is larger than the 10% social discount rate set by NEDA. Thus, this proposed "Metro Cebu ATC System" brings about positive economic effects on the national economy of the Philippines.

Table 10.2.9 Cost-Benefit Analysis of "Metro Cebu ATC System"

EIRR		11.3%					
B/C		1.07	(at discounted rate of				10%
NPV	(Million Php)	962.33	(at discounted rate of				10%
							(Php Million)
	Cost			Benefit			Net Cash
	Investment Cost	O/M Costs	Total Cost	VOC	TTC	Total Benefit	Flow
2021	2,809		2,809			0	-2,809
2022	2,809		2,809			0	-2,809
2023	2,809		2,809			0	-2,809
2024	19		19			0	-19
2025		419	419	213	298	510	91
2026		419	419	425	595	1,020	601
2027		419	419	638	893	1,530	1,111
2028		419	419	850	1,190	2,040	1,621
2029		419	419	1,063	1,488	2,550	2,131
2030		419	419	1,275	1,785	3,060	2,641
2031		419	419	1,275	1,772	3,047	2,628
2032		419	419	1,275	1,760	3,035	2,616
2033		419	419	1,275	1,747	3,022	2,603
2034		8,790	8,790	1,275	1,734	3,009	-5,781
2035		419	419	1,275	1,721	2,996	2,577
2036		419	419	1,275	1,709	2,984	2,565
2037		419	419	1,275	1,696	2,971	2,552
2038		419	419	1,275	1,683	2,958	2,539
2039		419	419	1,275	1,670	2,945	2,526
2040		419	419	1,275	1,658	2,933	2,514
2041		419	419	1,275	1,645	2,920	2,501
2042		419	419	1,275	1,632	2,907	2,488
2043		419	419	1,275	1,619	2,894	2,475
2044		8,790	8,790	1,275	1,607	2,882	-5,909
2045	8,446	25,122	33,568	22,313	29,899	52,211	18,643

Source: JICA Project Team

(iv) Sensitivity Analysis

A sensitivity analysis was carried out to verify the sensitivity of EIRR in accordance with the change of cost and benefit as shown in Table 10.2.10. All cases show that it is economically viable in terms of national economy.

Table 10.2.10 Sensitivity Analysis of "Metro Cebu ATC System"

Case	EIRR (%)
Benefit is more than 10% and cost is less than 10% than base case	14.9%
Benefit is more than 10% than base case	13.0%
Cost is less than 10% than base case	13.2%
Base Case	11.3%
Benefit is less than 10% than base case	9.3%
Cost is more than 10% than base case	9.5%
Benefit is less than 10% and cost is more than 10% than base case	7.2%

Source: JICA Project Team

2) Financial Evaluation for UMRT Priority Projects

(1) Conditions for the Analysis

(i) General

The main purpose of financial project analysis is to examine the financial viability of the UMRT Priority Projects from the viewpoint of the implementation body.

As a first step of financial analysis, based on the estimation in terms of revenues, investment costs, and O&M costs, the Financial Internal Rate of Return (FIRR) is calculated regardless of fund-raising conditions and without interest cost in which the initial investment is assumed to be made without any subsidized loan as well as any grant subsidies from the government.

(ii) Fare System and Demand Forecast of UMRT Central Line and UMRT Coastal Line Passenger

The fare system of UMRT Central Line and UMRT Coastal Line was set up based on the fare system of railway in Metro Manila area as shown in Table 10.2.11.

Table 10.2.11 Fare System

(Unit: PHP)

UMRT Central Line and Coastal Line	20.0+0.5/km

Source: JICA Project Team

Table 5.2.12 shows the results of the fare revenue based on the transportation demand forecast.

Table 10.2.12 Fare Revenue

	2030	2050
UMRT Central Line	4,765	9,469
UMRT Coastal Line (Phase-I)	2,142	3,872

Source: JICA Project Team

(2) Project Cash Flow of UMRT Priority Projects

(i) Cost

(a) Based on the cost estimate of the UMRT project described in Chapter 4.2, the investment cost of infrastructure and O&M costs are distributed to the annual allocation.

(b) **Prices.** Constant price in 2018 was used. Inflation is considered in both revenue and cost estimates during the evaluation period to calculate the FIRR.

(c) **Evaluation period of project.** The duration of UMRT Central Line is assumed to be 32 years, including a construction period of 7 years and an operating period 25 years. The duration of UMRT Coastal Line (Phase I) was assumed to be 29 years, including a construction period of 7 years and an operating period 22 years.

(d) **Cost**. Initial investment cost, replacement cost of capital, and OM cost for infrastructure and UMRT operation services are included.

(e) Additional investment cost for rolling stocks due to the increase in passenger demand is not estimated.

(f) Replacement cost of rolling stocks and signaling and electric facility is not estimated.

(ii) Revenue

(a) **Passenger Revenue.** The revenue of the UMRT Projects is calculated based on the results of the demand forecast.

(b) **Other revenue.** Other revenue from a related business to UMRT operation, such as advertisement and in-house business, is not assumed in this study.

(iii) Project Cash Flow

As a first step of financial analysis, based on the estimation in terms of revenues, investment costs, and O&M costs, the FIRR including VAT payment is calculated regardless of fund-raising conditions and without interest cost in which the initial investment is done without any subsidized loan as well as any grant subsidies from the government.

The result is shown in Tables 10.2.13 and 10.2.14. The FIRR of UMRT Central Line (Central Section) is 0.5% and UMRT Coastal Line (Phase 1) is -2.1%. On the other hand, current interest rate in Philippines is considered PHBOR[1] (7–8%) plus 2–3% in accordance with the degree of risk. Thus, it is difficult to find the commercial viability for UMRT priority projects.

[1] Philippines Inter Bank Offered Rate

Table 10.2.13 Financial Analysis of UMRT Central Line (Central Section)

FIRR		0.5%					
B/C		0.33	(at discounted rate of				10%
NPV	(Million Php)	-57,267.57	(at discounted rate of				10%
							(Php Million)
	Cost			Revenue			Net
	Investment Cost	O/M Costs	Total Cost	Farebox Revenue		Total Revenue	Cash Flow
2019	697		697			0	-697
2020	697		697			0	-697
2021	6,555		6,555			0	-6,555
2022	14,698		14,698			0	-14,698
2023	28,307		28,307			0	-28,307
2024	44,099		44,099			0	-44,099
2025	24,719		24,719			0	-24,719
2026		1,442	1,442		3,824	3,824	2,382
2027		1,442	1,442		4,060	4,060	2,617
2028		1,442	1,442		4,295	4,295	2,852
2029		1,442	1,442		4,530	4,530	3,088
2030		1,442	1,442		4,765	4,765	3,323
2031		1,442	1,442		5,000	5,000	3,558
2032		1,442	1,442		5,235	5,235	3,793
2033		1,442	1,442		5,471	5,471	4,028
2034		1,442	1,442		5,706	5,706	4,264
2035		1,442	1,442		5,941	5,941	4,499
2036		1,442	1,442		6,176	6,176	4,734
2037		1,442	1,442		6,411	6,411	4,969
2038		1,442	1,442		6,647	6,647	5,204
2039		1,442	1,442		6,882	6,882	5,440
2040		1,442	1,442		7,117	7,117	5,675
2041		1,442	1,442		7,352	7,352	5,910
2042		1,442	1,442		7,587	7,587	6,145
2043		1,442	1,442		7,823	7,823	6,380
2044		1,442	1,442		8,058	8,058	6,616
2045		1,442	1,442		8,293	8,293	6,851
2046		1,442	1,442		8,528	8,528	7,086
2047		1,442	1,442		8,763	8,763	7,321
2048		1,442	1,442		8,999	8,999	7,556
2049		1,442	1,442		9,234	9,234	7,792
2050		1,442	1,442		9,469	9,469	8,027
Total	119,772	36,058	155,829		166,167	166,167	10,337

Source: JICA Project Team

Table 10.2.14 Financial Analysis of UMRT Coastal Line (Phase-I)

FIRR		-2.1%					
B/C		0.27	(at discounted rate of				10%
NPV	(Million Php)	-35,083.44	(at discounted rate of				10%
							(Php Million)
	Cost			Revenue			Net Cash Flow
	Investment Cost	O/M Costs	Total Cost	Farebox Revenue		Total Revenue	
2022	396		396			0	-396
2023	396		396			0	-396
2024	3,726		3,726			0	-3,726
2025	8,500		8,500			0	-8,500
2026	16,381		16,381			0	-16,381
2027	24,924		24,924			0	-24,924
2028	13,762		13,762			0	-13,762
2029		721	721		2,056	2,056	1,335
2030		721	721		2,142	2,142	1,421
2031		721	721		2,229	2,229	1,508
2032		721	721		2,315	2,315	1,594
2033		721	721		2,402	2,402	1,681
2034		721	721		2,488	2,488	1,767
2035		721	721		2,575	2,575	1,854
2036		721	721		2,661	2,661	1,940
2037		721	721		2,748	2,748	2,027
2038		721	721		2,834	2,834	2,113
2039		721	721		2,921	2,921	2,199
2040		721	721		3,007	3,007	2,286
2041		721	721		3,094	3,094	2,372
2042		721	721		3,180	3,180	2,459
2043		721	721		3,267	3,267	2,545
2044		721	721		3,353	3,353	2,632
2045		721	721		3,440	3,440	2,718
2046		721	721		3,526	3,526	2,805
2047		721	721		3,612	3,612	2,891
2048		721	721		3,699	3,699	2,978
2049		721	721		3,785	3,785	3,064
2050		721	721		3,872	3,872	3,151
Total	68,085	15,865	83,951		65,205	65,205	-18,745

Source: JICA Project Team

(iv) Supplementary Analysis

In addition to the analysis shown above, supplemental analysis was conducted to confirm the amount of subsidies to be provided by the government for the implementation body to operate UMRT Priority Projects.

(v) Result of Supplementary Analysis

The result is shown in Tables 10.2.15 and 10.2.16. In the case of UMRT Central Line, subsidy budget a year ranges from Php117,390 million to Php5,481 million. UMRT Central Line could be operated from year 2049 without subsidy. As for the UMRT Costal Line (Phase 1), its subsidy budget a year range from Php66,751 million to

Php18,745 million. On the other hand, this project could not be operated without subsidy by the year 2050.

Table 10.2.15 Analysis of Subsidy for UMRT Central Line (Central Section)

(Php Million)

	Cost			Revenue		Net Cash Flow	Necessary Susidy Budget
	Investment Cost	O/M Costs	Total Cost	Farebox Revenue	Total Revenue		
2019	697		697		0	-697	
2020	697		697		0	-697	
2021	6,555		6,555		0	-6,555	
2022	14,698		14,698		0	-14,698	
2023	28,307		28,307		0	-28,307	
2024	44,099		44,099		0	-44,099	
2025	24,719		24,719		0	-24,719	-119,772
2026		1,442	1,442	3,824	3,824	2,382	-117,390
2027		1,442	1,442	4,060	4,060	2,617	-114,773
2028		1,442	1,442	4,295	4,295	2,852	-111,920
2029		1,442	1,442	4,530	4,530	3,088	-108,833
2030		1,442	1,442	4,765	4,765	3,323	-105,510
2031		1,442	1,442	5,000	5,000	3,558	-101,952
2032		1,442	1,442	5,235	5,235	3,793	-98,159
2033		1,442	1,442	5,471	5,471	4,028	-94,130
2034		1,442	1,442	5,706	5,706	4,264	-89,867
2035		1,442	1,442	5,941	5,941	4,499	-85,368
2036		1,442	1,442	6,176	6,176	4,734	-80,634
2037		1,442	1,442	6,411	6,411	4,969	-75,665
2038		1,442	1,442	6,647	6,647	5,204	-70,460
2039		1,442	1,442	6,882	6,882	5,440	-65,021
2040		1,442	1,442	7,117	7,117	5,675	-59,346
2041		1,442	1,442	7,352	7,352	5,910	-53,436
2042		1,442	1,442	7,587	7,587	6,145	-47,291
2043		1,442	1,442	7,823	7,823	6,380	-40,911
2044		1,442	1,442	8,058	8,058	6,616	-34,295
2045		1,442	1,442	8,293	8,293	6,851	-27,444
2046		1,442	1,442	8,528	8,528	7,086	-20,359
2047		1,442	1,442	8,763	8,763	7,321	-13,037
2048		1,442	1,442	8,999	8,999	7,556	-5,481
2049		1,442	1,442	9,234	9,234	7,792	2,310
2050		1,442	1,442	9,469	9,469	8,027	10,337
Total	119,772	36,058	155,829	166,167	166,167	10,337	

Source: JICA Project Team

Table 10.2.16 Analysis of Subsidy for UMRT Coastal Line (Phase-I)

(Php Million)

	Cost			Revenue		Net	Necessary
	Investment Cost	O/M Costs	Total Cost	Farebox Revenue	Total Revenue	Cash Flow	Susidy Budget
2022	396		396		0	-396	
2023	396		396		0	-396	
2024	3,726		3,726		0	-3,726	
2025	8,500		8,500		0	-8,500	
2026	16,381		16,381		0	-16,381	
2027	24,924		24,924		0	-24,924	
2028	13,762		13,762		0	-13,762	-68,085
2029		721	721	2,056	2,056	1,335	-66,751
2030		721	721	2,142	2,142	1,421	-65,330
2031		721	721	2,229	2,229	1,508	-63,822
2032		721	721	2,315	2,315	1,594	-62,228
2033		721	721	2,402	2,402	1,681	-60,547
2034		721	721	2,488	2,488	1,767	-58,780
2035		721	721	2,575	2,575	1,854	-56,927
2036		721	721	2,661	2,661	1,940	-54,986
2037		721	721	2,748	2,748	2,027	-52,960
2038		721	721	2,834	2,834	2,113	-50,847
2039		721	721	2,921	2,921	2,199	-48,647
2040		721	721	3,007	3,007	2,286	-46,361
2041		721	721	3,094	3,094	2,372	-43,989
2042		721	721	3,180	3,180	2,459	-41,530
2043		721	721	3,267	3,267	2,545	-38,985
2044		721	721	3,353	3,353	2,632	-36,353
2045		721	721	3,440	3,440	2,718	-33,634
2046		721	721	3,526	3,526	2,805	-30,830
2047		721	721	3,612	3,612	2,891	-27,938
2048		721	721	3,699	3,699	2,978	-24,960
2049		721	721	3,785	3,785	3,064	-21,896
2050		721	721	3,872	3,872	3,151	-18,745
Total	68,085	15,865	83,951	65,205	65,205	-18,745	

Source: JICA Project Team

10.3 Financing Strategy for Implementation of Proposed Master Plan

1) Introduction

This section will discuss the indicative financing envelope for the projects in the master plan using broad estimates of the public resources from the national budget and Metro Cebu LGUs. It will also review potential financing options for the subset priority projects. The project list is shown in Table 10.3.1. Those in green cells are the priority projects.

Table 10.3.1 Projects Identified in the Master Plan

Project	IA*	Const. Cost (PHP Billion)	Financing Option (tentative)	FIRR (%)	Status	Recommended Implementation (Commencement) Year
1. Metro Cebu Circumferential Road (Segment 1)	DPWH	36.4	Pure public financing	n/a	New	2020
2. Metro Cebu Circumferential Road (Segment 2)	DPWH	29.3	Pure public financing	n/a	New	2023
3. Metro Cebu Circumferential Road (Segment 3)	DPWH	17.0	Pure public financing	n/a	New	2020
4. Talisay–Naga Diversion Road	DPWH	9.70	Pure public financing	n/a	New	2020
5. Mandaue–Liloan Diversion Road	DPWH	12.7	Pure public financing	n/a	New	2020
6. Cebu Arterial Road Widening Phase 1-1 Central Section (Complete Street Type A, 6 lanes))	DPWH	6.0	Pure public financing	n/a	Upgrade	2021
7. Cebu Arterial Road Widening Phase 1-2 Central Section (Complete Street Type A, 4 lanes)	DPWH	14.2	Pure public financing	n/a	Upgrade	2022
8. Cebu Arterial Road Widening Phase 2-1 North Section (Complete Street Type A, 4 lanes)	DPWH	8.85	Pure public financing	n/a	Upgrade	2024
9. Cebu Arterial Road Widening Phase 2-2 South Section (Complete Street Type A, 4 lanes)	DPWH	14.4	Pure public financing	n/a	Upgrade	2025
10. Cebu Coastal Road Widening Phase 1 (Complete Street Type A, 6 lanes)	DPWH	2.15	Pure public financing	n/a	Upgrade	2022
11. Cebu Coastal Road Widening Phase 2 (Complete Street Type A, 6 lanes)	DPWH	1.60	Pure public financing	n/a	Upgrade	2023
12. Mactan Circumferential Road (Road Widening)	DPWH	19.60	Pure public financing	n/a	Upgrade	2025
13. Guadalupe–Lahug Diversion Road	DPWH	3.16	Pure public financing	n/a	New	2020
14. Metro Cebu Intersection Improvement	DPWH and LGUs	10.4	Pure public financing	n/a	Upgrade	2020
15. Cebu–Cordova Link Expressway Bridge	DPWH	27.9	Joint Venture	-	New/ On–going	2018
16. Mandaue Coastal Road (Viaduct)	DPWH	12.17	Pure public financing	n/a	New	2020
17. Mandaue Lapu-Lapu Link Bridge (4th Bridge)	DPWH	7.00	Pure public financing	n/a	New	2020
18. 1st Mactan Bridge Replacement	DPWH	13.86	Pure public financing	n/a	Upgrade	2023

Project	IA*	Const. Cost (PHP Billion)	Financing Option (tentative)	FIRR (%)	Status	Recommended Implementation (Commencement) Year
19. Metro Cebu Coastal Road Expressway (Elevated Highway along existing road)	DPWH	190.88	TBD	-	New	2035
20. Metro Cebu Circumferential Expressway (Elevated Highway along Metro Cebu Circumferential Road)	DPWH	84.26	TBD	-	New	2031
21. UMRT Central Line/ Central Section	DOTr	78	Hybrid PPP	0.5%	New	2023
22. UMRT Central Line/ North Section	DOTr	51	Hybrid PPP	-	New	2036
23. UMRT Central Line/ South Section	DOTr	72	Hybrid PPP	-	New	2033
24. UMRT Coastal Line/ Phase 1	DOTr	44	Hybrid PPP	-2.1%	New	2026
25. UMRT Coastal Line/ Phase 2	DOTr	32	Hybrid PPP	-	New	2030
26. Area Traffic Control System: detectors and CCTV, CPU and message signboards)	DPWH and LGUs	10.15	PPP/ Build-Transfer-Operate	n/a	New	2022

*IA=Implementing Agency

Source: JICA Project Team

A corollary discussion is expected in accordance with the institutional arrangement described in Chapter 12, including the collaboration of national government implementing agencies with LGUs and other key stakeholders in project implementation, operation, and maintenance.

This section will also explore innovative means of raising funds to pay for the cost of the infrastructure through transit oriented development (TOD) activities such as commercial development and land value capture. The latter is assumed on the increase in value of land due to the infrastructure investment. The assessment of the applicability of the land value capture concept will be underpinned by existing laws, such as the Local Government Code, and the enabling environment in the Philippines.

For this project, various financing options available to national government implementing agencies and LGUs were discussed. A summary is shown in Table 10.3.2.

Table 10.3.2 Types and Sources of Financing for Infrastructure Projects

Type of Financing	Sources of Financing	
	National Government Agencies and Government-Owned and Controlled Corporations	LGU
Public	Annual Budget • Internal revenues (tax and non-tax sources) • Domestic borrowings • Official Development Assistance (grants or loans from multilateral and bilateral sources; loans are predominantly with sovereign guarantees) Legislated Earmarked Funds, e.g., road fund. • Road Support Fund (80%). Road maintenance of primary and secondary roads.	Internal Revenue Allotment (share from annual budget) Legislated Earmarked Funds: LGU share from the Road Fund Locally generated revenues (local taxes and fees) Domestic Loans, e.g., • Municipal development fund, • Government financing institutions, and • Private banks.

Type of Financing	Sources of Financing	
	National Government Agencies and Government-Owned and Controlled Corporations	LGU
	• Local Road Fund (5%). Maintenance of local roads, traffic management, and road safety devises. • Road Safety Fund (7.5%). Installation of traffic signs, pavement markings, and safety devices. • Vehicle Pollution Control Fund (7.5%). Air pollution control. Tariffs, e.g., user fees from mass rail transit systems.	National government grant programs available to LGUs, for example, *Salintubig* Program for waterless municipalities, National Sewerage and Septage Management Program for Highly Urbanized Cities, and People's Survival Fund for climate change adaptation measures.
PPP or JVAs	Private Funding: Private Equity + Commercial Loans Public sources: such as viability gap funding or cost share in the JV	
Hybrid PPP	Public sources for a defined component (for example, capital investments of a project) Private sources for complementary project component (for example O&M costs)	

Source: JICA Project Team

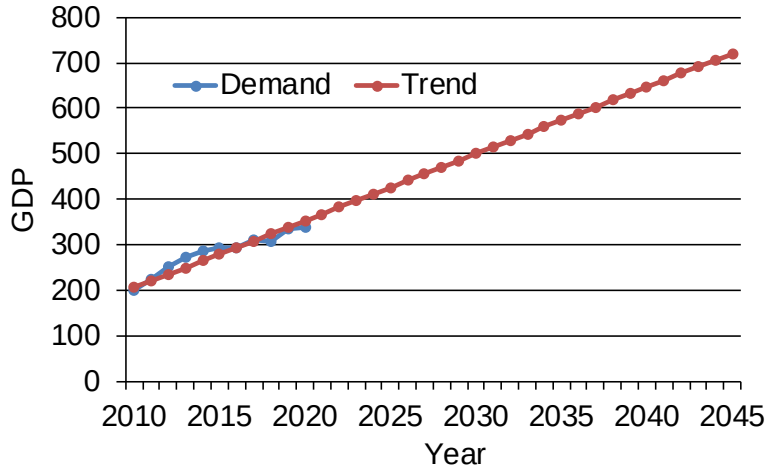
These are major financing sources that national government agencies or LGUs can draw from in the formulation of their respective financing strategies.

2) Estimating the Financing Envelope

In estimating the financing envelope, the JICA Project Team adopted a conservative stance and focused on public resources from the national government and LGUs.

To estimate the national budget envelope, the following assumptions were used:

- Used a time series projection of gross domestic product (GDP) from 2010 to 2045.



Source: JICA Project Team

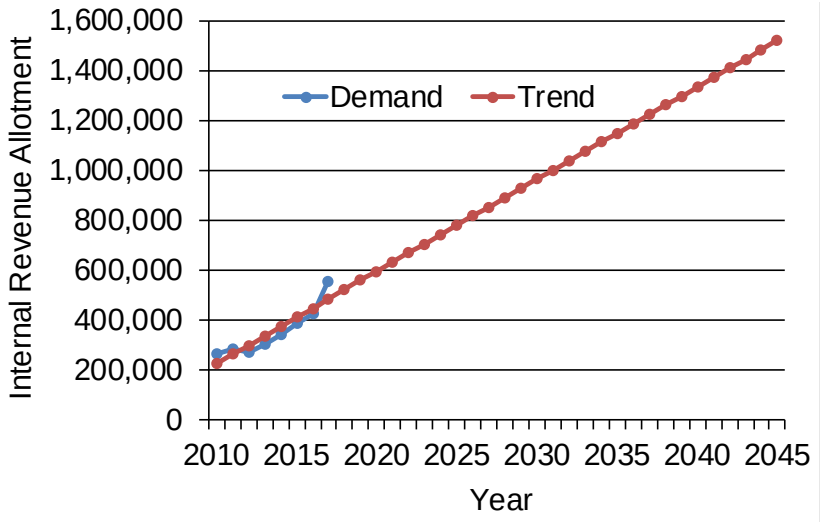
Figure 10.3.1 Projection of GDP from 2010 to 2045

- Assumed government's target of public infrastructure spending is from 5.9% in 2018, 6% in 2019, and 6.5% in 2020 to 7% of the GDP from 2021 to 2030 and 10% thereafter.

- Assumed the 3.3% pro-rated share of Region VII on the infrastructure public expenditure based on its budget allocation for fiscal year 2018; however, this is a very conservative assumption as there has been no budget for a rail-based transportation investment in the region.

The estimate of the Metro Cebu LGUs resources is based on:

- Time series projection of the internal revenue allotment to LGUs from 2010 to 2045.



Source: JICA Project Team

Figure 10.3.2 Projection of Internal Revenue Allotment from 2010 to 2045

- Assumed 1.16% pro-rated share of Metro Cebu LGUs on the total internal revenue allotment for LGUs based on the allocation for fiscal year 2018.

- Assumed local revenues will increase by 10% every 5 years. This is based on the provision of the Local Government Code allowing 10% increase in local taxes and fees every 5 years provided the updated Local Revenue Code is approved by the local legislative body.

- Assumed 20% allocation from the IRA and local revenues for the development fund, where capital investments are sourced.

The figures for the city budget are conservative as they do not consider the leveraging capacity of the LGUs from credit financing or PPP arrangements.

The results are summarized in Table 10.3.3 and the breakdown is shown in Table 10.3.4.

Table 10.3.3 Summary of Available Financial Resources

Implementation Period	Budget Envelope (PHP billion)		
	National	Local	Total
2018–2020	103	3.9	106.48
2021–2030	500	18.6	518.6
2031–2040	957	27.22	984.35
2041–2045	570	16.84	586.84

Source: JICA Project Team

Table 10.3.4 Estimate of the National and Local Resources for Infrastructure Investments

(Cost: PHP Billion)

Year	GDP Projection	Projected Infrastructure Investments	National Government: Pro-rated Share of RVII on Infra Budget	Projected Total IRA	IRA Share of 13 Cities and Municipalities in Metro Cebu	Local Revenues of 13 Cities and Municipalities in Metro Cebu	LGUs: Development Fund (20% of IRA+ Local Revenues)
2018	16151	953	31.41	522	6.08	7.43	1.22
2019	16887	1013	33.40	558	6.50	7.43	1.30
2020	17623	1146	37.76	595	6.93	7.43	1.39
2021	18360	1285	42.37	632	7.36	7.43	1.47
2022	19096	1337	44.07	669	7.79	8.17	1.56
2023	19832	1388	45.77	706	8.22	8.17	1.64
2024	20568	1440	47.46	743	8.65	8.17	1.73
2025	21304	1491	49.16	780	9.08	8.17	1.82
2026	22040	1543	50.86	817	9.52	8.17	1.90
2027	22776	1594	52.56	854	9.95	8.99	1.99
2028	23512	1646	54.26	891	10.38	8.99	2.08
2029	24249	1697	55.96	928	10.81	8.99	2.16
2030	24985	1749	57.66	965	11.24	8.99	2.25
2031	25721	2572	84.79	1002	11.67	8.99	2.33
2032	26457	2646	87.22	1038	12.09	9.89	2.42
2033	27193	2719	89.65	1076	12.53	9.89	2.51
2034	27929	2793	92.07	1113	12.96	9.89	2.59
2035	28665	2867	94.50	1150	13.39	9.89	2.68
2036	29401	2940	96.93	1187	13.83	9.89	2.77
2037	30138	3014	99.35	1224	14.26	10.88	2.85
2038	30874	3087	101.78	1261	14.69	10.88	2.94
2039	31610	3161	104.21	1298	15.12	10.88	3.02
2040	32346	3235	106.63	1335	15.55	10.88	3.11
2041	33082	3308	109.06	1372	15.98	10.88	3.20
2042	33818	3382	111.49	1409	16.41	11.97	3.28
2043	34554	3455	113.91	1446	16.84	11.97	3.37
2044	35291	3529	116.34	1483	17.27	11.97	3.45
2045	36027	3603	118.77	1520	17.70	11.97	3.54

Source: JICA Project Team

Table 10.3.5 shows a comparison of the investment requirements of the priority projects vis-à-vis investment schedule and the projected available resources.

Table 10.3.5 Comparison of Investment Requirements and Projected Available Resources

(Cost: PHP Billion)

Year	1 Area Traffic Control System	2 Road and Bridge Projects (short/medium term)	3 Road and Bridge Projects (long term)	4 UMRT Central/ Central Section	5 UMRT Central/ North Section	6 UMRT Central/ South Section	7 UMRT Coastal Line Phase 1	8 UMRT Coastal Line Phase2	9 Total Investment Requirement (Sum of 1-8)	10 Available Financing	11 Surplus/ Shortfall (10-9)
Total Cost	10.150	204.760	275.30	78.780	51.390	72.300	44.780	32.170	769.630	1542.230	
2020		15.520							15.520	39.1500	23.630
2021		25.280							25.280	43.8400	18.560
2022	1.450	31.110							32.560	45.6250	13.065
2023	1.450	44.960		15.756					62.165	47.4100	-14.755
2024	1.450	27.110		15.756					44.315	49.1950	4.880
2025	1.450	20.680		15.756					37.886	50.9800	13.094
2026	1.450	20.150		15.756			8.956		46.311	52.7650	6.454
2027	1.450	12.270		15.756			8.956		38.432	54.5500	16.118
2028	1.450	4.380					8.956		14.786	56.3350	41.549
2029		1.640					8.956		10.596	58.1190	47.523
2030		1.660	6.970				8.956	8.043	25.629	59.9040	34.275
2031			7.300					8.043	15.343	87.1270	71.784
2032			10.900					8.043	18.943	89.6380	70.695
2033			14.620			18.076		8.043	40.738	92.1530	51.415
2034			14.810			18.076			32.886	94.6660	61.780
2035			38.750			18.076			56.825	97.1800	40.355
2036			35.900		12.848	18.076			66.823	99.6930	32.870
2037			38.340		12.848				51.187	102.2060	51.019
2038			38.700		12.848				51.548	104.7180	53.170
2039			49.020		12.848				61.867	107.2310	45.364
2040			19.990						19.990	109.7450	89.755

Source: JICA Project Team

The projected total financing resources are more than enough to cover the investment requirements. However, there is one year where a shortfall is estimated and two years where the margin is tight. In which case, two options can be considered. Request for higher national government allocation or postpone the implementation to surplus year. Note previous observation that the projection of available financing is very conservative as it was based on historical budget allocation to the region, which has not had any rail investment. If the rail project is approved, then additional budget allocation is expected. Moreover, with better fiscal management, LGU revenues can increase by adopting land value capture principles.

3) Financing Strategy for Priority Projects

Financing options for each of the projects will be discussed here as well as the institutional arrangement for the implementation and areas for collaboration with project stakeholders.

Table 10.3.6 below summarizes the profiles and status of the priority projects. Based on preliminary analysis, all projects are estimated to be economically viable.[2]

Table 10.3.6 Priority Projects

Project	IA	Const. Cost (PHP Billion)	Financing Option	EIRR (%)	FIRR (%)	Status of Preparation	Recommended Implementation Year
1. Mandaue Lapu-Lapu Link Bridge (4th Mactan Bridge) including Mandaue Coastal Road (not a toll facility)	DPWH	19.2	Pure public financing	13%	N/A	Preliminary study done under the Roadmap Study Included in the Priority Investment Program (PIP)	2023
2. Metro Cebu Circumferential Road Segment 1 (not a toll facility)	DPWH	36.4	Pure public financing	18.9%	N/A	FS completed by DPWH; under review by NEDA	2023
3. UMRT Central Line / Central Section; Phase 1	DOTr	78	Hybrid PPP	14.2%	0.5%	Preliminary study done under the Roadmap Study	2023
4. UMRT Coastal Line/ Phase 1	DOTr	44	Hybrid PPP	10%	-2.1%	Preliminary study done under the Roadmap Study	2026
5. Area Traffic Control System (detectors and CCTV, CPU and message signboards)	DPWH and LGUs	10.15	PPP/ Build-Transfer-Operate	11.3%	N/A	Preliminary study done under the Roadmap Study	2022

Source: JICA Project Team

(1) Mandaue to Lapu–Lapu Bridge (4th Mactan Bridge) including Mandaue Coastal Road

This bridge is supposed to serve vehicular traffic, especially the Mandaue coastal road traffic. It is not designed to be a toll facility, so it will purely be public-financed. The bridge should be under the purview of DPWH as it will be along a national highway. Public procurement guidelines will be used in the construction of the project.

[2] Estimated economic internal rates of return higher than the NEDA-prescribed 10% social discount rate.

As the executing agency for the bridge project, DPWH will go through the requisite approval process of the project with the Investment Coordination Committee (ICC) of the NEDA Board and, if approved, guide its inclusion in the budget request (see Box 1 for the indicative budget calendar) and eventual implementation. After ICC approval of the project, Department of Finance (DOF) will decide on the appropriate financing source, i.e., domestic or ODA funding.

The affected LGUs are not expected to play a direct role in the implementation of this project; however, they can help with ROW acquisition if any and in the traffic management at construction stage.

(2) Metro Cebu Circumferential Road

The Circumferential Road is a national road, hence under the purview of DPWH. It is not designed as a toll road, so it is also best funded by pure public resources. The road involves a tunnel and bridge in the mountain area; the design is unlikely to be boiler plate. Given this condition, it is best to have discrete procurement for the design and construction rather than a design-build type of procurement. Public procurement guidelines will be used in the design and construction of the project.

DPWH will go through the requisite approval process of the project with ICC of the NEDA Board and, if approved, guide its inclusion in the budget request and eventual implementation. After ICC approval of the project, DOF will decide on the appropriate financing source, particularly either domestic or ODA funding.

As in the first project, the LGUs will have little direct involvement; but can facilitate ROW acquisition and traffic management during construction.

Table 10.3.7 Indicative Budget Calendar

Activity	Schedule
1. Issuance of Budget Call	January
2. Budget Forum: DBM, NGAs, GOCCs	February
3. DBM Regional Office/ Agency Regional Office Budget Forum	February
4. Consultations of Agencies' On-going Programs and Projects with: RDCs, CSOs, Stakeholders	January–February
5. Submission of Budget Form No. 201—Past Year's Actual Obligation and Current Year Appropriation	February
6. Formulation of Forward Estimates (Hard Budget Ceiling)	January–February
7. Technical Budget Hearings with Agencies	February
8. DBM Budget Review	March
9. Sending of Confirmation Letters to Agencies	March
10. Presentation to the President and the Cabinet and approval of the Hard Budget Ceiling of Departments/Agencies and Special Purpose Fund	March
11. Issuance of Ceiling and Budget Priorities Framework	March
12. Budget Forum: National Government Agencies and GOCCs	March
13. RDC Consultation/Dialogue with Selected Agency Central Offices	March–April
14. Deadline of Submission of Budget Proposals	April
15. Technical Budget Hearing on New Spending Proposal	May
16. DBM Budget Review	June

Activity	Schedule
17. Sending of confirmation letter to agencies of the total budget levels	June
18. Finalization of National Expenditure Program (NEP), Budget of Expenditures and Sources of Financing (BESF) Tables, Staffing Summary, and Budget Message	June–July
19. Printing of Budget Documents	July
20. Submission of Budget Documents to the President	July
21. Submission of the President's Budget to Congress	July
Note: Congress approval of budget is expected in December. If the budget is not approved, then the past year's budget will be reenacted.	

Source: Department of Budget and Management

(3) UMRT Central Line (Central Section) and UMRT Coastal Line (Phase 1)

The projects fall under the purview of DOTr. According to the policy of the department, implementation will be led by the Office of the Secretary rather than its attached rail agencies, such as LRTA or PNR, who will focus their role on regulation.

Based on the preliminary financial analyses of the projects, the FIRRs are 0.5% for the UMRT Central Link and -2.1% for the UMRT Coastal Line. Revenues from farebox are way below the capital cost of the project. Full cost recovery from tariffs is, therefore, not possible. However, the farebox can support securely the operation and maintenance cost of the projects. As such, both projects will be a hybrid PPP arrangement.

Hybrid PPP refers to an arrangement where projects are funded partly by public and private resources. The government agency concerned determines the best discrete delineation of project components for public and private financing. For example, the government undertakes project construction using public resources or ODA and the contracted private sector for operation and maintenance. This scheme is usually used for big infrastructure projects that can benefit from highly concessional ODA financing for the construction of the project. If there are management efficiencies recognized by the government, then, operation and maintenance are contracted to the private sector. Hence, in this case there will be two separate financing and procurement streams: (i) for the project construction using public funds and public procurement guidelines, and (ii) for operation and maintenance using private funds and PPP procurement guidelines. Table 10.3.8 illustrates an example of a hybrid arrangement for the LRT 1 project.

A bundled PPP arrangement would not have been legally tenable as the law limits government participation to a maximum of 50% of the project cost.

Table 10.3.8 LRT 1 Hybrid PPP Arrangement

The Light Rail Transit (LRT) Line 1 is the oldest of the three urban railway systems in Metro Manila. It was constructed and operated starting in 1984 by the Light Rail Transit Authority (LRTA), a government-owned and controlled corporation under the DOTr. In 2014, the government decided to enter a public-private partnership (PPP) arrangement for the extension of the line and the operation and maintenance thereof and that of the existing line.

The arrangement is referred to as a hybrid PPP; essentially government paying for a component of the project and the private proponent or the concessionaire, shouldering the rest of the investment cost. In the LRT 1 PPP project, the agreed attribution of components is as follows:

Government using ODA, budget appropriation or other PPP schemes	Private proponent using 20% equity and 80% loan
• New light rail vehicles (LRVs).	• Rehabilitation of the existing line and stations.

• Refurbishment of existing LRVs. • Right-of-way for the line extension. • New satellite depot and expansion of existing depot. • Automated Fare Collection System (under a separate PPP scheme).	• Extension line with eight stations. • Operation and maintenance of the existing and the extension line. • Performance enhancement works throughout the concession period.
Government will implement its components using public procurement guidelines and other PPP arrangement and, upon completion, assign them to the concessionaire who will be given the right to use them. They will, in turn, be responsible for the operation and maintenance of the system.	

Source: JICA Project Team

Structuring the Hybrid PPP arrangement:

The discrete delineation of components will be capital investment and construction of the project and operation and maintenance. DOTr will shoulder the investment cost and undertake the procurement of the design and the project construction using public procurement guidelines. In the design, DOTr should consider the potential for new commercial development in the stations or integrate in existing commercial activities to the stations through convenient access to generate additional revenues—other than the farebox. Major stations can also be designed to be intermodal nodes or terminals to improve viability of commercial activities.

For the operation and maintenance phase, the government has two basic options: management contract or affermage or structured lease agreement. A management contract is simpler and much more straightforward but lacks opportunity for government to share project risks with the private sector.

(i) Management Contract

The simplest management contract involves the private sector being paid a fixed fee by the government implementing agency for performing specific tasks. In this arrangement, there is very little risk borne by the private sector. Some contracts are designed to be performance-based in which private sector takes on more risk, such as asset condition or achievement of pre-defined performance indicators.

Key features of management contracts are:

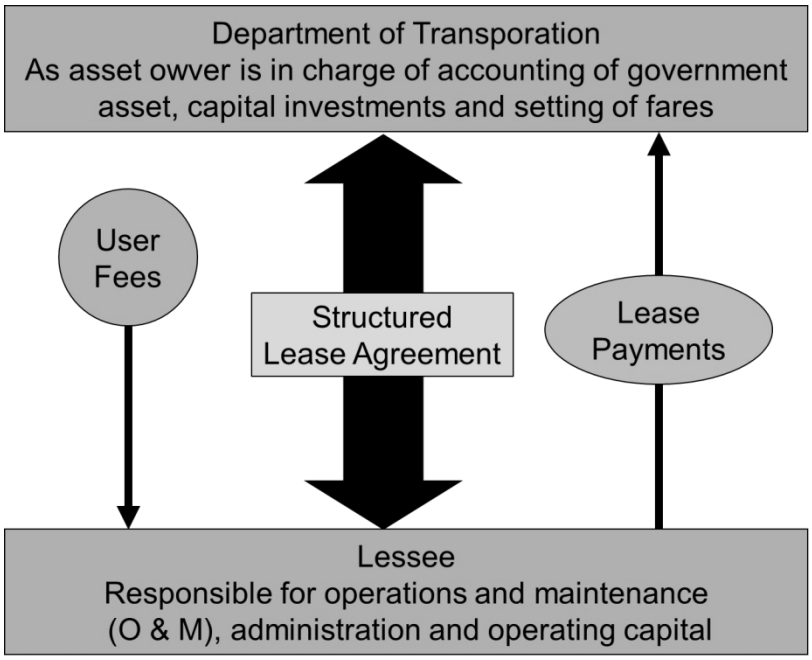
- Defined range of activities that the contractor will manage.
- Usually short-term in nature.
- Limited potential for improvements in efficiency and performance.
- Contractor is usually paid a fixed fee to cover staff and expenses. They may also be a performance-based fee and liquidated damages for failure to achieve performance parameters

(ii) Management Contract

Affermage is a revenue sharing contract in which the private contractor leases the facility and operates it commercially. The public sector retains the ownership of the leased assets and finances their renewal or expansion, while the private contractor delivers services, runs the business, and maintains the existing assets for the period of the lease.

An affermage bid is usually based on the lowest share of the contractor on the unit user fee or, in the case of a rail project, on the fare per passenger. Hence, under an affermage arrangement, the lessee assumes much of the commercial risk of the operations. The lessee's profitability depends on how much the private operator can reduce costs and increase service delivery while meeting quality standards in the lease contract.

The basic structure of this arrangement is shown in Figure 10.3.3.



Source: JICA Project Team

Figure 10.3.3 Affermage or Structured Lease Agreement

The affermage approach has the following advantages over management contracts:

- **Direct incentives for performance improvement.** The lessee has strong, direct incentives to reduce costs, increase service delivery, and improve customer satisfaction with the service provided. The basis for the direct incentives is the share of the contractor for the fare paid by each passenger. For each additional passenger that the contractor attracts, it will earn a corresponding additional share from the added ridership. This gives them a strong incentive to provide good service to increase patronage.

- **Separation of capital investment from "management investment."** As capital investments will be borne by the government, the private contractor will focus on the management investments only and attend on risks that are mostly within his ability to control or mitigate. This includes investment in developing new organization structures and systems, information technologies and systems, training staff, putting in place incentive systems, and so forth. In many cases, a private operator will need to invest heavily in management improvements and systems for several years before the benefits of these investments begin to accrue.

  As the private operator builds new management systems and capabilities, the government can more easily access external funding for expansion because donors and investors have more certainty about the revenue stream of the facility.

To make this agreement more attractive, the private contractor can be given development rights for commercial activities within the ROW or terminals. The contract can have separate provisions for leasehold on land owned by DOTr (or partner LGUs of DOTr, if any) or revenue sharing.

DOTr will need to secure approval of ICC for the hybrid PPP scheme as well as the capital investment required.

About the involvement of LGUs, once again, they do not have a direct role in the execution but can help with the ROW acquisition and traffic management during construction. LGUs can also ensure facilitation of development activities through appropriate zoning ordinance and fast processing of business permits.

(4) Area Traffic Control System Project

Area traffic control systems (CCTVs, CPUs for data processing and telecommunication network, control room and variable message sign boards) are under the purview of DPWH for national roads and local governments.

In Metro Manila, a metro-wide traffic control system is under the administration of the Metro Manila Development Authority. In the absence of such an institution in Metro Cebu, the respective LGUs plan, finance, and install their respective traffic control systems. Only three LGUs in Cebu, namely Cebu City, Lapu-Lapu City, and Mandaue City have their own traffic control centers to manage signalized intersections within their jurisdictions. There is, however, no linkage between the three traffic control centers or any strategic coordination on traffic management across LGUs in Metro Cebu.

For the area traffic control system project to be effective, it should have seamless operation and unbridled by political jurisdictions. major challenges are anticipated in project development, financing, and operation and maintenance as several LGUs will be involved. The following options on the institutional arrangement and financing are for consideration.

With respect to the capital cost, the project is eligible for financing by the Road Fund. However, the fund will very likely not be able to cover 100% of the cost as the project cost is 11 times the annual collection of the sub fund that invests on traffic management projects. The remainder of the project cost must be shouldered by the Metro Cebu cities and municipalities or the province if willing.

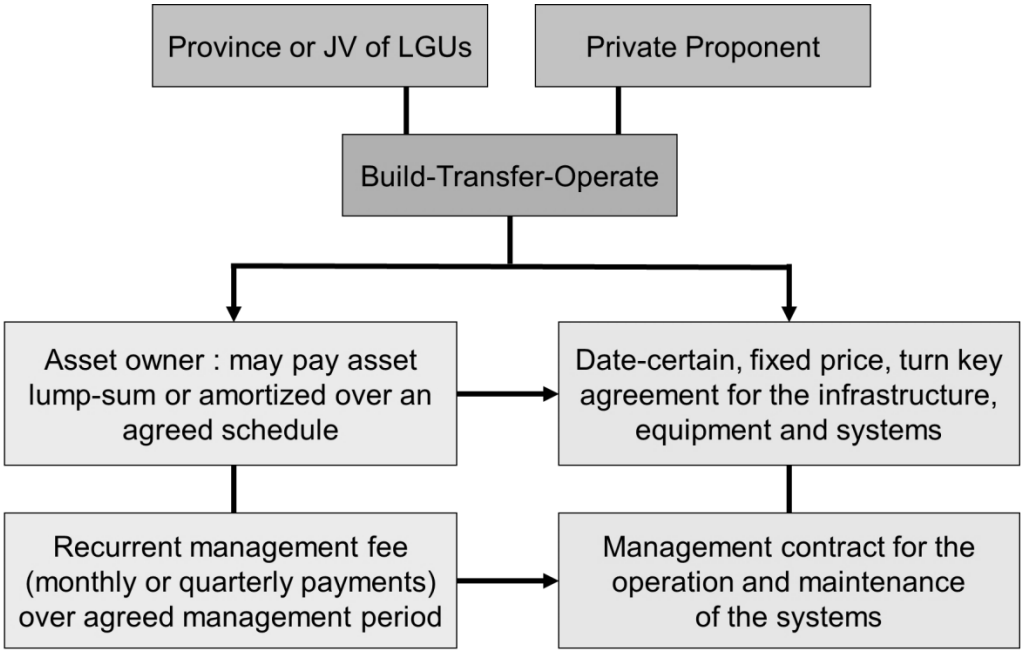
- **Option 1.** The simplest will be for the province to take on this project and defray the residual cost. It will also serve as the lead in the project development and implementation.

- **Option 2.** Metro Cebu LGUs enter into a Memorandum of Agreement (akin to and with the force of a contractual JV) for joint implementation of the project. This agreement will include cost sharing formula, delineation of roles and responsibilities in the project development, procurement and implementation, and operation and maintenance of the facility. Of course, this is not easy as this requires unanimous buy-in for it to work, complex fiduciary arrangements (budgeting, accounting, funds flow and audit), project management, and service provision. MCDCB can provide unbiased facilitation and coordination work in setting up the agreement and the institutional arrangement for the operation and maintenance of the facilities.

As of this writing there are pending legislative bills that will create a single body that will oversee metro-wide transportation planning and implementation or traffic management (i.e. Metro Cebu Traffic Coordinating Council or a Metro Cebu Urban Transport Development Authority). However, as passage of any of these bills is uncertain, there should be a reliable interim institutional arrangement. It is best for the operation and maintenance phase to be

under one entity. Options are to designate a lead among the LGUs to be the service provider or contract a private service provider.

An option to consider is to implement the project through a PPP/build-transfer-operate (BTO) contract. The BTO will have two components (i) build and transfer will be under a date certain, fixed price, and turnkey arrangement; and (ii) operation and maintenance under a management contract.



Source: JICA Project Team

Figure 10.3.4 Structure of the Build-Transfer-Operate Arrangement

Financing of the first component will come from a mix of DPWH Road Fund and LGU capital contributions. In the O&M stage, a formula for the LGU shares for the periodic O&M and management fee will be agreed upon and stipulated in the memorandum of agreement, including the mechanism to ensure payments such as setting up an escrow account. Payment obligations can also be backed up by a third-party guarantee (for example, by LGU Guarantee Corporation or Philippine Export-Import Credit Agency (PhilEXIM)) to enhance the bankability of the PPP arrangement. So, in case the LGU fails to deposit the required contribution for the management contract fees, the guarantee entity will provide the payment. In return the guarantee entity will have a recourse on the resources of the LGU, most likely in the form of an IRA pledge. In lieu of a guarantee, the LGU can opt to earmark recurrent revenues. For example, an amount received real estate taxes that will flow automatically to the escrow account for the management contract.

A major challenge for this undertaking is defining categorically the minimum performance standards and specifications (MPSS) for the capital investment and key performance indicators for the operation and maintenance stage. Hence, LGUs are advised to get expert advice in crafting the MPSS and, in general, the bid terms of reference for this project including the draft contract and contract management guide.

Although a PPP arrangement for this type of project has not yet been tried in the Philippines, there are successful precedents in other countries, particularly Germany, Italy, UK, Ireland, among others. In all cases, the private O&M provider acted as a traffic adviser. Traffic control and enforcement remained to be responsibility of the public sector. Operating efficiency was unequivocally successful, but problems arose with financial sustainability for contracts that required the private operator to recoup their costs from collateral business

such as sale of traffic information. Thus, in the case of Metro Cebu, the viable arrangement will be a turn key contract and guaranteed management fee from the LGUs.

4) Exploring Application of TOD and Land Value Capture (LVC) for Financing Infrastructure Projects

JPT introduced the concept of raising financing for infrastructure projects from TOD and LVC. This concept is new to the Philippines but has been used extensively and successfully in other countries such as Japan, Korea, and Hongkong among others.

TOD projects refer to activities that are enabled or made viable by transportation projects, such as commercial development in rail stations or terminals, or real estate development around a transport network. In cities such as Tokyo, Hong Kong, Seoul and New York, LVC from TOD is used to pay for the cost of infrastructure services.

This scheme is most effective for infrastructure facilities with costs of which cannot be recovered from user fees alone. These countries have matured urban and transport integrated planning systems, conducive enabling environments, and tested mechanisms for this LCV, including real property taxation, leasehold, sale of air rights, land readjustment or redevelopment. In these cities, there were deliberate plans to use transport infrastructure as the backbone of their urban development plans and how LVC can be used significantly as a financing strategy.[3]

In the Philippines, gains on LVC has redounded mostly to private developers. No surprise that PPP infrastructure projects have attracted conglomerates with business lines on commercial and real estate development.

Although limited, there exist legal bases for private sector participation and the government taxation and regulatory powers that can open opportunities for LVC, particularly:

(i) The BOT Law has a specific variant, develop-operate-transfer (DOT), that capitalizes on opportunities for property development together with the infrastructure project. It has also an explicit provision that part of the proponent's repayment in other variants would be development rights. There are several examples of projects with property development elements. However, most were not deliberately structured to contribute to the infrastructure cost recovery, but rather property development was used as an incentive for proponents.[4]

   (a) **MRT-3.** The project used the build-lease-transfer variant of the BOT Law. The proponent was given the right to develop the property at the North Depot (North Triangle area in Quezon City). The private proponent financed and built the facility; leased it to the government who operated it. Capital cost recovery was through the lease payments that were pegged to a 15% rate of return for the proponent. The contract included development rights to enable the proponent to potentially get profits beyond the stipulated 15% rate of return from the rail project. Government was supposed to get a share from the property development profits.

   (b) **LRT-1 extension to Cavite and O&M.** This project consists of a BTO arrangement for the line extension and an O&M contract for the entire line. The winning bidder offered the highest premium instead of requiring a subsidy. The project includes development rights in key stations.

[3] Ibid

[4] Source: Philippine PPP Center project information

(c) **Southwest Terminal of the Integrated Transport System (STIS).** STIS will connect passengers coming from the Cavite side to other transport systems, such as the LRT-1 extension, bus, taxi and other public vehicles serving inner Metro Manila. It has terminal buildings, arrival and departure bays, public information systems, ticketing and baggage handling facilities, and park and ride facilities. The project will be done through the BTO variant under the BOT Law. The private proponent will design, construct, and finance the terminal as well as operate and maintain it. An estimated PhP2.5 billion investments from user fees and commercial development rights is expected to be recovered by the proponent.

An example of a project that uses commercial development to finance infrastructure is the proposed Laguna Lakeshore Expressway Dike. It includes a 47-km toll road, a dike for flood control, and 700 m^2 reclamation. The high construction cost of the road and dike make them financially unviable. Therefore, coupling the infrastructure development with a reclamation component, the cost of the infrastructure facilities can be recovered from the revenues from the commercial and real estate development of the reclaimed area.

(ii) The NEDA Joint Venture Guidelines for Government-Owned and Controlled Corporations also allows grant of development rights.

(iii) The LGU Code presents several opportunities too, namely:

(a) LGUs have the authority to adjust real property taxes, subject to the amendment of its Revenue Code.

(b) Zoning ordinances and fiscal incentives can encourage redevelopment of a land area.

(c) They are allowed leaseholds on their real property.

(d) They are also allowed to undertake joint development with the private sector through joint venture arrangements; or use the BOT Law for build operate type of projects with development rights and get a share from the profits therefrom.

The immediate opportunities under the Metro Cebu Transport Plan include:

(i) **Commercial development benefits from UMRT Projects.** This can be designed to account for commercial development in stations supported by appropriate zoning ordinance. DOTr can require a share in the revenues from commercial development. In case LGU-owned land will be used, it can enter into a MOA with the concerned LGU to share revenues; or facilitate lease agreements between the LGU and the private operator.

(ii) **Raising funding of the Area Traffic Control System (ATCS) from adjustment of real estate taxes.** LGUs who will benefit from the infrastructure development can do two things to raise additional revenues to fund the ATCS investment share:

(a) Where appropriate, revise the zoning of areas to encourage commercial development and other high value activities.

(b) Revise the respective Revenue Code to increase the real estate taxes. A portion of this revenue can be earmarked for recurrent management fee to the ACTS operator.

(c) Enter into leasehold agreements or joint venture development of lands owned by the LGU.

5) Conclusion

From a general perspective, the Philippines has larger fiscal space to finance projects from internal resources and ODA funds, especially for hybrid PPPs. Similarly, high liquidity and prevailing low interest rate regime of the Philippine financial market enables PPP private developers to source financing domestically.

From the point of view of the priority projects

(i) The road and bridge projects, except for Cebu–Cordova Link Expressway Project and potentially the two long-term projects Metro Cebu Coastal and Outer Metro Cebu Circumferential Expressways are appropriate for pure public financing, possibly using ODA resources. DPWH is the implementing agency for both projects; therefore, they must secure approval of the projects from ICC and with the budget appropriation request.

(ii) The two rail projects, UMRT Central and UMRT Coastal Lines are potential candidates for hybrid PPP implementation. DOTr is the implementing agency for the UMRT project. Like DPWH's role, it must secure ICC approval of the project, request the budget for the public component, and manage the procurement of the O&M PPP contract.

(iii) The General Intersection Improvement Project, involving Area Traffic Control System is required to have a metro-wide application for it to be effective. However, in the absence of a Metro Authority, the project must be undertaken jointly among the Metro Cebu LGUs or the Province if willing to do so. The project is eligible for funding by the Road Fund. However, it may not get 100% funding, hence the need for cost sharing from LGUs or by the province.

This project has the most complicated institutional arrangement because several LGUs may be involved in financing and project implementation. A contractual joint venture type of arrangement may be used to govern inter-LGU agreements on project implementation.

For the installation and operation and maintenance of the project, the LGUs may consider engaging a PPP contractor under a build-transfer-operate arrangement.

(iv) For the national projects, LGUs will not have direct participation in the implementation of the projects but can assist in ROW acquisition and traffic management during construction.

11 STRATEGIC ENVIRONMENTAL ASSESSMENT AND ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

11.1 Approaches for Strategic Environmental Assessment and Environmental and Social Considerations

1) Strategic Environmental Assessment Approach in this JICA Project

The JICA Project Team carried out a situation analysis of environmental and social considerations from the perspective of urban transport and, in the process, reviewed CLUPs and CDPs of the LGUs. The Team then held meetings to discuss scoping and screening methods as part of Strategic Environmental Assessment (SEA) and will carry out environmental and social consideration evaluation of the proposed master plan alternatives when the draft master plan is prepared.

The proposed master plan will be disseminated to the people in Metro Cebu through newspapers, the Internet, and other possible means since part of the SEA activities is to get the public's comments. The Team has already developed a website where people could also send comments. As for the priority projects, preliminary screening at the initial stage of selection was carried out. (Website: www.mcutmp.org)

Stakeholders' meetings for the purpose of public hearing or consultative meeting were carried out twice in each LGU. The first stakeholders' meetings were mainly to introduce the JICA Project as a form of information, education and communications (IEC) activity to disseminate the information and to solicit support and participation in the Project's planning and activities. The second stakeholders' meetings were conducted for the purposes of a) validation of the first stakeholders' meeting results, 2) presentation of the Project's initial findings and recommendations (priority projects) and 3) presentation of the direction of the transport infrastructure development in Metro Cebu and hearing opinions on the findings and recommendations on the transport network plan.

SEA and environmental and social considerations (ESC) activities to conduct in this project are as follows.

(i) Review of existing development plan, development projects, studies, and public and private investment.

(ii) Analysis to identify environmental and social constrains to the urban transport system developments.

(iii) Confirmation of legal framework and institution of the Philippines on environmental and social considerations, and examination of the experiences of SEA study in the Philippines.

- Review of laws, regulations, and standards related to environmental and social considerations, such as Environmental Impact Assessment (EIA), resettlement, public participation, information disclosure, and others.
- Sort out gaps between the "JICA Guideline for Environmental and Social Considerations (April 2010)" and legal framework in the Philippines on environmental and social considerations.
- Institute of relative agencies responsible for implementation of projects and their roles on environmental and social considerations including EIA and SEA.

(iv) Study of methods for SEA implementation under coordination with the stakeholders.

(v) Study to identify the subjects of SEA, the urban transport system developments with alternatives proposed as strategic scenarios, development plans or project prioritization under consideration of developed policy and plans.

(vi) Data collection of the existing environmental and social conditions for SEA subject scenarios, plans or project prioritizations with alternatives as the baseline data.

(vii) Scoping (clarify extremely important items on environmental and social impacts and its evaluation methods with indicators and criteria for evaluation).

(viii) Prediction of likely impacts according to the scoping.

(ix) Evaluation of likely impacts of the alternatives including 'without project' option through comparative analysis based on (viii).

(x) Examination of the mitigation measures (to avoid, minimize, and compensate) for the selected alternative in (ix).

(xi) Examination of the monitoring methods (monitoring items, frequencies, and methods) for the selected alternative in (ix).

As part of the IEC activities, the scoping, assessment for SEA, stakeholders' meetings, consultative/workshop sessions were conducted to involve the public in the JICA Project undertakings.

Stakeholders' meetings were conducted in each of the 13 Metro Cebu LGUs. The first of the stakeholders' consultative meetings was basically for IEC and scoping (determination of issues and concerns and the coverage/extent of the SEA/ESC/EIA) with participants from the LGUs, local communities, and sectoral representatives.

The second will be to present the completed Draft Urban Transport Master Plan for comments and further inputs from the stakeholders. This will be the equivalent of "public hearing" in the Philippine EIA System procedural guidelines. The participants for these meetings will be the same as those from the first stakeholders' consultative meetings.

The consultative/workshop session with representatives from government agencies—DENR-Environmental Management Bureau (DENR-EMB), Department of the Interior and Local Government (DILG), DPWH, Department of Health (DOH), Housing and Land Use Regulatory Board (HLURB)—councils/bodies (e.g. RDC and Protected Area Management Board), and private sector resource persons (e.g. academics and professional organizations—environmental planners, architects) was conducted to discuss the SEA/ESC methodology, SEA objectives and indicators, and preliminary assessments of JICA Project's environmental/social impacts with reference to identified objectives/indicators.

Environmental and social concerns related to transport identified in the stakeholders scoping meeting, roadmap study, and environmental reports (e.g. DENR-EMBs Air Quality monitoring) served as basis for the determination and selection of the environmental objectives and indicators for SEA of the JICA Project and the selected priority programs/projects.

The SEA Environmental Objectives and Indicators were selected based on the results of the stakeholders meeting/scoping exercise, consultative/workshop sessions, roadmap study, and current environmental conditions.

The JICA Project's SEA Environmental Objectives are as follows:

(i) Prevention/reduction of detrimental effects of air pollution on human health and the environment.

(ii) Prevention/reduction of transport contribution to climate change.

(iii) Protection and maintenance of watersheds, green/open areas, and coastal areas/mangroves.

(iv) Avoidance of sprawl and destruction of the environment by transport infrastructure.

(v) Avoidance of illegal displacement/relocation and loss of livelihood.

(vi) Others

Table 11.1.1 Environmental Objectives and Indicators

	Environmental Objectives and Indicators
1. Prevention/reduction of detrimental effects of air pollution on human health and the environment.	
Reducing atmospheric pollution	Decreased level of air pollution—nitrogen oxides, hydrogen oxides, escaping organic compounds, persistent organic pollutants, dusts
Health Statistics	Decreased mortality/morbidity rates of respiratory diseases
2. Prevention/Reduction of transport contribution to climate change	
Climate change	Transport greenhouse gas emission per capita
3. Protection and maintenance of watersheds, green/open areas, and coastal areas/mangroves	
CLUPs/Zoning districts	Identification of watersheds, protection areas
	Percentage increase/decrease of road openings in protection areas
4. Avoidance of sprawl and destruction of the environment by transport infrastructure	
Land coverage of transport infrastructure	Land consumption by transport infrastructure (as % of total surface)
5. Avoidance of illegal displacement/relocation and loss of livelihood	

Source: JICA Project Team

3) Stakeholders' Meeting

(1) 1st Stakeholders' Meeting

At the first step of the SEA, the JICA Project Team conducted stakeholders' meetings from February to April 2018. The program for the scoping meetings is follows:

(i) Project/Study overview and the requirements/methodology for SEA/ESC;

(ii) Discussions on transport-related issues and concerns of your city/municipality;

(iii) Discussions on transport-related policies, legislations/ordinances, programs, projects, measures, and action plans of the LGU; and

(iv) Provisional scoping of environmentally and social considerations' impacts and mitigation.

The first stakeholders' meetings were conducted at all LGUs. Participants in this scoping meeting are department heads; city or municipal councilors in-charge of the committees on planning, infrastructure/public works, traffic management and safety, environment and health; barangay captains; and representatives from the private sector, such as business group, transport group, and civic organization who were designated by the mayor are expected.

Although the meetings were initially planned to start from the end of February to the middle of March, the last stakeholders' meeting was conducted in the middle of April due to various factors. There were also more attendees in plan to attend the meetings so as to get different point of views on traffic issues, yet somehow most of the stakeholders' meetings were attended only by the departments of cities and municipalities. That is one of the lessons learned by the Project Team during this SEA activity.

LGUs needs more time to prepare for a stakeholders' meeting and the Project Team needs to strive to make the LGUs understand the purposes and expected outcomes of the SEA.

The first stakeholders' meetings identified the following environmental and social issues:

(i) Increasing incidence of respiratory diseases and tuberculosis attributed to air pollution from transport vehicles emissions. Some LGUs reported that upper respiratory tract infection (URTI) is becoming number one on the morbidity/mortality rates.

(ii) Transport infrastructure influences sprawl with some participants expressing concerns and one expressing opposition for mountain highways adverse impacts on watersheds and protection areas. They are against the upland expressways since it will affect the upland mountain areas and some watersheds and protected areas, one expressing preference for development/upgrading of existing highways or along its alignment.

(iii) Transport infrastructure along or within the coastal foreshore areas (e.g. causeways, ports/docking facilities for water taxis/buses) could have an impact on mangroves and marine resources.

(iv) Policies on preservation of trees hinders removal of old trees which poses hazards and risks to motorists.

(v) Displacement of people and property along road widening, opening of new roads, building/development of transport infrastructures

(vi) Transport infrastructures that will influence the increase in the number of establishments and residents and the corresponding increase in flood occurrence, solid wastes generation and pollution.

(vii) Safety, accessibility, and convenience of transport infrastructures/facilities by students, PWDs, senior citizens, women and children.

(viii) Development of green transport modes and infrastructures, such as e-bikes (e.g. tricycles, cars), bike lanes, green corridors, etc.

(2) 2nd Stakeholders' Meeting

The second stakeholders' meetings were initially planned to present the draft urban transport master plan, yet they were instead conducted for the purposes of a) validation of the first stakeholders' meeting results, b) presentation of the Project's initial findings and recommendations (priority projects) and c) presentation of the direction of the transport infrastructure development in Metro Cebu and hearing opinions on the findings and recommendations on the transport network plan

The second stakeholders' meetings started from the middle of August and will complete in the first week of September, although the initial plan was to complete by the end of August. Although it was planned ahead and informed to the LGUs regarding the date and the preparation, the Team has encountered schedule change for half of LGUs, which made the Team difficult to complete the necessary reporting for this DMP.

While the second stakeholders' meetings were carried out better in some LGUs, such as Talisay, Naga, Lapu-Lapu and Cebu City, but the Team also experienced very limited number of participants in some LGUs.

The second stakeholders' meetings identified the following transport network, and environmental and social issues, and opinions and questions from the LGUs:

(i) Urban Transport and Traffic Management

- In the transport network plan, where the LGUs can see their road network development plans and how those plans are connected/related to the proposed urban transport master plan? For example, Mandaue City's CLUP has already identified the plan for inner and outer Mandaue City circumferential road, and a part of it is identified in the MCUT master plan as the Coastal Road. Since the Coastal Road is just a bypass road, whether there is a plan to connect it to the inner circumferential road to connect to the inner city of Mandaue, and whether the Mandaue inner and outer circumferential roads will be considered as national highway to be included in the MCUT master plan or to be developed by the city? It is not clear the connectivity of the road network proposed by the Team and the proposed plan of the city. It is suggested that the widening of the inner circumferential road be part of the medium/long-term plan of the MCUT master plan.

- How the MCUT master plan align all the plans of the different LGUs is a key concern and it does not show in the MCUT master plan. The LGUs need to align all the plans to the master plan so that the master plan will be completed or the LGUs who have not completed their CLUP shall need to align their plans to the master plan, but clear guidance or development directions are not suggested in the master plan.

- Will all proposed projects be implemented by the national government, or is there any projects that the LGUs shall allocate budget so that the LGUs can be of help to the master plan?

- BRT project is not explicitly illustrated in the urban transport network plan. What is the stance of the Team regarding the BRT project and whether it will be extended to adjoined LGUs, how it is considered in the future network?

- Green loop or green corridor proposed in the Roadmap Study shall be part of the master plan as well.

- It was suggested to have another route exclusively for cargo trucks so that national highways will not be affected with heavy traffic congestions considering cargo trucks from the southern Cebu into Cebu City and Mandaue City cause most of traffic congestions adjoined cities of those two cities. Besides that, in near future, it is expected to see more cargo trucks and six-wheeler trucks along with the economic growth and more industrial investments to LGUs in southern Cebu Island.

- Sea transport system shall be taken into the consideration of transport network system.

- It was questioned whether the Team has review and/or consider unsolicited proposals from private companies, such as monorail and LRT projects?

- It was suggested to consider transport mode for residents who live in hillside. It was commented that 80% of the population live on mountain barangays, so that

the Team shall not only focus on CBD on the urban area, but also the suburban, the mountain barangays as well. Because of limited transport means in those barangays except for illegal habal-habal (motorcycle taxi), Cebu City is looking into institutionalizing motorcycle taxi as public transport. It was question if motorcycle taxi is included in the master plan as one of transport system.

- Hierarchy of transport policies and transport development plans shall be adjusted because not all LGUs (executive and legislative administration) in Metro Cebu have endorsed the Mega Cebu "Vision 2050" although it was included in the Roadmap Study and endorsed by the RDC. The plan to be referred which have endorsed by the executive and legislative administration of the LGUs is the "Central Visayas Medium-term Regional Development Plan 2017-2022" and also the policies and development plans of respective LGUs in Metro Cebu.

- If the plan of distributor roads of Metro Cebu Circumferential Road are decided without the consultation of affecting LGUs, the particular city and municipal development councils, and even the provincial development council, how the LGUs cooperate with the national government agency for its implementation is the main question to be asked. Development of distributer roads connecting to the Circumferential Road will affect informal setters in the mountain barangays, so the careful study of the alignment shall be carried out with necessary public consultation with the stakeholders.

- It was suggested that a road network plan for mountain area is needed, such as connecting mountain area of Carcar, San Fernando, Minglanilla and others so that people who live in mountain areas will not need to come down to national highways and go up again to mountain areas to go to their destinations. It would also decongest national highways.

- All mid and long-term plans and projects are very promising, but what would be the programs and plans from now until to those plans?

- An ordinance on an inter-LGU cooperation from Camotes, Sogod, Catmon, Compostela and Carment is under preparation. The ordinance has uniformed implementation of their projects and it has a provision regarding uniformed speed limits from Danao to Sogod.

- Service roads that are not far away from national highways would greatly benefits tricycle drivers in their livelihood, so it is proposed to have such.

(ii) Environmental Considerations

- Upper respiratory tract disease is common in some LGUs, but it is not that serious.

- It was questioned whether the master plan includes sidewalks lined up with threes so as to provide shade for the pedestrians. It would also help in the environment aspect of urban areas.

(iii) Social Considerations

- Relocation of informal settlers shall be taking into consideration seriously because highly urbanized LGUs have limited relocation sites since it is very expensive within the cities. Relocation to available and less expensive lots outside the cities would affect the livelihood of the involuntary resettles who mainly have marginal works in urban areas.

- Is there any policy suggested by the Team to regulate or control the volume of private cars?
- It was suggested that traffic education shall be integrated in school education.
- Is the new transport system can accommodate the PWD and in what way? What is the policy in the master plan to better accommodate the PWD?
- What will be alternative solutions for drivers of multicabs, tricycles and trisikads, if the new transport system is implemented?
- The master plan does not much consider about the poor. Instead of developing transport infrastructure it is more effective if the traffic volume is reduced, and what would happen to the drivers to habal-habal, tricycles and trisikads after the implementation of new transport system?
- The priority projects show less consideration to the informal sector. The priority projects will affect informal settlers by demolishing their houses, so it is anti-poor. Since 50% of the population of Metro Cebu are informal settlers, many of them will be affected by the proposed priority projects.
- It was commented that traffic law enforcement is not strictly applied so drivers and road users do not comply to the traffic code, which would lead to limit the usage of road capacity. Drivers are not well educated and disciplined to follow traffic rules.
- Cargo trucks and large vehicles on national highways endanger to commuters and pedestrians. Accidents caused by motor vehicles have been growing fast because of drivers who do not respect traffic rules and commuters. Some habal-habal drivers do not even have driver's license. If there is an accident, there is no one to answer for loss and damages.
- It was questioned whether a separate vehicle for PWDs and women are considered in transport policy of the master plan project because at present PWDs and women friendly public transport does not exist, and it is inconvenient for them.

(3) Focus Group Discussion/Consultative Workshop

The focus group discussion/consultative workshop held last 30 April 2018 at the Provincial Capitol Social Hall was participated in by representatives from line agencies (notably, with mandates or planning functions relevant to environmental assessments and/or review, endorsements, and approval of plans, programs, and projects), LGUs, MCDCB, and the private sector. The purposes and aims of the discussion/workshop were as follows:

(i) Introduction of the JICA Project (objectives, outputs, etc.) as a form of IEC;

(ii) Introduction and discussion of the ESC/SEA/EIA process/methodology and objectives;

(iii) Determination of transportation issues and concerns;

(iv) Presentation of Roadmap Study Transport Proposals-Priority Projects and Identification of Additional Proposals;

(v) Clarification of extremely important items on environmental and social impacts and its evaluation methods with indicators and criteria for evaluation; and

(vi) Workshop for provisional project's ESC impacts and mitigation.

To provide the background and references for the discussions on existing legal framework, system and practices for environmental assessment, endorsement and approval of plans, programs and projects especially on the transport sector, representatives from line agencies, presented and discussed their respective functions.

(i) EMB. The Philippine EIA system and procedures for review and evaluation of projects applied for the issuance of ECC.

(ii) DPWH. The agency's mechanism for mainstreaming environmental and social considerations on projects that the agency is implementing.

(iii) National Economic Development Authority. PPPs that requires RDC's endorsement, system/procedures, and criteria for evaluation.

During the open forum, the following issues were raised and discussed with the three presenters/discussants:

DPWH transport and road projects lacks drainage, siltation/sediment control facility, and water treatment facility, which significantly contributes to flooding and pollution. A specified example is in Lapu-Lapu City. While DPWH is aware of these issues, there are hurdles that hinders the implementation of these measures, such as difficulty in right of way acquisition of road and land areas that will host these environmental facilities.

On the review and approval of PPPs, there are assertions about political influences that could lead to disruption on the review process, such as prioritization of projects for funding and implementation.

Considerations for trees, relocation/resettlement of households, and other environmental issues in transport projects are often overlooked in planning and implementation process.

DPWH already has a division that looks into environmental and social considerations; however, its functions are constrained by the limited manpower and resources. EMB could only monitor projects that were issued ECCs and most transport and road projects of DPWH were exempted or not covered by the Philippines EIS System (PEISS). PEISS is also limited to projects and has no provisions/mechanism for environmental assessment of plans and programs.

The non-compliance of transport and road projects to guidelines and standards of the PWD Accessibility Law is rampant and a common issue in most cities and municipalities in the Metro.

The workshop that followed after the presentations and discussion were designed to identify the methodology/process, environmental objectives, and indicators that could be used for SEA evaluation of the urban transport master plan and its identified priority PPPs. As reference and a sample for undertaking SEA, the policy, strategy, programs, and projects identified in the roadmap study were assessed (except for the bypass road) and included are the following:

(i) Monocentric and densely inhabited urban area,

(ii) Polycentric and equitably developed urban areas,

(iii) Metro Cebu Highway Network,

(iv) Green Loop in Metro Cebu,

(v) Dual Mode Bridge,

(vi) MRT System,

(vii) BRT & UMRT-Coastal line, and

(viii) Mandaue–Consolacion–Liloan Bypass Road.

The participants were divided into two groups. Eight of the PPPs were equally distributed to the two groups to assess. Only items a & b were completed, and the remaining projects were considered as “take-home assignments” by the participants.

Listed below are the initial observation by the participants in the assessment:

(i) SEA objectives and indicators could vary according to the project type, location, and the applicable environmental parameters.

(ii) The interpretation of the rating of impacts of the PPPs on an environmental receptor and the degree of significance of the objectives and indicators on a particular PPP’s policy, strategy, measures, etc. are according to the evaluator’s background and experiences.

(iii) The determination of SEA objectives and indicators best capture and classify the transport issues and concerns as perceived by the stakeholders.

(iv) Given the varying interpretations and results, how would the stakeholders come up with a common recommendation? Will there be a point or rating system, or will it just be through a consensus?

(v) The methodology and identified SEA objectives or indicators could be applied to any PPPs for transport or any other sectoral PPPs.

Second focus group discussion meetings were planned to have with five groups, but so far, only one meeting, youth group, was conducted. The second focus group discussion meeting is different from the first one, consultative workshop, which is planned to carry out in September after the DMP is presented to the stakeholders. Main concerns of the youth group are summarized as follows.

(i) Jeepneys are always full and people need to wait for quite time to get on jeepneys to go to schools, especially on morning peak hours, and it is same going back to home on evening peak hours.

(ii) Sidewalk are not safe anymore because of motorcycles. Motorcycle drivers use sidewalks to overtake or pass through traffic congestion and besides that sidewalks are occupied by street vendors, so it is not convenient to walk.

(iii) Habal-habal (motorcycle taxi) always counterflow and even use sidewalks which also cause traffic congestion and unsafe to walk sidewalks.

(iv) Jeepneys were very convenient transport mode before, so people chose jeepneys over taxi, but now, jeepneys are no longer convenient.

(v) There should be strict law enforcement, specially on traffic rules. In Lahug, there are many right turns and left turns, although they are legal, it still causes traffic congestion, so there should be well design transport plan and traffic management.

(4) Focus Group Discussion/Various Groups

Focus group meetings were conducted with small groups besides the consultative workshop, in order to capture various groups' opinions on transport issues. The Project Team had separate meetings with small groups from youth, small vendor, women and PWD.

Table 11.1.2 shows the summary of opinions raised in the focus group meetings. Most of opinions are already raised during the first and second stakeholders' meetings. Most of groups perceives the mindset of people need to be changed and drivers need to be educated and disciplined, so stricter law enforcement of law enforcers, such as traffic enforcers and national and local government agencies who are responsible for such should take it more seriously. Another point to be emphasized is that vulnerable road and public transport users are currently left out from the transport administration, or it can be said that not much attention was given to them.

Table 11.1.2 Results of Focus Group Meetings

Group	Opinions
Youth	● Jeepneys are always full when participants want to go to school, so they need to wait every time to get on jeepney to school. To avoid traffic congestion, one must wake up early to avoid peak hours. Even if you wake up early, you will be stuck up in traffic sometimes. It takes almost two hours from Consolacion to get to Cebu City for travelling. Another 30 minutes to one hour or more for just waiting for jeepneys. It is waste a lot of time that could be spent for other important things rather than being stuck in traffic congestion. ● It is suggested to make special jeepneys for women, PWD and senior citizens. ● Jeepneys are no longer comfortable to ride, especially small jeepneys. ● Because of the scarcity of jeepneys responding to the increasing demand of passengers, passengers have to run after jeepneys and sometimes do elbow to elbow with other passengers just to get on jeepneys. Jeepneys are not friendly transport for PWDs, senior citizens or women with children ● Re-routing of jeepneys would be one of the best solutions for now while we are waiting for the long-term goal plan. ● Sidewalks are not safe anymore because motorcycle drivers use sidewalks sometime and sidewalks are blocked and/or used by street vendors, thus it is not safe to walk sidewalks anymore. ● Biking is not safe since there are no bike lanes. Non-motorized transport modes are very much recommended as long as roads are people friendly. ● Motorcycles (habal-habal) always counterflow and even use sidewalks when traffic congestion happens. ● Filipinos need to change mindset if we want to improve the country. ● Jeepneys were very convenient before that people choose jeepneys over taxicabs, but now, jeepneys are no longer convenient transport mode. ● Strict law enforcement is needed so that people will realize and feel their poor choices or violation of rules and laws. ● Because of too narrow streets, there are many accidents. Drivers counterflowing streets also caused traffic accidents. ● BRT would help alleviating current situations since it can carry a lot of passengers and it will lessen the volume of jeepneys. ● In Punta Princessa community, people are really affected by the construction of underpass. Jeepneys are always full and the traffic is always congested. ● There should be strict law enforcement. In Lahung, many drivers often change lanes and turn right and left and cause traffic congestion, although the practice of changing lanes is still legal.

Group	Opinions
	● At jeepney terminals, drivers and conductors force passengers to fit in a jeepney even though it is already full. ● It is scare to cross pedestrian crossing since drivers do not make a way for pedestrians, and skywalks are useless because people do not use it anymore since some skywalks are not maintained well. Some homeless people are living on the skywalks. ● If the BRT or MRT become operational, what will happen to jeepney drivers? Do they get new jobs? ● As for cargo trucks, it is better that they have exclusive roads because cargo trucks cause traffic congestion during peak hours because they occupy almost all road capacity. ● Solutions of other countries might not work in the Philippines. Singapore and Japan still have traffic congestion, yet drivers in those countries always give a way to pedestrians when they cross pedestrian crossings. Drivers are disciplined, and they respect the laws and rules. That is why Filipino really need strict law enforcement. ● Unified enforcement of traffic laws in all LGUs is also a must. <A facilitator asked about the participants opinions about making habal-habal as a legal means of transportation while waiting for the long-term goals.> ● If it is legalized, drivers of habal-habal need to know all traffic rules and laws. ● Habal-habal is not safe because drivers counterflow roads and they sometimes use sidewalks even they are so narrow.
Small Vendor	● What will happen to small arterial roads in Cebu City when UMRT lines are implemented. ● It would be better to have other jeepney or bus routes to the Carbon market for buyers and another road to exit to the Circumferential Road from the market. ● It would be nice to have a station of UMRT near the Carbon market for economic activities. ● Fish supplies are from Zamboanga then O Santander then to the Pasil Fish market. During the travel from Santander, heavy traffic in Carcar and Minglanilla causes delay to fish supplies which causes spoiling the supplies. It is also same when fish supplies come from Daan Bantayan. It would be easier if there is a coastal road so that there won't be delay on delivery. ● Another way of transportation of goods in the markets was suggested. Most of the products at public markets are perishable products, such as fruits, vegetables, meat and fish, and delay on delivery is a severe issue. A coastal road that connects the Carbon Market, the Pasil Fish market and the SRP was suggested. The road will be similar to highway and diversion roads for goods to move in and out of the markets besides from the inner arterial roads that also are already congested. It was underlined that the Carbon and Pasil markets are the main markets of the whole Cebu and as well as the region. ● Sea bus not only for passengers but also cargo was suggested. When using national highway, the travel time to transport goods from Mantalungon and Barili takes a long time. Besides that, cargo trucks are mostly caught by traffic enforcers because of overloading of goods. It would be nice to have a sea bus that directly transport to Carbon and Pasil since they are located near port areas as well.
Women	● A participant shared her experience how difficult for women to use public transport. Drivers of jeepneys try to crowd passengers into jeepneys as many as possible and overload the passengers. Passengers suffer from pickpocket in public transport. Women sometimes experience sexual harassments in public transport. ● In neighboring Asian countries have train car for women only and it is strictly implemented. It is suggested that the UMRT should also have such, especially for pregnant women who have difficulty getting on and off public transport. ● Travelling time in morning peak hours takes too long. A student needs to start travelling from 6 a.m. not to be late for school. ● As being a mother, she always packs food and drink in case her family stuck in traffic

Group	Opinions
	congestion for a long time. ● If motorcycles can also use bike lanes, then it would not be safe for bikers.
PWD	● A braille system on sidewalks, pedestrian bridges and pedestrian crossings should be installed for blinds when widening and improvement of roads will be implemented. ● On sidewalks, ramps and gutter areas are not PWD friendly. Sometimes sidewalks do not have ramp for PWDs, and sidewalks are too high (from roadway) especially for orthopedic PWDs. ● PWD friendly infrastructure in Hong Kong was shred by one participant who visited Hong Kong. Sidewalks and pedestrian crossings have a guiding system like a braille-system, stations have elevators for PWDs, and people with wheelchair can easily ride public transportation. Buses have ramps or extensions where wheelchairs can easily get on. There are different lanes for abled and disabled people on sidewalks because abled people walk faster than PWD. ● It is difficult to cross pedestrian crossings alone. If a voice command system is available, it may be easier for PWD, especially for blinds to cross streets. ● Not all people are educated with English language or its pronunciation, a participant suggested that the voice command also be in Visayas language. ● Vendors block pedestrian lanes and it is sometimes difficult to cross streets. Vendors are also on sidewalks which makes PWDs difficult to walk safely. ● A participant concerns that drivers do not have discipline. Drivers do not give a way (prioritize) pedestrians. Some drivers do not give special considerations to PWDs, especially when PWDs walk streets which do not have sidewalks and ride on jeepney.

Source: JICA Project Team

11.2 Environmental and Social Considerations

1) Review of the Roadmap Study

The environmental and social considerations for the “Roadmap Study” identified the major environmental challenges in Metro Cebu, namely: contamination of water sources, increase risk due to poor waste management, and air pollution caused by exacerbated traffic jams. The roadmap also indicated that proponents for transportation programs/projects “should make efforts to minimize resettlement and land acquisition for the purpose of securing right of way, and the negative impact during constructions—which causes traffic jams.”

The roadmap recognizes the need to address and implement mitigation measures for flooding and contamination of rivers in Metro Cebu and destructive development practices in the watershed and coastal zone (especially mangrove areas).

2) Current Environmental Conditions

(i) Topographical and Geological Conditions

Metro Cebu area extends from northeast to southwest at the central area of Cebu Island. The area has limited flat land along the coast and is mainly composed of uplands and mountains behind the flat land. Elevation in Metro Cebu varies from below 0 m to more than 500 m from the eastern coastal area to the western uplands. The suitable urban land use, gentle slope, is located mainly in the alluvial lowland areas along the coastline. The main geology of the area is sedimentary rock, which forms the backbone of Cebu Island. Tertiary rocks that consists of limestone, sandstone, and conglomerate are widely distributed in the island. Quaternary limestone is also distributed widely in the fringe area of older sedimentary rocks. Alluvium has developed near the mouths of rivers and coastal lowland.

(ii) Protected Areas

Republic Act No. 7586 or the National Integrated Protected Areas System (NIPAS) Act of 1992 defines protected areas as the "identified portions of land or water set aside by reason of their unique physical and biological significance, managed to enhance biological diversity and protected against destructive human exploration." The law provides the legal framework for the establishment and management of protected areas in the Philippines. The three identified NIPAS areas in Metro Cebu are Guadalupe Mabugnao Mainit (Carcar, Cebu), Olango Island Wildlife Sanctuary (Sta. Rosa, Lapu-Lapu City), and the Central Cebu Protected Landscape (CCPL). CCPL being in the mainland and the heart of Metro Cebu will be most affected by the direct and indirect impacts of transport infrastructure programs and projects and related land-use (e.g. urban sprawl).

(iii) Air Quality

Based on the 2015 Regional Emissions Inventory, the mobile sources from the transport sector is the major source of pollution in Region VII. It was estimated that 10% of pollutants came from stationary sources, 77% from mobile sources, and 13% from area sources. However, ambient air quality monitoring results show that air quality in the region is in "good to fair" condition since concentrations of PM10 and TSP are within Republic Act No. 8749's guideline values.

TSP monitoring sites are situated in Cornilla Lao residence in Naga City and within the DENR7-Banilad compound, while PM10 monitoring sites are situated in Mabolo Police Station and the Cebu Business Park-Ayala.

A total of 1,248 industrial firms were monitored by EMB Region VII in 2016 relative to their compliance to the Philippine Clean Air Act of 1999. In the same period, 672 firms were issued a Permit-to-Operate Air Pollution Source Equipment (APSE) and 97 were issued Notices of Violations (NOV).

Compliance to emission standards on Private Emission Testing Centers (PETC) data showed that 37,222 vehicles passed the emission standards, while 1,908 vehicles failed.

The Metro Cebu Airshed Governing Board (MCASGB) has developed policy recommendations and conducted various activities in support to air quality management efforts in the region.

(iv) Water Quality

EMB Region VII regularly conducts monitoring of water quality in a number of rivers in Metro Cebu. The Butuanon River in Mandaue City and Guadalupe River in Cebu City were found to have extremely high pollution levels, low dissolved oxygen concentrations, and high biochemical oxygen demand (BOD) especially at the downstream portion where the rivers pass heavily industrialized and densely populated areas.

Aside from the eight rivers, under the Beach Watch program is a monthly monitoring of the Hilutungan Channel in Mactan, Liloan coastal waters. Results showed high counts of fecal coliform in some sampling stations. The source of pollution in coastal waters may be attributed to the untreated wastewater discharge from resorts and other establishments along the coast, as well as the informal settlers living near the coastlines.

(v) Solid Waste

Solid waste management is the most serious problem in urban centers since high population density equates to high amounts of solid waste generation and a high percentage of population at risk of health hazards associated with solid wastes. In Cebu

province, there are three categorized sanitary landfill facilities, five materials recovery facilities, and 50 LGUs with solid waste management plan.

3) Legal Framework of Environmental and Social Impact Analysis in the Philippines

(1) National Transport Policies

(a) Executive Order Nos. 290 and 390 promotes the implementation of the Natural Gas Vehicle Program for Public Transport.

(b) National Electric Vehicle Strategy (NEVS) promotes the use of alternative fuel vehicles. It is a joint partnership between the Government of the Philippines and Asian Development Bank that aims to reduce the country's carbon footprint in road transport.

(c) Biofuels Act of 2006 (Republic Act No. 9367) provides fiscal incentives and mandate the use of biofuel-blended gasoline and diesel to mitigate greenhouse gas (GHG) emissions.

(d) The Climate Change Act was enacted in 1999 (Republic Act No. 9729) with amendments introduced in 2012 through the enactment of Republic Act No. 10174.

(e) In 2007, Administrative Order No. 171 was issued for the creation of the Presidential Task Force on Climate Change (PTFCC) to promote national projects, programs, and actions on climate change. On 26 December 2008, former President Arroyo issued Executive Order No. 774 that reorganizes the PTFCC—the Philippine President as Chair and organizes 14 task groups. One of the task groups involved in mitigation work is the Task Group on Fossil Fuels (DOTC, DPWH, DILG, Office of the Presidential advisor on Climate Change (OPACC), DBM) that shall reduce consumption on fossil fuels; reform transport sector to include walking, cycling, and other human-powered vehicles; and conduct consultations, mass media social marketing, and mobilization campaign.

(f) The National Climate Change Action Plan (NCCAP) and the National Framework Strategy on Climate Change (NFSCC) were signed in November 2011 and April 2012, respectively; these outlined the country's agenda for adaptation and mitigation for 2011 to 2028 and the policy framework and guiding principles for the national strategy on climate change. Through the IACCC, the NCCAP redefined its mitigation strategies to include:

- Accelerated use of renewable energy and alternative energy sources (e.g. biofuels). Promote efficient power generation and conservation (the Department of Energy: DOE);

- Promote production efficiency and use of low carbon technologies (DTI). Promote reduction in fuel consumption through strict registration and franchising, anti-smoke belching and PETC monitoring, and conversion of engines and vehicles into fuel efficient units (DOTr).

- Better management of air quality especially in urban areas through the airshed council. Reduce air pollution through strict stack monitoring and prevent open burning and expand vegetation cover through the Green Philippines Program (DENR).

(g) Administrative Order No. 254 mandates the former DOTC, now Department of Transportation or DOTr, to lead in the formulation of a national environmentally sustainable transport (EST) in the Philippines.

(h) DOTC officially launched the National EST Strategy on 20 May 2011. The strategy has two objectives:

- To reduce the annual growth rate of energy consumption and associated greenhouse gas and air pollutant emissions from the transport sector in urban areas of the country; and
- To achieve sustainable mobility through the development of a viable market for EST goods and services, which includes promoting transportation systems of low carbon intensity and shifting towards the use of more sustainable transport modes

(i) The EST identified 12 thematic areas that seeks to address challenges in the transport sector, namely:

- Public health;
- Strengthening roadside air quality monitoring and management;
- Traffic noise management;
- Vehicle emission control, standards, and inspection and maintenance;
- Cleaner fuels;
- Public transport planning and travel demand management;
- Non-motorized transport;
- Environment and people friendly infrastructure development;
- Social equity and gender perspectives;
- Road safety and maintenance;
- Knowledge base, awareness, and public participation; and
- Land use planning.

(2) Provincial and Metro Cebu Policy, Legislation, and Institutional Framework that Relates to Transport and the Environment

(i) Cebu Provincial Government Local Legislations

Environment Code (Ordinance No. 2012-13). The province adheres to the principles for attaining sustainable development and its pillars, namely, economic viability, environmental responsibility, social equity, and political/cultural vitality as defined in Agenda 21 signed and ratified by the Philippines. The Environment Code translates these sustainable development concepts into guiding principles and provide management directions for various sectors (e.g. land use, energy, biodiversity, forestry, coastal and marine, water resources), as well as promote sustainable approaches to development planning and environmental protection.

The Environment Code promotes the use of renewable sources of energy and encourages the use of "smart growth codes" to influence the development of compact and walkable neighborhoods and TOD.

Article XV, Section 3 (Strategic Transportation Planning) of the code states, "The Province recognizes that transportation planning play a critical role in how cities and towns grow and develop, and where stores and residences, sports stadiums and manufacturing plants, and every other imaginable type of land use is located; how people travel from place to place influences what is built and where; the potential effects of transportation projects on air and water quality and other environmental resources; how transportation projects meet the long-range residential and economic development goals of the province and its component cities and municipalities; and how they can assure that specific projects fit the context and scale of the communities they are designed to serve." As such, the province supports, encourages, and implements actions for:

- **TOD**. Supporting transit and TOD yield benefits for the transportation system as a whole for the environment and for compact, walkable, mixed-use communities. The province can give priority for projects in existing nodes, designated growth centers, and TOD zones. A well-designed TOD can be a powerful engine for local growth and for maintaining and growing the local tax base.

- **Adoption of a broad or provincial-regional approach to mitigation planning**. The province recognizes the regional impact of transportation projects and supports the use of a regional approach to mitigate the impacts of highway investments. The environmental impacts of transportation projects are typically addressed at a project level in which leads to several significant problems. Many environmental impacts are cumulative and large scale. Project level mitigation either fails to identify such impacts or leaves few alternatives to address them. Additionally, many mitigation measures, such as preservation of lands that contain critical habitats, stream buffers, and wetlands, are more easily implemented and cost effective at broader provincial scales. Planning-development programs can fundamentally shift toward a more comprehensive approach either by ensuring that a broad range of indirect impacts is considered or by conducting an impact analyses at a programmatic level.

Article XIV, Section 2 (Public Consultation/Participation) notes, "The Province will assist in the public consultation process of major projects affecting two or more LGUs... The Province on its own initiative or recommendations of affected LGUs may convene a consultative meeting with the participation of the Environment Management Bureau of the DENR prior to the issuance of the ECC to address trans-jurisdictional issues such as air pollution, distortion on the water supply and utilization in other LGUs or water districts, and other issues as provided for in RA 7160."

Proposed Low Carbon Development Ordinance of the Province of Cebu. The primary purpose of this ordinance is to comprehensively implement the Cebu Provincial Government's policies on the promotion of low carbon and, thus, contribute to the sustainable development and the improvement of the quality of life of residents/constituents of the province.

Article 2, Section 2 (Transportation Infrastructure) of the Ordinance noted, that "[d]esign and redesign transportation infrastructure to improve public health and air quality through more transit, pedestrian and bicycle infrastructure, and redesign of existing automobile infrastructure to encourage vehicle-sharing, carpooling, and alternative travel modes"

Article 7, Section 2 (Mainstreaming of Low-Carbon Development Principles/Measures to Plans, Programs and Projects), noted that "[t]he

application/conduct of Environmental Assessment (Social Environmental Assessment: SEA and EIA) for .. PPPs shall be required prior to issuance of endorsement, approval, certification, resolution or any other actions required from the Provincial Government (Governor, Provincial Legislative Council/Sangguniang Panlalawigan, Provincial Development Council), and the Regional Development Council

- Plans and Programs of National Government Agencies and its instrumentalities (including studies funded, commissioned, and/or conducted by foreign/international bodies, such as ODA, WB, ADB, JICA, EU, USAID, etc.) within the province or any part thereof as the study/impact/planning area will be subjected to SEA.

- Comprehensive Land Use Plans of LGUs

(ii) Metro Cebu Airshed Governing Board (MCAGB)

As provided in the Implementing Rules and Regulations (IRR), airsheds shall be managed by a governing board. The Metro Cebu Airshed Governing Board was created primarily to conduct air quality management through strategic management, development of policy recommendations, and coordination of its inter-agency links. The Metro Cebu Airshed was designated through the Memorandum Circular No. DAO 2002-21 on 7 October 2002.

(iii) Local, Provincial, and RDC

Cities, municipalities, and provinces have local development councils that would formulate socio-economic development policies and plans and coordinate, monitor, and evaluate programs and projects, among others. The Cebu Provincial Development Council (PDC) endorses plans, programs, and projects (that will be funded by the National Government) of the provincial government as well as that of the component cities and municipalities to the Regional Development Council for review and endorsement to the National Government (through the NEDA Board). PPPs of highly urbanized and independent cities will go directly to the RDC.

The RDC has its Sectoral Committees (infrastructure, social, economic, and development administration) that will review programs, activities, and projects (PAPs) of their respective concerns. The RDC secretariat provides a 'guideline' for the review, which include an item on 'environmental considerations'. However, given the lack or absence of appropriate criteria for environmental parameters, there were no substantive results and recommendations gathered from such reviews.

There is a proposal for the creation of an Environment Committee that would give focus on environmental matters, and the resolution for this initiative was approved by the RDC during its full council meeting last 16 March 2016. With the Environment Committee, the review process that would give more attention to mainstreaming of environmental considerations in the PAPs will be enhanced.

(iv) The Roadmap Study for Sustainable Urban Development in Metro Cebu

In 2013, MCDCB and JICA agreed to conduct a follow-up study to formulate a roadmap and action plan to realize Mega Cebu Vision 2050. The roadmap study promotes low-carbon development through the following recommendations.

Land Use:

- Compact urbanization in a polycentric urban structure.

- Green loop encompassing Cebu City, Mandaue, Lapu-Lapu and Cordova.
- Promotion of TOD.

Transport:

- Mass transit network consisting of BRT, LRT (AGT), and MRT.
- Area-wide traffic control (ATC).
- Mactan Link & bypass roads.

(3) Laws, Regulations and Standards related to Environmental and Social issues including Requirements and Procedures of Environmental Impact Assessment (EIA) and Stakeholders' Participation

Philippine Environmental Impact Statement System (PEISS)

(i) Presidential Decree No.1151. Philippine Environmental Policy, 1977.

(ii) Presidential Decree No. 1586. Establishing an Environmental Impact Statement System including other Environmental Management related Measures and for other purposes, Environmental Impact Statement System. 1978.

(iii) Presidential Proclamation No. 2146. Proclaiming Certain Areas and Types of Projects as Environmentally Critical and within the scope of the Environmental Impact Statement System established under Presidential Decree No.1586. 1981.

(iv) Presidential Proclamation No. 803. Declaring the Construction, Development, and Operation of a Golf Course as an Environmentally Critical Project Pursuant to Presidential Decree No. 1586. 1996.

(v) Administrative Order No. 42. Rationalizing the Implementation of the PEISS and giving authority in addition to the Secretary of the DENR, to the Director and Regional Directors of the Environmental Management Bureau to Grant or Deny the Issuance of ECC. 2002.

(vi) DENR Administrative Order No. 2003-30. IRR for the PEISS.

(vii) DENR Administrative Order No. 2003-30. Revised Procedural Manual for DENR Administrative Order No. 30 Series of 2003.

(viii) DENR Memorandum Circular No. 2010-14. Standardization of Requirements and Enhancement of Public Participation in the Streamlined Implementation of the Philippine EIS system.

(ix) EMB Memorandum Circular No. 2014-005. Revised Guidelines for Coverage Screening and Standardized Requirements under the PEISS amending relevant portions of Memorandum Circular No. 2007-002.

(x) EMB Memorandum Circular No. 2011-005. Incorporating Disaster Risk Reduction and Climate Change Adaptation concerns in the Philippine EIS System.

(xi) DENR Administrative Order No. 2017-15. Guidelines on Public Participation under the Philippine Environmental Impact Statement System. The guideline provides for a public participation process for EIS project types applied for an ECC, which includes the undertaking of an IEC, perception survey, public scoping, technical scoping by the EIA review committee, and public hearing.

12 ALTERNATIVE OPTIONS FOR METROPOLITAN CEBU TRAFFIC MANAGEMENT COORDINATING BOARD

12.1 Updates of Institutional System of Urban Transport Development

Almost all cities and municipalities have a designated body or commission, which were independently created to oversee and undertake transport administration. Six LGUs created a special commission on the matter as per their respective traffic codes, namely Cebu City, City of Talisay, Municipality of Compostela, Municipality of Liloan, Municipality of Consolacion, and Municipality of Minglanilla. The commission is usually headed by the mayor or a member of the *Sangguniang Bayan* (Municipal Council) or *Sangguniang Panlungsod* (City Council) while the members consist of representatives from law enforcement, police, bureau of fire protection, business sector, and public transport operators, such as jeepneys and tricycles.

Instead of a special commission on transport administration, Danao City has a traffic division under the supervision of the mayor while Mandaue City has an office attached to its office of the mayor.

Except Mandaue City, Lapu-Lapu City, and the Municipality of Consolacion, LGUs have a designated traffic violations bureau that is tasked to adjudicate traffic violations.

Table 12.1.1 List of Transport Administration

LGU	Office/Agency Name	Traffic Violations Bureau
Cebu City	Cebu City Traffic Office (CCTO)	Traffic Violations Bureau of the Traffic Court of the City of Cebu
Mandaue City	Traffic Enforcement Agency of Mandaue (TEAM)	TEAM Board (organized only through an Executive Order)
Lapu-Lapu City	City Traffic Management System (CTMS)	N/A
City of Talisay	City of Talisay – Traffic Operations & Development Authority (CT-TODA)	Special Traffic Violation Bureau
Danao City	Danao Traffic Division	Chief of the Traffic Division
Municipality of Compostela	Compostela Traffic Commission (CTCOM)	Municipal Trial Court of the Municipality of Compostela and Liloan
Municipality of Liloan	Liloan Traffic Commission (LITCOM)	LITCOM Adjudication Board
Municipality of Consolacion	Consolacion Traffic Enforcement and Special Services (CTESS)	CTESS
Municipality of Minglanilla	Minglanilla Traffic Commission (MITCOM)	Municipal Trial Court of the Municipality of Minglanilla

Source: JICA Project Team

Almost all LGUs have a specific provision for respective traffic codes regarding enforcement and obedience to traffic regulations. As per their traffic code, the police officers or such officers are assigned by the special commission or the designated authority to enforce the provisions of their corresponding traffic code. On the other hand, the traffic code of Danao City provides that the police force and the traffic division are authorized to apprehend for any violations against the provisions of its traffic code. Danao City's traffic code also gives power to issue a subpoena, compel the appearance of vehicle operators and drivers, and use all reasonable means to secure enforcement of the provisions of the code.

Lapu-Lapu City's Traffic Enforcement Division enforces and implements city ordinances pertaining to traffic and assists the Philippine National Police in the implementation and enforcement of national laws on traffic control and regulations.

Regarding selling on public streets and highways, only Cebu City, Danao City, Municipality of Liloan, and Municipality of Compostela placed prohibitions while other LGUs do not have a specific provision to forbid this activity.

A questionnaire about the profiling of traffic management office and organizational structure has yet to be filled out by all the LGUs, so it is still early to conclude on the institutional capacity of traffic administration of LGUs in Metro Cebu. However, responses from the participants of the capacity development seminars provided some clues of the current capability of traffic administration of each LGU.

Except a few participants in position for about 10 years from Cebu City, Mandaue City, and Municipality of Consolacion, the rest of the respondents have none or a little knowledge about transport planning, traffic engineering, public transport planning, urban planning, and GIS. The responses also show that most did not have opportunities to receive training for their related fields in past. Also through this questionnaire, the individual and institutional capabilities for traffic administration, in particular, for transport planning, traffic engineering and public transport planning—which are now more than important ever because of LTPRP—are insufficient. It should be also emphasized that many traffic enforcers from the LGUs cannot fully function as expected because most are either casual or job order employees, which means their law enforcement capability is limited to the jurisdiction of ordinance in their respective LGUs and not based on the national laws and regulations.

As mentioned above, not all LGUs have their own traffic code and independent office for traffic administration. An office for traffic administration is not mandatory unlike, for example, engineering or planning offices that are required by the Local Government Code. Under provincial administration, the traffic administration is not even mentioned in the code as it is a functional responsibility. Cebu City, however, is an exception because it has CCTO (see Appendices).

In the case of the City of Carcar, its traffic management office (TMO) was established under Special Order No. 207 series of 2017 by the city mayor and it is attached to the office of the city mayor. The office is led by a TMO head, who is also the city administrator, with 14 officers. Out of the 14 officers, 11 of which are traffic enforcers and all the officers are either casual or job order employees. There is no planner, civil engineer, traffic engineer, or GIS/Mapping specialist. It is presumed that most of the municipalities are approximately in the same situation.

1) Laws and Regulations Regarding Road and Land Transport

The list of road and land transport laws and regulations since 1964 and recent major regulations are summarized in the Appendices. It should be noted that since the enactment of the so-called Traffic Code in 1964, there were amendments for particular articles but no major revision or amendment of the code itself. This simply implies that the laws of land transport and traffic rules were based on the land transport and traffic environment more than 50 years ago in spite of many changes since then, including the technologies, traffic volumes and flows, and people's movement and trip patterns. The traffic code was never overhauled.

Nonetheless, LGUs may impose ordinances of traffic rules and administrative instructions or implementing instructions as outlined in the Progress Report.

During the 17th Congress, there were 18 bills and resolutions filed related to traffic code, but none passed the referred committees to succeed the plenary except for an act

extending the period of validity of the driver's license from three to five years. The following house bills and house resolution seek the amendment of the traffic code.

(i) House Bill No. 747 "An act amending Republic Act No. 4136, otherwise known as the land transportation and traffic code" (status: pending with the committee on transportation since 27 July 2017)

(ii) House Bill No. 4561 "An act instituting a national traffic code and appropriating funds therefore" (status: pending with the committee on transportation since 7 December 2016)

(iii) House Resolution No. 1486 "A resolution seeking the creation by the executive branch of an inter-agency task force on the revision of laws on land transportation, road safety for the primary purpose of drafting a new land transportation and traffic code" (status: pending with the committee on transportation since 29 November 2017).

The house resolution states patchwork amendments to laws that have been done over the years, and overall or major renovation to keep relevant and up-to-date is in need. Some laws are outdated so those should be repealed or replaced with new structures with adaptability features for future. It suggests the DOTr, Department of Public Works and Highways (DPWH), Department of Trade and Industry (DTI), Technical Education and Skills Development Authority, Department of Justice (DOJ), and other government agencies to form a joint inter-agency task force on the revision of laws on land transportation and road safety.[1]

Another notable house bill filed during the 17th Congress is House Bill No. 2530 that is about the emerging new public transport service nationwide known as motorcycles-for-hire or locally known as *habal-habal*. The full title is "An act regulating motorcycles-for-hire or *habal-habal*, thereby authorizing cities and municipalities to grant franchise for their operations, amending for the purpose sections 447 and 458 of Republic Act No. 7160, as amended, otherwise known as the local government code of 1991, and section 7 of Republic Act 4136, otherwise known as the land transportation and traffic code" and its short title is "Motorcycle-for-Hire Act of 2014." The act was filed on 4 August 2016 and the action was taken by the committee of rules. Its status is pending at the committee on transportation since August 2016.

Table 12.1.2 Summary of the House Bill No. 2530 on the Motorcycle-for-Hire Act of 2014

Section	Articles
1. Short title	Motorcycle-for-Hire Act of 2014
2. Declaration of Policies and Principles	• It is the policy to safeguard public interest, provide and regulate basic services, and promote safe, coordinated, and efficient transportation services to the people. • Roads and trails in rural, mountainous areas and even side streets are not passable by tricycles and four-wheeled vehicles. Thus, the mode of transportation accessible to the people shall be recognized by the State in reality and in actual policy. • LGUs, particularly cities and municipalities, are hereby mandated to regulate the operations of motorcycles-for-hire, locally known as *habal-habal*.
3. Definition of Motorcycle-for-Hire	• Motorcycle-for-hire shall denote any motorcycle that is designed and customized to carry passengers, goods, and other small cargo for a fee as a common carrier.
4. Local Franchise	• Municipality or city shall receive, process, and evaluate application for grant of franchise to operate motorcycle-for-hire within their territorial jurisdiction. • Motorcycle-for-hire shall be subject to the provisions of the Public Service Act and the rules

[1] House Resolution No. 1486. A Resolution Seeking the Creation by the Executive Branch of an Inter-Agency Task Force on the Revision of Laws on Land Transportation, Road Safety for the Primary Purpose of Drafting a New Land and Transportation and Traffic Code. Second Regular Session of 17th Congress. 28 November 2017.

Section	Articles
	and regulations issued thereunder.
5. Prohibitions	• Motorcycle-for-hire are prohibited from operating along national highways or other roads where the allowed maximum speed is greater than 40 kilometers per hour.
6. Implementing Rules and Regulations	• The secretary of DOTr, in coordination with the Leagues of Cities and Municipalities, shall within 60 days after the effectivity of this act, issue the appropriate rules and regulations for the implementation of the provisions of this act.

Source: House Bill No. 2530 Motorcycle-for-Hire Act of 2014. House of Representatives. http://www.congress.gov.ph

Motorcycle-for-hire is considered an illegal transport mode since motorcycles are not allowed to operate for a fee and not considered as public transport. However, as the bill states, motorcycles are not only prevalent in rural areas but also in urban areas. It becomes an inevitable transport mode for many commuters and particularly convenient for residents without other public transport options in their areas. *Habal-habal* is also perceived as a way to make a living for urban poor who do not have any other means. Some administrative bodies simply shut their eyes and let *habal-habal* operate even if knowing it is illegal. Although motorcycle-for-hire has emerged rapidly and far and wide in the past year, interestingly, it's rarely put on media that LGUs have cracked down motorcycle-for-hire drivers to stop their operation.

A crucial issue of this non-regulated transport mode, motor-for-hire, is that without proper risk management mechanism for drivers and passengers, such as insurance coverage for third party liability like other transport modes. Liability will be a critical issue if a passenger got in an accident or was mortally injured and the driver does not take out any insurance. What if a driver loses balance because of a passenger and that leads to an accident? Who would be liable for damages? If motorcycle-for-hire is to be regulated by the government, then there should be similar systems with other transport modes. The concern is on the willingness of the government to accommodate motorcycle-for-hire into the public transport. Once it becomes an official mode of public transport, it would be easy to foresee that many for-hire motorcycles will operate in urban and rural areas, and those will be one cause of traffic congestion and maybe more traffic accidents. DOTr shall study the pros and cons of motorcycle-for-hire in the forerunner cities, such as Bangkok, Jakarta, and Hanoi.

12.2 Review of Sub-roadmap for Metropolitan Governance in the Roadmap Study and Recent Discussion about Institutional Aspect

In this section, the analysis made on the metropolitan government in the Roadmap Study would be reviewed and recent movements on institutional setups for metropolitan development authority and transport administration in Metro Cebu would be introduced as the basis for further discussion among the stakeholders.

In the Roadmap Study, three models for metropolitan governance were presented, which are (i) inter-municipal association mode—Metro Cebu Development Alliance, (ii) establishment of mono-sectoral agencies/special purpose district, and (iii) metropolitan authority model—Metro Cebu Development Authority.

Considering the purpose of a new institutional setup, which is to execute the measures, programs, and projects outlined in the urban transport master plan and to function as a coordination body for planning, implementation, and monitoring, a mono-sectoral council seems to be a suitable structure.

1) Review of Sub-roadmap for Metropolitan Governance in the Roadmap Study

In conclusion, the Roadmap Study indicated that the metropolitan area should be regarded as a single development governance area, and development of an effective administrative system is further required with legal basis in order to implement the projects outlined by sub-roadmaps to solve metropolitan-wide issues.[2]

Metro Cebu has established a metropolitan-wide development administration several times in the past. The regional administration offices were organized as project offices for the Central Visayas Rural and Urban Project Office in 1981, Central Visayas Regional Projects Office in 1983, and Metro Cebu Development Council (MCDC) in 1997. MCDC was designed as a coordinating body tasked with coordination, preparation, and monitoring and implementation of development planning, programs and projects.[3] The house bill for the creation of "Metropolitan Development Authority" was brought to the House of Representatives by the Senator of Cebu in 2001 but remained unacted.

The Roadmap Study presented two models of institutions for metropolitan governance and these are (i) metropolitan authority model, which is to establish certain form of formal authority covering a metropolitan area, and (ii) inter-municipal cooperation model, which is to manage metropolitan issues and development through inter-municipal cooperation. The metropolitan institution models are eventually categorized into four types in accordance with five characteristics of territorial match with metropolitan area, multi/mono-purpose, political legitimacy, financial resources, and intergovernmental relationships as shown in Table 12.2.1

Table 12.2.1 Metropolitan Governance Institution Models

Models	Metropolitan Authority Model		Inter-municipal Cooperation Model	
	Metropolitan Authority	Special District	Inter-municipal Association	Inter-municipal Agreement
Territorial Match with Metropolitan Area	Matched	Not always	Not always	No
Multipurpose	Multi-purpose	Mono-purpose	Multi-purpose	Multi-/ Mono-purpose
Political Legitimacy	Direct / Indirect	Indirect	Indirect	Indirect
Financial Resources	Own resources / central / provincial governments	Own resources / central / provincial governments	Provincial / local government	Local governments
Inter-governmental relationships	Autonomous / part of provincial governments	Autonomous / part of central / provincial government	Association of local governments	Selected local governments
Examples	• Greater London Authority • Vancouver • Poland • Metro Manila Development Authority	• Transport authority • Special district (water, drainage & sewerage, school, etc.)	• Bolongne • Metro Naga Development Council	

Source: JICA. 2015. *The Roadmap Study for Sustainable Urban Development in Metro Cebu – Final Report. Main Text.*

(1) Metropolitan Authority Models

(i) Metropolitan Authority

[2] JICA. 2015. *The Roadmap Study for Sustainable Urban Development in Metro Cebu – Final Report, Main Text.*

[3] JICA. 2015. *The Roadmap Study for Sustainable Urban Development in Metro Cebu – Final Report, Main Text.*

Metropolitan authority model is basically a creation of a new form of body for metropolitan management, which is responsible for development planning, economic development, land use, transportation, environmental management, public and social services, etc. The authority has its own financial resources from taxes, user charges, and other revenues and transfer from the national government. It can be autonomous or founded under the local government, such as a province.

Establishment of a metropolitan authority is a typical practice for metropolitan management, which has been adopted in urban areas all over the world. However, it has been criticized for inefficiency and ineffectiveness in public service delivery and other expected roles. Recently, a new type of "weak" authority, for example, that does not have the functions of project implementation or relies on consensus of local government has become more prevalent than a "strong" authority with autonomy and responsibilities covering most government functions. The examples include Greater London Authority and Metro Vancouver. Metro Manila Development Authority (MMDA) is also one, although its authorization system is different from others.

(ii) Special Purpose District

Establishment of special purpose districts are within a metropolitan area for provision of a certain public service, such as transport, water, sewage, drainage, and school. Considering the economies of scale and externality, many special districts were designed to provide mono-sectoral service and receive user fees and charges and occasionally subsidies and grant from the central and regional governments.

(2) Inter-Municipal Cooperation Model

Flexible arrangements for metropolitan governance—the so called "new regionalism"—is a model to establish an inter-municipal association or council based on voluntary cooperation and collaboration among local governments. This type of associations differs from a formal government such as a metropolitan authority, which has an established jurisdiction over the metropolitan area. The decision-making mechanism of an inter-municipal cooperation association or council relies on consensus among local governments whilst respecting their autonomy. This model becomes a venue for coordination and cooperation of planning and implementation of development plans, projects, and programs. Primary financial sources of the associations are often contributions from local government members. Examples of inter-municipal associations include Bologna and Milan, Italy, and Metro Naga Development Council (MNDC), Philippines.

(3) Inter-Municipal Agreement

The inter-municipal agreement model is one where local governments make inter-municipal agreements or develop voluntary cooperation arrangements, and based on those agreements, jointly provide public services and develop and implement spatial plans and projects. This model is the most flexible model with a wide variety of forms, including PPP and informal consensus to more formal written agreements. Financial resources are basically contributions from local governments.

The Japanese model is a typical case. In Japan, LGUs that cover area-wide administration can form a "cooperative for mutual partial administration" to provide joint public services. While respective LGUs fundamentally provide public services, those which might be neither financially viable nor effective for human resource in terms of scale merit, such as firefighting, referral hospital services and/or solid waste management, are joint services provided by the cooperative organized by member LGUs. LGUs endorse partial authorization to the cooperative while the provincial governor's approval is required to establish these cooperatives for provision of such multi-LGUs collective services.

Establishing an "LGU Alliance" has been increasing recently in Japan. By forming an alliance with strong coordination among LGUs, partial authorization for provision of national government services can be transferred to this alliance especially on advanced medical care and higher education. The approval of the Minister of Internal Affairs and Communications is required for the establishment of an LGU Alliance. The selection of chief and representatives of the alliance are legally accepted by direct election of residents, but mostly the selection is approved by the concerned local government assemblies.

2) House Bill for Mega Cebu Development Authority

In 2016, the "House Bill No. 148 An Act Creating the Mega Cebu Development Authority, prescribing its powers, functions, and duties, providing funds therefore, and for other purposes" was filed and approved at the committee level at the 17th congress.

The house bill states:

> "It is hereby the declared policy of the State to promote and accelerate the sustainable development and balanced growth of the Province of Cebu and the highly urbanized Cities of Cebu, Mandau, and Lapu-Lapu, within the context of national policies for economic, social and environmental well-being.
>
> It is likewise hereby declared to be the policy of the State to treat Metropolitan Cebu as a special development and administrative region where certain policies, programs, and services affecting or involving Metro Cebu, on a metro-wide or multi-LGU level, are more efficiently and effectively planned, supervised, implemented, and coordinated by a development authority as created herein, without prejudice to the autonomy of the affected local government units."

Aspirations and principles were also declared.

In terms of the embraced area of Mega Cebu Development Authority (MCDA), the house bill states:

> "It is anchored on and considers the island-wide or larger provincial (whole Cebu) and regional (Visayas) context, while starting out is on-ground engagement and intervention at the Metropolitan Cebu (13 LGUs) level. Conceptually, thus, Mega Cebu is larger than Metro Cebu and considers the population of the entire 'province' or 'island' in the year 2050…
>
> Metropolitan Cebu Area or Metro Cebu covers the highly urbanized cities of Cebu, Mandaue, and Lapu-Lapu, the cities of Danao, Talisay, Naga and Carcar, and the municipalities of Consolacion, Liloan, Compostela, Cordova, Minglanilla and San Fernando."

The main functions of MCDA seem somehow similar to those of the provincial government and NEDA Region 7 as well as RDC that are to impose policies and short-, middle-, and long-term development plans; coordinate among stakeholders; and management of approved programs and projects.

Table 12.2.2 shows the summary of House Bill No. 148 Mega Cebu Development Authority Act of 2016.

Table 12.2.2 Summary of House Bill No. 148

Section	Articles
1. Short title	Mega Cebu Development Authority Act of 2016
2. Declaration of Policies and	• To promote and accelerate the sustainable development and balanced growth to the Province

Section	Articles
Principles	of Cebu and the highly urbanized Cities of Cebu, Mandaue, and Lapu-Lapu within the context of national policies for economic, social, and environmental well-being. • To treat Metropolitan Cebu as a special development and administrative region where certain policies, programs, and services affecting or involving Metro Cebu on a metro-wide or multi-LGU level are more efficiently and effectively planned, supervised, implemented, and coordinated by a development authority as created herein, without prejudice to the autonomy of the affected legal governments units.
3. Metropolitan Cebu Area or Metro Cebu	• It covers the highly urbanized cities of Cebu, Mandaue, and Lapu-Lapu, the cities of Danao, Talisay, Naga, and Carcar, and the municipalities of Consolacion, Liloan, Compostela, Cordova, Minglanilla, and San Fernando.
4. Mega Cebu	• Mega Cebu refers to the platform (for inter-local cooperation, public–private sector partnership and local–regional–national–integration) promoting the "big picture perspective" and advancing collaborative planning and action on shared assets and common trans-boundary concerns towards a sustainable, smart, and inclusive Cebu. • Conceptually, Mega Cebu is larger than Metro Cebu and considers the population of the entire "province" or "island" by the year 2050.
5. Creation of the Mega Cebu Development Authority	• Mega Cebu Development Authority, referred to as "MCDA," shall be organized within 30 days after approval of this act. • The affairs of the MCDCB shall be hereinafter administered by the MCDA.
6. Powers and Functions of the Mega Cebu Development Authority	The authority shall primarily seek to: • Formulate, coordinate, regulate, and monitor the short-, medium-, and long-term plans, policies, and programs for the sustainable development and integration of Metropolitan Cebu Area, including investment programs for the delivery of multi-LGU or metropolitan wide services, land use, spatial, and physical development using strong and coherent governing values and shared vision with focus on integrated systems for urban development. • Ensure that plans policies, programs, and services are pursued for the purpose to realize the Mega Cebu 2050 Vision and implement the Metropolitan Cebu Roadmap and other subsequent and related roadmaps.
7. Scope of Services of the MCDA	• Spatial and integrated planning, and infrastructure planning and development, which includes the formulation, adoption, and implementation of plans, policies, programs, projects, standards, rules and regulations. • Transport and traffic management, which includes the formulation, coordination, and monitoring of policies, standards, plans, programs and projects, including its implementation and its integration with land use, rationalization of the existing transport operations, infrastructure requirements, and use of thoroughfares. • Solid waste management, waste water, septage, and sewerage and storm water management, and disaster risk reduction and management.
8. Composition of the Mega Cebu Development Board (MCDB)	The governing and corporate powers of the MCDA shall be vested and exercised by the MCDB composed as follows: • Governor of the Province of Cebu; • Mayors of the 13 cities and municipalities of Metro Cebu; • President of the League of Municipalities of Cebu; • Congressional District Representatives of all congressional districts of Cebu; • Directors of National Government Agencies and other government instrumentalities on Region VII; • Heads of private sector and civil society organizations, association and coalitions; and • General Manager of the Authority, to be recommended by the Executive Committee.
9. Institutional Linkage (Development Plan)	The MCDA shall submit its development plans and investment programs to NEDA for integration into the Medium-Term Philippines Development Plan (MTPDP) and public investment program.
10. Appropriations and Financing	For the organizational and operating expenses of the authority, an initial fund of one billion Pesos*1 shall be appropriated by the national government. Thereafter, the national government shall appropriate annually and include in the General Appropriations Act the funds as may be needed or necessary for its personnel, capital expenditures, maintenance, and other operating expenses.

Source: Representative Raul V. Del Mar and others. 30 June 2016. *House Bill No. 148 An Act Creating the Mega Cebu Development Authority, Prescribing its Powers, Functions, and Duties, Providing Funds therefore, and for Other Purposes.* http://www.congress.gov.ph/legisdocs/?v=bills

3) Indicative Institutional Setup for Urban Transport Regulation and Management in Traffic Crisis Act of 2017

The House Bill No. 6425 that was submitted on 19 September 2017 regarding the Traffic Crisis Act of 2017 provides an indicative concept to institute a system of responsibility and accountability for all land-based traffic policies, measures, and activities in the metropolitan areas.

In Section 9 of this act, there is a formation of the Metropolitan Cebu Traffic Coordinating Council (Cebu Council). The Cebu Council shall be composed of the local chief executives of Metropolitan Cebu, which (by the definition of the act) refers to the area composed of the cities of Cebu, Mandaue, Lapu-Lapu, and any other city or municipality in the Province of Cebu as may be identified for inclusion by the Traffic Chief (the Secretary of the DOTr) upon the recommendation of the Metropolitan Cebu Traffic Coordinating Council. Thus, also by the definition of the act, the pre-determined cities of the Metropolitan Cebu are the three abovementioned. The Cebu Council shall be the sole, centralized authority for land-based traffic.

The Cebu Council, with the approval of the Traffic Chief, shall set the policies concerning land-based traffic and road use in the metropolitan area, and coordinate and regulate the implementation of all programs and projects concerning traffic management specifically pertaining to enforcement, engineering, and education. Upon request, all other government agencies and LGUs and offices involved with traffic management and enforcement may assign personnel and provide logistical support.

The house bill states that the DOTr Secretary shall make a recommendation on whether the Congress should create a permanent and separate development authority for Cebu as analogous in powers, authority, and functions to MMDA by the end of one year from the creation of the Cebu Council (Section 7).

4) Alternative Options for Metro Cebu Urban Transport Development Authority/Council

DOTr and the Project Team agreed to seek the urban transport master plan to be submitted to the RDC council and then to INFRACom (NEDA National) for their endorsement. It is presumed that an institutional setup discussed in this project is for implementing measures, programs, and projects in the urban transport master plan.

Table 12.2.3 shows a simplified matrix of functional responsibilities of the involved government agencies and LGUs in each programs/projects until implementation regarding the short-term programs/projects (up to 2020) and UMRT projects.

Table 12.2.3 Functional Responsibilities by Implementation Stage of the Priority Projects

Program/Project Blue arrows show the steps from planning, endorsement and to implementation	Proponent/Concurrence with					Endorsed		Milestones of Implementation							
	Cebu	Mandaue	Lapu-Lapu	Cebu Province	Other LGUs	RDC Region 7	DOTr/DPWH	Plan/ Design	Regulator/Administrator	Procurement	Appropriation	Construction	Operation	Maintenance	Appropriation for O&M
1. 4th Mactan Bridge and Coastal Road		✓	✓			✓	✓	C	C	C	C	C	-	C	C
2. Metro Cebu Circumferential Road	✓	✓		✓	✓	✓	✓	C	C	C	C	C	-	C	C
3. Metro Cebu Intersection Improvement	✓	✓				✓	✓	C	C	C	C	C	-	C	C
4. Diversion Roads (Talisay – Naga, Mandaue – Liloan, Guadalupe – Lahug)		✓		✓	✓	✓	✓	C	C	C	C	C	-	C	C
5. Mandaue Coastal Road (Viaduct)		✓		✓		✓	✓	C	C	C	C	C	-	C	C
6. UMRT CML Line	✓	✓	✓			✓	✓	C	C	C/P	C/P	C/P	?	?	?
7. UMRT Central Line *1	✓	✓			✓	✓	✓	C	C	C/P	C/P	C/P	?	?	?
8. Area Traffic Control System	✓	✓	✓			✓	✓	C	?	C	C	C	?	?	?
9. Traffic Management (traffic signal optimization, road improvement, proper traffic operation, traffic information, etc.)	✓	✓	✓		✓	✓	✓	C/L	C/L	C/L	C/L	C/L	C/L	C/L	C/L

Note: *1 Section: Talisay – Cebu City – Mandaue – Consolacion (21.2km)
C: Central Government, P: Private Sector (possible financial scheme of PPP), C/P stands for either Central Government or Private Sector
L: LGU

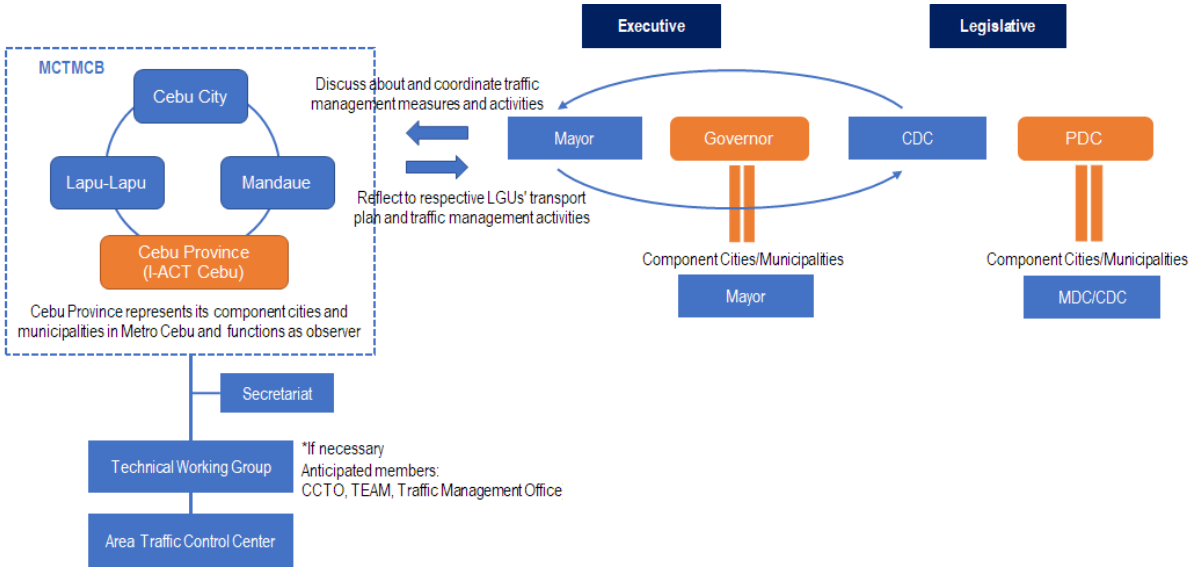
Source: JICA Project Team

Each project needs concurrence from LGUs where the projects would be located. For example, the 4th Mactan Bridge and Coastal Road needs concurrence from Mandaue and Lapu-Lapu cities, as shown in the table, even though this will be a state project implemented by DPWH. DPWH Region 7 will be the main project proponent with the concurrence from two cities and the proposal will be submitted to RDC for its endorsement to be submitted to NEDA National.

As shown in the table, all projects except the Metro Cebu Circumferential Road Project, Diversion Roads and Traffic Management are located in three cities only. Those cities will become the main proponents or at least they need to agree with the proposal before submission to RDC.

The Traffic Crisis Act of 2017 suggested an establishment of the Metro Cebu Traffic Coordinating Council (MCTCC)—although this still needs further study and discussion—that will function well enough to implement the priority projects mainly because cross-border projects or mega infrastructure investment projects are all planned, budgeted, procured, constructed and maintained by the central government agencies. However, there are still unclear role demarcations on the Area Traffic Control System and UMRT Lines as well as monitoring of constructed infrastructure, particularly, the Intersection Improvement and ATC management projects. Supposedly those two projects were monitored for further improvement by the three LGUs where the intersections and system are located, then an institutional setup is needed to get involved in only those three cities. Therefore, an inter-municipal cooperation model is suitable for the implementation of metropolitan Cebu, Cebu, Lapu-Lapu and Mandaue cities, traffic management, which needs cross-border coordination and operational management. It is deemed that the principles of the Local Government Code explicitly indicate that each local government has the jurisdiction of administering traffic management, so a new institutional setup is going to be a coordinating body to harmonize traffic management measures, programs and projects within those cities

to lesson traffic congestions, synchronize traffic codes and to be a platform for sharing local traffic data.



Source: JICA Project Team

Figure 12.2.1 Alternative Option for Metropolitan Cebu Traffic Management Coordinating Board (MCTMCB)

Figure 12.2.1 shows one option for the (Metropolitan Cebu Traffic Management Coordinating Board) MCTMCB. It is an urban transport sector-exclusive body unlike Mega Cebu Development Authority, and its main function is to execute the measures, programs, and projects in the urban transport master plan. The institutional structure will be similar to that of Mactan-Cebu Bridge Management Board (MCBMB) established in 2005. The MCBMB was established based on the memorandum of agreement, which was signed by the governor, the city government of Cebu, Mandaue, Lapu-Lapu, the municipal government of Cordova and national government agencies. The MCTMCB is proposed to be consisted of Cebu City, Lapu-Lapu and Mandaue as the core members and I ACT Cebu (Cebu Province) as an observer, considering it does not have direct authority to govern traffic management according to the Local Government Code. (Although the establishment of I ACT Cebu was ratified at the local council of the province, the details are not clear yet, so further discussion with I ACT Cebu is necessary, in particular, how that institution can contribute to the MCTMCB).

The board consists of three highly urbanized cities where most urban transport issues are seen, and the Cebu Provincial Government represents its component cities and municipalities in Metro Cebu area, as observer or as coordinator to other remaining LGUs in the Metro Cebu area. The Executive Board consists of the head of cities and the governor and, preferably, either the head of traffic management office or a representative from the traffic management board or local councils. The technical working group consists of representatives from the offices of planning and development, engineering, traffic management, environment and natural resources, and any other offices related to transport and traffic management issues. If necessary, civil organizations can be a member of the technical working group. They shall be selected through the existing rules and regulations on the selection of private stakeholders to join LGU commissions and committees. However, several steps of planning already exist for getting civil organizations and business sector involved to voice their opinions, such as various committees, local council, RDC committees, and its full council. It is better to arrange a manageable-sized technical working group with qualified and exceptional talents for the technical working group, otherwise a coordination and management themselves for managing technical working group meetings become inefficient and may take more time.

The first roundtable discussion on the creation of an institutional set-up for traffic management in implementing the Master Plan was conducted in October 2018. Representatives of three highly urbanized cities, the province, branch offices of national government agencies, such as NEDA, DPWH and LTFRB and the DOTr were invited. While the cities basically understood the needs of such coordination, they also agreed not to start from the creation of a new institution to work on traffic management, since each city already has such unit to deal with it and what is more important is to capacitate those existing bodies first. The first coordination meeting for the establishment of MCTMCB was also held in 2018 among Cebu City, Mandaue City and Lapu-Lapu City. Considering the traffic enforcers and commanders of those bodies have been already coordinating in daily basis, it was suggested to sort out a gap and needs to manage better traffic management measures.

In 2013 and 2015, House Bill 372 and 5556 was submitted respectively to Congress to thrive though the establishment of Metro Cebu Development Authority. House Bill 148 submitted in the first regular session of the seventeenth Congress was a collective effort of congressmen representing Cebu district to again establish the Mega Cebu Development Authority. The difference of this bill, however, is that its main function is similar to a coordinating council mentioned above, although it is named as authority because the previous two bills encountered disagreement from LGUs because of its mighty power and authority to control and administer the broad range of development in Metro Cebu.

Although the house bill was submitted last year, it is understood by the stakeholders that Congress may not pass the bill in near future, thus, the most attendees of the working group and steering committee meetings view and desire to establish a sector-specific organization first to focus on traffic management in Metro Cebu. Not only because of this reason, but RDC has adopted a resolution in June, “RDC Resolution No. 40 (S.2018) Requesting the DOTr to Study and Recommend the Appropriate Organization and Management of a Transport and Traffic Management Council for Metro Cebu” at the RDC council held on 29 June 2018.

Since MCTMCB focuses on coordination of traffic, establishment of supervisory body which is in charge of implementation of overall transport policy is desirable. In the course of the Metro Cebu Land Use and Transport Study (MCLUTS) introduced in Chapter 7, Joint Project Management Office (JPMO) was established by the Ministry of Transportation and Communication (MOTC: current DOTr) and the Ministry of Public Works and Highways (MPWH: current DPWH) through a Memorandum of Agreement to implement the proposed projects and transport policy. The personnel of JPMO were hired through a contract with a consulting firm administrated by MOTC. Director of JPMO was under the direct supervision and control of both Ministries. A similar set-up can be adopted to implement the proposed projects by the Master Plan, except that it might be better to establish JPMO through an Executive Order.

While it is understood and should be emphasized from experience on the lack of coordination and corporation in transport administration in Metro Cebu, the establishment of a new region-wide organization does not necessarily promise better coordination and cooperation among LGUs in the region. Establishment of a new organization requires effort, such as “cooperation and coordination” among existing organizations and finding qualified human resources and financial resources for its operation. Considering the existing conditions of Metro Cebu LGUs in terms of limited human and financial resources for transport administration, it is better to focus and invest more on human resources and institutional capabilities.

13 PILOT PROJECT ON LOCAL PUBLIC TRANSPORT ROUTE PLAN (LPTRP)

13.1 Introduction

1) Rationale

DOTr launched the Public Utility Vehicle Modernization Program (PUVMP) that revolves on the replacement of old jeepneys with new (and modern) vehicles that are compliant with global standards.

For this purpose, DOTr issued on 19 June 2017 the Department Order No. 2017-011 entitled "Omnibus Guidelines on the Planning and Identification of Public Road Transportation Services and Franchise Issuance" (OFG). It is a bold departure from the transport regulatory regime of the past three decades and promises to transform the provision and operation of buses and jeepneys in urban centers of the country.

One of the major departures of the OFG from the past is its tacit acknowledgment of the vital role of LGUs on the planning and formulation of public transit services in their own jurisdictions. Before this department order, this task was assumed inherent in the function of the LTFRB. LTFRB has failed to perform that role for many reasons—least of which is its lack of technical manpower to study and plan local transit needs. As a result, all routes and service coverage of public utility buses (PUB) and public utility jeepneys (PUJ) have been dictated or determined solely by the private sector that invest in the vehicles and operate them. The corresponding grants of Certificate of Public Convenience (CPC) or franchise were decided by lawyers and all sorts of lobbyists. To be sure, there were putative attempts by DOTr to bring order through the mechanism of route measured capacities (RMC) that is supposedly a more technocratic way of determining supply and demand.

Thus, the delegation of public transport planning to LGUs is a salutary development. While LGUs also lacks the capability (as LTFRB), it is in a better position to meet the challenge. At the very least, LGUs know their local problems and requirements and are more sensitive to commuters' woes. Failures would be limited to one jurisdiction and there would be accountability.

To lessen difficulties LGUs could face in their new role, DOTr and LTFRB formulated the LPTRP Manual (October 2017) and conducted training sessions for LGUs. LGUs in Cebu received training sessions over a 4-day period sometime in July 2018. Volume 1 of the manual is targeted for small cities with simple route structure, while volume 2 for more urbanized cities (like those in Metro Cebu) remains un-issued.

The project includes an institutional development component on public transport route planning for 3 LGUs in Metro Cebu. The choice of Municipality of Cordova, Lapu-Lapu City, and Mandaue City (CLM) out of 13 LGUs was dictated by three factors: (i) resource limitations of the JICA project; (ii) to produce an impact as wide as possible and by extension largest benefits; and (iii) demonstrative of challenges posed by, if not as pilot, PUVM and OFG.

This report documents the study's efforts (and outcomes) of the 3 LGUs.

2) The CLM Area

The Municipality of Cordova is the smallest among the 13 LGUs of Metro Cebu with a land area of only 9.6 km^2 and a population of 61,000 (second lowest to Compostela's population

of 48,000). It is essentially a “bedroom” community in which most residents commute to work to Lapu-Lapu, Mandaue, and Cebu Cities. In terms of public transit, its situation is representative of the northern towns of Consolacion, Compostela, Liloan, and Danao, as well as the southern towns of Carcar, Naga, Minglanilla, and San Fernando.

Lapu-Lapu City has the second largest population (more than 408,000) next to Cebu City but an area one-fifth of the latter. As the host city of a major gateway international airport (next to Manila), it naturally attracts traffic from all over Cebu province and, to some extent, in the entire Region 7. The industrial zone of Mactan Export Processing Zone (northern part of Lapu-Lapu City) is also a major employer as it attracts workers from all over Metro Cebu, while the southern part is a tourist belt that brings international and domestic visitors. Tourism is the largest area of the city’s different land uses.

Mandaue City, the third LGU, has a population of 363,000 and an area of 34.9 km^2. It is a highly-urbanized city with a population density of 10,000 (versus Cebu City with 2,929). More than 50% of its land area is classified as industrial followed by residential at 27%.

In terms of public transport services, the 3 LGUs account for 127 franchisees (21.2% of 598) and 3,026 units of PUJs (23.7% of 12,778) in Metro Cebu.

13.2 Methodology for Route Planning

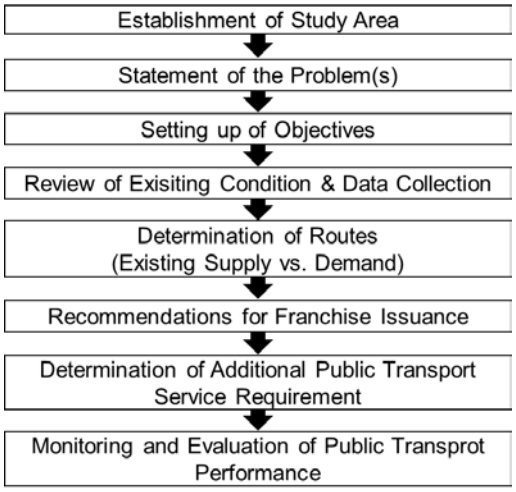
1) Manual from DOTr/ LTFRB

DOTr and LTFRB issued the LPTRP Manual to help LGUs formulate their respective plans; it is meant to be a step-by-step procedure to formulate a transport route plan. Volume 1 was intended for small urban areas with simple route structure like one or two routes, while volume 2 was supposed to be for highly-urbanized areas such as Cebu City, Lapu-Lapu City, Mandaue City, and Talisay City.

The second volume has not materialized (as of this writing) but can be inferred from volume 1 pointing at the use of computerized network transport planning model (i.e. STRADA) as the added step. This was the highlight of the training programs by LTFRB for Cebu sometime in the first semester of 2018.

The prescribed planning process in the manual is illustrated in Figure 13.2.1. The manual emphasizes data collection, i.e., the conduct of several surveys to establish demand for public transport services. Its first step is the statement of the problem followed by a determination of supply and demand per route. There is little about route analysis and route design in volume 1 except for a prescription that a computer model is needed to address this crucial step.

Two things work against the manual’s usefulness and practicality. It assumes a base of technical knowledge, particularly in traffic surveys and computer network simulation, that is present among LGU staff. LTFRB itself is deficient on this aspect. The expected outcome is for the LGU to calculate the supply gap, i.e., the number of units in addition to the current supply. The implicit premise of the manual is the retention of the status quo of existing route structure.



Source: JICA Project Team

Figure 13.2.1 Planning Process to LPTRP

2) Inductive and Deductive Approach

While this study does not disagree with the concepts laid out in the aforementioned manual, it opted for a more practical approach that LGUs can follow besides being less reliant on computer modeling and primary data gathering.

Accordingly, it has placed route restructure or redesign as the primary objective with determination of the demand–supply gap only as a secondary objective.

Thus, the first step is to understand the existing situation (rather than a statement of the problem) where public transport routes and service providers are already present in a messy, if not chaotic, abundance. The major trip patterns evoked by these trips can be inferred from secondary data re-enforced by field survey. The trip patterns would point to an implicit network topology with its inherent deficiencies on coverage.

The second step is a first approximation of the network topology. Missing links or connections can then be deduced and included, as well as removal of redundant paths, if any. It presumes that existing route definitions are weak on coverage or accessibility and should be modified and expanded. Several routes with similar and/or duplicate service areas can then be merged or aggregated. This revised framework is then subjected to a kind of “goodness of fit test” vis-a-vis the physical layout of roads and other physical limitations.

Selective (rather than a “shotgun” approach to data gathering) traffic surveys are then conducted. The various route definitions are outputs or logical outcomes of the third step of disaggregation from the overall network. It is akin to identification of trees after delineation of the forest.

The supply–demand estimation by route is the last step. Specific variables (e.g. operating speed, route distance, etc.) that affect supply are based on empirical data from surveys. This methodology acknowledges that the initial supply for the route is the number of authorized units for the newly-defined but topologically-similar route. This presumption will, therefore, ensure no reduction in the level of service.

Under this revised approach, it is possible to formulate route-restructuring under limited data. The default value on required number of units (vehicle supply) is the existing number of PUVs licensed by LTFRB. This is equivalent to a desired minimum. In most cases, the

actual number of PUVs in operation exceeds that on the official list because of the grey market, i.e., jeepneys without franchises (colloquially known as “colorum”).

If and when possible, a second approximation of supply is derived from the output of the computer simulation (i.e. STRADA), or from field surveys. It should be noted that STRADA was designed to estimate and forecast demand. Public transport route structure is an input rather than an output.

The recommended structure and vehicle-supply by routes comes down to a simple choice between the first and second estimates of supply. The routes are clustered from the viewpoint of transit operation, as well as be amenable to the grant of an omnibus franchise. The ultimate output is an entirely new set of routes to underpin a franchising system geared towards larger-scale operation (the intention of PUVM).

The old system, which the OFG wants to change, is based on fragmented small-scale operations that may work well in small towns but dysfunctional in large urban areas where integration makes for a good public transport system.

13.3 Route Restructuring

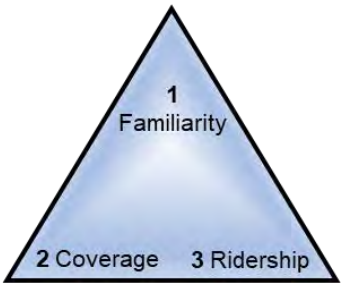
1) Basic Consideration

The planning of public transport route involves the trade-off of 3 planning factors as illustrated in Figure 13.3.1. Commuters have no choice but to adjust their trips to the available and to what they are most familiar with—routes that are visible every day.

Individual jeepney operators put ridership goal as top and foremost because it is a question of viability and survival. Service where there are large numbers of people means profitable business. But if service is concentrated into fewer routes, the frequency will be high and bus/jeepney will almost always arrive sooner.

A non-profit government transit agency, on the other hand, considers coverage of great significance. The service provider would spread out services, so that every street has access to a bus route/service. The walking distance of commuters would be reduced, but spreading out services also mean spreading the vehicle fleet thin. As a result, all routes would be infrequent, even those on the main roads. Infrequent service, in turn, would discourage riders besides entailing subsidy from the government. Politicians like coverage-oriented networks because they provide a visible semblance of equity as everyone has access to some transit service especially the poor residents who are often out of the way and far from places of work.

Thus, an incremental improvement of the present route would mean expanding the coverage and improving the familiarity feature.



Source: JICA Project Team

Figure 13.3.1 Trade-Offs in Public Transport Design

2) Base Case: Current Situation

The current situation, therefore, can be presumed to be poor coverage or accessibility. These routes have evolved over many years and are biased towards high ridership and financial viability because of their private-sector character. Coverage (factor 2) or accessibility is the given the least consideration among the three due:

- Atomized structure of the industry that means each one fends for itself and no one looks at the whole urban area;
- No government agency (LGUs or LTFRB) has done public transport route planning in the past; and
- Split responsibilities in transit that means no one is accountable.

More than 3 decades ago, PUVs in Cebu started the practice of carrying route numbers or identification on their marquee to improve factor 1 (familiarity) but this was not sustained. Today, majority of the PUVs on the road have no such markings. The prevalence of overlapping routes further decreases familiarity index.

PUJ service providers in Metro Cebu have 598 operators with 12,754 units based on the 2017 data from LTFRB. The subset for CLM areas that is grouped by destinations and/or corridors is shown on Table 13.3.1, showing 127 operators and 3,026 units. Anecdotal evidence indicates that the number of PUVs in service are actually higher than the official statistics. This implies widespread existence of unlicensed operators (locally referred to as "colorums" that means public transport vehicles operating without a franchise).

Table 13.3.1 List of PUV Operators and Route Clusters in CLM

Number of Operators	Route Descriptions/Directions	Authorized Number of Units
10	Mandaue-only routes	44
29	Mandaue to points in Liloan, Danao, and Compostela	792
20	Mandaue to points in Consolacion	806
23	Mandaue to points in Cebu City	700
13	Punta Engano to points in Lapu-Lapu City (Mactan-only routes)	20
18	Punta Engano to points in Mandaue and/or Cebu Cities	435
10	Soong-Maribago area to points in Mandaue and/or Cebu Cities	25
11	Cordova to points in Lapu-Lapu City	138
20	Cordova to points in Mandaue City*	147
2	Cordova to points in Cebu City*	11
1	Punta Engaño to Liloan	1
127	Total	3,119
598	Metro Cebu (13 LGUs)	12,778

* It may be possible for some PUVs to be counted twice, since a route has OD pairs.

Source: JICA Project Team

Mapping the above cluster of routes also reveals the important or strategic transit corridors (see Figure 13.3.2) in the CLM area as well as those outside.

Thus, to Cordova, the most important routes are those with Lapu-Lapu City that are primarily on the western side of the Mactan circumferential road often referred to as Tiangue Road. Only 6 units are listed from Cordova to Marigondon.

On the other hand, there are 3 important routes for Mandaue: (i) to/from Cebu City (on 2 corridors); (ii) to Consolacion and 3 LGUs in the northern area (on 2 corridors); and, (iii)

Mactan (crossing the two bridges). Lapu-Lapu City, besides the corridor it shares with Cordova, has two routes. These are the extensions of Mandaue–Mactan crossings at the center and at eastern part of the island. The number of PUVs that cross Mactan Shrine is 677 that reduces to 435 on Punta Engaño Road.



Notes: Data are in units/ day
Pax volume are in both directions
PUV are the authorized number of units

Source: JICA Project Team

Figure 13.3.2 Current PUV Volumes in Major Corridors

3) Inadequacies in Coverage

The spanning tree for the current set of routes in Mactan is shown in Figure 13.3.3, while that for Mandaue is shown in Figure 13.3.4. Areas without coverage can be seen in the maps, i.e., no routes within 500-m radius. Barangays in Mactan with poor accessibility are Kalawisan, Canjulao, Basak (southern half), Buaya, Pajac, Suba-basbas, Marigondon, and Buagsong. About three-fourths of the central road (Patalinghug-Basak-Marigondon) have no access.

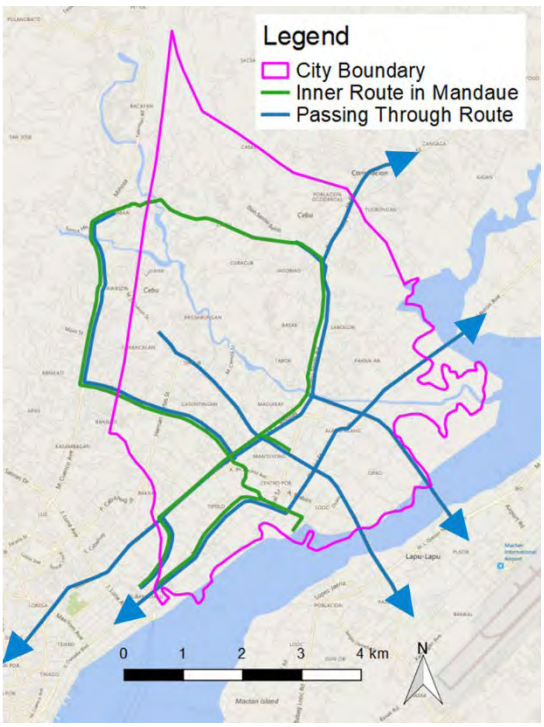
In Mandaue, barangays with low accessibility are Casil, Canduman, Cubacob, Casuntingan, Cabancalan, Labongon, and Paknaan.

While the lack of roads may prevent transit services, it is not a good explanatory variable as several barangays have passable roads, such as Suba-Basbas, Casuntingan, or Cabancalan.



Source: JICA Project Team

Figure 13.3.3 Current Public Transport Routes in Mactan



Source: JICA Project Team

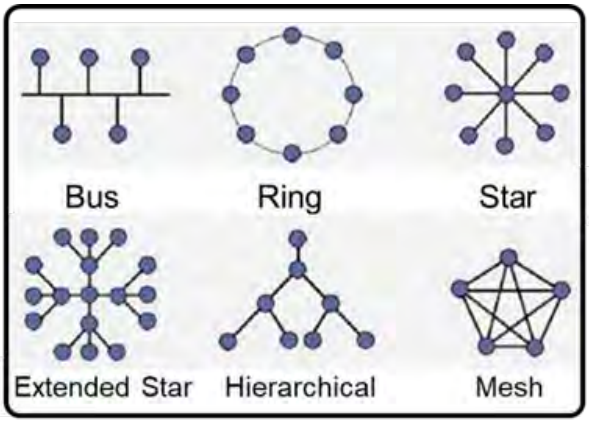
Figure 13.3.4 Current Public Transport Routes in Mandaue

4) Intrinsic Topology of the Network

The next step in public transport route design (after establishing the coverage of the current one) is to hypothesize the network topology that will provide a coherent organization to the current list of PUV routes and road network. A mix of routes does not make a network, but needs an organizing framework to improve its connectivity.

The different templates are shown in Figure 13.3.5.

A three-legged hierarchical topology would describe Mactan's public transit route with each of the 3 branches (west to Cordova, central to MEPZ1, and eastern to Punta Engaño) having a distinct bus topology. The addition of the missing length (Cordova to Punta Engaño) becomes the 4th corridor that is also on a bus topology. At first glance, the routes in Mactan would seem to fit into a ring topology, but on closer scrutiny, they could not fit because the Mactan circumferential road is still rudimentary with many narrow sections made up of a directional commuting pattern.



Source: JICA Project Team

Figure 13.3.5 Network Topology

On the other hand, Mandaue routes would conform more to a star topology except for the absence of a common hub. There are several competing, albeit near each other, mini-hubs (e.g. Parkmall, North Bus Terminal, and Pacific Mall, and other terminals).

Figure 13.3.6 shows several routes with numerous twist and turns, which is confusing to commuters, within 1-km radius from the corner of AC Cortes and SB Cabahug Streets.

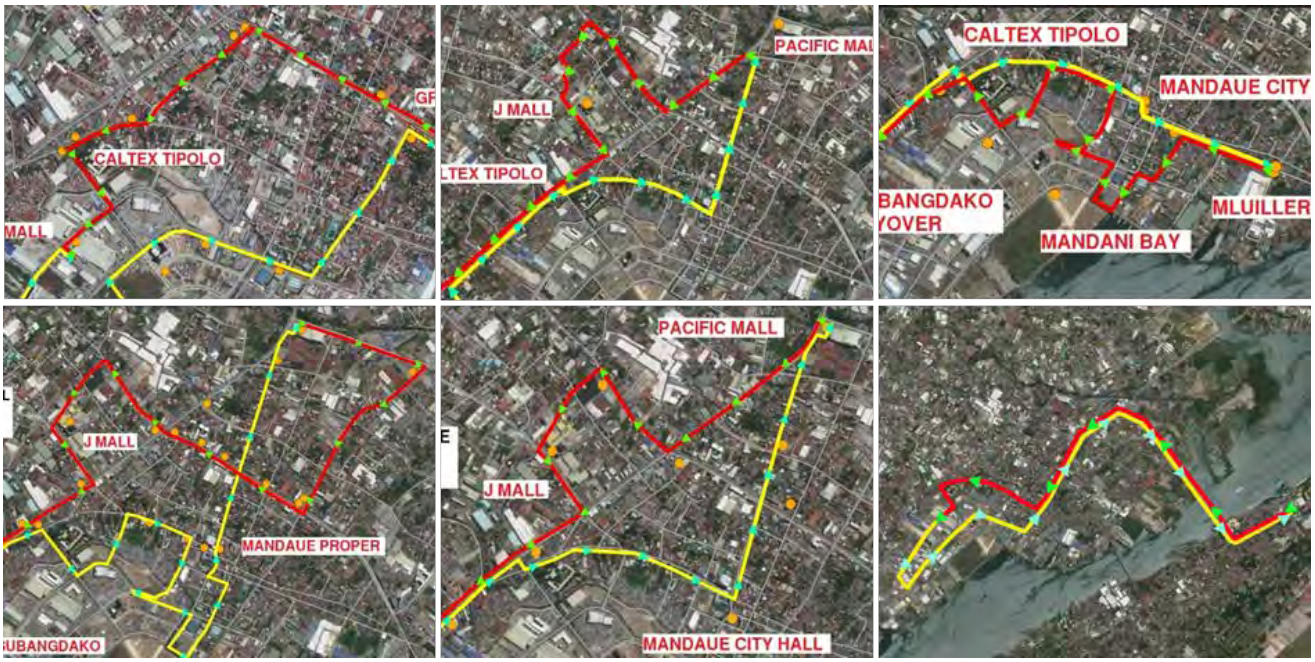


Figure 13.3.6 Turnbacks for Several Routes in Central Mandaue

The multiple and criss-cross turn backs can be remedied if there is a single hub where PUVs can maneuver.

The best transport hub candidate in Mandaue is the current location of Cebu International Convention Center (Hub-1) as shown in Figure 13.3.7. The roads around this center can be reconfigured to form a roundabout with all public transport routes rerouted to pass the roundabout; thus, making it a convenient transfer area or hub of the public transport network. In the future, it has the potential to be the central station of an underground MRT.

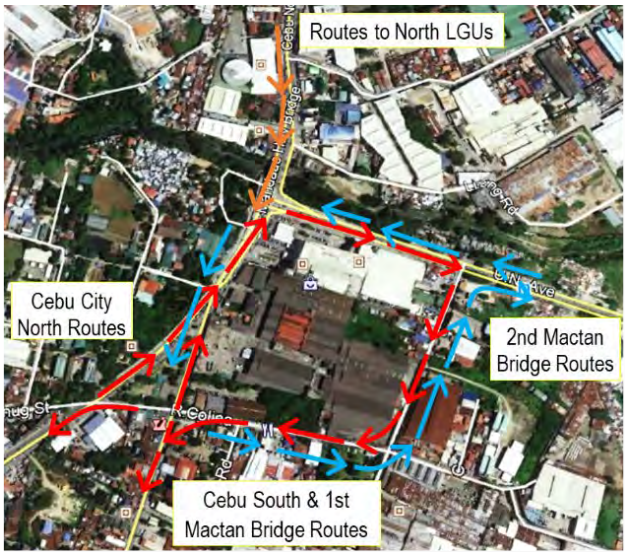


Source: JICA Project Team

Figure 13.3.7 Conceptual Hub-and-Spoke for Mandaue

Since this property has been acquired by the Mandaue City Government, the LGU can turn it into a civic center that provides a focal center; an icon and pride of place for the city (similar to Arc de Triomphe in Paris). (There are reports that it is being contemplated to turn into a casino, which is not an ideal land use as it could induce heavy traffic around the vicinity.)

The second best alternative (Hub-2), which would not require road widening and reconfiguration, is to use the block where Gaisano Super Metro Mall and Pacific Mall are located (see Figure 13.3.8). All routes that come from the north (Consolacion, Liloan, Compostela, and Danao) can follow the traffic scheme for the routes coming from Cebu City. The two routes with Mactan (via Osmeña and Fernan Bridges) can also turn back on the same block. Moreover, if the Mandaue-only routes can also use Hub-2, then maximum interconnectivity is achieved. The Traffic Enforcement Agency of Mandaue should also look at the possibility of turning two secondary roads (R. Colina and M. Quizon) into one-way and enable counter-clockwise movements for turn backs for all routes converging or passing through Mandaue.



Source: JICA Project Team

Figure 13.3.8 Hub 2 Option for Turn Back in Mandaue

5) Minimizing Overlaps

OFG stipulates that no more than 25% of a route (in terms of length) shall overlap with another PUV route. This logic is:

- To promote wider service coverage and minimize duplication;
- Reduce to a minimum street-level competition among drivers, which engender traffic congestion; and
- Achieve balance in supply of vehicles and transport demand.

This has not transpired largely because of the absence of route distance in the franchises or provisional authorities granted to PUV operators. An example of this is the routes with Punta Engaño as destination. The total number of units is 414 and number of operators 34. The overlap exceeds 25% of their respective lengths.

A similar observation can be made for routes going to Consolacion, Liloan, Compostela, and Danao. The longest route is about 29.5 km from Danao to North Bus Terminal. The common section (along Cebu North Road) is 14 km long, which is 47.6% of the entire length. There were 107 franchisees counted with a combined total of 2,138 units serving the 4 northern LGUs.

It is impossible to allocate total demand on a corridor between and among multiple operators when their routes and service areas overlap.

6) Terminals or Layover Areas

The existing PUV terminals in CLM are viewed as termination point of routes and parking facilities to wait for passengers. They do not function as passenger interchange areas unlike Ayala PUV Terminal in Cebu City.

A terminal is any location where passengers (or freight) either originates, terminates, or is handled in the transportation process. Terminals are central and intermediate locations in the movements of passengers, and often require specific facilities and equipment to accommodate the traffic they handle.

Terminals may be points of interchange within the same modal system and assure continuity of flow. This is particularly appropriate for modern air and port operations with hubs that connect parts of the network. Terminals are also important points of transfer between modes – thus intermodal station, like the ferry port on Lapu-Lapu City and Pier 3 in Cebu City. Buses, taxis, and private cars deliver people to airports. A basic attribute of transport terminals is their convergence function. To maximize their benefits, they are often made obligatory points of passage. Thus, transport terminals are either created by their centrality or the intermediacy of their respective locations.

There is confusion on the role of terminals for road-based public transit in an urban setting.

The conventional thinking (e.g. as in the case of North Bus Terminal in Mandaue) is terminals are points of assembly to consolidate passengers at the point of origin and delivered in batches to their destination or conversely redistributed to other modes upon arrival. When not in service, the bus is parked within the terminal. This can be contrasted with the PUV terminal in Ayala Mall that is a point of interchange for passengers and short-time layover area for the vehicles, and not a parking facility for vehicles to wait for passengers to arrive.



Source: SunStar, JICA Project Team

Figure 13.3.9 PUV Terminals in Ayala Mall and at the Tamiya Park (MEPZ 1)

If a terminal is not centrally-located or is not in a natural point of convergence, they tend to become parking facilities for PUVs. There is no reason for passengers to take them as their ultimate destination or origin. Buses wait for passengers in inter-urban service (like provincial buses bound to outlying towns), but it is the opposite as passengers wait along the route at bus stops to get a ride. Many of the "terminals" in Mactan and Mandaue are closer to the character of the North Bus Terminal or the "Jeepney and V-Hire Terminal" in Lapu-Lapu City than the Ayala PUV Terminal. The SM City Cebu Jeepney Bay Terminal was built on the same premise as the Ayala PUV Terminal except that very few of the routes are "obliged" to pass in the former.

Thus, to become a transport hub (a major passenger interchange area), several routes must converge at that point.

Parkmall and Pacific Mall in Mandaue are being used as lay-over areas, which is good as there is no expense on the part of the LGU and it keeps not-in-service vehicles off the roads. However, they are not passenger interchange zones per se.

According to OFG, "The minimum terminal size ≥ 130% of the total space requirements = 50% of franchised units," where 1 PUV would need 16 m^2 area. This statement is more appropriate for a terminal that serves inter-urban/provincial routes rather than urban commuting routes. In Metro Cebu, where land space is scarce and expensive, such a prescription would lead to over-investment, if not the lack thereof.

During peak hours, all available vehicles are on the road and in-service, so the terminal space is nearly empty. During off-peak periods, some vehicles are off-service and would need off-street layover areas. Data on sample routes showed load factors with an average of 51% during off-peak hours. This means that one can reduce the fleet size to as much as 51% during off-peak hours. Maintaining 60% supply is more reasonable to minimize waiting times for commuters.

Thus, the study recommends a space requirement equivalent to 20% of the fleet size (number of authorized units), assuming 2 of such facilities are available along the route. Since they are meant as lay-over areas (and not terminal per se), they can also be located midway of the route's endpoints. To minimize pressure on the finances from an LGU, it should arrange with major malls for the provision of off-road loading/unloading bays at the very least and possibly layover areas at best.

7) Interconnection with Other Modes

There are other transport modes that should be integrated with the PUV routes, mainly, tricycles and water transport.

(1) Road-Ferry Interface

In the case of Mactan, integration with the water ferry is desirable.

The two important ferry-road transfers in Mactan are the Cebu-Mactan Ferry Terminal near the Lapu-Lapu Public Market and the Cordova RORO Port.



Source: JICA Project Team

Figure 13.3.10 Road and Ferry Terminals

While PUV routes pass the Lapu-Lapu Ferry Port, there is no passenger bay area that allows loading/unloading. Sidewalks are not uniform and often unavailable. Installation of covered walkways, waiting sheds, paved sidewalks need to be provided.

On the other hand, PUV service is absent in the Cordova RORO Port. This port has several outriggers that provide ferry service to Bohol. A passenger terminal should be built in this area as well as a lay-over facility for PUVs.

Thus, the re-design of the public transport routes for Mactan should aim to improve interconnectivity between these two ferry ports.



Source: JICA Project Team

Figure 13.3.11 The Cordova Ferry Port (Inter-Island Jump-off to Panglao)

The third port is the “Hilton port” (adjacent to Movenpick that was formerly Hilton Hotel) on Punta Engaño. It mainly serves the barangays on Olango islands. The port is walking distance from a PUV route. A covered loading bay along the main road is needed.

(2) Suited for Tricycle Service

PUV services are usually non-existent in areas characterized by the following:

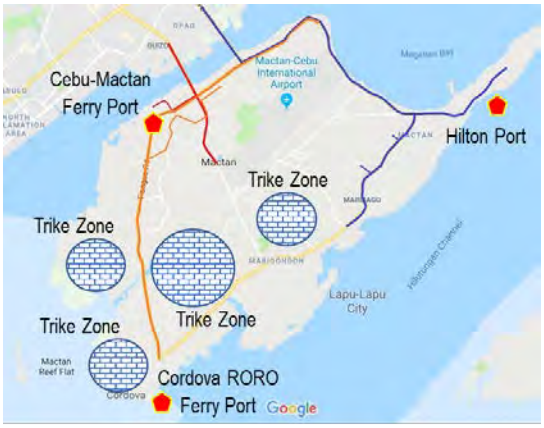
(i) Narrow roads, if not alleys and pedestrian footpaths;

(ii) Low density housing of mainly residential and low to middle-level income; and

(iii) Demand is a “pendulum” type that is high outbound in the morning and inbound in the afternoon.

Figure 13.3.12 shows the areas in Mactan that can be designated by the LGUs as tricycle operating zones. Tricycles should be banned from running along the major PUV corridors, such as the Mactan Circumferential Road and the Patalinghug-Basak-Marigondon Road.

In Mandaue, the possible tricycle-only zones are in the rural barangays of Canduman, Tingub, and Cubacob, as well as in urbanized barangays of Pagsabungan and Jacobiao. Paknaan may also be in need of public utility services. Tricycles should not be allowed in other barangays of Mandaue especially in Subangdaku, Centro, Guizo, Ibabao, Estancia, Opao, and Umapao.



Source: JICA Project Team

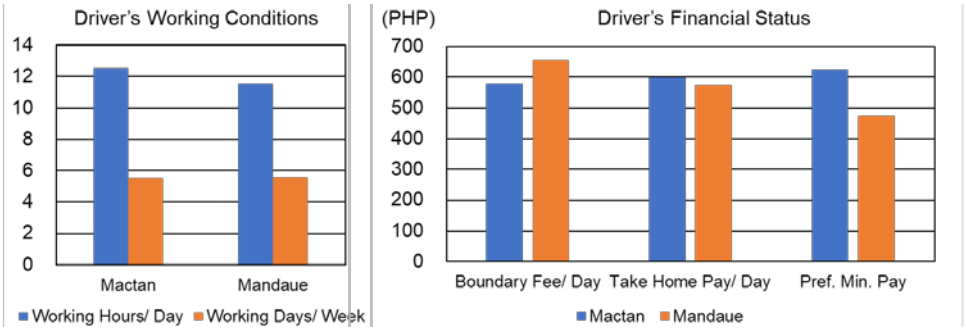
Figure 13.3.12 Tricycle Zones and Ferry Ports

8) Opinions of Stakeholders

(3) Driver Interview Survey

This study also took sample surveys of drivers in Mactan and Mandaue.

The drivers work 6 days a week with an average of 11.5 hours per day in Mandaue and 12.5 hours per day in Mactan. For a day’s effort, their take home pay averages PHP 587 that is slightly lower than the PHP 614 fee they pay to vehicle owners as kind of a lease payment for the day (see Figure 13.3.13).



Source: JICA Project Team

Figure 13.3.13 Key Data from PUV Drivers

More than 60% are not in favor of a fixed wage as they prefer the uncertain higher net income over the certain lower pay. However, Lapu-Lapu City drivers would accept a wage of PHP 625/day (higher than their current net) and Mandaue drivers consider PHP 476/day (17% lower) as reasonable.

More than half are SSS members (mostly in Lapu-Lapu City); thus, they could look forward to some retirement packages.

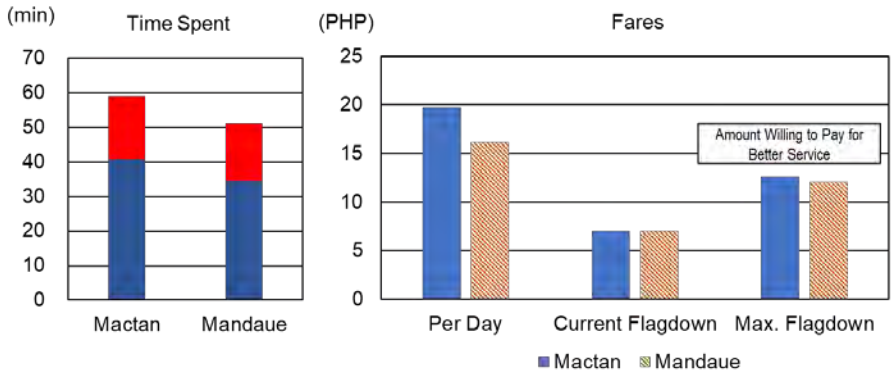
While there is near unanimity in raising the current farebox, opinions vary as to whether this should be applied on the flag down or on the distance-related part of the tariff. An average of 86% would accept a flat fare regime that range from PHP 11.91 to PHP 13.51.

(4) The Views of Commuters

Surprisingly, most commuters consider the current configuration of PUVs as comfortable probably because of the absence of a higher level of service to compare with.

The average journey time if commuters in Lapu-Lapu City is nearly 60 minutes and 51 minutes in Mandaue. More than 30% of the travel time is due to waiting at the terminal that also implies that drivers wait at the terminal for a full load rather than maintain a constant headway or schedule.

Mandaue commuters spend 18% lower than Mactan travelers likely due to shorter trip lengths.



Source: JICA Project Team

Figure 13.3.14 Opinions of Lapu-Lapu and Mandaue Commuters

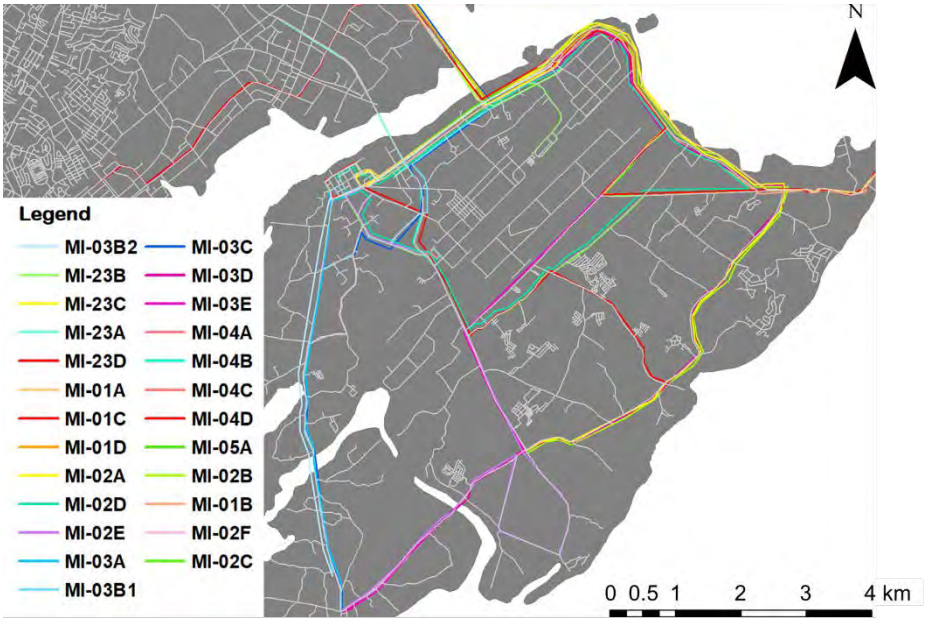
There is willingness to pay a higher fare from PHP 12.07 to 12.58 for better service.

Therefore, the introduction of modern PUVs could be accompanied by higher fare that would be acceptable to commuters and be most welcome to drivers.

(5) Initial Approximations of CLM LGUs

As part of the capacity-building, the planning and traffic staff of the 3 LGUs were asked to produce route plans after their training sessions from DOTr.

The results for Mactan and Mandaue are shown in Figures 13.3.15 and 13.3.16.



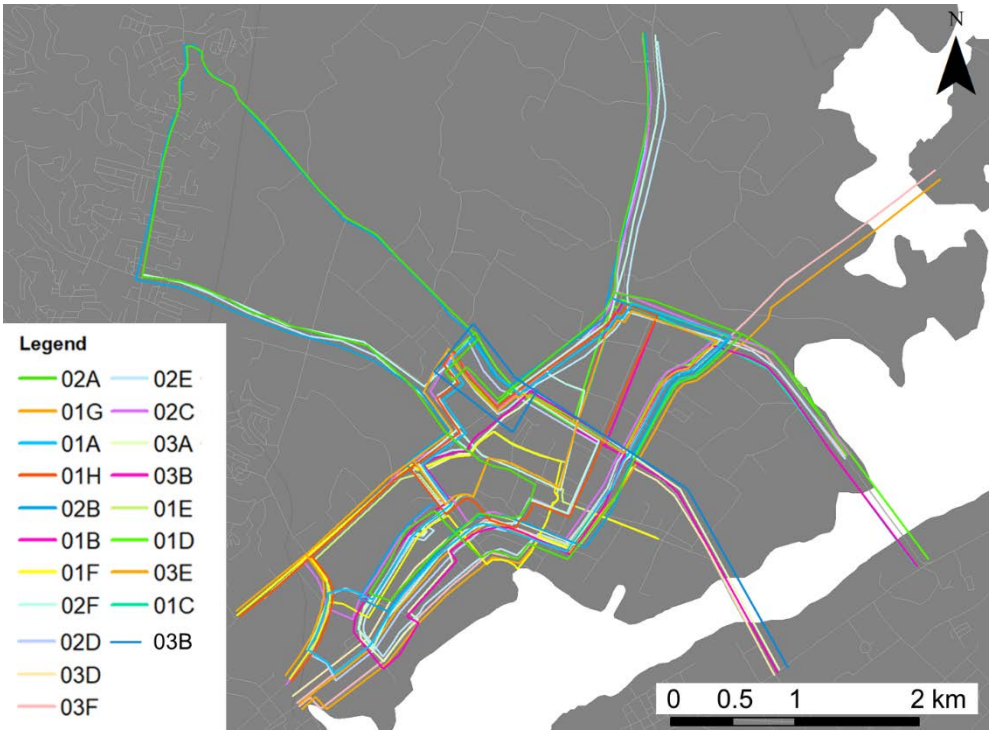
Source: JICA Project Team

Figure 13.3.15 First Approximation of Public Transport Routes in Mactan

These can be presumed to be based on local impressions where PUV services would be needed and, thus, still strong on "coverage." The shortcomings are listed below.

- Proliferation of several short and separate routes (25 for Mactan and 20 for Mandaue) that create problems on turnarounds aside from multiple transfers.
- Low on familiarity factor as commuters would have a hard-time to determine which PUV to take in order to get to their destinations.
- Overlapping routes, such as in the case of Mandaue, would make determination of supply difficult if not impossible.
- Silent on large zones without PUVs (particularly apparent in the case of Mandaue's northern Barangays).

Implicitly, the initial proposals from the 3 LGUs also revealed that the trainings provided by DOTr have not been helpful.



Source: JICA Project Team

Figure 13.3.16 First Approximation of Public Transport Routes by Mandaue

13.4 Disaggregating into Individual Routes

1) Proposed PUV Routes in Mactan Island

Four corridors with demand can be discerned for Lapu-Lapu City and Cordova.

(a) Western coastline: Cordova to Lapu-Lapu City via Tiangue Road;

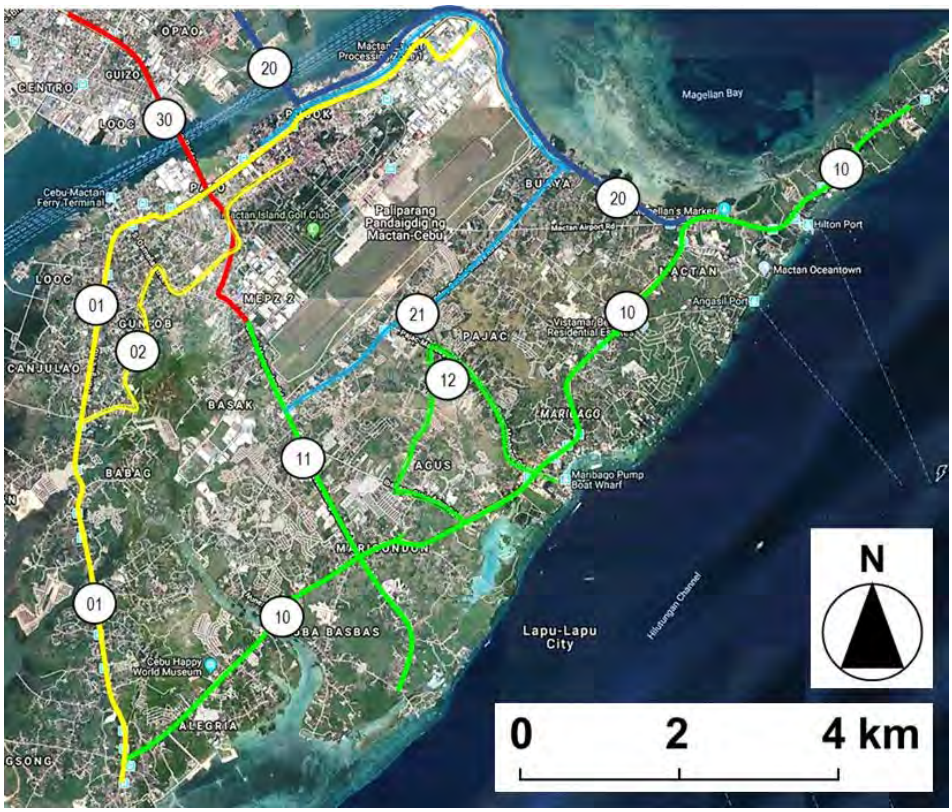
(b) Southern coastline: Cordova to Punta Engaño via the MLQ National Highway

(c) Eastern coastline: Fernan Bridge to Mactan Shrine; and

(d) Central spine: Osmeña Bridge to Tamiya Park/MEPZ 1.

The routes are shown in Figure 13.4.1. It should be noted that the above clustering lends itself to consolidation of disparate but topologically similar routes and the corollary consolidation into 4 omnibus franchises. The Red and Blue Lines are inter-LGU routes that connect Mandaue to Lapu-Lapu City.

A description of the routes is shown in Table 13.4.1. In terms of coverage, the new network spans 72 km versus 41 km for the current one.



Source: JICA Project Team

Figure 13.4.1 Proposed Routes for Cordova and Lapu-Lapu City

Table 13.4.1 New Set of Routes for Mactan Island

Route ID	From	To	Via	Length	Layover Area	Turnback
01 (Yellow)	Cordova Church	MEPZ Gate 3/4	Tiangue Road, MLQ Avenue	14.2 km	• Cordova RoRo Terminal • Pajo PUV Terminal	• Cordova Roro Terminal; • MEPZ Gates 3–4
02 (yellow)	Kalawisan Road	Lapu-Lapu City Hall	Tiangue Road, Tumulak, Looc Basak, Patalinjug, Pusok Road	5.8 km	• Gaisano Island Mall Terminal	• Gaisano Island Mall Terminal
10 (green)	Cordova Crossroad	Punta Engaño Elementary School	MLQ National Highway and Punta Engano Road	15.0 km	• Cordova Roro Terminal • Mactan New Town	• Cordova Roro Terminal • Mactan New Town
11 (green)	Tamiya Park	Marigon-don	Basak-Marigondon Road, Marigondon Beach Road	5.1 km	• Tamiya Park Terminal	• Tamiya Park • Suba-Basbas Road
12 (green)	Pajak-Maribago	Basak-Agos Road	Basak-Maribago cor. MLQ, Fuentes Road, Basak-Agos Road/MLQ	5.5 km	• TBD	• TBD
20 (blue)	Mactan Shrine	Mandaue Hub 2	MLQ National Highway, Fernan Bridge, UN Avenue, Plaridel Ave	9.7 km	• Mactan New Town • Pacific Mall	• Mactan New Town • Mandaue Hub-2
21	LLC City Hall	Buaya-Basak-Cagodoy	MLQ Avenue, Bankal-Buaya Road, Basak-Cagodoy	9.7 km	• Gaisano Island Mall Terminal	• Gaisano Island Mall • TBD
30 (red)	Tamiya Park	Remedio-Aguirre Streets	Patalinjug Avenue, Osmeña Bridge, AC Cortez, M. L. Quezon Ave	7.4 km	• Tamiya Terminal • Park Mall	• Tamiya Terminal • Remedio Street

Source: JICA Project Team

Transfers can be minimized if the Red Line from Mandaue to Tamiya Park is extended to Marigondon Beach Road. However, Basak-Marigondon Road is not wide enough to allow

minibuses, which is the recommended PUV for the Red Line. Thus, this new path from Tamiya to Marigondon is made part of Green Lines (in the form of microbus).

A litmus test of the proposed route structure is whether there would be an ensuing diminution of PUV services, but there is none even for the truncated or modified routes. Notable changes from the current mix of routes are as follows.

- In lieu of Punta Engaño as endpoint for all routes coming from Mandaue City, Cebu City, and Lapu-Lapu City, the new endpoint is Mactan New Town. Aside from the low-volume on the Punta Engaño segment of the routes, these routes exceed the 15 km threshold. They can be grouped together under the Blue Line cluster.

- The Punta Engaño Road branch (removed from the Mandaue–Cebu City lines) is made part of the new route from Cordova to Punta (i.e. Green Line).

- A completely new route is the LLC City Hall to Basak-Cagodoy (Route 21). This will serve barangays Pajac and Buaya (dense residential areas without any access to PUV). The roads in these two barangays are narrow but could accommodate microbuses. For greater connectivity, this route should connect with Red and Green Lines at Tamiya Park, provided that a direct road link is available.

- The Red and Blue Lines should combine microbus (for feeder routes) and minibuses (for trunk routes) into their fleet. These will reduce vehicular volumes on Osmeña and Fernan Bridges and increase overall public transport capacity.

- Routes between Mactan and LGUs in the northern area have been truncated to end at Mandaue as they exceed the 15 km limit.

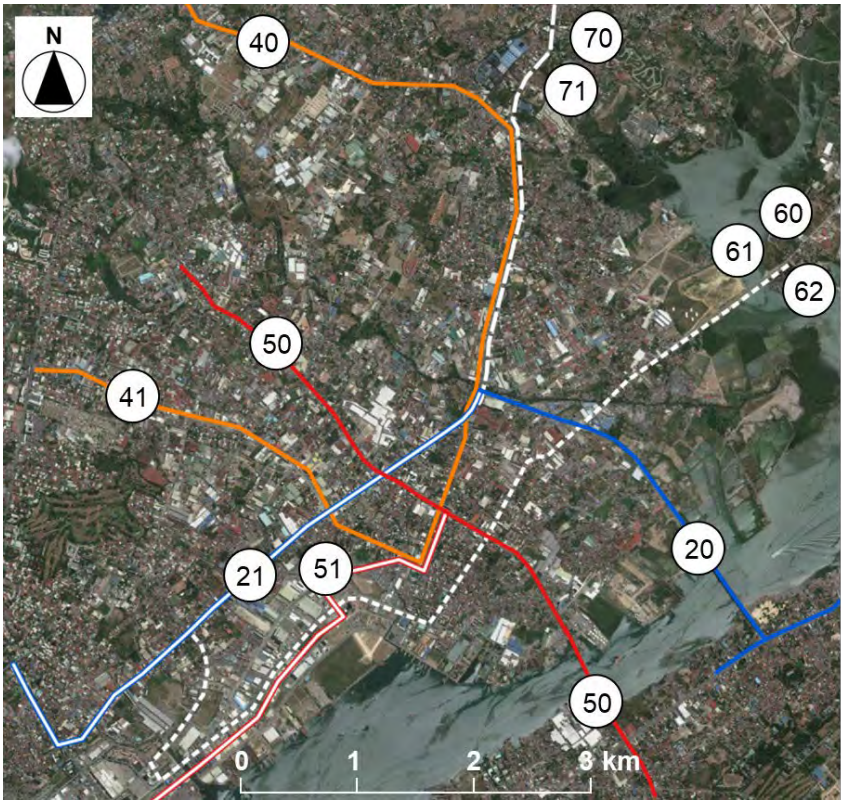
- Route 12 is currently served by tricycles since the roads in those barangays are too narrow. Hence, this route maybe dropped in favor of leaving the area.

2) Proposed PUV Routes in Mandaue

The fundamental challenge in Mandaue is separating the passing through of routes from the local Mandaue-only routes and removing the overlaps between them. At present, roads with no or very little PUV services are M.L. Quezon Avenue (north of MC Briones St.) and Habella/Canduman Road.

Eleven franchises with a combined total of 45 units are listed as Mandaue-only services, but several franchises overlap with longer routes coming from the north and Cebu City.

The most significant routes are those from Consolacion, Liloan, Compostela, and Danao. They account for 49 franchises and 1,598 units that enter Mandaue.



Source: JICA Project Team

Figure 13.4.2 Proposed Public Transport Routes for Mandaue City

Nearly all vehicles pass through the Cebu North Road and converge in barangays Maguikay, Ibabao, and Estancia. Part of these volumes (>24% of 1,598 are those from Danao and Compostela) should be diverted to the under-used Cebu North Coastal Road and Canzaga Bay Bridge. Anyway, the bridge is destined for the North Bus Terminal or to Mandaue Civic Center (Hub-1).

The second most significant of routes that connect the City of Mandaue and Cebu City consist of 23 franchises and 700 units. These routes are actually oriented to two destinations: one to north of Cebu City (mainly to Talamban and Ayala Business Park) and another to south of Cebu City (mainly to the Metropolitan Cathedral and Cebu City Hall).

Descriptions of the new set of routes for Mandaue are shown in Table 13.4.2.

Table 13.4.2 New Set of Routes for Mandaue City

Route ID	From	To	Via	Length	Layover Area	Turnback
Mandaue City Only Routes						
40 (Orange)	Hub2/4	Canduman Market	SB Cabahug Street, Cebu North Road, HAbellana Street	6.6km	• Parkmall • Gaisano Grand Mall North	• TBD/1 • Tintay Jeepney Terminal
41 (Orange)	Hub1/3	Foodland	AS Fortuna Street	4.0km	• Parkmall • Gaisano Country Mall	• TBD/1 • Gaisano Country Mall
Mandaue-Mactan Routes						
20 (blue)	Hub2	Mactan Shrine	UN Avenue and Fernan Bridge	9.7km	• Pacific Mall	• Mactan New Town • TBD/1
50 (red)	Remedio-Aguirre	Tamiya Park	ML Quezon Avenue (Mandaue), AC Cortes and Osmeña Bridge	6.4km	• Tamiya Terminal	• TBD/1 • Tamiya Terminal

Route ID	From	To	Via	Length	Layover Area	Turnback
Mandaue-Cebu City Routes						
21 (blue)	Hub2	Ayala Business Park	Del Rosario, Lopez Jaena, Juan Luna Ave.,	6.2km	• Pacific Mall • Ayala PUV Terminal	• Ayala PUV Terminal • TBD/1
51 (red)	Hub1/3	Cathedral	Ouano Avenue, Port Service Rd.,Legaspi St	6.7km	• Parkmall	• Cathedral • TBD/1
Mandaue – Northern LGUs						
60 (white)	North Bus Terminal (NBT)	Danao Bus Terminal	Ouano Ave., Plaridel Ave., Canzaga Bay Bridge, Cebu North Coastal Road	30.0km	• NBT • Danao Bus Terminal	• NBT • Danao Bus Terminal
61 (white)	NBT	Compostela	Ouano-Plaridel-Canzaga-North Coastal	21.9km	• NBT • Compostela Municipal Park	• NBT • Compostela Seaoil(?)
62 (white)	Hub 1	Liloan	Canzaga Bay Bridge, Cebu North Coastal Rd	12.3km	• Parkmall • Liloan (tbd)	• Hub 1 • Liloan (tbd)
70 (white)	Hub1	Consolacion	Cebu North Road	6.6km	• Park Mall • SM Consolacion	• Hub 1 • Consolacion (TBD/1)
71 (white)	Hub2	Liloan	Cebu North Road	10.5km	• Pacific Mall • Liloan Seaoil?	• TBD/1 • Liloan (TBD)
Notes:		1/ TBD – To be determined by Mandaue Traffic Enforcement Agency 2/ NBT – North Bus Terminal 3/ Hub1 – Mandaue Civic Center, aka Cebu International Convention Center 4/ Hub2 - the turnaround block @Pacific Mall & Gaisano Super Metro				

Source: JICA Project Team

In terms of route coverage, the new network mentioned in the above table spans 111 km versus 71 km of the current route (56% improvement).

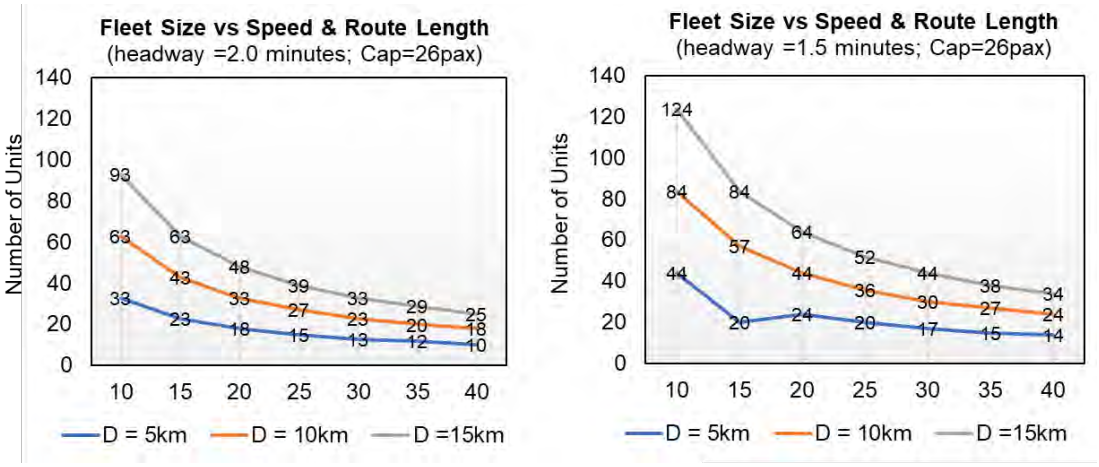
13.5 Demand and Supply

1) Factors to Consider

(1) Distance, Headways and Operating Speed

Official data on routes licensed by the government do not reflect the route length that renders the approved supply number of authorized units (NAU) without any empirical basis. The number of trips a unit can make is a function of route length and operating speed. Faster speed, as well as on shorter routes, permit more trips; hence, a smaller number of units. Obviously, no such calculations were made prior to the grant of franchises.

The relationships of these factors to determine supply is illustrated in Figure 13.5.1. Higher demand can be met by shorter headways (or more frequent trips) rather than by simply adding more units. A good transit operator will try to maximize the productivity of his fleet with more round trips to capture more passengers while deploying the same number of vehicles.



Source: JICA Project Team

Figure 13.5.1 Relationship of Headways, Route Length, and Speeds on Fleet Size

Because of traffic congestion, the operating speed in Metro Cebu becomes unpredictable, if not uncertain, leading to erratic scheduling. The Boarding and Alighting Surveys conducted for 21 routes in the pilot LGUs showed an average travel speed of 16 kph for PUVs (see Table 13.5.1).

Table 13.5.1 Operating Speeds, Selected Routes

Route	Average Operating Speed (kph)					
	AM D1	AM D2	OP D1	OP D2	PM D1	PM D2
NBT–Liloan	17.1	30.2	13.7	10.7	13.9	14.6
Ayala Mall–Pacific Mall	13.4	12.1	12.1	11.6	5.9	11.2
Cordova–MEPZ 4	15.9	14.5	19.2	23.0	17.8	16.0
Urgello–Park Mall	13.5	11.3	10.9	11.6	9.3	10.1
Parkmall–Punta Engaño	19.6	23.0	24.4	17.7	13.2	13.3
Parkmall–Punta Engaño	21.8	25.7	27.2	23.1	14.7	14.8
Pacific Mall–Marigondon	19.7	22.8	21.1	27.4	19.2	21.7
Cathedral–Mandaue	9.1	7.7	6.9	7.2	8.7	10.2
Pacific Mall–Marigondon	17.6	20.4	18.9	24.5	17.2	17.0
Foodland–Consolacion	10.3	9.8	10.9	10.5	8.2	10.4
Cathedral–Mandaue (Ibabao)	11.3	10.6	16.7	18.4	15.2	9.3
Parkmall–Liloan	13.9	10.8	18.0	12.8	12.1	13.1
Cebu City–Consolacion	25.9	28.0	21.2	25.0	14.7	11.2
SM Mall (CC)–Danao	33.0	23.3	29.6	23.0	27.4	21.2
Cebu City–Mandaue–Liloan	15.1	17.2	13.8	11.6	11.2	15.9
Compostela–Makro (Mandaue)	17.9	15.3	17.5	14.8	16.9	18.2
Parkmall–Tamiya	10.2	7.1	10.1	8.7	9.0	7.3
Foodland–Compostela	18.1	14.9	16.3	16.9	14.5	22.2
LLC PM–Punta Engaño	15.7	21.2	15.2	20.7	15.1	17.8
Liloan–Country Mall (Mandaue)	15.2	10.0	10.7	14.0	12.6	16.3
Mandaue–LLC PM	8.3	8.8	6.6	12.5	7.5	6.0
LLC–MEPZ 4	4.2	6.1	6.7	6.8	6.2	7.0
Cebu City–Danao	21.9	14.9	11.6	13.4	14.2	26.4
NBT–Danao (Minibus)	19.0	21.2	20.4	23.3	18.4	25.8
Average	16.1	16.1	15.8	16.2	13.5	14.9

Note: CC is Cebu City

Source: JICA Project Team

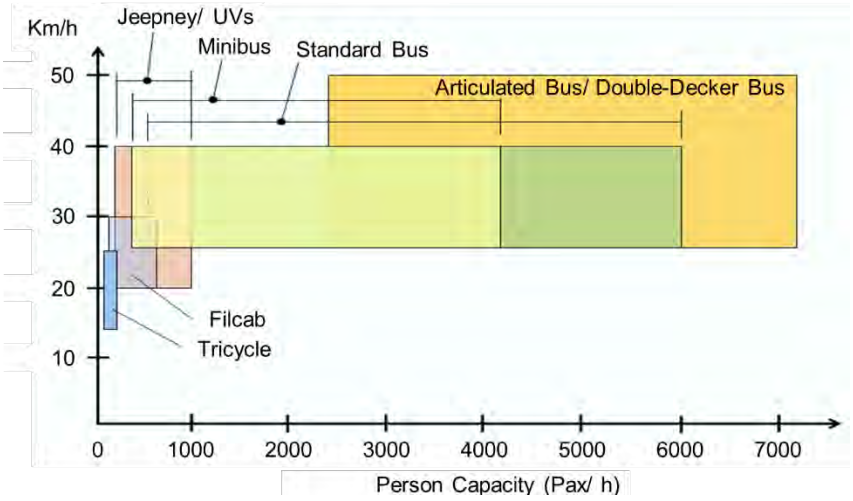
Aside from the very low operating speed between end points of a route, it is noticeable that speed during off-peak hours—when travel speed is expected to be faster—is nearly the same as in the morning rush hours. This can be traced back to the tendency of drivers to wait for passengers at bus stops to get full passenger capacity before moving. Real-time dispatch could minimize the effect of such intentional delays combined with a change in the compensation method for drivers.

Hence, an average speed of 20 kph was adopted in this study to calculate the number of units to serve a route. This would result in lower NAU. A higher NAU would be from using a speed lower than 16 kph. This will be consistent with the fundamental change in franchising mentioned under the OFG where a minimum number of units would be imposed on operators rather than maximum (which was the prevailing practice over the last 30 years).

(2) Sizing of Vehicles vis-a-vis Demand

The OFG also prescribes the efficiency principle of deploying the right size of vehicles appropriate to demand. It would be uneconomical to use a big bus where demand is low. The deployment of larger-capacity buses on high-demand corridor also leads to traffic decongestion on the road as more passengers can be transported on lesser number of vehicles.

A jeepney is generally recognized having a 16-passenger capacity, but enterprising operators have modified their vehicle (in the absence of standards) to squeeze in 22 passengers. In Metro Cebu, a Filcab may be construed as analogous to the more widely-known multicab. The latter also has stretched versions that has capacities approximately same with PUJs.

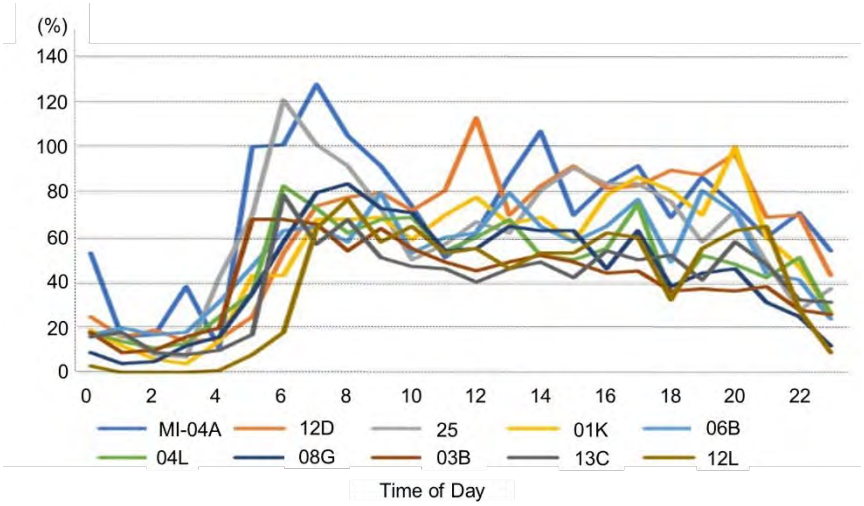


Source: DOTr, Local Public Transport Route Plan Manual, 2017

Figure 13.5.2 Guidelines on Vehicle Size vis-a-vis Peak-Hour Demand

Under the newly-issued technical standards, Class 2 or 3 PUVs would be able to carry 26 passengers. To get to 1,000 PPHPD level, the frequency would have to be 39 vehicles per hour or headway of 512 meters at operating speed of 20 kph.

For the CLM area, this means that a PUJ should be excluded from consideration where demand already exceeds 1,000 PPHPD unless the roads along the route are not wide enough to accommodate larger vehicles.



Source: JICA Project Team

Figure 13.5.3 Ridership during the Day

In applying the above guidelines, however, a transit planner will also be confronted by a corollary problem. Shall the 1,000 PPHPD be applied at peak-hour demand or the average load during the day? As seen in Figure 13.5.3, demand varies during the day; the highest demand occurs in the morning peak hours. If the supply is based on peak-hour demand, there would be overcapacity during off-peak. A daily average load factor of 60% is a reasonable compromise, which recognizes occasional overloading (via standees) during peak hour. Alternatively, 90% peak-hour demand equates to 110% overloading.

Boarding and alighting surveys made on 48 PUV routes in Metro Cebu revealed a daily average load factor of 56.3% and a maximum of 127%.

To comply with LTFRB guidelines, LGUs are expected to conduct surveys to quantify demand. This is a desirable requirement, but perhaps impractical. For one, LGUs do not have budget allocations for surveys. LTFRB has not been exactly data-driven in approving or rejecting applicants, and LGUs could not be expected to be an exception.

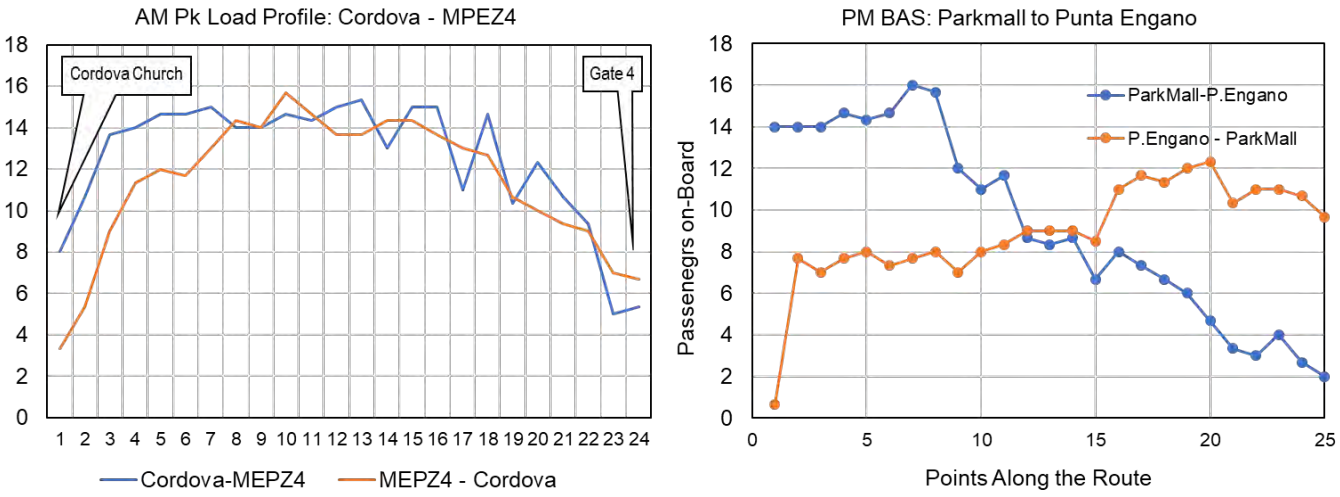
A simpler heuristic for LGU is to count the existing number of PUVs that ply a road or the most commonly-traversed section of a route. If frequency exceeds 40 PUJs (microbus) in an hour, then the fleet on that route has to upgrade to minibus. When 100 minibuses per hour is reached, then it is time to move up to standard and to bigger buses.

(3) Demand Along the Route

If all rode from one origin and disembarked at one destination, the load profile would be flat and demand would be equal to the load.

However, that is not the nature of urban commuting. Passengers board and alight along the way that, at some point, the vehicle will either be full or nearly empty in some sections. This can be seen in Figure 13.5.4, which is the load profile for two routes in the CLM area.

This kind of survey data would suggest points in the route with high transfers and/or points of aggregation such as malls or schools. It also hints opportunities to shorten the route and for dispatchers to initiate deadheading to improve service.



Source: JICA Project Team

Figure 13.5.4 Example of Boarding and Alighting Data

2) Surveys Undertaken

The study conducted boarding and alighting surveys for 55 routes (see Table 13.5.2) sometime in the last quarter of 2017. Out of the 56 survey results, 26 were relevant to the CLM pilot study area.

Table 13.5.2 Metro Cebu Boarding and Alighting Surveys

No.	Route Description	In CLM?	Remarks
1	North Bus Terminal to Liloan	Yes	
2	Naga-to Basak-Pardo	No	South LGUs
3	Colon–Talamban	No	Cebu City
4	Urgello–Parkmall	Yes	Cebu City–Mandaue
5	Talamban Pito-os, Ramos, Carbon (Rte62c)	No	Cebu City
6	Carbon–Gauadalupe (Rte 06B)	No	
7	Tabunok–Carcar	No	South LGUs
8	Colon–Inayawan (Rte 11A)	No	
9	Basak–Minglanilla	No	South LGUs
10	Cathedral–Mandaue	Yes	Cebu City–Mandaue
11	Pacific Mall–Marigondon	Yes	Mandaue–Lapu-Lapu CIty
12	Foodland–Consolacion	Yes	Mandaue–Consolacion
13	Carbon Apas Lahug (Rte 17B)	No	
14	Ibabao Mandaue (Rte 21D)	Yes	Mandaue only
15	Lahug–SM/Ayala (Rte 04L)	No	
16	Labangon–Colon (Rte 12D)	No	
17	Parkmall–Liloan	Yes	Mandaue to Northern LGUs
18	Labangon–Ayala	No	
19	Bulacao–SM (Rte 10H)	No	
20	Carbon Plaza Housing (Rte 04C)	No	
21	Colon–Bulacao	No	
22	Colon–Mabolo	No	
23	Cebu Consolacion (Rte 24C)	Yes	Mandaue to Northern LGUs
24	Colon–Ayala (Rt3 14D)	No	
25	Colon–Guadalupe (Rte 06C)	No	
26	Alumnus–Colon (Rte 08B)	No	
27	SM Cebu–Danao	Yes	Mandaue to Northern LGUs
28	SM Cebu South Terminal–Pier 3 (Rte 02B)	No	

No.	Route Description	In CLM?	Remarks
29	Cebu–Liloan (Rte 25)	Yes	Mandaue to Northern LGUs
30	Mandaue–Compostela	Yes	Mandaue to Northern LGUs
31	Colon–Guadalupe (Rte 06A)	No	
32	Parkmall–Tamiya (Rte 104A)	Yes	Mandaue–Lapu-Lapu City
33	Foodland–Compostela (Rte 25)	Yes	
34	Punta Engano–MEPZ 1	Yes	Lapu-Lapu only
35	Foodland–Liloan	Yes	Mandaue to Northern LGUs
36	Mandaue–Lapu-Lapu (Rte 23D)	Yes	Mandaue–Lapu-Lapu City
37	Colon–Labangon–SM (Rte 12I)	No	
38	Carbon–Mabolo (Rte 03B)	No	
39	Labangon–SM (Rte 12G)	No	
40	Basak- Ibabao–Colon (Rte 09F)	No	
41	Colon–Lahug (Rte 17C)	No	
42	MEPZ 1 to MEPZ 4	Yes	Lapu-Lapu City only
43	Carbon–Mabolo (Rte 03L)	No	
44	Carbon–Kalunasan (Rte 15)	No	
45	Danao–White Gold	Yes	Mandaue to Northern LGUs
46	Banawa–Colon–Carbon (Rte 07B)	No	
47	Parkmall–Punta Engaño	Yes	Mandaue–Lapu-Lapu City
48	Cordova–MEPZA 4	Yes	
49	Ayala Terminal–Pacific Mall	Yes	Cebu City - Mandaue
47	Cebu–Daanbantayan	No	Provincial route, Bus
48	Parkmall–SM Seaside	Yes	MyBus route
49	SM Cebu–Parkmall	Yes	MyBus route
50	Talisay–Parkmall	Yes	MyBus route
51	North Bus Terminal–Danao Church	Yes	Provincial bus route
52	SM City North to Mactan Airport	Yes	MyBus route
53	SM Seaside–Lawaan	No	MyBus route
54	Cebu–Balamban	No	Provincial route, Bus
55	Metro Cebu–Santander	No	Provincial route, Bus
56	Carcar–Cebu	No	Provincial route, Bus

Source: JICA Project Team

The aforementioned surveys established passenger load profiles along the route. Supplemental surveys were also conducted in June–July 2018 in the forms shown in Table 13.5.3. The occupancy counts estimate the number of passengers in PUVs at specific locations (or cordon line) in a day, while the traffic counts determine the number of PUVs that pass through a specific location in a day.

Table 13.5.3 Supplemental Surveys for Public Transport Routes Planning

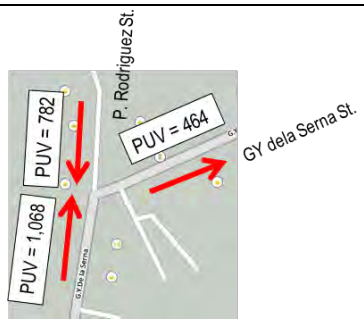
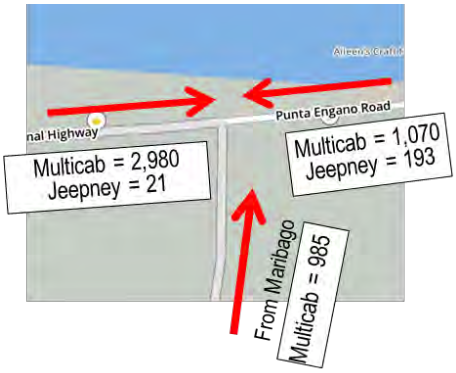
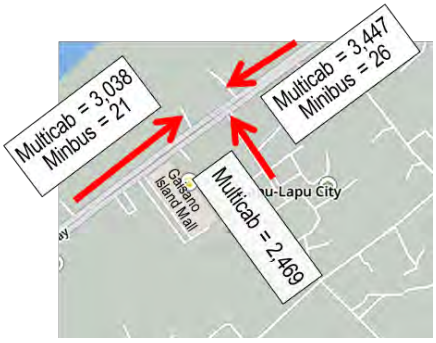
No.	Survey Locations	City
Occupancy Counts at Intersections		
1	Punta Engano Road and MLQ Highway	Lapu-Lapu
2	Soong Mahayhay and MLQ Highway	Lapu-Lapu
3	GY dela Serna, Tiangue Road, P.Rodriguez	Lapu-Lapu
4	Pajac, MLQ Highway, Ontique	Lapu-Lapu
5	UN Avenue and Plaridel Street	Mandaue
6	UN Avenue and Maguikay Flyover	Mandaue
7	Ac Cortes and Mandaue causeway	Mandaue
Traffic Counts at Intersections/Junctions		
1	Babag Road and V. Pacaldo Street	Lapu-Lapu
2	DM Cortes corner AC Cortes	Mandaue
3	MLQ Highway and Basak Marigondon Road	Lapu-Lapu
4	MJ Cuenco Avenue and Pope John Paul II Avenue	Mandaue
5	DM Cortes and UN Avenue	Mandaue

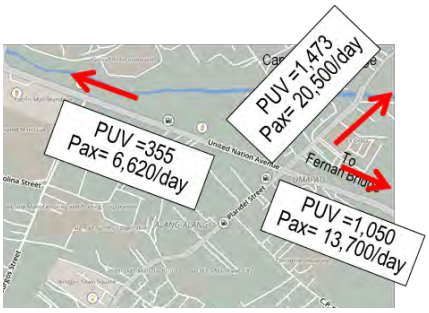
No.	Survey Locations	City
6	ML Quezon Avenue and Lapu-Lapu City Hall Entrance	Lapu-Lapu
7	M.J. Cuenco and Ayala-Mactan Road	Cebu City
8	Soong Mahayhay and MLQ Highway	Lapu-Lapu
9	ML Quezon Avenue and Airport Road	Lapu-Lapu
10	GY dela Serna and Tiangue Road	Cordova
11	M. Logarta Avenue and Lopez Jaena Street	Mandaue
12	UN Avenue and Plaridel Street	Mandaue
13	UN Avenue and MC BrionesStreet	Mandaue

Source: JICA Project Team

Salient observations from the afore mentioned surveys are discussed below.

Table 13.5.4 Selected Results of Traffic Surveys

	Traffic counts made on the intersection of Basak-Marigondon Road and MLQ Highway Key findings: • Although no PUVs are licensed/registered to ply MLQ Highway from Cordova, 137 multicabs were observed • LTFRB data do not show authorized operators on Basak-Marigondon Road, but a significant number (~4,942 units) were counted during the field surveys Based on average ridership (8.4pax/multicab/day), the number of passengers on the Basak-Marigondon Road is 41,500 per day; and 17,300 pax/day on the MLQ Highway towards Maribago.
	Traffic counts made on GY dela Serna junction with P. Rodriguez Street (Lapu-Lapu City) Key findings: • Mostly multi-cabs. Biggest volume from Cordova northbound (1,068 units/day). LTFRB authorized units = 296, which implies 3.8 round trips per day/unit • Occupancy counts indicated 12 pax/unit, which means total pax/day (from Cordova) =12,800. • LTFRB data do not list a route path from Tiangue to GY dela Serna Street, but it exist per survey.
	Traffic counts made on ML Quezon Highway junction with Punta Engano (Lapu-Lapu City) Key findings: • Mostly multi-cabs. Biggest volume from Mactan Shrine towards the junction (~3,000 units/day). LTFRB authorized units = 419, which implies 7.2 round trips per day/unit (which is too high as to suggest existence of colorum units) • Peak hour volume is highest at noon time, unlike other routes • No PUVs turning to Punta Engano, from Maribago; they all turned towards Mactan Shirne and thence MPEZ and bridges • Pax/day thru Mactan Shrine to junction ~20,100 Pax per day from Punta Engano ~6,900; which implies many terminate their journeys before the vehicles enter the Road.
	Traffic counts made on ML Quezon Avenue junction with Access Road to Lapu-Lapu City Hall Key findings: • Mostly multi-cabs. Biggest volume from Airport to LLC market (~3,450 units/day). LTFRB authorized units = 419, which implies 8.2 round trips per day/unit (which is too high as to suggest existence of colorum units) • Unusually large volume coming from City Hall, which may originate from back street (Pusok Road) and/or PUVs intentionally entering the City Hall compound to load/unload passengers Pax per day along ML Quezon Avenue ~ 23,100 pax. The Red, Yellow and Blue lines converge on this road section

	Traffic counts on Carreta/John Paul II Avenue, on main entry of PUVs to the Ayala Business Park Key findings: • Per LTFRB data, NAUs = 29 units, from Mandaue to Ayala. Traffic count showed 1,462 PUVs/day. Only conclusion is that there are many unlicensed PUVs • Jeepneys are dominant in calling at Ayala Terminal. Estimated pax/day from Ayala Business Park =29,700 • Estimated pax volume, from Mandaue to Ayala, = 19,830/day (based on Occupancy Counts) • Pax volume from SM to Ayala is 11,800/day; opposite direction =32,450/day From Cebu south, along Carreta Street, pax volume =23,180/day
	Traffic counts on Plaridel St/UN Avenue/Canzaga Bay Bridge Key findings: • Per LTFRB data, no PUVs go to Canzaga-Coastal Road from Mandaue to northern LGUs. Traffic count showed 1,473 PUVs/day with estimate pax volume of 20,500/day. • However, no PUVs return via the same route. They take the Cebu North Road via Consolacion. Estimated volume of passengers going to Fernan Bridge from Pacific Mall =13,700/day. This compares with pax traffic of 54,000 that actually cross the bridge, which means other PUVs go through the bridge without passing Pacific Mall.

Source: JICA Project Team

3) Apparent Demand on 2017 Network

The field surveys and demand estimation quantified several characteristics of individual routes as if they stand alone. In fact, no route is secluded from the effects of other routes. A change in the flow of one route could modify the demand on other connecting or crossing routes. That is the nature of a network.

It is difficult to manually calculate the inter-routes effects; thus, the resort to computer modeling.

Figure 13.5.5 illustrates the relative distribution of demands on public transport across the entire road network that assumes availability of services where they are needed and where there are seamless transfers. This computer model (STRADA) output simulates the behavior of the entire network.

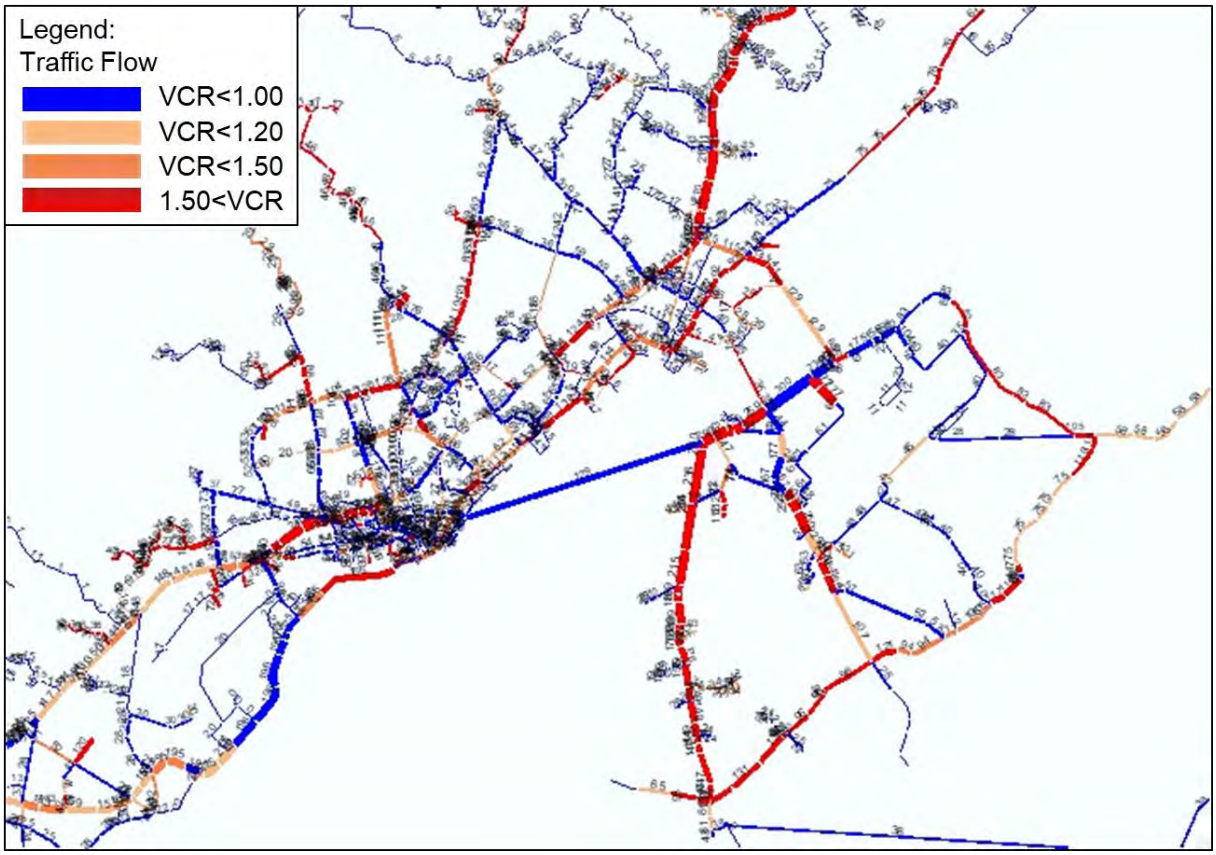
The Red Line indicates saturated (or heavily congested) roads. The thickness of lines are also indicative of the volume of passengers. The numbers are the daily passenger flows, expressed in units of 100, e.g., 5,800 passengers/day on the Punta Engaño Road and 8,300 on the connecting Circumferential Road (east side).

On the other hand, the Cebu North Road is shown to have 14,500 to 15,000 passengers/day. That road is served by 1,598 jeepneys. At this level, the required capacity equates to 1,500 PPHPD; therefore, implies that a minibus as minimum vehicle size on the Mandaue to Consolacion to Liloan corridor. Total replacement of vehicles would be 800 minibuses or 400 standard buses.

The public transport volume across the bridges, however, appear too low compared to field surveys. The model assumed the existence of the Cordova-Cebu bridge and, consequently, split the volume to 3 bridges. In any case, the aggregate total for the 3 bridges (~29,800 pax/day) is significantly different from the screen line survey results of nearly 124,000 passengers on-board public transport crossing the 2 bridges. In this situation, the latter should prevail.

The junction of MLQ Highway and Punta Engaño is also noteworthy as traffic count was conducted by the study team on that intersection (see Table 13.5.4). The volume of 5,800 (based on model) is not far from 6,900 passengers/day (traffic count survey). However, the count on MLQ Highway is 20,200 vs 8,300 (model values). In such a case, the higher value should be adopted.

The flow volumes in Figure 13.5.5 also suggests on what corridor should larger vehicles (mini and standard buses) be introduced in the CLM area.



Source: JICA Project Team

Figure 13.5.5 Daily Average Public Transport Passenger Volumes, 2017

4) Presaging Shift to Buses

While there are buses running on Metro Cebu roads, these are provincial buses. None has been franchised to operate as urban buses. They are prohibited from picking up passengers along the way or must charge a boarding passenger the same fare as a provincial trip. A passenger boarding in Liloan has to pay the same fare as those that board in Danao even if the latter is 15 km farther.

At present, the only urban bus operations that can be construed for urban commuting is MyBus. They were introduced by SM primarily to encourage patronage of the SM mall complex in SRP and to serve the Mactan International airport. They have very limited role in daily urban commuting with designated (and very few) stops on the routes. As such, MyBus can be classified as Express Buses.

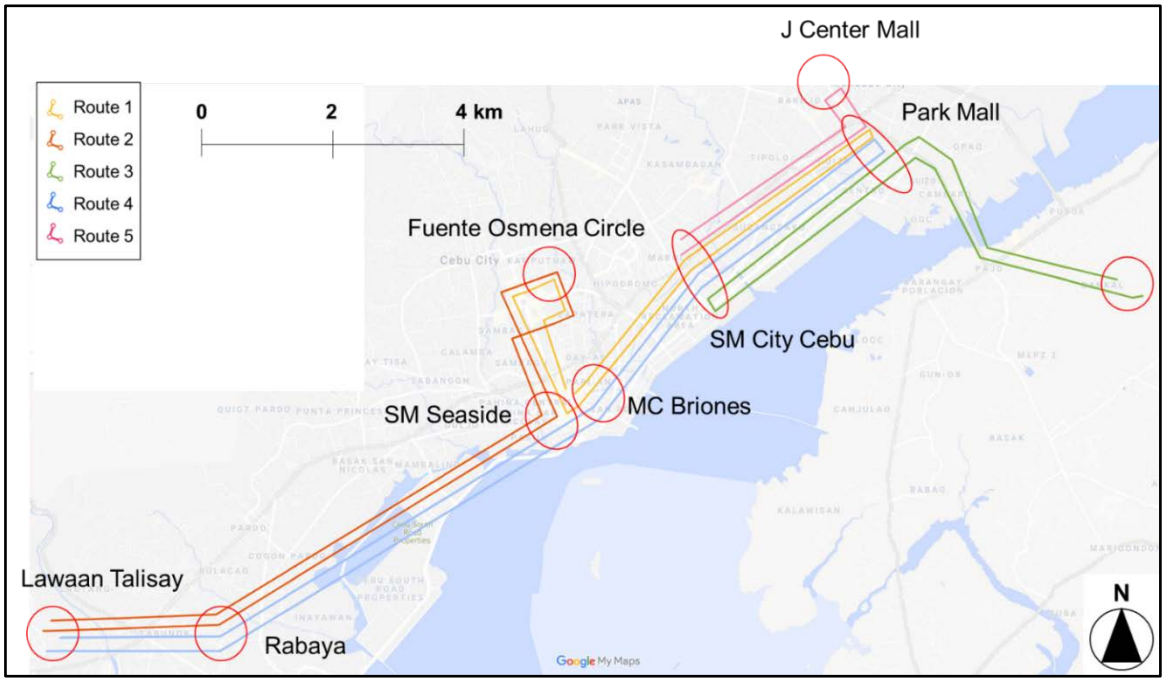
A survey conducted as part of this study showed load factors in the low range except in the evening ridership.

Table 13.5.5 Load Factors on MyBus, 3 Routes

Route	Time of Day	Direction	Load Factor (%)	
			Average	Maximum
MCIA – SM North	AM	D-1	58.4%	90.5%
		D-2	17.3%	32.1%
	Noon	D-1	53.1%	71.4%
		D-2	48.4%	76.2%
	PM	D-1	72.4%	114.3%
		D-2	76.5%	120.3%
SM Cebu - Parkmall	AM	D-1	17.6%	18.9%
		D-2	2.8%	3.7%
	Noon	D-1	6.2%	7.0%
		D-2	3.0%	4.4%
	PM	D-1	15.1%	16.7%
		D-2	6.2%	6.7%
SM Seaside - Lawaan	AM	D-1	6.6%	12.7%
		D-2	42.1%	66.7%
	Noon	D-1	10.1%	14.3%
		D-2	22.1%	34.9%
	PM	D-1	40.5%	59.5%
		D-2	19.3%	29.4%

Source: JICA Project Team

Because more jeepney routes would have to be converted into bus routes, the teething experiences of MyBus should provide some lessons.





Source: Metro Rapid Transit System Inc.

Figure 13.5.6 “Missionary Routes” of MyBus

5) Converting Demand into PUV Supply

At the very least, the number of units to be assigned to a public transport route should yield a capacity equal to or higher than the currently authorized number of units. This is the initial supply (Supply 1) based on current configuration where capacity ranges from 16 to 24 passengers.

The second step is to calculate the required frequency and corresponding number of units based on the simulation results of 2017 network (see Figure 13.5.5). This would be Supply 2 based on new vehicles where capacity is 26 passengers. A third estimate (Supply 3) is those coming from traffic counts.

The recommended supply is the highest of the three values. The number is not as important as the prescribed minimum level of service in terms of frequency or headway. If this is imposed by LTFRB on the franchisee, the operator can acquire and deploy the optimal number of units.

The results for Mactan and Mandaue routes are shown in Table 13.5.6.

Table 13.5.6 Prescribed Minimum Number of Units by Routes

Route ID	Route Description	S_1	S_2	S_3	Proposed Supply	Vehicle Type
01	Cordova Church to MEPZ ¾	188	129		129	Microbus (26)
02	Kalawisan to Lapu-Lapu City Hall	0	26		26	Microbus (26)
10	Cordova Crossroad to Punta Engaño	n.a.	70	104	104	Microbus (26)
11	Tamiya Park to Marigondon B.Road	n.a.	33		33	Microbus (26)
12	Pajac-Maribago to MLQ Highway		9		9	Microbus (26)
20	Mandaue (Hub-2) to Mactan Shrine	414	49	146	207	Minibus (36)
21a	LLC Hall to Buaya-Basak-Cagodoy	n.a.	18		18	Microbus (26)
30	Tamiya Park to Mandaue-Aguirre	n.a.	144		144	Minibus (36)
40	Mandaue (Hub-2) to Canduman	13	13		13	Microbus (26)
41	Mandaue (Hub-1) to Foodland	28	13		13	Microbus (26)
50	Mandaue (Hub-2) to Ayala Biz park	29		70	70	Minibus (36)
51	Mandaue (Hub-1) to Cathedral	671		These routes are outside the study area for the 3 pilot LGUs. Hence, no recommendations can be made on NAUs, except: ° Changes in their turn backs in Mandaue; ° Diversion of part of the Mandaue-Liloan supply from North Road to Coastal Road		
60	North Bus Terminal to Danao	229				
61	North Bus Terminal to Compostela	150				
62	Mandaue (Hub-1) to Consolacion	806				
63	Mandaue (Hub-2) to Liloan	413				

Source: JICA Project Team

Clustering is made from the viewpoint of efficient transit operations. The routes are contiguous and feed into each other to allow convenient dispatch and optimization of fleet utilization within one operator.

Changes in routing and supply of vehicles that ply between Cebu City and Mandaue, as well as between Cebu City and Mactan, need to be coordinated with Cebu City LGU. But, that was not part of the study's scope. The following revisions, however, are recommended to be adopted (without alterations as to their paths within Cebu City).

- Shorten all current routes between Cebu City and Punta Engaño as to terminate at Mactan Shrine and/or Mactan New Town.

- Likewise, all routes between Mandaue City and Punta Engaño shall terminate at Mactan New Town.

- All PUVs crossing Fernan Bridge (Bridge #2) should be consolidated under one

franchise (indicated herein as the Blue Line).

- All PUVs crossing Osmeña Bridge (Bridge #1) should be consolidated under one franchise (indicated herein as the Red Line).

- The Mandaue-Cebu route to Ayala Business Park and Talamban should be bundled with the Red Line franchisee or given to another group, preferably the consolidation of existing operators.

- The Mandaue-Cebu route to Cathedral and SRP should be bundled with the Blue Line.

As to the PUV routes in the 4 northern LGUs, redesign of their route structure is not necessary nor required because there is only one national highway being traversed. Nevertheless, in accordance with the OFG, this study recommends the following.

- PUVs from Danao City and/or Compostela—whether ending at Mandaue or Cebu City—shall be made to pass through the North Coastal road and Canzaga Bay Bridge, so as to lessen congestion on Cebu North Road. The 2017 data from LTFRB showed 8 operators with 229 NAUs on the Danao-Mandaue route plus 11 operators with 150 NAUs on the Compostela-Mandaue route. At least 379 units will be diverted. Field surveys showed that a number of PUVs take the coastal road path northbound from Mandaue but take the North Road southbound on the return journeys to Mandaue.

- PUVs from Consolacion shall continue to use the North Road, but their replacement under the PUVM program would entail higher-capacity vehicles (at least standard bus). With a listed supply of 806 jeepneys (not counting those coming from Liloan and Compostela), the equivalent passenger volume exceeds 10,000 pphd.

- A fourth of the current supply on the Mandaue-Liloan route (413 jeepneys) should be diverted to the Coastal Road/Canzaga Bay bridge path, whilst retaining the balance on the traditional path following the North Road.

- All routes taking the Canzaga Bay bridge should be consolidated under one omnibus franchise and a separate franchise for all PUV routes taking the North Road.

13.6 Implementing PUVM in the CLM

1) Approvals/ Concurrence per OFG

The local governments of Cordova, Lapu-Lapu City, and Mandaue should conduct public consultations on the revised route structure.

A primary concern to Cordova is the “Yellow Line,” but its end point is in Lapu-Lapu City; hence, the need for an agreement with Lapu-Lapu City.

The routes that cross the two bridges end up or pass through Mandaue, they need the concurrence of Mandaue.

Their respective councils may weigh in on the proposals. Implementation of the agreed changes should proceed on a trial-basis pending approval (no objection) from LTFRB. Under the OFG, approval from LTFRB is to be secured first and then approval from the LGUs’ respective councils.

The suggested change in the process is to take into account possible improvements in the routes that may arise during the trial runs.

In lieu of repainting "old" vehicles into the new livery, an interim solution is to require operators to display their new route IDs/codes plus a band (1 m^2 of tarpaulin would suffice) of the right color at the right side.

Based on the OFG, the following authorities need to approve or endorse the PUV routes, as follows:

Table 13.6.1 Responsibility for Approval of Route Plan

Route ID	Route Description	Responsibility (per OFG)	Recommendation
01	Cordova Church to MEPZ ¾	DOTr (LLC is independent)	Cebu Province
02	Kalawisan to Lapu-Lapu City Hall	DOTr (LLC is independent)	Cebu Province
10	Cordova Crossroad to Punta Engano	DOTr (LLC is independent)	Cebu Province
11	Tamiya Park to Marigondon B.Road	Lapu-Lapu City	Lapu-Lapu City
12	Pajac-Maribago to MLQ Highway	Lapu-Lapu City	Lapu-Lapu City
20	Mandaue (Hub-2) to Mactan Shrine	DOTr	Cebu Province
21a	LLC Hall to Buaya-Basak-Cagodoy	Lapu-Lapu City	Lapu-Lapu City
30	Tamiya Park to Mandaue-Aguirre	DOTr	Cebu Province
40	Mandaue (Hub-2) to Canduman	Mandaue City	Mandaue
41	Mandaue (Hub-1) to Foodland	Mandaue City	Mandaue
50	Mandaue (Hub-2) to Ayala Biz Park	DOTr (2 independent cities)	Cebu Province
51	Mandaue (Hub-1) to Cathedral	DOTr	Cebu Province
60	North Bus Terminal to Danao	Cebu Province	Cebu Province
61	North Bus Terminal to Compostela	Cebu Province	Cebu Province
62	Mandaue (Hub-1) to Consolacion	Cebu Province	Cebu Province
63	Mandaue (Hub-2) to Liloan	Cebu Province	Cebu Province

Note: LLC is Lapu-Lapu City

Source: JICA Project Team

Lapu-Lapu City has several PUV "terminal" facilities provided by public (e.g. PUV Terminal in Pajo and Tamiya MEPZ 1) and private (e.g. Gaisano Island Mall). It is recommended that Cordova built an inter-modal terminal adjacent to the Roro Ferry Port in Camolinas, Poblacion, which the LGU built through a loan from the Land Bank of the Philippines. Mandaue has no public-funded terminals but has many private terminals adjacent to malls (e.g. Parkmall and Pacific Mall). It should initiate the building of similar facilities at the end of AS Fortuna St. (Foodlandia area is no longer adequate) and the end of Habellana St. (Canduman) preferably via private sector partnership.

The 3 LGUs need to build bus stops or waiting sheds with approximately 500 meters spacing on the PUV routes identified herein. A standard and simple design is illustrated in Figure 13.6.1 below. They should indicate the route number of PUVs that pass the bus sheds and/or carry the same color as the route clusters. One way to finance these structures is via naming rights and commercial advertisements.



Source: Bureau of Transportation, Tokyo Metropolitan Government

Figure 13.6.1 Illustrative Examples of Standard Bus Shed

2) Actions from LTFRB (and DOTr)

According to the OFG, the approval process are as follows:

(iv) Documentary requirements on the LPTRP shall be submitted to LTFRB by the entities indicated in column 3 of Table 13.6.1. Thus, 7 of the 16 routes has to come from DOTr, 4 from the provincial government, 2 from Mandaue, and 3 from Lapu-Lapu City.

(v) LTFRB shall evaluate and approve the submitted plans to comply with the guidelines (not the logic of the plan itself as LTFRB also has no capability for route planning).

(vi) Once approved, the LTFRB shall conduct an open and transparent process to select the public transport operators to deliver the needed services.

Nothing in the above limits the selection of operators to existing PUV franchisees, but in the presentation of the components of PUVM, the existing operators are supposed to form a cooperative among themselves. This cooperative shall then be issued an Omnibus Franchise covering all the consolidated routes.

This study's public transport plan proposes 7 clusters: 4 (Yellow, Green, Blue, and Red Lines) in Mactan, 2 (White and Orange Lines) for Mandaue and northern LGUs, and 1 (pink) for Mandaue-only routes. The 7 can be equated into 7 omnibus franchises. Since Mandaue-Consolacion and Mandaue-Cebu City clusters may end up too big (i.e. number of units >500), these can be split.

Franchise for the Green Line is recommended to be awarded to a new corporation or a PUV network company (subject to transparent tender), since the route is "missionary" and there are very few existing operators to be affected. The minimum fleet size is 146 units, which is the smallest among the 7 clusters. With 15% reserves, the new operator needs to buy 168 units (168 × 1.6 m = PHP 268.8 million investment). At a debt-equity ratio of 80:20, the equity capital is PHP 54 million, not counting investment in garage/depot.

Presumably, LTFRB should call on existing operators (for the 6 other clusters) to organize themselves into 6 separate cooperatives. This study has attempted to build the database for the affected (or existing) operators, but collaboration with LTFRB was not achieved and no comprehensive data about operators was collected.

LTFRB Region 7, therefore, must collect the operators' database and initiate the formation of cooperatives. If these are not formed or organized in 6 months, LTFRB can take the following options.

- Invite new investors that will finance new vehicles for each cluster (implies a corporation).

- Select a PUV transport network company to oversee the fleet management and revenue consolidation for existing drivers and operators in the cluster.

LTFRB should impose minimum conditions to the three alternative industry consolidation modalities of employing many drivers to ply the cluster. The bureau should also invalidate or amend all existing CPCs as deemed necessary as each Omnibus Franchise gets issued or awarded.

In the LPTRP training program, LTFRB staff should also be included. They need capacity building assistance no less, or perhaps even more, than the LGUs. It is inconceivable for a "reviewer" to evaluate "reviewees" when the former is not as competent as the latter.

3) Inclusion of 4 Northern LGUs

The municipalities of Consolacion, Liloan, and Compostela, as well as Danao City, were not part of the pilot LGUs under this study, so field surveys were not conducted. Nonetheless, route consolidation indicated in Table 13.6.1 was proposed to be adopted.

Although no minimum number of units were prescribed, the existing number of old units can be used as the base to be replaced with 1 minibus for every 2 jeepneys or multicab or 1 standard bus for every 5 old PUVs.

The proposed clustering is 2 omnibus franchise. One for routes that take Canzaga Bay bridge and another for routes that take the Cebu North Road.

4) A Suitable Pilot Implementation for Cebu

The government is looking for a pilot project to demonstrate PUVM in Metro Cebu. It has previously announced two “missionary routes” in Cebu City, which on closer look, are not in a sense there is no service and/or untested route. The announced routes are Cebu City Hall-Asia Town I.T. Park-Robinsons Galleria Cebu-Cebu Business Park that overlap with many of the existing PUV routes except for some with minor changes in the ending points.

For the CLM area, the best candidate for the pilot PUVM is the Cordova to Punta Engaño route that is approximately 15 km long. It is currently non-existent and can serve the tourist belt of Mactan. Only 19 multi-cab units were listed as operational on the section between Maribago and Punta Engaño, but none on the entire route between Cordova’s Crossroad and Maribago. Along Punta Engaño Road (about 3.0 km, from the Mactan Shrine), 362 units from Mandaue and Cebu City are supposed to ply there, but the traffic surveys showed oversupply.

If the volume of passengers on the Maribago–Marigondon section is any indication, the ridership can be as much as 18,000 pax/day near the Mactan New Town and Mactan Shrine. On the other hand, calibrating the results of the demand forecast with survey data, the passengers from Cordova crossing can be as high as 23,000 pax/day.

An omnibus franchise can be granted to a new operator (to invest in 104 units) on the new Cordova–Punta route. Adding the 5.1 km Tamiya Park–Marigondon Beach Route and the 4.7 km Basak-Agus-Pajak line means an additional fleet of 44 units. Having one operator for these 3 routes can achieve efficient dispatch as the same units can be deployed for the two routes creating 4 service variants: Crossroad–Tamiya, Tamiya–Mactan Newtown, Tamiya–Beach Road, and Crossroad to Punta Engaño.

This new CPC should lead to the modification of franchises of existing operators coming from Cebu City and Mandaue that have Punta Engaño (31 franchises with 362 units) and/or Marigondon (10 franchises with 25 units) as endpoints. Adverse impacts on these 41 franchise holders would be minimal. There would be no reduction in their units, but only shorten routes. The distance from Punta Engaño to North Bus Terminal is nearly 17 km, while the distance from Casia-Soong Road to Mandaue is slightly above 15 km. On the other hand, the shortened routes should improve their dispatching ability. Only Punta Engaño–Marigondon–Basak route (~10 km) would be displaced, but it has only 2 units on record.

Another route that could be the second pilot or prototype for PUVM rollout is the Mandaue Hub to Canduman and to Talamban (via AS Fortuna). These routes appear as mere extensions of longer routes from the northern LGUs. Only 45 PUVs are registered to operate on these routes.

5) Affordability of New Units

The indicative price for a new PUV that complies with the technical standards is PHP 1.6 million. It was claimed that operators can recover this investment with 5% subsidy from the government plus financing with a tenor of 7 years and 6% interest. Table 13.6.2 shows the government's economic justification. Monthly amortization on such a financing scheme equates to PHP 22,205 or PHP 854 per day. Assuming that the net profit of PHP 1,348 is correct, then a vehicle can be manageable. In such a case, special financing from the government is superfluous as the shift is viable or bankable.

Table 13.6.2 Viability of New PUVs

	Old Jeepney	New Jeepney
Days of Dispatch	14 days	26 days
Average Passengers	328 Pax	646 Pax
Average Income	PHP 2,524.93	PHP 6,605.55
Seating Capacity	20 Seats	24 Seats
Repairs & Maintenance	PHP 761.90	PHP 194.70
Fuel Mileage	4.2 km/L	7.5 km/L
Operating Profit	PHP 476.30	PHP 1,348.02

Source: DOTr

However, existing transport operators do not find the proffered financial scenario realistic. They are near unanimous in opposing the PUVM on the argument of non-affordability. Aside from the obvious reluctance to let go of their fully-depreciated units, which will cost them less than half a million, there is some empirical bases for their resistance to change.

On the same market or route, either "old" or "new" jeepney will generate the same gross revenues as the demand and fares are the same. It may be reasonable to expect the new units to earn higher net profit due to lower operating expenses. However, for a new unit to get 646 passengers a day, it must be able to replace nearly 2 old jeepneys (646 ÷ 328 = 1.97), which could only operate 14 days in a month (per claims). The comparison also implicitly grants 306 km revenue-run for the old jeepney vs 675 km for the new. The reality on the ground is that traffic congestion limit jeepneys to less than 200 km per day. Provincial buses generally turn in a more respectable 350-km run per day.

For the new vehicle to achieve the revenue target, it must replace and displace two old jeepneys. With the same mileage and market size, the new unit can be afforded. Instead of paying a boundary fee of PHP 600 each for 2 old units, only PHP 854 daily loan amortization has to be paid for a new unit. Operators would then have to live with a lower income of PHP 346 per day (instead of PHP 1,200 before the shift).

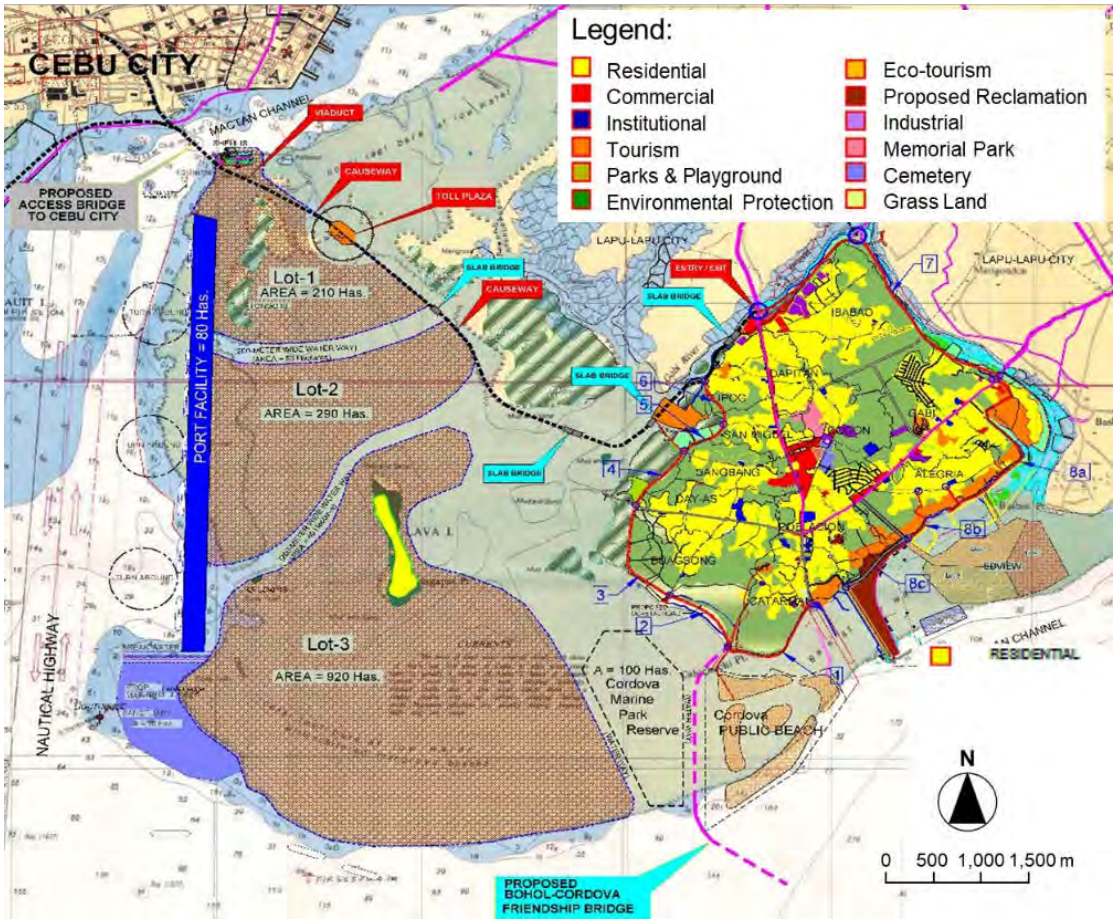
Regardless of the financial viability, existing operators would not jump in being fearful of the debt trap. They are currently debt-free after all. Thus, it would do well for the government to raise the 'subsidy' for the first year converts (to cushion the fear of 1st mover). As more operators show they are able to survive, then more operators would follow. The subsidy can be decreased for the second and third year converts. As an added incentive, higher base fares should be allowed for the new PUVs.

13.7 Public Transport Outlook to Year 2030

1) Infrastructure Developments to Year 2030

Cordova is expected to undergo a massive change in land use. First is the expected completion of the Cebu–Cordova Link Expressway in 2021, and second is the proposed reclamation, which if materializes on the scale claimed by proponent, would expand the

land area of Cordova from 700 to 1,980 ha. These two developments are shown in Figure 13.7.1.



Source: Municipality of Cordova

Figure 13.7.1 Future Changes on Cordova's Land Use

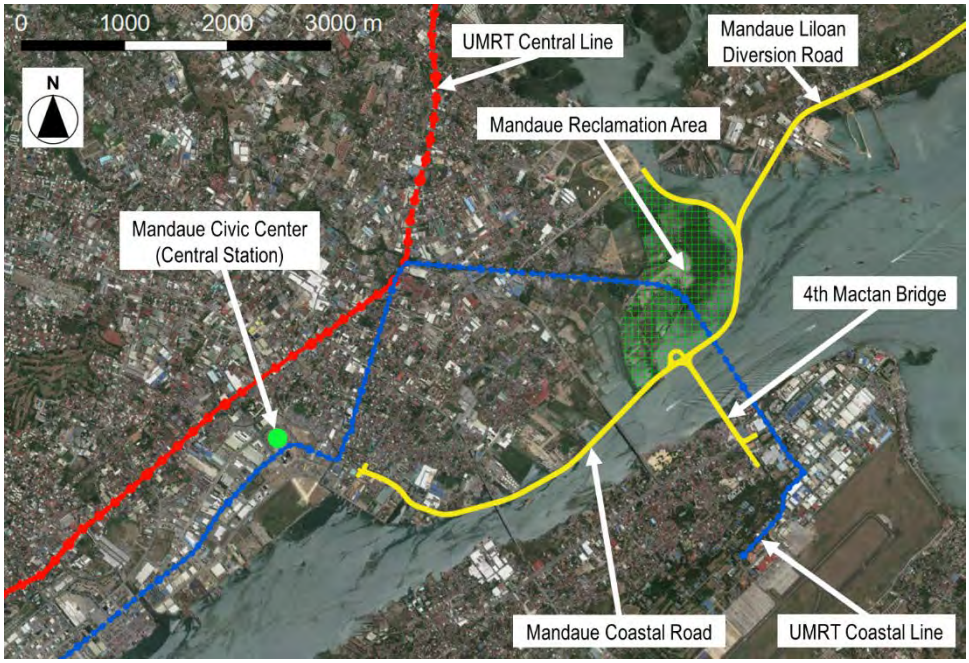
Lapu-Lapu City's landscape is also expected to change with the construction of the 4th Bridge, 2nd runway of MCIA, and the city's reclamation project.



Source: Mactan Cebu Ocean City, Cebu Provincial Government

Figure 13.7.2 Future Changes on Lapu-Lapu's Land Use

Five infrastructure projects are also expected to alter Mandaue's travel patterns. These are the (i) construction of the Central Line of the N–S MRT, (ii) 200 ha North Reclamation project, (iii) Mandaue Coastal Road, (iv) 4th Mactan Bridge, and (v) the Mandaue-Liloan Diversion Road. See Figure 13.7.3. The sequence of development is unclear.

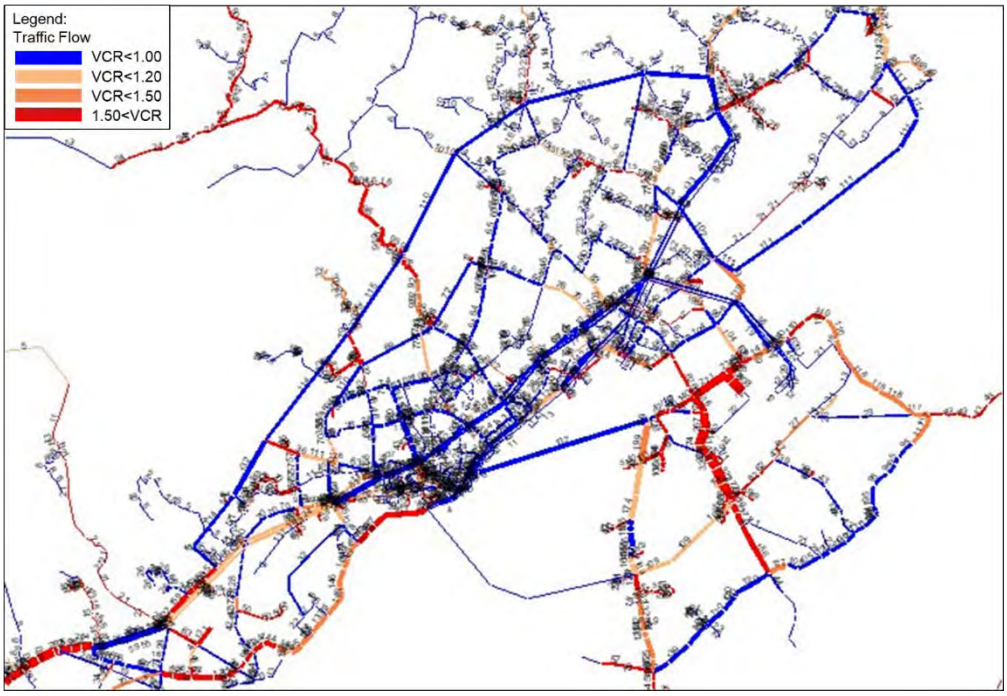


Source: JICA Project Team

Figure 13.7.3 Development Projects in Mandaue City

2) Demand at Key Corridors in CLM

The passenger volumes on Metro Cebu's road network by year 2030 is shown in Figure 13.7.4. It assumes completion of the bridge and road projects mentioned in the previous sections.



Source: JICA Project Team

Figure 13.7.4 Public Transport Passenger Volumes on Year 2030 Road Network

The probable increase (or decrease) in transport demand on selected routes are shown in Table 13.7.1. The relative change is more important than the values; some routes would suffer a decrease in demand while other routes would increase.

Table 13.7.1 Probable Changes in Public Transport Demand

Route ID	Route Description	2017	2030	Remarks
01	Cordova Church to MEPZ 3/4	21,500	17,400	Impact of CCLEX
02	Kalawisan to Lapu-Lapu City Hall	11,600	10,000	Impact of new axial road
10	Cordova Crossroad to Punta Engaño	9,600	12,000	
11	Tamiya Park to Marigondon B. Road	10,700	15,600	
12	Pajac-Maribago to MLQ Highway	4,000	4,300	
20	Mandaue (Hub-2) to Mactan Shrine	8,300	11,800	4th bridge will add traffic
21a	LLC Hall to Buaya-Basak-Cagodoy	4,500	2,700	Impact of axial road
30	Tamiya Park to Mandaue-Aguirre	25,000	32,300	
62	Mandaue to Consolacion	22,900	13,300	Impact of Mandaue-Liloan Road

Source: JICA Project Team

The changes in demand through time as a consequence of the major infrastructure projects in the CLM area should be taken into account in the clustering of routes to ensure continued growth in their respective service areas.

The new route from Cordova to Cebu City via CCLEX should be part of the service area of Yellow Cluster, while that on the 4th Bridge should be part of the Blue Cluster (has Mandaue to Mactan Shrine as its major route).

The franchisee on the Mandaue-Consolacion-Liloan corridor would likely suffer a decline in market share if, and when, the N–S MRT Central gets built.

Densification of urban developments on the coastal strip—from Cordova to Punta Engano—is seen to outstrip the capacity of the two-lane MLQ Highway. Adding more PUVs on the road will not be adequate to meet future demand. Widening of the highway is

desirable, but the prospect is gloomy. The only option is to build an Aerial Transit System as shown in Figure 13.7.5.

A Skylink transit is also consistent with the tourism character of the corridor. It can be built in stages and need not follow the road's alignment or right-of-way.



Source: JICA Project Team

Figure 13.7.5 Cable-Propelled Transit for the Tourist Belt of Mactan

13.8 Conclusions and Recommendations

In the absence of a mass transit system, the current traffic congestion in Metro Cebu can only get worse. The construction of two additional bridges across Mactan Channel, as well as several other road projects, will help, but the relief they offer will take time (by 2021 at the earliest) and likely to be short-lived.

The only viable option in the short- to medium-term is to improve and modernize the road-based public transport system along the lines of DOTr's PUVM program. It will also be a necessary complement when, and if, the MRT system is built. Improvements at the earliest possible time would temper the increasing share of private cars in daily commuting.

1) Public Transport Route Plan

This study has undertaken the first step for the three pilot LGUs: Cordova, Lapu-Lapu City, and Mandaue. A proposed route restructuring plan has been prepared in coordination with the three LGUs in tandem with a capacity building effort of learning by doing. Once adopted by their respective councils, the LPTRP can be submitted to LTFRB in accordance with Joint Memorandum Circular of DILG-DOTr No. 01 (19 June 2017).

The Cebu province can initiate the formulation of LPTRPs for the four LGUs in the south area that comprise of Carcar, Minglanilla, Naga, and San Fernando. Their cases are similar

to those in the north area. Talisay is a bit more complicated, but it can take cue from Lapu-Lapu City and Mandaue.

The Cebu BRT Project Office was understood to take care of the route plan of Cebu City. This will complete the requisite route plans for Metro Cebu.

2) Route Rationalization and Industry Consolidation

There are currently 127 operators and 3,026 PUVs (jeepneys and multi-cabs) that provide services in the CLM area. The recommendation is to consolidate their franchises under 5 clusters (or omnibus franchises), to wit:

- Cordova cluster (or Yellow Line) with an initial 2 routes and starting fleet of 207 units.
- Fernan Bridge cluster (or Blue Line) with an initial set of 3 routes that connect to Mandaue and Cebu City south, and a starting fleet of about 1,085 units.
- Osmeña Bridge cluster (Red Line) with an initial set of 2 routes that connect Lapu-Lapu City to Mandaue and Cebu City north, its starting fleet is approximately 740 units.
- Tourism (Green Line) cluster with an initial set of 3 routes and starting fleet of 134 units.
- Mandaue-only cluster with an initial set of 2 routes and 41 units (can be merged with the Red cluster.

Although not originally part of the pilot study, the routes to the Municipalities of Consolacion, Liloan, Compostela, and Danao City, which are all in the northern part of Cebu, got looped into the analyses. They can be consolidated into 2 clusters with a combined starting fleet of 1,598 units.

The proposed consolidation does not foresee displacement of any drivers or operators—at least not immediately. Once vehicle replacement (1 new PUV replaces 2 old PUJs) takes place would there be dislocation, but only for operators. There will be no unemployed drivers if 2 drivers each with 8 hours shift would be adopted for per new vehicle.

The 10 components of the PUVM can be realized easily on the Green Line. It is a new or missionary route with very few operators running and only on parts of the route. Consolidation, therefore, will not be a hurdle. There being no existing operators, a corporation should be a quicker entity to authorize than a cooperative.

A cooperative may sound egalitarian to consolidate existing operators; however, it is unlikely to happen voluntarily without a lead investor and organizer. Besides, the experience of the jeepney cooperative in Metro Cebu, as well as in other parts of the country, do not bode well. None actually pools revenues and perform fleet dispatch when these are the two basic rationale for industry re-structuring. A transport network company can takeover the expected role of a cooperative more efficiently and effectively without consolidating ownership of old jeepneys in one entity.

3) Fleet Replacement

The specification of PUV Class 2 or 3 and the economic justification for replacing old and non-compliant vehicles implicitly calls for 1 new microbus for every 2 old jeepneys.

For some high-demand routes, the microbus no longer suffices. Shift to Minibus or standard bus is desirable. Accordingly, the current microbus fleet crossing the Osmeña and Fernan

bridges is recommended to be replaced with higher-capacity vehicles (at least Minibus). Same prescription applies to the Mandaue-Consolacion-Liloan routes.

Fleet replacement will not happen overnight. It may take 5 to 8 years depending on the aggressiveness of the franchisee (cooperative, corporation, or network company) and amount of capital subsidy.

4) Financing the Modernization

To encourage early converts into PUVM, there were two proposals. First is the amount of capital subsidy should be increased. The current level of boundary fee in the 3 pilot LGUs cannot afford a loan greater than Ph 1.0 million. Second is the fares for new vehicles should be raised. A flat fare of PHP12–15 per ride is reasonable and acceptable. Higher revenue streams would also redound to a lower subsidy.

The subsidy should be high on year 1 (say PHP500 thousand) and would be reduced yearly and then end with zero subsidy by year 5. Operators who chose to wait will be confronted with diminishing subsidy.

Since government is precluded from an outright grant to a private entity, subsidy can be in a form of purchase of old units (equivalent to “cash-for-clunkers” or buying clean air). The Vehicle Pollution Control Fund can be used for this purpose.

To avoid any leakage and setting up another agency to administer this program, the subsidy can be released or paid out directly to the vehicle-supplier that must also assume the burden of scrappage. It is the buyer who will choose the supplier and not the government; the latter will have the incentive to promote the modern vehicles.

5) Regulatory Reforms

The ban on provincial buses that pick-up passengers in Compostela and Liloan or not charging passengers for the longer trips should be lifted. Alternatively, urban bus service (or point-to-point bus service) should be introduced. The route lengths to Danao (~30 km) and Compostela (~22 km) exceed the LTFRB guidelines for microbus route (<15 km).

A key component of the PUVM is the change in the compensation method of drivers. the practice for already several decades is locally known as boundary system wherein a driver leases the unit from the vehicle owner for a fixed fee for the day. In the case of the CLM area, this fee averages Php 612 (Php 578 for Mactan and Php 656 for Mandaue). More than 2/3 of drivers are not in favor of a fixed wage, which means they prefer the uncertainty of a higher take-home pay. Small “mom-and-pop” operators find the method very efficient as there is no need to check on work hours rendered by drivers. The boundary system largely explains the phenomenon of longer travel times during non-peak hours, and the negative behavior on the streets.

The payment of a guaranteed wage was adopted as a policy as far back as 2013, but was challenged in the courts. In a decision by the Supreme Court in 27 September 2018, it upheld the government order for bus operators to provide for fixed salaries to drivers and conductors. This will ripple through PUVs. A third compensation option is to pay PUV drivers on their performance with a minimum amount for a threshold vehicle-km-run (e.g. Php 450 for 80 km) plus a bonus for the number of passengers transported. In this case, the omnibus franchise holder pools the revenue and redistributes the bonus bi-monthly according to the passengers transported by the driver in the preceding two-week period.

For corollary to the new compensation, part of the operator’s obligation is to limit working hours of drivers to 8 hours a day and 5 days a week; thus, end up with 2 drivers per vehicle.

This will ensure a no-displacement or no-unemployment that could result from the vehicle modernization. As previously indicated, the modern vehicle compliant to the technical standards would displace 2 old units in most cases.

The policy reform—maximum to minimum number of units (fleet size)—is a step in the right direction. This should be accompanied by two basic measures to be effective.

(i) No prior approval from LTFRB for operators to buy and add to its fleet.

(ii) The operator must be obligated to maintain a minimum frequency of service during peak and off-peak hours. Abandonment of service, however, should require regulatory approval.

14 PILOT PROJECT ON TRAFFIC SIGNAL CONTROL

14.1 Background

In order to grasp the current issues on traffic signal control, the observation survey on traffic conditions were conducted at 20 signalized intersections, which were already derived as congested intersections.

Various factors were detected as cause of traffic congestion. One of the main factors mentioned are traffic signal control methods and signal control parameter setting that do not correspond to the actual traffic flow.

The following examples of traffic situations occur at any time.

- Continuous green light even if there is few or no traffic inflow, while the queue length of inflow at the red light side is longer and worsens. This can be called “a few inflow situation.” This occurs often, which is one of the biggest reasons why traffic congestion becomes worse.

- The queue length from the intersection on the downstream side extends to the inside of the intersection, while the other side of inflow cannot go to the intersection even at green light. It can be called “blocking situation.” This is another waste of green time.

These traffic problems are caused by very long cycle length is compared to the actual traffic flow situation. In other words, the setting of cycle length and times of green and red lights are not optimal and do not correspond to the traffic flow situation.

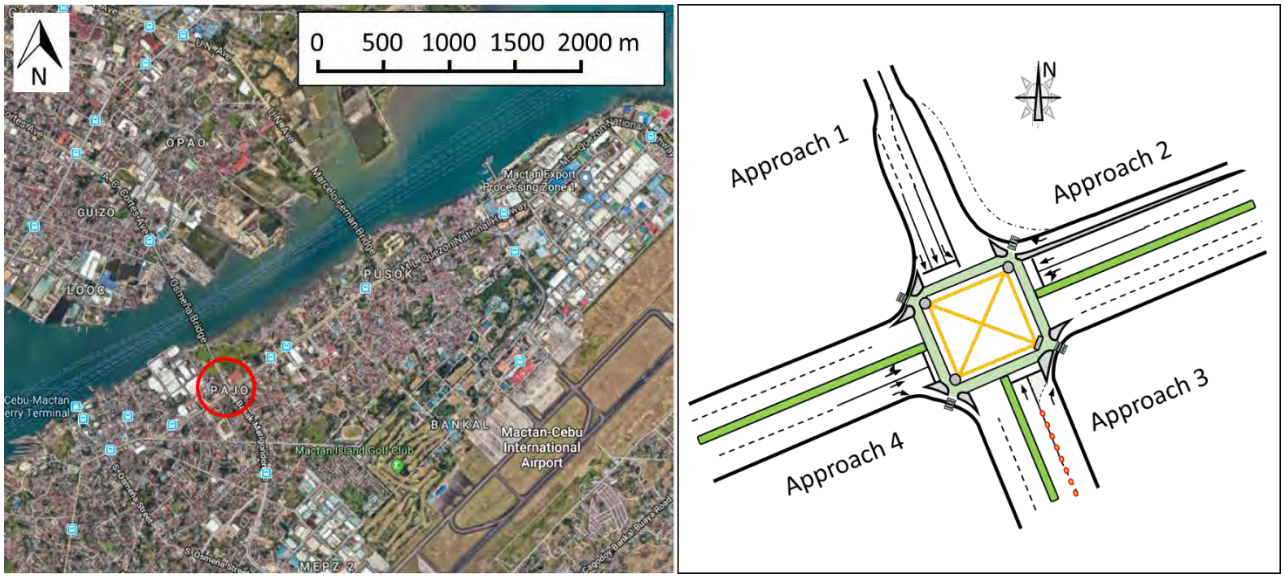
1) Purpose

In response to the traffic conditions, JICA Project Team transferred basic knowledge related to methods on traffic signal control and traffic signal control pattern setting through a practical field study.

2) Target Intersection

In selecting the target intersection, the traffic situation related with traffic signal control method was assumed. The intersection should be independent with almost no relationship with the adjacent intersections. So, the JICA Project Team selected the 1st Mactan Bridge intersection in Lapu-Lapu City.

Traffic signal control has already been carried out at the target intersection where traffic lights were installed last November. However, serious traffic congestion has occurred since traffic congestion from the 1st Mactan Bridge has reached the intersection.



Source: JICA Project Team

Figure 14.1.1 The Location of the Target Intersection

14.2 Methodology

In this pilot project, the following steps were taken separately.

(a) Survey on the current traffic situation (traffic volume, right-turn control by traffic enforcers, travel time, and traffic behaviors related to traffic signal control).

(b) Analysis of data on traffic volume survey.

(c) Analysis of data on travel time survey.

(d) Analysis of survey data on right-turn control by traffic enforcers and the necessity of traffic signal installation.

(e) Calculation of traffic signal control parameters based on the results of analysis on traffic volume survey.

(f) Analysis of traffic behavior survey using recorded videos.

(g) Setting traffic signal parameters calculated by (e) and (f).

(h) Installation of traffic signal at right-turn on red path in intersection and start operation.

(i) Traffic signal operation with new parameters (signal control No. 1) and survey traffic situation under the new operation and the data analysis.

(j) Setting traffic signal parameters by using the result of traffic situation survey under the signal control No. 1.

(k) Traffic signal operation with new parameters (signal control No. 2), survey traffic situation under the new operation, and then data analysis. (During the new operation No. 2, traffic flow situation became abnormal through road failure; therefore, evaluation of traffic flow situation under new operation No. 2 was impossible.)

(l) Setting new signal parameters to change clearance intervals (yellow signal and all red signal lengths) in order to decrease blocking of the remaining vehicles in intersection after a green signal.

(m) Traffic signal operation with new parameters (signal control No. 3), survey traffic situation under the new operation, and then data analysis.

(n) Based on the above results, select the optimum signal phases and parameters and make recommendations if necessary.

Table 14.2.1 shows implementation items and schedule of this pilot project.

Table 14.2.1 Implementation Schedule of This Pilot Project

	April	May	June	July	August	September	October
① Traffic survey (traffic volume, travel time, traffic behavior, others)	⇩ **April 17**						
② Data analysis on traffic volume	⟺ April 18 to 24						
③ Data analysis on travel time	⟺ April 18 to 24						
④ Analysis on requirement of signal instalation for right-turn traffic	⟺ April 20 to May						
⑤ Computation of traffic signal parameters by traffic volume data	⟺ April 24 to May						
⑥ Analysis on traffic behavior by using video footage		⟺ May 24 to June 22					
⑦ Setting new traffic signal parameters				August 19 ⇨			
⑧ Install traffic signal for right-turn traffic and starting operation				August 23 ⇨			
⑨ Start of new control (No.1), and conduct traffic survey/analysis				August 24 ⇨ **August 29 (survey)**			
⑩ Setting new traffic signal parameters by using traffic survey data				September 6 ⇨			
⑪ Start of new control (No.2), and conduct traffic survey/analysis				September 8 ⇨ **September 11 (survey)**			
⑫ Setting new clearance interval to prevent the blocking				September 14 ⇨			
⑬ Start of new operation (No.3), and conduct traffic survey/analysis				September 17 ⇨ **September 18 (survey)**			
⑭ Selecting the optimum parameters based on the new operation and the recommendation in the future activities					September 23～⇨		

Source: JICA Project Team

14.3 Survey and its Analysis on Current Traffic Situation

1) Outlines of Current Traffic Situation Survey

In the traffic situation survey, the following items were done.

(a) Traffic volume: By time of day, inflow and outflow, and vehicle types.

(b) Right-turn control: By time of day and traffic enforcer's permission time.

(c) Travel time: By time of day, start time at origin, reach at the tail of queue, pass-through at stop line of intersection, and reach at destination.

(d) Traffic behaviors: By time of day, inflow and outflow, blocking situation, and a few inflow situation.

The survey was done on 17 April 2018; (a), (b), and (d) went for 16 hours from 6:00 to 22:00, while (c) went for 6 hours from 6:00 to 9:00 and 16:00 to 19:00.

On the other hand, traffic enforcer's permission time for right-turn vehicles was measured in order to discuss the necessity to install traffic light to control right-turning traffic to the 1st Mactan Bridge.

Traffic volume survey was also conducted to set traffic signal parameters and evaluate the effect of pilot project using the traffic background data. Analysis of the effect of pilot project was by analyzation of the results of travel time and traffic behavior survey.

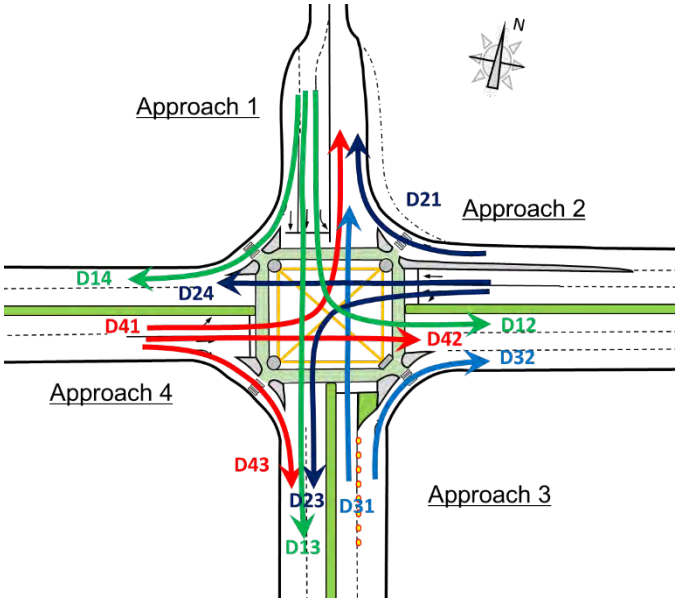
2) Traffic Volume Survey and its Analysis

Traffic volume by type of vehicles and inflow and outflow is compiled every 30 minutes for 16 hours from 6:00 to 22:00. The type of vehicles and conversion factors is shown in Table 14.3.1. The data is to obtain passenger car units value of traffic volume.

Table 14.3.1 Conversion Factors by the Type of Vehicles for Calculating Passenger Car Unit

Bicycle	Motorcycle	Car/Jeep/	Pedicab	Tricycle	Taxi	Jeepney	Multi-cab
0.25	0.33	1.00	0.25	0.50	1.00	1.50	1.50
UV Exp/ Vhire	Mini-bus	Std. Bus	School/ Co. Bus	Delivery Van/ P-up	Truck	Trailer	Others
1.50	2.00	2.50	2.00	1.50	2.50	3.00	1.00

Source: JICA Project Team



Source: JICA Project Team

Figure 14.3.1 Traffic Inflow and Outflow by Approaches

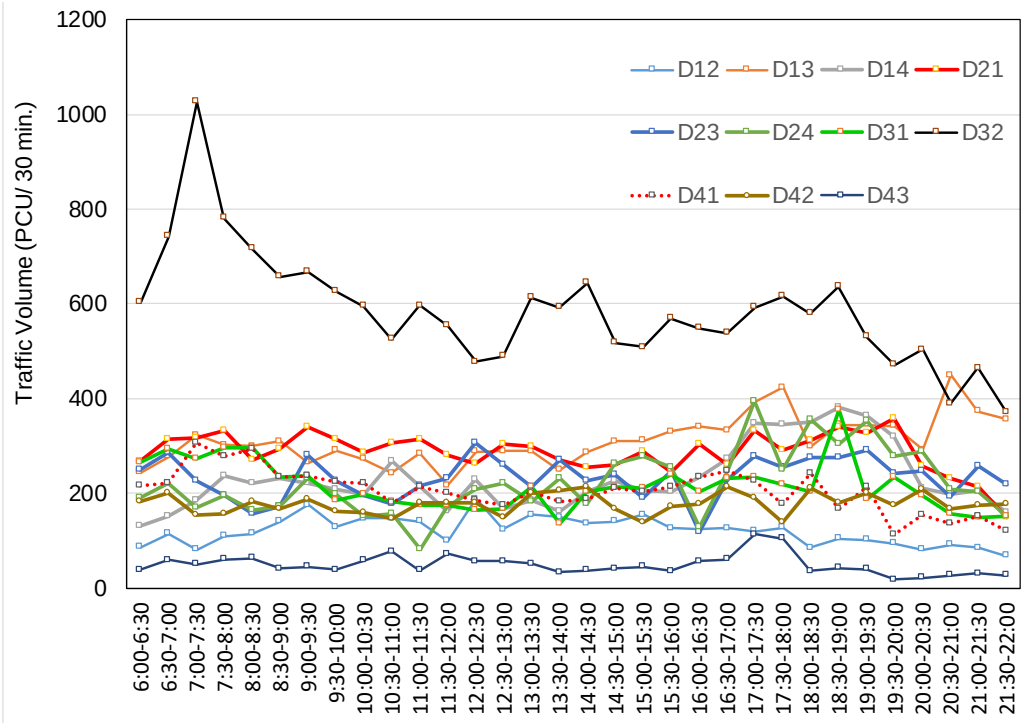
As shown in Figure 14.3.1, the arrows of D12, D13, D14, D21, D22, D23, D31, D32, D41, D42, and D43 show the approach numbers of the inflow and outflow. There is no D34 because left-turn is prohibited from approach 3 by Lapu-Lapu City.

Table 14.3.2 shows the results of traffic volume by inflow and outflow and time zone.

Table 14.3.2 Traffic Volume by Inflow and Outflow, Directions and Time Zone (PCU/30 min)

Time	D12	D13	D14	D21	D23	D24	D31	D32	D41	D42	D43	Total
6:00-6:30	87	244	131	269	251	191	265	604	217	183	39	2,479
6:30-7:00	115	278	152	314	286	223	294	742	223	201	60	2,889
7:00-7:30	82	323	186	317	228	170	274	1,027	306	155	51	3,120
7:30-8:00	110	303	237	332	196	196	297	781	279	158	61	2,951
8:00-8:30	116	300	223	270	157	165	297	717	295	184	63	2,785
8:30-9:00	141	311	231	294	172	173	235	658	235	168	41	2,658
9:00-9:30	176	265	221	341	281	231	238	668	237	189	45	2,892
9:30-10:00	130	291	208	315	227	198	186	626	225	162	38	2,607
10:00-10:30	148	273	199	287	196	153	198	595	223	160	59	2,491
10:30-11:00	147	243	269	306	178	156	182	526	181	147	78	2,414
11:00-11:30	140	284	214	315	217	83	176	596	214	180	38	2,458
11:30-12:00	100	218	162	282	233	172	176	554	200	181	73	2,352
12:00-12:30	189	288	231	264	308	210	164	478	187	181	58	2,555
12:30-13:00	124	289	168	305	262	223	169	490	176	151	57	2,412
13:00-13:30	155	290	185	299	213	182	214	614	205	202	52	2,609
13:30-14:00	150	250	162	272	271	231	138	593	182	205	34	2,488
14:00-14:30	137	287	203	255	227	177	204	644	189	214	38	2,575
14:30-15:00	141	310	227	259	240	263	213	518	211	167	41	2,589
15:00-15:30	156	311	207	288	190	279	212	509	205	139	46	2,542
15:30-16:00	127	331	204	245	248	256	239	569	213	173	36	2,642
16:00-16:30	125	341	235	305	120	130	204	549	235	178	58	2,478
16:30-17:00	127	333	272	261	229	248	231	539	248	213	61	2,762
17:00-17:30	121	393	347	333	278	394	234	593	226	191	114	3,223
17:30-18:00	128	423	345	291	256	250	218	616	179	139	105	2,950
18:00-18:30	86	299	350	311	276	357	203	580	242	212	36	2,951
18:30-19:00	105	345	382	342	275	303	376	636	169	180	43	3,156
19:00-19:30	103	345	365	327	290	352	187	530	213	201	41	2,954
19:30-20:00	95	342	320	358	242	280	235	472	114	175	18	2,650
20:00-20:30	82	292	212	258	249	290	195	504	154	210	22	2,469
20:30-21:00	92	450	199	232	194	208	157	390	137	167	27	2,253
21:00-21:30	85	374	205	214	259	204	148	465	152	175	31	2,312
21:30-22:00	69	357	161	150	219	151	151	372	121	178	28	1,957

Source: JICA Project Team



Note: The values in Table 14.3.2 and Figure 14.3.2 are that no adjustment by traffic blocked situation.
Source: JICA Project Team

Figure 14.3.2 Traffic Volume by Inflow, Outflow Approaches and Time Zone

In Figure 14.3.2, D32 is highest among the others possibly because:

- Vehicles select 2nd Mactan Bridge to avoid traffic congestion at 1st Mactan Bridge.
- Vehicles go to 1st Mactan Bridge to turn right and make U-turn, and then make a right-turn at the intersection to avoid the big congestion when the straight-through lane is taken to go to 1st Mactan Bridge.
- Vehicles that want to turn left have to turn right (due to prohibition), and make U-turn and go straight to the approach 4.

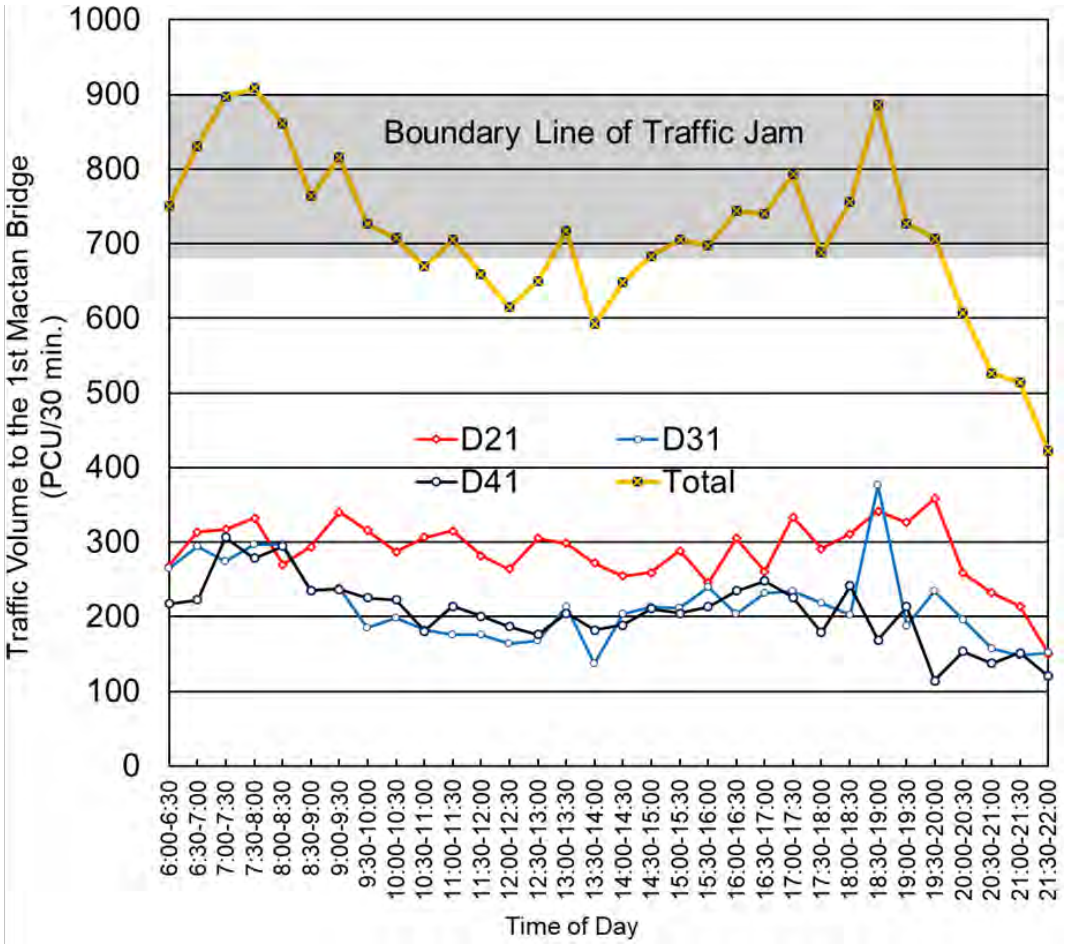
All these reasons are related to congestion at target intersection. Countermeasures for traffic jam is important to decrease inefficient route choices. Also, it is very important to verify why D34 was prohibited.

To know the cause of traffic jam, the result of aggregate traffic volume going to 1st Mactan Bridge is shown in Table 14.3.3 and Figure 14.3.3.

Table 14.3.3 Traffic Volume to 1st Mactan Bridge

Time	D21	D31	D41	Total
6:00-6:30	269	265	217	751
6:30-7:00	314	294	223	831
7:00-7:30	317	274	306	897
7:30-8:00	332	297	279	908
8:00-8:30	270	297	295	861
8:30-9:00	294	235	235	764
9:00-9:30	341	238	237	815
9:30-10:00	315	186	225	726
10:00-10:30	287	198	223	708
10:30-11:00	306	182	181	669
11:00-11:30	315	176	214	705
11:30-12:00	282	176	200	659
12:00-12:30	264	164	187	615
12:30-13:00	305	169	176	650
13:00-13:30	299	214	205	717
13:30-14:00	272	138	182	592
14:00-14:30	255	204	189	648
14:30-15:00	259	213	211	683
15:00-15:30	288	212	205	705
15:30-16:00	245	239	213	698
16:00-16:30	305	204	235	744
16:30-17:00	261	231	248	740
17:00-17:30	333	234	226	793
17:30-18:00	291	218	179	688
18:00-18:30	311	203	242	756
18:30-19:00	342	376	169	887
19:00-19:30	327	187	213	727
19:30-20:00	358	235	114	707
20:00-20:30	258	195	154	607
20:30-21:00	232	157	137	526
21:00-21:30	214	148	152	514
21:30-22:00	150	151	121	422

Unit: PCU
Source: JICA Project Team



Source: JICA Project Team

Figure 14.3.3 Traffic Volume to 1st Mactan Bridge

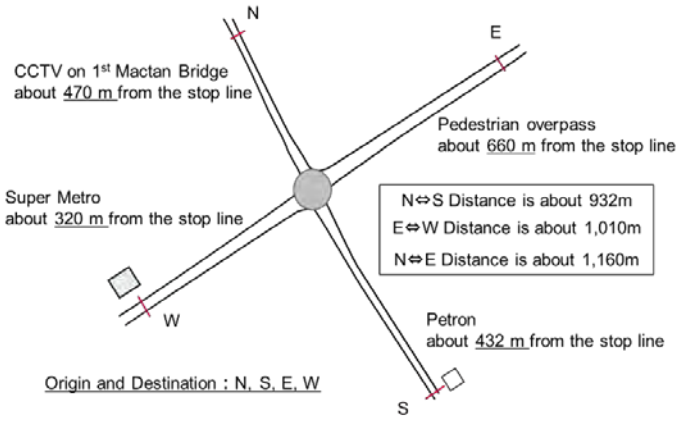
The 1st Mactan Bridge has one lane in one direction and an up-slope in the direction from the intersection; therefore, the traffic capacity will be 1,500 to 1,700 PCU/ h. The average will be 1,600 PCU/h or 800 PCU/30 min. Traffic volume of 1st Mactan Bridge, therefore, can be assumed to exceed capacity from 6:30 to 9:30 and from 17:00 to 20:00.

As for the traffic volume in 1st Mactan Bridge by routes, traffic volume of D21 controlled by a traffic enforcer is higher compared to other routes in all time zones. Traffic volume of D31 is especially high from 18:30 to 19:00.

3) Travel Time Survey and its Analysis

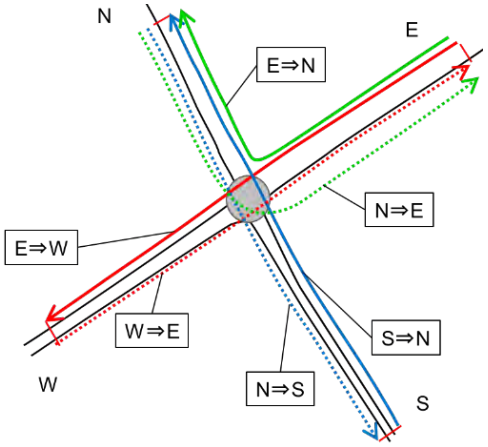
Travel time survey was carried out the same day of the traffic volume survey. The total survey duration was 6 hours from 6:00 to 9:00 and from 16:00 to 19:00.

The survey was to grasp the passing situation at the intersection. As shown in Figures 14.3.4 and 14.3.5, the travel time survey covered 4 origins and 4 destinations and 6 routes.



Source: JICA Project Team

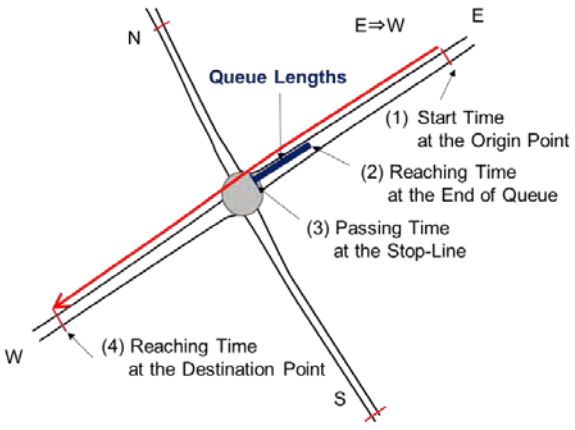
Figure 14.3.4 4 Origin and Destination points set for Travel Time Survey



Source: JICA Project Team

Figure 14.3.5 6 Routes set for Travel Time Survey

There is 1 surveyor and 1 survey vehicle for each allocated route, and each surveyor measures different times at 4 points: (i) time starting at origin, (ii) time joining the tale of queue, (iii) time passing on the stop line, and (iv) time arriving at destination, as shown in Figure 14.3.6.



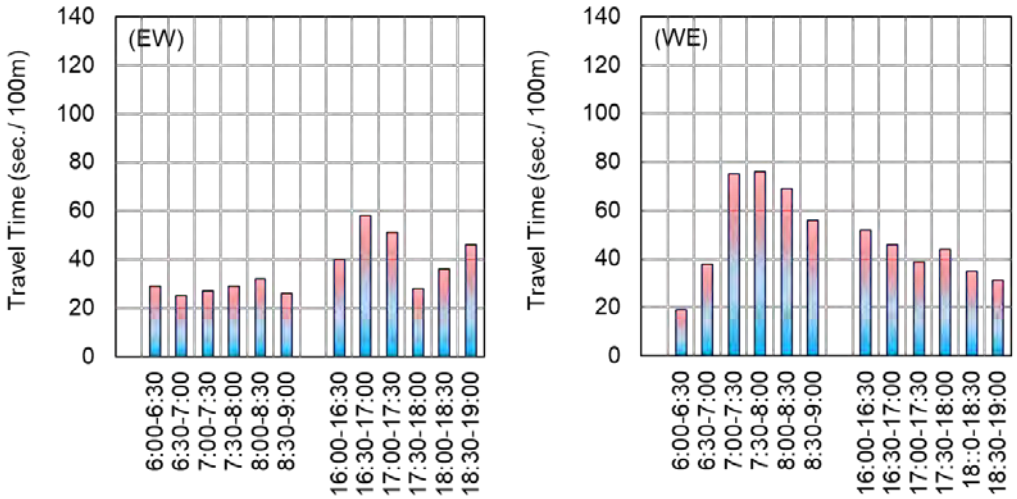
Source: JICA Project Team

Figure 14.3.6 4 Time Measuring Points

Figures 14.3.7, 14.3.8, and 14.3.9 show the results of travel time survey. Figure 14.3.7 displays the results of travel times from East (E) to West (W) and W to E. Figure 14.3.8 has travel times of North (N) to South (S) and S to N. Lastly, Figure 14.3.9 shows N to E and E to N.

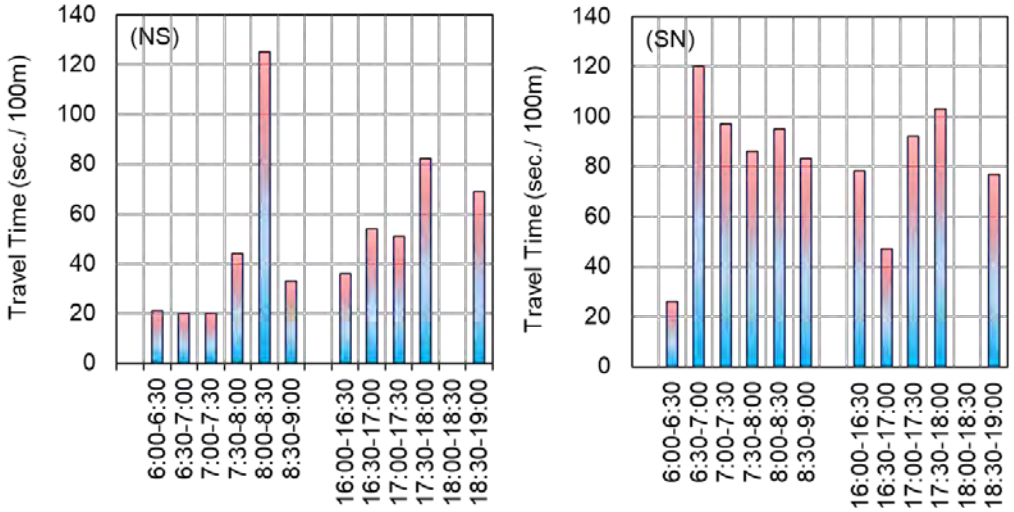
As shown in Figure 14.3.7, the overall travel time of E to W is short than that of W to E. The peak travel time for E to W is in the evening, while the peak for W to E is in the morning.

Travel time of W to E has large variations by time zone. It is about 70 to 75 sec/ 100 m that is about 5 km/h of travel speed. Peak is around 7:00 to 8:30.



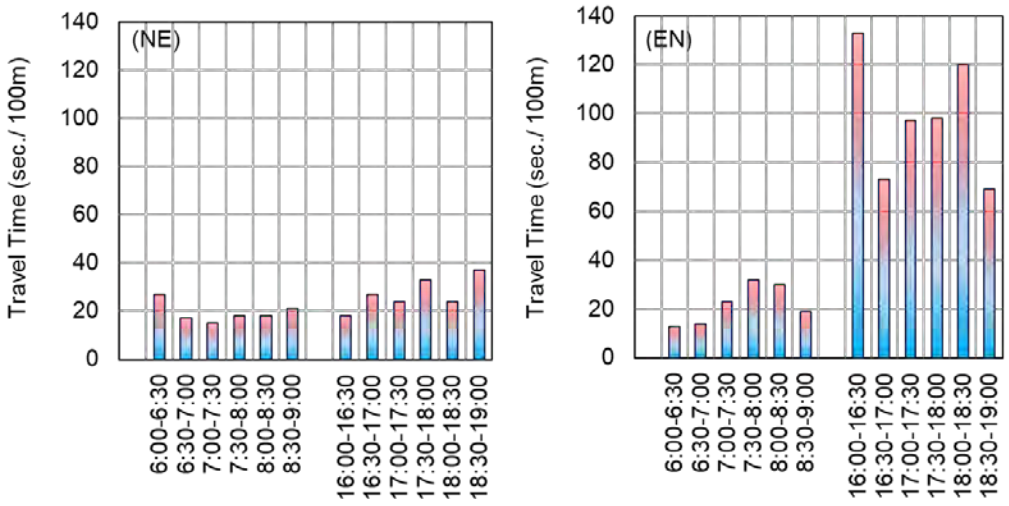
Source: JICA Project Team

Figure 14.3.7 Travel Time between E and W by Time Zone



Source: JICA Project Team

Figure 14.3.8 Travel Time between S and N by Time Zone

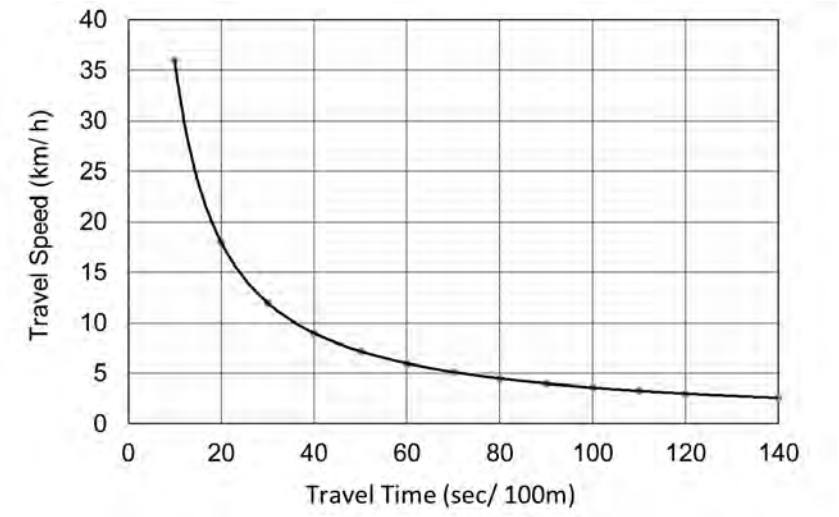


Source: JICA Project Team

Figure 14.3.9 Travel Time between N and E by Time Zone

The travel time between N to S is different between N to S and S to N, the peak of N to S is 8:00 to 8:30, 17:30 to 18:00 and 18:30 to 19:00, but the peak of S to N is almost all time zone except 6:00 to 6:30 and 16:30 to 17:00. On the other hand, the travel time between N and E is greatly different between N to E and E to N, the travel time of E to N is large almost all time zones in the afternoon.

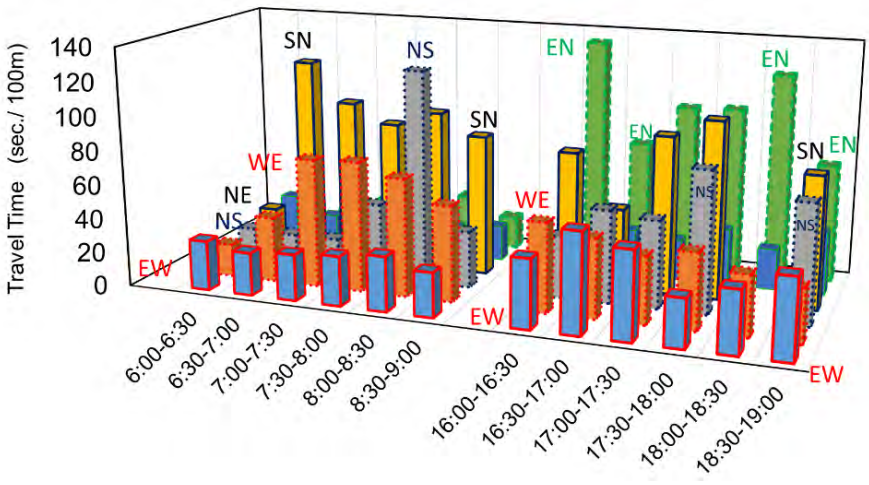
For our reference, Figure 14.3.10 shows the relation between travel time (sec/100 m) and travel speed (km/ h). As shown in Figure 14.3.10, 20 sec/100 m of travel time is same as 18 km/h of travel speed and 100 sec/100 m of travel time is about 3 km/h of travel speed.



Source: JICA Project Team

Figure 14.3.10 Relation between Travel Time and Travel Speed

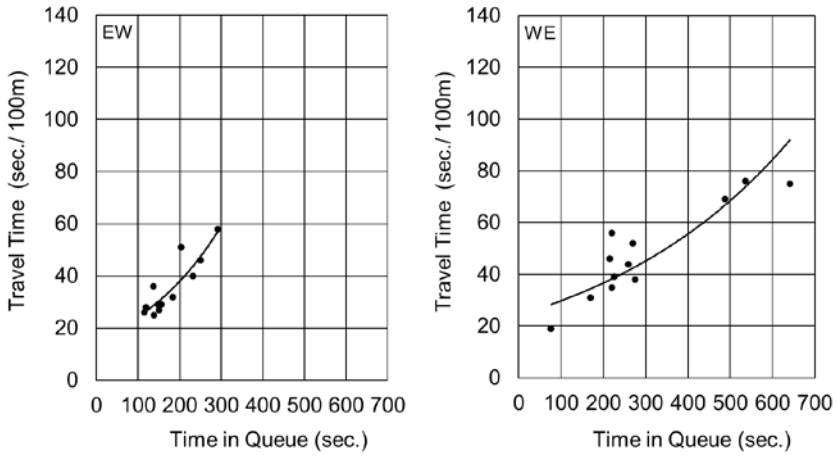
Figure 14.3.11 shows the results of travel survey for all routes. As can be seen in this figure, most all time zones for S to N, afternoon for E to N, and part time zone N to S has long travel times.



Source: JICA Project Team

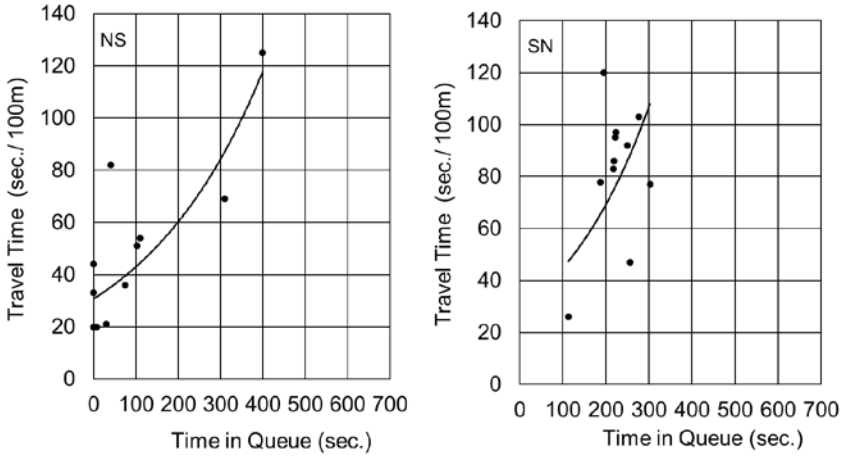
Figure 14.3.11 Travel Time by 6 Test Routes and Time Zone

Figures 14.3.12 and 14.3.14 show the relation between time in queue and travel time for 6 routes. There is a tendency when time in queue becomes longer, so does the travel time. However, even when time in queue is almost the same, the travel time is different by routes.



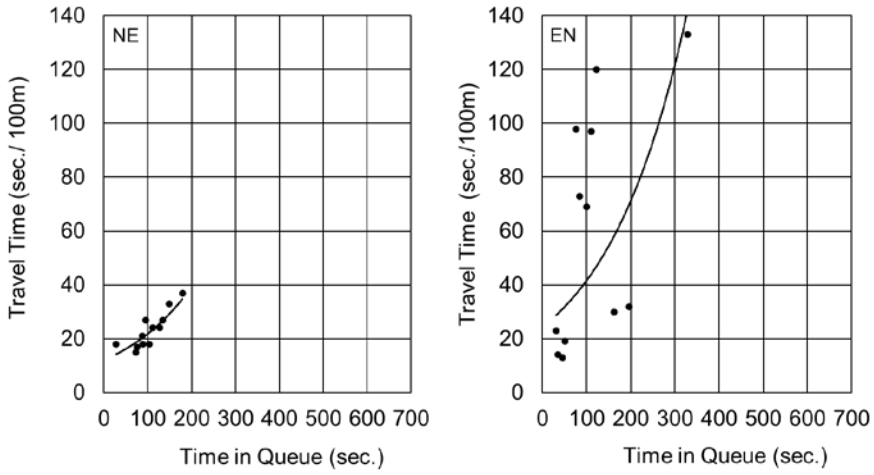
Source: JICA Project Team

Figure 14.3.12 Relation between Time in Queue and Travel Time between E and W



Source: JICA Project Team

Figure 14.3.13 Relation between Time in Queue and Travel Time between N and S



Source: JICA Project Team

Figure 14.3.14 Relation between Time in Queue and Travel Time between N and E

Figure 14.3.15 shows the relation between waiting time in queue and travel time of each route in order to see the difference among each route. According to this figure, the travel time of W to E was not very long even if waiting time in queue is long. As for the travel time of E to N, even if the waiting time in queue is not so long, the travel time became extremely long.

All 6 routes listed in order of longevity travel time.

(i) E to N

(ii) S to N

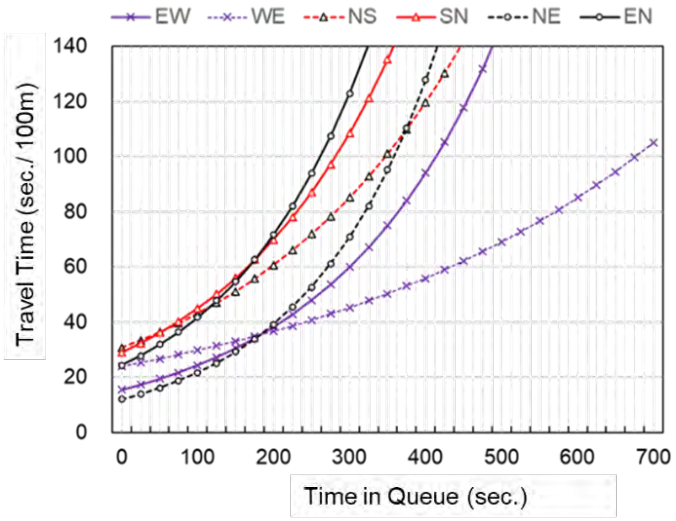
(iii) N to E

(iv) N to S

(v) E to W

(vi) W to E

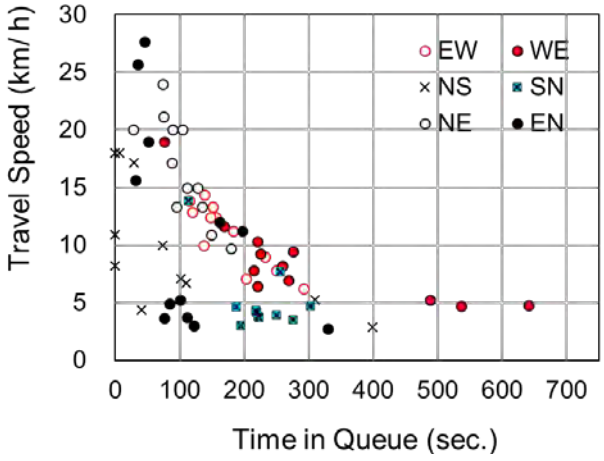
From this result, it can be said that travel time is related to the congestion situation after passing through the intersection being E to N or S to N has passed the traffic congestion of the 1st Mactan Bridge going through the intersection. The traveling time of N to E and N, which will be described later on, can be regarded as longer because it is affected by the hanging situation in the intersection.



Source: JICA Project Team

Figure 14.3.15 Relation between Time in Queue and Travel Time for All 6 Routes

The summary of the analysis results is in Figure 14.3.16. There is a relation between time in queue and travel speed. In general, the longer the time in queue, the slower the travel speed. So, W–E, E–W, and N–E correspond to this correlation well, while E–N and S–N do not probably because these routes are affected by 1st Mactan Bridge.



Source: JICA Project Team

Figure 14.3.16 Relation between Time in Queue and Travel Speed of all 6 Routes

4) Traffic Behavior Survey and its Analysis

Traffic behavior survey was mainly to extract and quantify traffic behavior, which would be negative when trying to improve the traffic control at an intersection. To analyze traffic behavior, checking the same traffic occurrences repeatedly is essential. Therefore, a video recording of a traffic situation at the target intersection was on repeat.

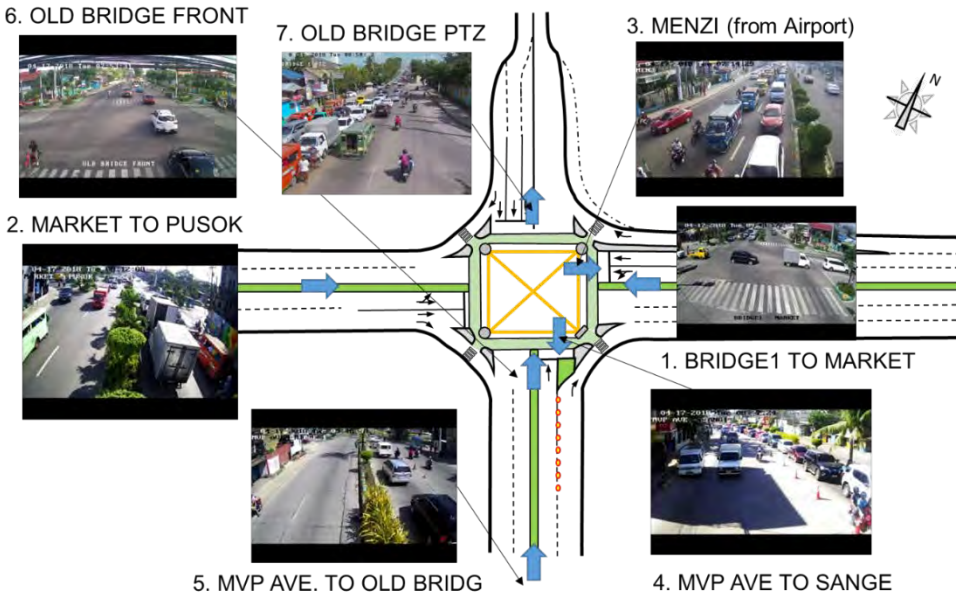
Traffic Command Center of Lapu-Lapu City provided the video taken on 17 April 2018 and the recording time is 16 hours from 6: 00 to 22:00.

The provided video is no. 7 in Figure 14.3.17, but “old bridge front” was used instead, mainly to analyze the traffic situation at the intersection. “Bridge1 to market” video was also used as supplementary. Based on the results of the traffic behavior survey, the extracted traffic

behavior which become negative for effective traffic signal control are the following 2 traffic behaviors as listed follow and shown in Figure 14.3.18,

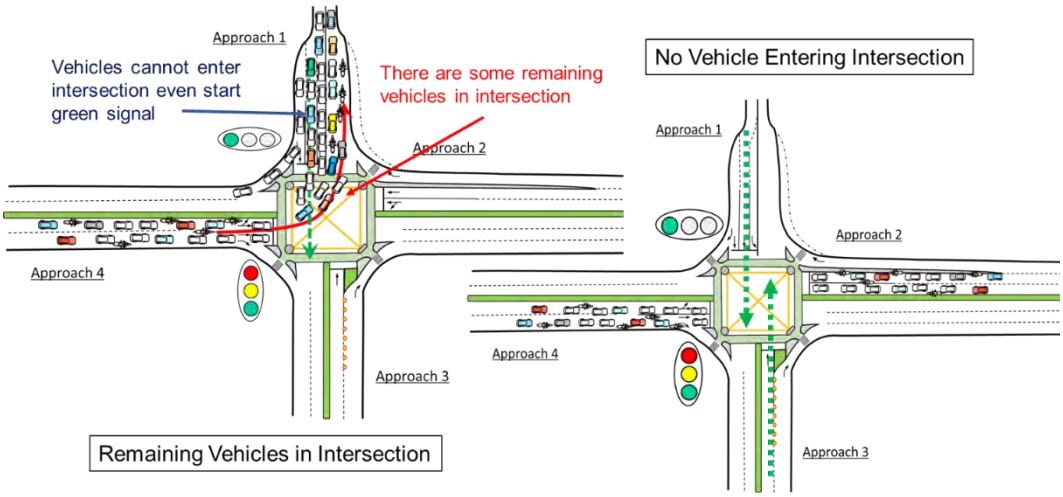
(i) Green light continues to be displayed even when there is few or no traffic inflow and the queue length of the inflow at the direction of the red light is longer and worse at the same time. It can be called “a few inflow situation.” The time of wasted green light occurs often, which is one of the reasons why traffic congestion worsens.

(ii) Queue length from the intersection on the downstream side extends to the inside of the intersection and another side of inflow cannot flow into the intersection even if the green light starts. It can be called “blocking situation.” This is also wasted green time.



Source: Lapu-Lapu City and JICA Project Team

Figure 14.3.17 Video provided by Traffic Command Center of Lapu-Lapu City



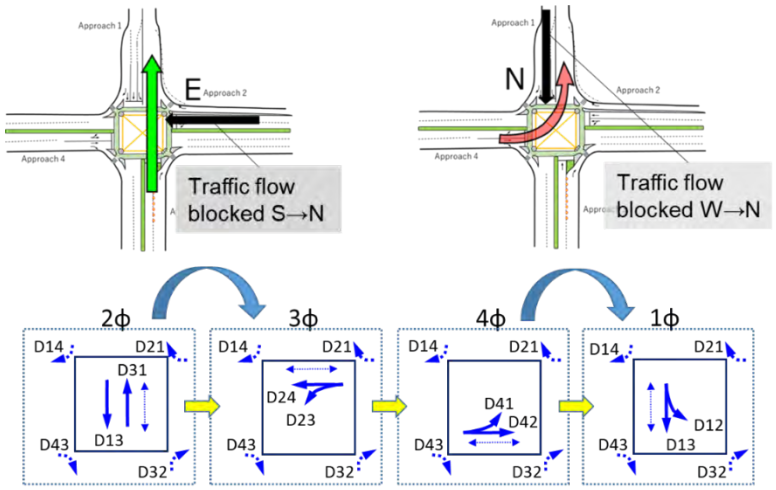
Source: JICA Project Team

Figure 14.3.18 Negative Traffic Behaviors (Blocking Situation and A Few Inflow Situation)

In a blocking situation, vehicles from another direction cannot enter an intersection because of the remaining vehicles in it. It can be separated by 2 types however, as shown in Figure

14.3.19, by the remaining vehicles from S to N and W to N. These are affected by traffic queue that extends from 1st Mactan Bridge.

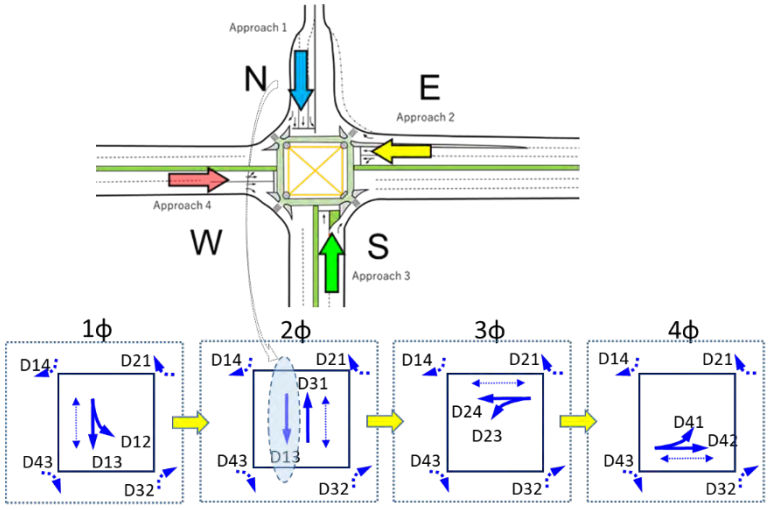
The situation of remaining vehicles from S to N occur in the 2nd signal phase and disturb the inflow traffic from E of the 3rd signal phase. On the other hand, the situation of the remaining vehicles from W to N occur in the 4th signal phase and disturb inflow traffic from N of the 1st signal phase.



Source: JICA Project Team

Figure 14.3.19 Inefficient Traffic Signal Control by Blocking

On a few inflow situations, inflow from all approaches is shown in Figure 14.3.20. D13 with straight traffic flow from north is the highest. In terms of signal phase, the highest direction can be seen in 2nd phase. The green signal time of D13 starts in 1st phase and continues until the end of 2nd phase; this may be related to phase sequences.

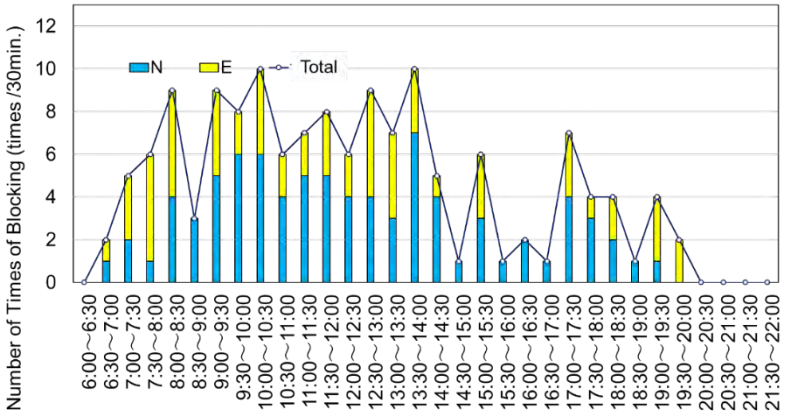


Source: JICA Project Team

Figure 14.3.20 Inefficient Traffic Signal Control by A Few Inflow

Figure 14.3.21 shows the number of blocking times when the intersection cannot be entered even after the green signal light because of the remaining vehicles in it.

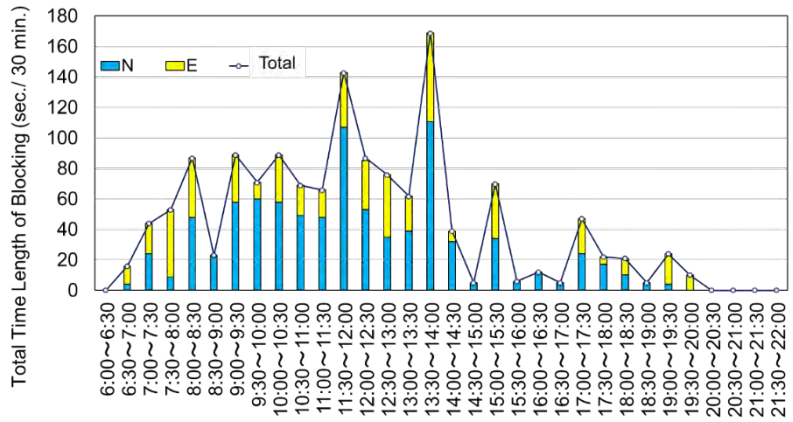
As shown in the figure, the maximum number of blocking times is 10 times/30 min and the average from 6:00 to 22:00 is 4.5 times/30 min.



Source: JICA Project Team

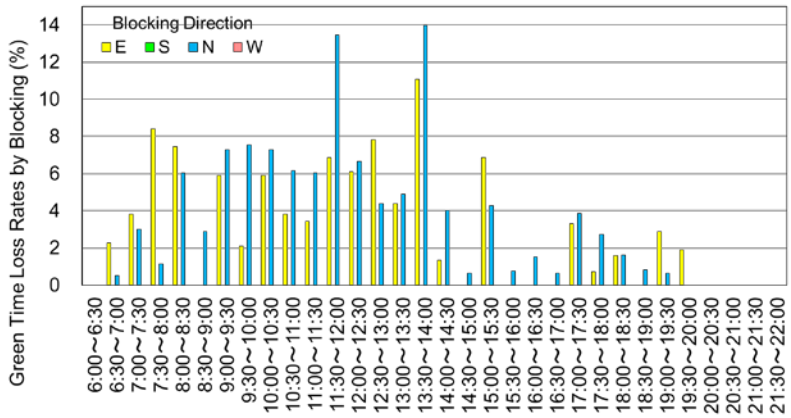
Figure 14.3.21 The Number of Times of Blocking on 18 April 2018

Figure 14.3.22 shows the total time length of blocking. The maximum total time length is 169 sec/30 min from 13:30 to 14:00. The average is 44.1 sec/30 min.



Source: JICA Project Team

Figure 14.3.22 Total Time Length of Blocking on 18 April 2018



Source: JICA Project Team

Figure 14.3.23 Green Time Loss Rates by Blocking on 18 April 2018

As described earlier, the blocking situation of the remaining vehicles from W to N occurs during the 1st signal phase, and that from S to N occurs during the 4th signal phase. Figure 14.3.23 shows green time loss rates by time zone. The rates are divided by signal phase length. The maximum green time loss rate by remaining vehicles of W to N is 14.0% during the 1st phase from 13:30 to 14:00 and the average rate during survey hours is 3.5%. The maximum green time loss rate by the remaining vehicles of S to N is 11.1% from 13:30 to 14:00 during the 3rd phase and the average rate during survey hours is 3.1%.

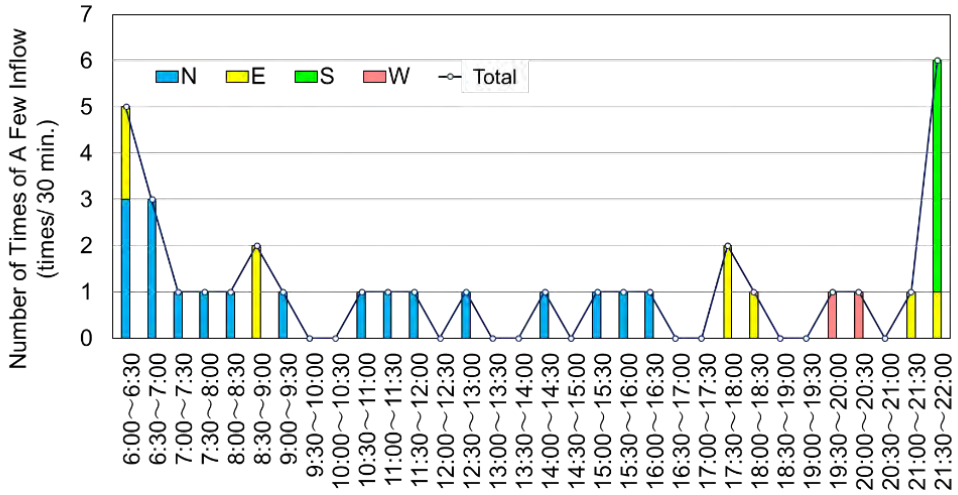
As a side note, which will be detailed later on, the required traffic volume for setting signal control parameters should be the original traffic volume demand; however, it is very difficult to measure. So, it was decided to just use traffic volume in the intersection because it is easily measurable. In the case of blocking situation, revision of the measured traffic volume by using the wasted green time rates was determined.

Table 14.3.4 Green Time Loss Rate by Blocking

Time of Day	Blocked Traffic Inflow						Green Signal Length (sec.)		Cycle Length (sec.)	No. of Times of Cycle (No./30 min.)	Green Signal Length (sec./ 30 min.)		Green time loss rates by blocked (%)	
	No. of Times of Blocking Situation			Total Blocked Time (sec.)			1φ+2φ	3φ			1φ+2φ	3φ	1φ+2φ	3φ
	Total	N	E	Total	N	E	N	E			N	E	N	E
6:00～6:30	0			0			117	77	265	6.8	795.6	523.6	0.0	0.0
6:30～7:00	2	1	1	16	4	12	117	77	265	6.8	795.6	523.6	0.5	2.3
7:00～7:30	5	2	3	44	24	20	117	77	265	6.8	795.6	523.6	3.0	3.8
7:30～8:00	6	1	5	53	9	44	117	77	265	6.8	795.6	523.6	1.1	8.4
8:00～8:30	9	4	5	87	48	39	117	77	265	6.8	795.6	523.6	6.0	7.4
8:30～9:00	3	3		23	23		117	77	265	6.8	795.6	523.6	2.9	0.0
9:00～9:30	9	5	4	89	58	31	117	77	265	6.8	795.6	523.6	7.3	5.9
9:30～10:00	8	6	2	71	60	11	117	77	265	6.8	795.6	523.6	7.5	2.1
10:00～10:30	10	6	4	89	58	31	117	77	265	6.8	795.6	523.6	7.3	5.9
10:30～11:00	6	4	2	69	49	20	117	77	265	6.8	795.6	523.6	6.2	3.8
11:00～11:30	7	5	2	66	48	18	117	77	265	6.8	795.6	523.6	6.0	3.4
11:30～12:00	8	5	3	143	107	36	117	77	265	6.8	795.6	523.6	13.4	6.9
12:00～12:30	6	4	2	87	53	32	117	77	265	6.8	795.6	523.6	6.7	6.1
12:30～13:00	9	4	5	76	35	41	117	77	265	6.8	795.6	523.6	4.4	7.8
13:00～13:30	7	3	4	62	39	23	117	77	265	6.8	795.6	523.6	4.9	4.4
13:30～14:00	10	7	3	169	111	58	117	77	265	6.8	795.6	523.6	14.0	11.1
14:00～14:30	5	4	1	39	32	7	117	77	265	6.8	795.6	523.6	4.0	1.3
14:30～15:00	1	1		5	5		117	77	265	6.8	795.6	523.6	0.6	0.0
15:00～15:30	6	3	3	70	34	36	117	77	265	6.8	795.6	523.6	4.3	6.9
15:30～16:00	1	1		6	6		117	77	265	6.8	795.6	523.6	0.8	0.0
16:00～16:30	2	2		12	12		117	77	265	6.8	795.6	523.6	1.5	0.0
16:30～17:00	1	1		5	5		117	77	265	6.8	795.6	523.6	0.6	0.0
17:00～17:30	7	4	3	47	24	23	110	123	320	5.6	616.0	688.8	3.9	3.3
17:30～18:00	4	3	1	22	17	5	110	123	320	5.6	616.0	688.8	2.8	0.7
18:00～18:30	4	2	2	21	10	11	110	123	320	5.6	616.0	688.8	1.6	1.6
18:30～19:00	1	1		5	5		110	123	320	5.6	616.0	688.8	0.8	0.0
19:00～19:30	4	1	3	24	4	20	110	123	320	5.6	616.0	688.8	0.6	2.9
19:30～20:00	2		2	10		10	117	77	265	6.8	795.6	523.6	0.0	1.9
20:00～20:30	0			0			117	77	265	6.8	795.6	523.6	0.0	0.0
20:30～21:00	0			0			117	77	265	6.8	795.6	523.6	0.0	0.0
21:00～21:30	0			0			117	77	265	6.8	795.6	523.6	0.0	0.0
21:30～22:00	0			0			117	77	265	6.8	795.6	523.6	0.0	0.0

Source: JICA Project Team

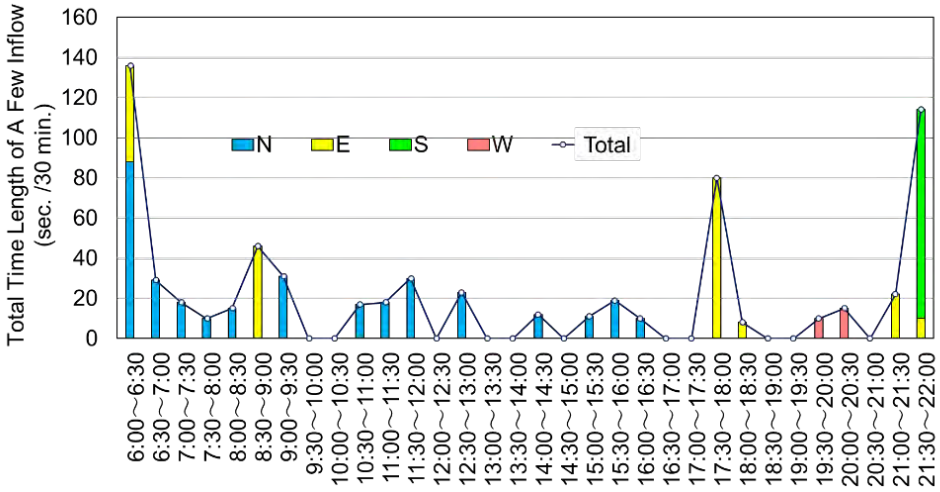
Traffic flow from the north is blocked by flow of W to N during the 1st and 2nd phases. Traffic flow from east, meanwhile, is blocked by flow of S to N during the 3rd phase. Table 14.3.4 shows the loss rates during green time due to the blocking situation at intersection.



Source: JICA Project Team

Figure 14.3.24 Number of Times of A Few Inflow on 18 April 2018

Figure 14.3.24 shows the number of times of a few inflow. It often occurs on the north and east approach for almost the whole day. On the west and south approach, this situation can be seen at a very few instances. However, the situation was seen 5 times/30 min on the south approach but only between 21:30 to 22:00. That is already the maximum number of this situation. This makes the maximum number of times from 21:30 to 22:00 at 6 times/30 min. The average of a few inflow from 6:00 to 22:00 was 1.1 times/30 min.

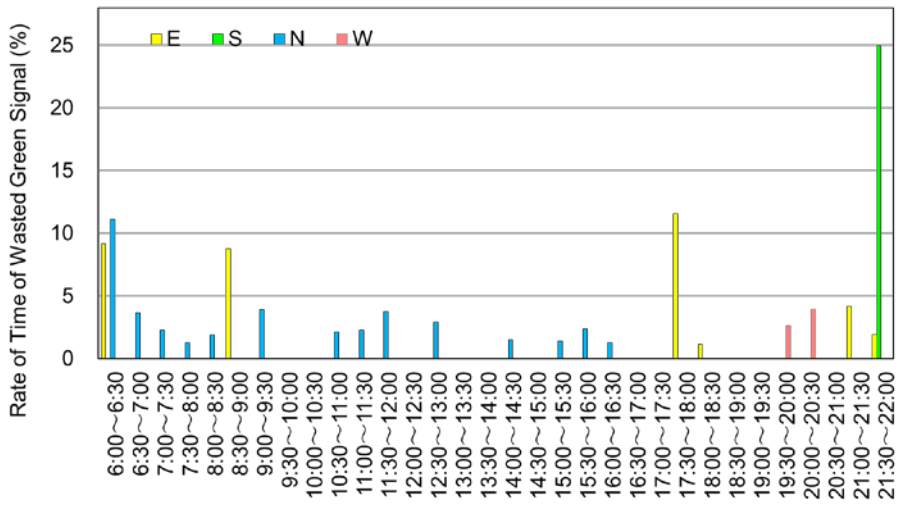


Source: JICA Project Team

Figure 14.3.25 Total Time Length of A Few Inflow on 18 April 2018

Figure 14.3.25 shows total time length of a few inflow. The maximum time length is 136 sec/30 min from 6:00 to 6:30, and the average is 21.1 sec/30 min. As mentioned above, a few inflow situations of the north approach can be seen mostly during the 2nd phase, not the 1st phase. Meanwhile, green signal phases in each approach are 3rd phase for east approach, 4th phase for west approach, and 2nd phase for south approach.

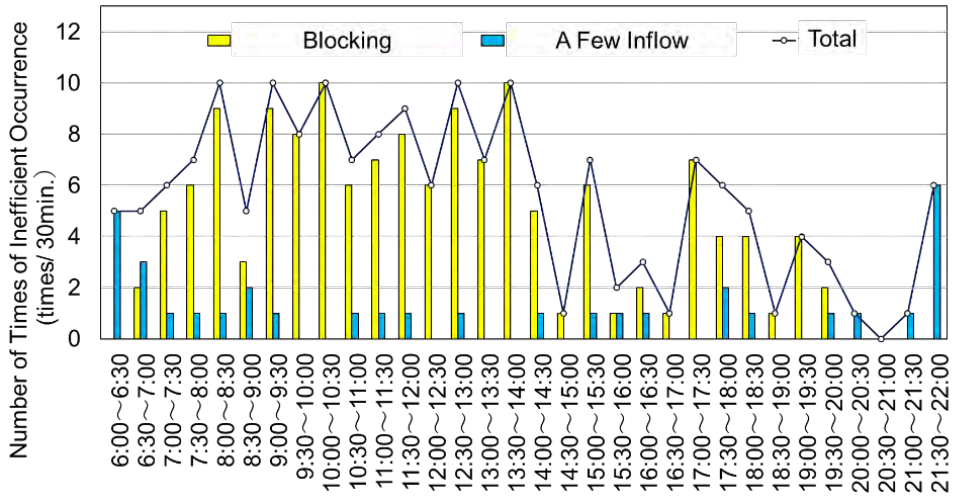
Therefore, the rate of time of wasted green signal was calculated by compiling the length of green signal in each phase (results in Figure 14.3.26). The wasted green time rates were defined as rates of time lengths of a few inflow situations for each phase length.



Source: JICA Project Team

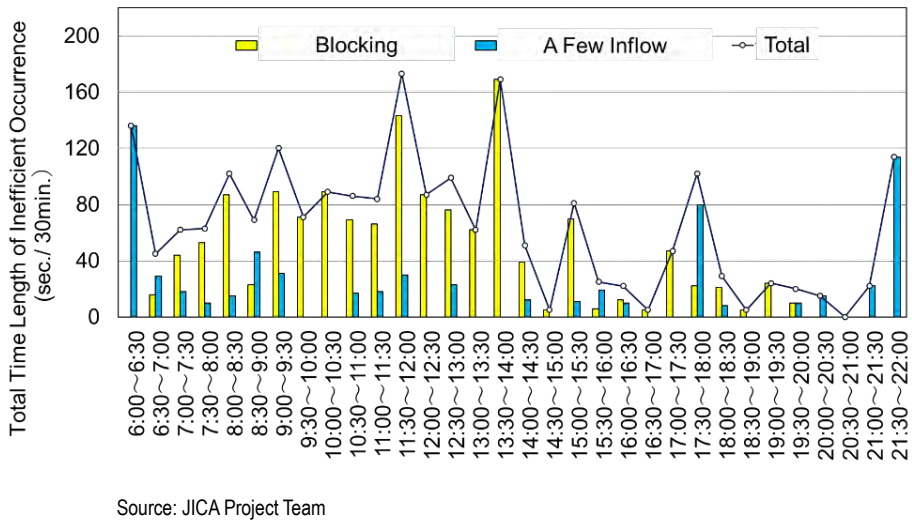
Figure 14.3.26 Green Time Loss Rate by A Few Inflow on 18 April 2018

Figure 14.3.26 shows the 25% maximum loss rate of green time caused by south approach during the 2nd phase from 21:30 to 22:00. The average rate was 3.4% from 6:00 to 9:00 and 16:00 to 19:00. Rate of the north approach during the 2nd phase from 6:00 to 6:30 was 11.1% and the average was 1.3%. The maximum loss rate of green time of east approach during 3rd phase from 17:30 to 18:00 was 11.6% and the average was 1.1%.



Source: JICA Project Team

Figure 14.3.27 Number of Times of Inefficient Occurrence on 18 April 2018

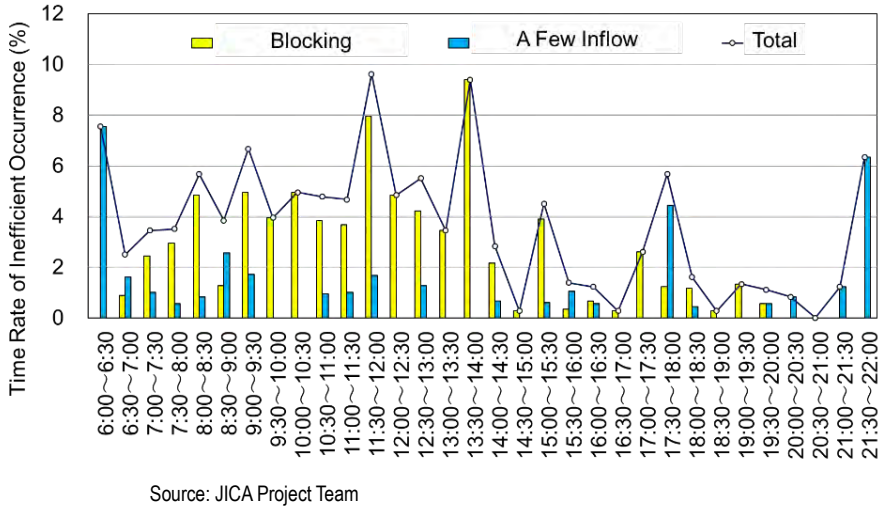


Source: JICA Project Team

Figure 14.3.28 Total Time Length of Inefficient Occurrence on 18 April 2018

Figure 14.3.27 shows number of times of inefficient occurrence by blocking and a few inflow by length of time. It can be noticed that a few inflow situation occur in the early morning and late evening, but the blocking situation occur all day except early morning and late evening. The maximum total number of both situations was 10 times/30 min and the average was 5.5 times/30 min.

Figure 14.3.28 shows the total time length of inefficient occurrence by blocking and few inflow by length of time. The maximum total time length was 173 sec/30 min from 11:30 to 12:00 and the average was 65.1 sec/30 min.



Source: JICA Project Team

Figure 14.3.29 Inefficient Time Rate

Figure 14.3.29 shows time rate of inefficient situations. This can be called the time rate of wasted green signal (%). The maximum was 9.6 % during 11:30 to 12:00 and the average was 3.6%.

5) Calculation of Traffic Signal Parameters Based on Traffic Volume Survey Data

The traffic signal control parameters should correspond to the actual traffic situation to become most efficient. The most efficient signal control means to maximize the rate of traffic flow during green signal and minimize the total waiting time during red signal. That kind of traffic signal control is called “optimum signal control.” Basic factors to consider for efficient

signal control are rate of saturation flow, lost time during phase change interval, and minimum cycle length.

(1) Rate of Saturation Flow

The rate of saturation flow means the maximum number of vehicles to enter an intersection during green signal. The unit is PCU/1-hour green signal. Rates differ by the number of lanes at stop line, lane width, road slope and the direction of outflow, and so on, but the conventional rate is as follows.

Straight-through lane: 1,800 to 2,200 (PCU/ 1-hour green signal/ 1 lane)

Left or right lane: 1,500 to 1,800 (PCU/ 1-hour green signal/ 1 lane)

In this pilot project, the following values were applied based on the observation survey at target intersection.

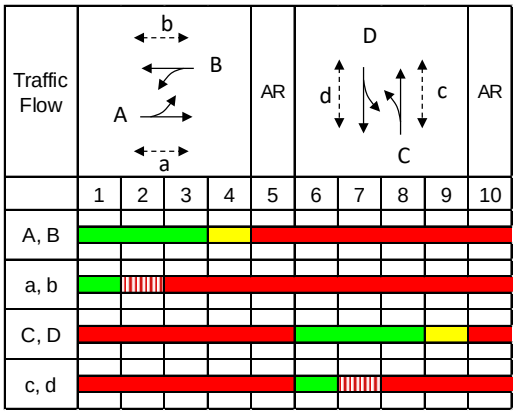
Straight-through lane: 2,000 (PCU/ 1-hour green signal/ 1 lane)

Left and/or right lane：1,600 (PCU/ 1-hour green signal/ 1 lane)

(2) Lost Time during Phase Change Interval

Signal phase means to give the right of way by flashing green signal. If the number of phase changes is X, it can be called X phase control. The simplest phase is two-phase control wherein the number of phases is 2 and number of signal changes is also 2.

There are green, yellow, and red signals in each phase. The signal step diagram shows how to change each signal by time. Figure 14.3.30 is an example of a signal step diagram of a two-phase signal control. As shown in this figure, signal steps change from green, yellow, and red; after an all-red signal, which is when two phases are both red signals, the green signal starts in next phase.



Source: JICA Project Team

Figure 14.3.30 Example of Signal Step Diagram for Two-Phase Signal Control

There is a case of no all-red time, but even with or without it, time intervals should be allocated to change phases and should almost be the same. The required time interval is 5 seconds for one phase. This is almost the same as having an interval time of 3 seconds for yellow signal with an additional 2 seconds for all-red signal. The required time for change phase is called “lost time” since it is when vehicles cannot go through an intersection.

Figure 14.3.30 also has a signal step diagram for pedestrians (shown as a, b, c and d). After pedestrian green and flashing signals turn on, the pedestrian red signal turns on. Subsequently, vehicle signal will be green for a while. Vehicles have to stop when

pedestrians are crossing. Therefore, the green signal phase for vehicles is necessary after pedestrian flashing and red signal to make up for the stoppage time for pedestrian crossing.

Both vehicle and pedestrian signals cannot be green at the same time to allow vehicle green time and for the pedestrians' safety.

(3) Minimum Cycle Length

The notion is minimum cycle length is based on fulfilling the required lost time as described above. Its concept is to secure the required loss time as a part of time for 1 cycle. Loss time must be included in 1 cycle with green signal time to flow measurable traffic volume that corresponds to the actual traffic situation. The equation of minimum cycle length (C_{min}) is $C_{min} = L \div (1 - \rho)$.

Where,

L: Lost time for changing phases if phases are n, L = n (Y + A R)

ρ: Degree of saturation (ρ) for 1 cycle. This is the summing up the degree of saturation of each phase (ρi), that is, $\rho = \Sigma\rho i$.

Y: Yellow signal length (normally 3 sec)

AR: All-red intervals (normally 2 sec)

Therefore, the minimum cycle length can be calculated using $C_{min} = n (Y + AR) \div (1 - \Sigma \rho_i)$.

Where,

n: Number of phases

Y: Yellow signal length (normally 3 sec)

AR: All-red intervals (normally 2 sec)

ρi: Degree of saturation for phase i

(4) Optimum Cycle Length

Optimum cycle length is the shortest possible cycle length under the condition when the cycle length is longer than the minimum cycle length. In general, if cycle length that is a little longer than the minimum length is applied under the situation of fluctuating traffic volume, it will apply on the remaining vehicles in a queue. The remaining vehicles will continue to wait in a queue until next green signal time. The queue extends at the same time.

Various calculation formulas of the optimum cycle length have been proposed; however, the most famous and popular in many countries is Webster's Formula as follows:

$C_o = (1.5 \times L + 5) \div (1 - \rho)$

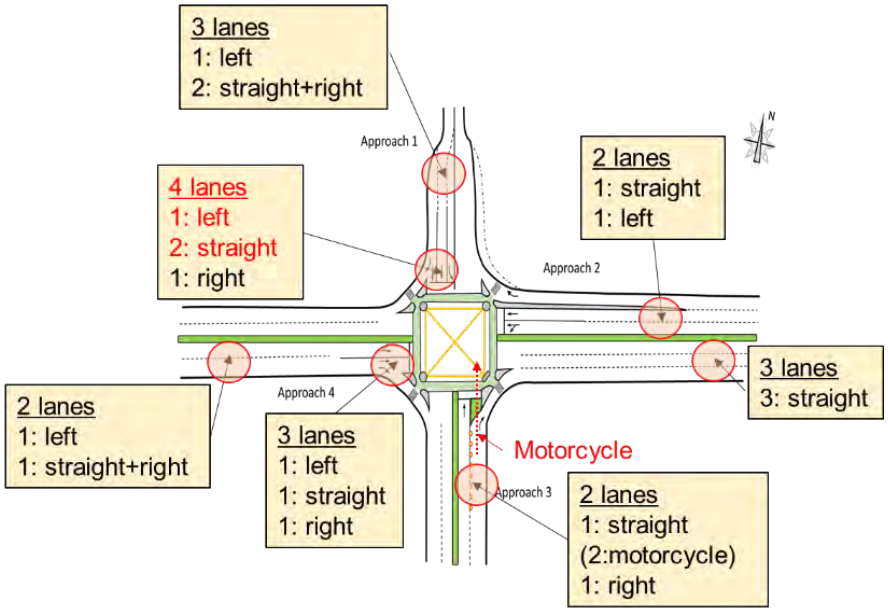
Where,

L: Lost time for changing phases if phases are n, L = n (Y + AR).

ρ: Degree of saturation (ρ) for 1 cycle, this is summing up the degree of saturation of each phase (ρ_i), that is, $\rho = \Sigma\rho_i$.

The optimum cycle length was set using the traffic volume data already shown in Table 14.3.2, also considering the situation already described above. When we set cycle length, grasping the actual traffic flow situation of each approach at the target intersection is the most important thing. But here, the number of lanes is not always same as the number of lanes shown on the lane markings. It should be determined by observing actual traffic flow

situation. Figure 14.3.31 shows the number of lanes by outflow direction at the target intersection, which was obtained by observing actual traffic flow situation. The number of lanes at north approach is 4 lanes at the stop line but 3 lanes at the slightly upstream side. This is just one example. The number of lanes required to calculate the degree of saturation is at the stop line.



Source: JICA Project Team

Figure 14.3.31 The Number of Lanes by Outflow Directions at the Target Intersection

As an example, the number of lanes at approach 1 is 3 at the stop line. One lane is for left-turn and 2 lanes are for straight-through. Therefore, the following are the degree of saturation by each lane.

ρ_{11} = Q1/1,600 (left turn lane)

ρ_{12} = Q2/2,000 (straight-through lane)

ρ_{13} = Q3/2,000 (straight-through lane)

Where,

Q1: Traffic volume at left turn lane (PCU/h)

Q2: Traffic volume at straight-through lane (next lane of left turn lane) (PCU/h)

Q3: Traffic volume at straight-through lane (outside lane) (PCU/h)

A signal phase is needed to calculate the degree of saturation by each phase. Firstly, the degree of saturation in the case of current traffic signal phase as shown in Figure 14.3.32. The degree of saturation at 1st phase was calculated using the degree of saturation of D12 and D13. In the figure, D12 is a single-lane left turn and D13 is a two-lane straight-through.

Therefore, the degree of saturation of each lane are as follows.

ρ_{11} = D12/1,600

ρ_{12} = D13/2/2,000

ρ_{13} = D13/2/2,000

Where,

ρ_{1i}: Degree of saturation at lane number i

Unit of D12, D13: PCU/h

The degree of saturation of the 1st phase was calculated based on the traffic flow characteristic of when drivers normally select the first running lane to balance the degree of saturation of each lane. (Left-turn traffic from the 2nd lane can be seen by actual observation, even though the left-turn lane is specified as the 1st lane.)

Where,

ρ_1 = [D12 ÷ 1,600 + (D13 ÷ 2 ÷ 2,000) + (D13 ÷ 2 ÷ 2,000)] ÷ 3

Unit of D12, D13: PCU/ h

In the 2nd phase, D13 and D31 are, at the same time, inflows from the different approaches to the intersection. The degree of saturation of each approach should be calculated. The higher one would be adapted as the degree of saturation of 2nd phase.

$\rho_2 = MAX(\rho_{21}, \rho_{23})$

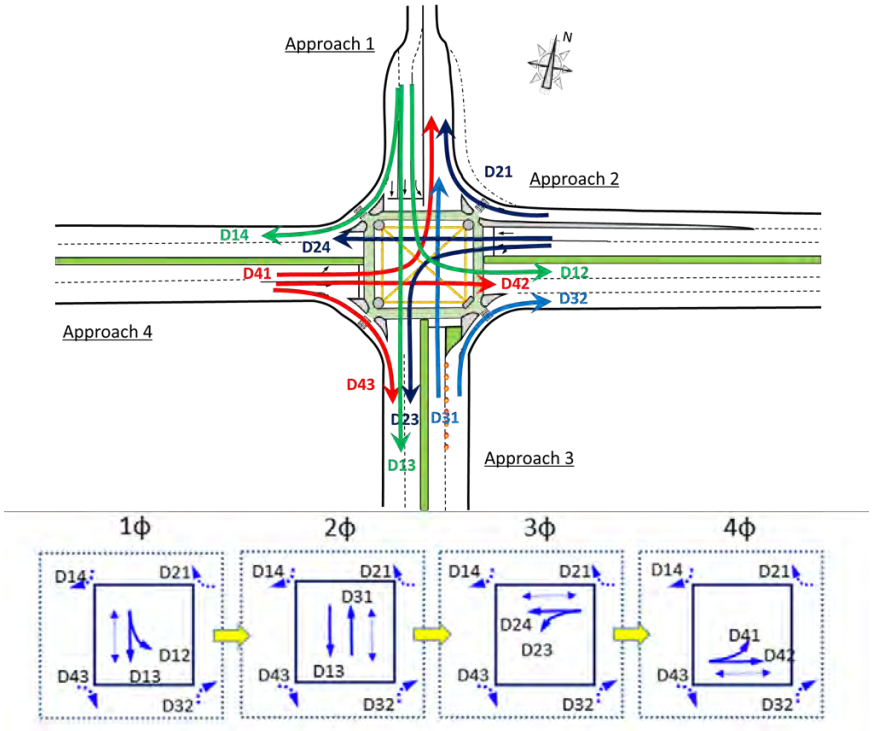
Where,

ρ_{21}: Degree of saturation at 1st approach of 2nd phase.

ρ_{23}: Degree of saturation at 3rd approach of 2nd phase.

Additionally, as shown in Figure 14.3.32, the 3rd approach has just one lane for four-wheeled vehicles, while almost all motorcycles use the additional side lane. Therefore, PCU of D31 was calculated except motorcycles (see Table 14.3.5).

D12, D13, D23, and D24 are blocked by the remaining vehicles at intersection, so the traffic volume measured by traffic survey was adjusted using green time loss rates shown in Table 14.3.4. The results are shown in Table 14.3.5.



Source: JICA Project Team

Figure 14.3.32 Number of Lanes by Each Approach and Current Traffic Signal Phase

Table 14.3.5 Traffic Volume by Inflow, Outflow Directions and Time Zone (PCU/ 30 min.)

Except for Motorcycles in D31

Time	D12	D13	D14	D21	D23	D24	D31	D32	D41	D42	D43	Total
6:00-6:30	87	244	131	269	251	191	167	604	217	183	39	2,381
6:30-7:00	116	280	152	314	293	228	199	742	223	201	60	2,807
7:00-7:30	84	333	186	317	236	177	151	1,027	306	155	51	3,025
7:30-8:00	111	306	237	332	213	213	195	781	279	158	61	2,886
8:00-8:30	123	318	223	270	168	177	182	717	295	184	63	2,720
8:30-9:00	145	320	231	294	172	173	158	658	235	168	41	2,594
9:00-9:30	188	284	221	341	298	245	155	668	237	189	45	2,872
9:30-10:00	140	313	208	315	232	203	137	626	225	162	38	2,599
10:00-10:30	159	293	199	287	207	162	146	595	223	160	59	2,490
10:30-11:00	156	258	269	306	184	162	132	526	181	147	78	2,400
11:00-11:30	149	301	214	315	225	86	125	596	214	180	38	2,443
11:30-12:00	114	247	162	282	249	183	130	554	200	181	73	2,376
12:00-12:30	201	307	231	264	326	222	122	478	187	181	58	2,576
12:30-13:00	129	302	168	305	282	240	132	490	176	151	57	2,432
13:00-13:30	162	304	185	299	222	190	160	614	205	202	52	2,594
13:30-14:00	171	284	162	272	301	257	100	593	182	205	34	2,561
14:00-14:30	143	299	203	255	230	179	157	644	189	214	38	2,550
14:30-15:00	142	312	227	259	240	263	167	518	211	167	41	2,546
15:00-15:30	162	324	207	288	203	298	160	509	205	139	46	2,542
15:30-16:00	128	333	204	245	248	256	193	569	213	173	36	2,598
16:00-16:30	127	346	235	305	120	130	155	549	235	178	58	2,436
16:30-17:00	128	335	272	261	229	248	172	539	248	213	61	2,706
17:00-17:30	126	408	347	333	287	407	164	593	226	191	114	3,195
17:30-18:00	131	435	345	291	258	252	142	616	179	139	105	2,892
18:00-18:30	87	304	350	311	280	363	114	580	242	212	36	2,878
18:30-19:00	106	348	382	342	275	303	284	636	169	180	43	3,068
19:00-19:30	103	348	365	327	299	362	117	530	213	201	41	2,905
19:30-20:00	95	342	320	358	246	285	165	472	114	175	18	2,590
20:00-20:30	82	292	212	258	249	290	127	504	154	210	22	2,401
20:30-21:00	92	450	199	232	194	208	95	390	137	167	27	2,191
21:00-21:30	85	374	205	214	259	204	97	465	152	175	31	2,261
21:30-22:00	69	357	161	150	219	151	103	372	121	178	28	1,909

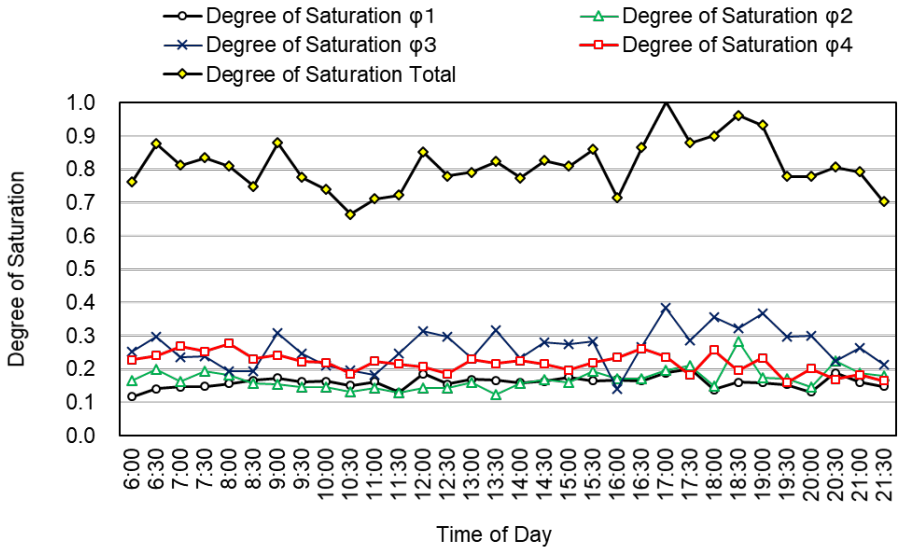
Source: JICA Project Team

Table 14.3.6 contains results of the calculation of degree of saturation at each phase under the conditions described above. Figure 14.3.33 shows the time fluctuation of degree of saturation at each phase in one cycle. As shown in the figure, the degree of saturation for one cycle is little bit high at around 17:00 to 19:00.

Table 14.3.6 Calculation Result of Degree of Saturation for Each Phase in One Cycle

	φ 1 (Approach 1)					φ2 (Approach 1, 2)					φ3 (Approach 2)							φ4 (Approach 4)					Intersection
	4 Lanes: Left=1, Straight=2, Right=1 "Right" is right-turn on red					No. 1: 4 Lanes : Left=1, Straight=2, Right=1 No. 3: 2 Lanes: No Left, Straight=1, Right=1					3 Lanes: Left=1, Straight=1 Right=1 (Separated)				Right-Turn on Red			3 Lanes: Left=1, Straight=1, Right=1					
Time	Approach 1		4 Lanes			No. 1:3 Lane	No. 3: 2 Lane				Approach 1	2 Lanes							Approach 4	2 Lanes				
	D12	D13	D14	Total	DS	D13	D31	D14	D32	DS	D23	D24	D23+D24	DS	D21	DS	Total	D41	D42	D43	Total	DS	DS
	Left Turn	Through	Right Turn			Through:2	Through:1	Right Turn	Right Turn		Left-turn	Through						Left Turn	Through	Right Turn			
6:00	87	244	131	461	0.1173	244	167	131	604	0.1668	251	191	441	0.2520	269	0.3358	710	217	183	39	439	0.2274	0.7635
6:30	116	280	152	548	0.1414	278	199	152	742	0.1985	293	228	521	0.2970	314	0.3925	835	223	201	60	484	0.2400	0.8769
7:00	84	333	186	604	0.1462	323	151	186	1027	0.1617	236	177	413	0.2361	317	0.3961	730	306	155	51	513	0.2690	0.8130
7:30	111	306	237	655	0.1484	303	195	237	781	0.1948	213	213	425	0.2393	332	0.4155	758	279	158	61	497	0.2530	0.8355
8:00	123	318	223	663	0.1570	300	182	223	717	0.1823	168	177	345	0.1938	270	0.3375	615	295	184	63	542	0.2763	0.8094
8:30	145	320	231	696	0.1668	311	158	231	658	0.1578	172	173	345	0.1938	294	0.3676	639	235	168	41	444	0.2309	0.7492
9:00	188	284	221	694	0.1733	265	155	221	668	0.1553	298	245	543	0.3086	341	0.4256	883	237	189	45	471	0.2423	0.8794
9:30	140	313	208	660	0.1625	291	137	208	626	0.1454	232	203	434	0.2460	315	0.3943	750	225	162	38	426	0.2218	0.7757
10:00	159	293	199	651	0.1638	273	146	199	595	0.1458	207	162	369	0.2104	287	0.3591	656	223	160	59	442	0.2193	0.7392
10:30	156	258	269	683	0.1510	243	132	269	526	0.1318	184	162	347	0.1964	306	0.3830	653	181	147	78	405	0.1864	0.6655
11:00	149	301	214	664	0.1625	284	125	214	596	0.1421	225	86	310	0.1833	315	0.3940	626	214	180	38	432	0.2236	0.7116
11:30	114	247	162	523	0.1298	218	130	162	554	0.1303	249	183	432	0.2473	282	0.3526	714	200	181	73	454	0.2158	0.7231
12:00	201	307	231	738	0.1861	288	122	231	478	0.1438	326	222	549	0.3151	264	0.3301	813	187	181	58	425	0.2070	0.8520
12:30	129	302	168	599	0.1544	289	132	168	490	0.1445	282	240	522	0.2965	305	0.3812	827	176	151	57	384	0.1854	0.7807
13:00	162	304	185	651	0.1689	290	160	185	614	0.1598	222	190	412	0.2338	299	0.3734	711	205	202	52	459	0.2289	0.7913
13:30	171	284	162	617	0.1659	250	100	162	593	0.1248	301	257	558	0.3165	272	0.3401	830	182	205	34	422	0.2165	0.8238
14:00	143	299	203	644	0.1590	287	157	203	644	0.1570	230	179	409	0.2335	255	0.3182	664	189	214	38	440	0.2249	0.7745
14:30	142	312	227	680	0.1630	310	167	227	518	0.1670	240	263	503	0.2813	259	0.3241	762	211	167	41	419	0.2151	0.8264
15:00	162	324	207	694	0.1756	311	160	207	509	0.1598	203	298	502	0.2762	288	0.3603	790	205	139	46	390	0.1977	0.8093
15:30	128	333	204	665	0.1643	331	193	204	569	0.1925	248	256	504	0.2831	245	0.3063	749	213	173	36	423	0.2199	0.8598
16:00	127	346	235	708	0.1683	341	155	235	549	0.1707	120	130	249	0.1396	305	0.3815	555	235	178	58	470	0.2355	0.7141
16:30	128	335	272	735	0.1649	333	172	272	539	0.1720	229	248	477	0.2673	261	0.3260	738	248	213	61	522	0.2617	0.8659
17:00	126	408	347	881	0.1883	393	164	347	593	0.1963	287	407	694	0.3830	333	0.4169	1028	226	191	114	530	0.2364	1.0040
17:30	131	435	345	911	0.1995	423	142	345	616	0.2116	258	252	510	0.2871	291	0.3640	801	179	139	105	423	0.1811	0.8793
18:00	87	304	350	741	0.1378	299	114	350	580	0.1495	280	363	642	0.3562	311	0.3890	954	242	212	36	490	0.2571	0.9006
18:30	106	348	382	836	0.1601	345	284	382	636	0.2840	275	303	578	0.3235	342	0.4270	920	169	180	43	391	0.1953	0.9629
19:00	103	348	365	815	0.1589	345	117	365	530	0.1727	299	362	661	0.3680	327	0.4082	988	213	201	41	455	0.2339	0.9334
19:30	95	342	320	757	0.1535	342	165	320	472	0.1709	246	285	531	0.2964	358	0.4478	889	114	175	18	307	0.1587	0.7796
20:00	82	292	212	587	0.1317	292	127	212	504	0.1462	249	290	539	0.3004	258	0.3230	797	154	210	22	386	0.2010	0.7793
20:30	92	450	199	740	0.1881	450	95	199	390	0.2248	194	208	402	0.2250	232	0.2904	634	137	167	27	332	0.1694	0.8072
21:00	85	374	205	664	0.1601	374	97	205	465	0.1870	259	204	463	0.2639	214	0.2672	677	152	175	31	358	0.1824	0.7933
21:30	69	357	161	587	0.1478	357	103	161	372	0.1785	219	151	370	0.2123	150	0.1876	520	121	178	28	327	0.1645	0.7031

Source: JICA Project Team



Source: JICA Project Team

Figure 14.3.33 Time Fluctuation of Degree of Saturation by Each Phase in One Cycle

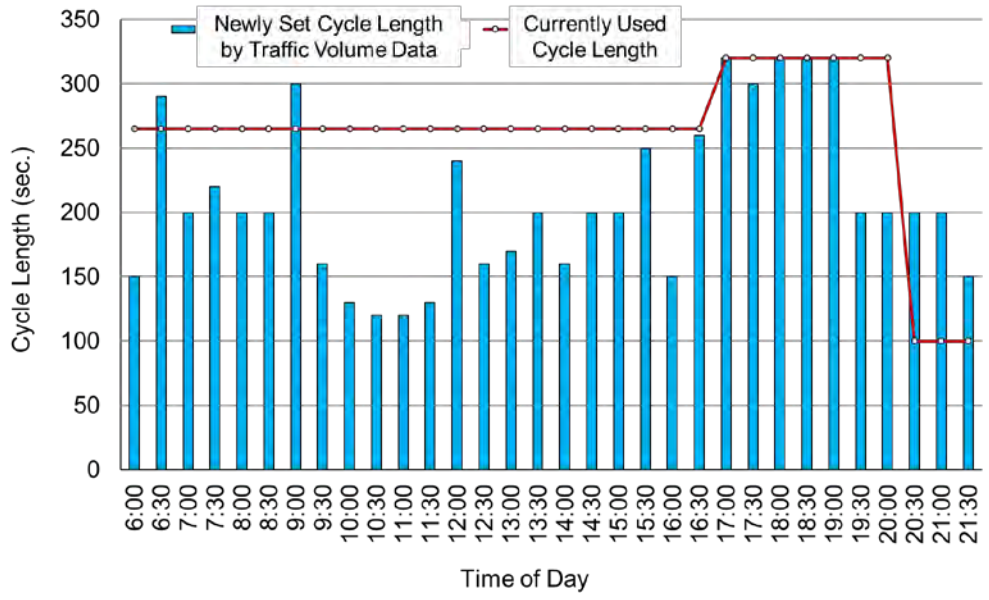
Table 14.3.7 Calculation Result and the Setting Value of Split in One Cycle

Time	DS	Computed Value Based on the Degree of Saturation					Setting Cycle Length and Phase Length*)				
		C	φ1	φ2	φ3	φ4	C	φ1	φ2	φ3	φ4
6:00	0.7635	148	23	32	49	44	150	23	33	50	45
6:30	0.8769	284	46	64	96	78	290	47	66	98	79
7:00	0.8130	187	34	37	54	62	200	36	40	58	66
7:30	0.8355	213	38	50	61	64	220	39	51	63	67
8:00	0.8094	184	36	41	44	63	200	39	45	48	68
8:30	0.7492	140	31	29	36	43	200	45	42	52	62
9:00	0.8794	290	57	51	102	80	300	59	53	105	83
9:30	0.7757	156	33	29	49	45	160	34	30	51	46
10:00	0.7392	134	30	26	38	40	130	29	26	37	39
10:30	0.6655	105	24	21	31	29	120	27	24	35	34
11:00	0.7116	121	28	24	31	38	120	27	24	31	38
11:30	0.7231	126	23	23	43	38	130	23	23	44	39
12:00	0.8520	237	52	40	87	57	240	52	40	89	58
12:30	0.7807	160	32	30	61	38	160	32	30	61	38
13:00	0.7913	168	36	34	50	49	170	36	34	50	49
13:30	0.8238	199	40	30	76	52	200	40	30	77	53
14:00	0.7745	155	32	31	47	45	160	33	32	48	46
14:30	0.8264	202	40	41	69	52	200	39	40	68	52
15:00	0.8093	184	40	36	63	45	200	43	39	68	49
15:30	0.8598	250	48	56	82	64	250	48	56	82	64
16:00	0.7141	122	29	29	24	40	150	35	36	29	49
16:30	0.8659	261	50	52	81	79	260	50	52	80	79
17:00	1.0040	-	-	-	-	-	320	60	63	122	75
17:30	0.8793	290	66	70	95	60	300	68	72	98	62
18:00	0.9006	352	54	58	139	100	320	49	53	127	91
18:30	0.9629	943	157	278	317	191	320	53	94	108	65
19:00	0.9334	526	89	97	207	132	320	54	59	126	80
19:30	0.7796	159	31	35	60	32	200	39	44	76	41
20:00	0.7793	159	27	30	61	41	200	34	38	77	52
20:30	0.8072	182	42	51	51	38	200	47	56	56	42
21:00	0.7933	169	34	40	56	39	200	40	47	67	46
21:30	0.7031	118	25	30	36	28	150	32	38	45	35

*) When the calculated value is larger than the existing maximum value, the existing maximum value is adopted as the cycle length.

Source: JICA Project Team

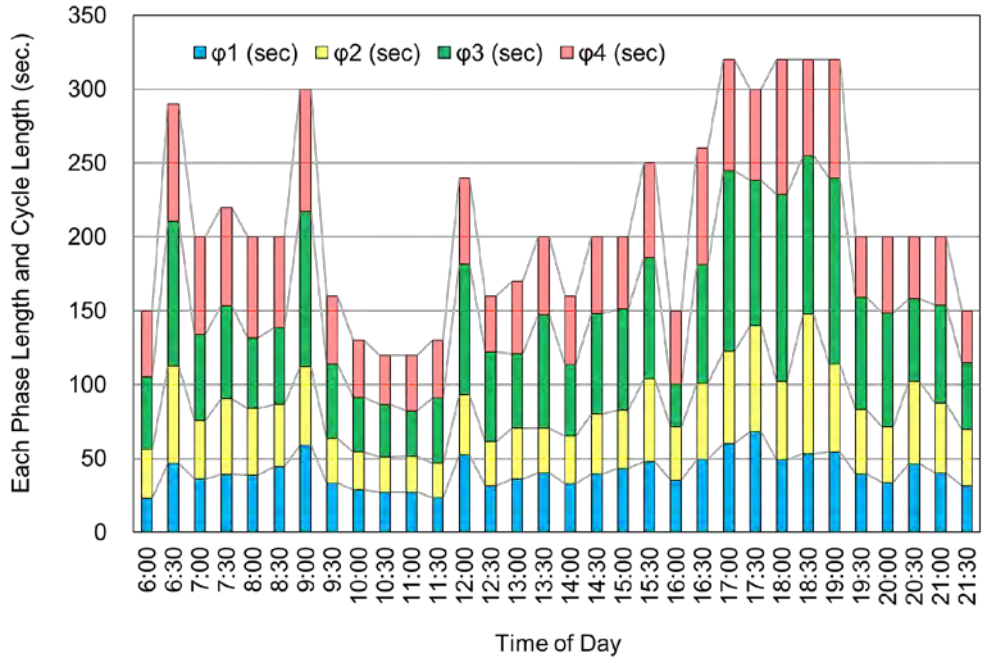
Table 14.3.7 shows the calculation results and setting values of splits in one cycle. The calculated cycle length from 17:00 to 19:00 is longer than the maximum cycle length of 320 sec that is currently used. In this situation, the calculated cycle lengths were not used and 320 sec was set as the maximum cycle length, which is the same as the current. Many reasons are considerable to adapt 320 sec as the maximum cycle length, but most important is the accuracy of PCU conversion factors used here. But in this pilot project, the factors used are just the same as those from another project. PCU conversion factors should be checked for their adaptability by analyzation of the actual traffic flow by each intersection, but this process couldn't be done because of time limitations in this pilot project. Therefore, PCU conversion factor used for intersection analysis in Chapter 4 was used for this pilot project (see Chapter 4). Figure 14.3.34 shows the new setting values of cycle length based on calculation results and the current cycle length. Cycle lengths during 6:00 to 6:30, 7:00 to 9:00, 9:30 to 15:00, and 16:00 to 16:30 are considerably shorter than the currently used cycle length. With these setting values, the waiting queue length is expected to be shorter than the current during red signal time. In addition to this, the cycle length during 20:30 to 21:30 are longer than the current; therefore, it is also expected to be able to reduce the occurrence of traffic congestion.



Source: JICA Project Team

Figure 14.3.34 New Setting Value of Cycle Length for Traffic Signal Control (No.19 Based on Calculation Results and the Current Cycle Length

Figure 14.3.35 shows the calculated and setting values of cycle length by each phase length. Table 14.3.8 and Figure 14.3.36 show the currently used and newly set each phase lengths and cycle length.



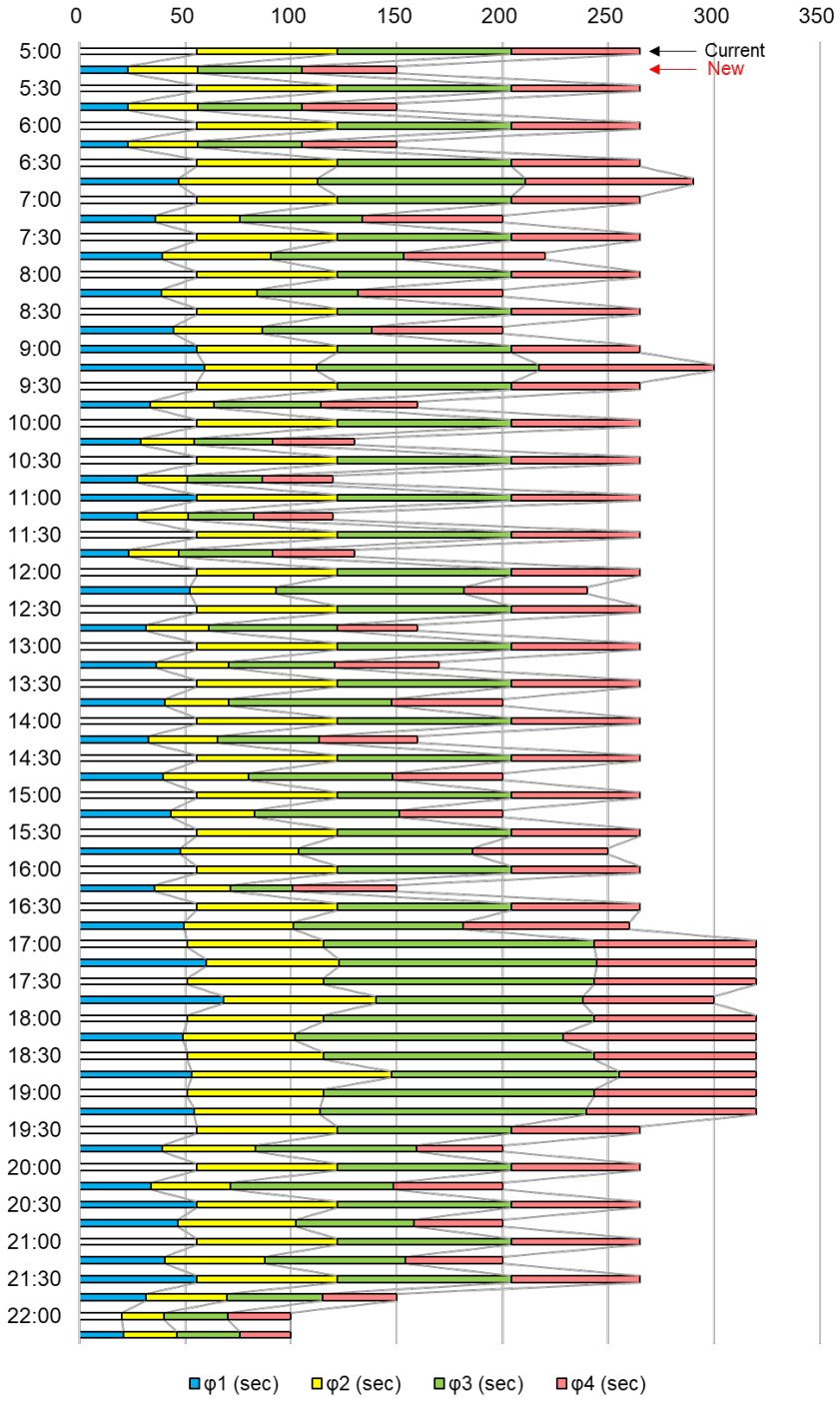
Source: JICA Project Team

Figure 14.3.35 Setting Value of Each Phase Length Based on Calculation Results

Table 14.3.8 Phase and Cycle Length

	Time	φ1 (sec)	φ2 (sec)	φ3 (sec)	φ4 (sec)	C (sec)
Current Setting	5:00	56	66	82	61	265
	17:00	51	64	128	77	320
	19:30	56	66	82	61	265
	22:00	20	20	30	30	100
	1:00	Flash				
New Setting	6:00	23	33	50	45	150
	6:30	47	66	98	79	290
	7:00	36	40	58	66	200
	7:30	39	51	63	67	220
	8:00	39	45	48	68	200
	8:30	45	42	52	62	200
	9:00	59	53	105	83	300
	9:30	34	30	51	46	160
	10:00	29	26	37	39	130
	10:30	27	24	35	34	120
	11:00	27	24	31	38	120
	11:30	23	23	44	39	130
	12:00	52	40	89	58	240
	12:30	32	30	61	38	160
	13:00	36	34	50	49	170
	13:30	40	30	77	53	200
	14:00	33	32	48	46	160
	14:30	39	40	68	52	200
	15:00	43	39	68	49	200
	15:30	48	56	82	64	250
	16:00	35	36	29	49	150
	16:30	50	52	80	79	260
	17:00	60	63	122	75	320
	17:30	68	72	98	62	300
	18:00	49	53	127	91	320
	18:30	53	94	108	65	320
	19:00	54	59	126	80	320
	19:30	39	44	76	41	200
	20:00	34	38	77	52	200
	20:30	47	56	56	42	200
	21:00	40	47	67	46	200
	21:30	32	38	45	35	150

Source: JICA Project Team



Source: JICA Project Team

Figure 14.3.36 Current and New Set Value of Cycle and each Phase Length

14.4 Survey and its Analysis on New Traffic Light Introduction

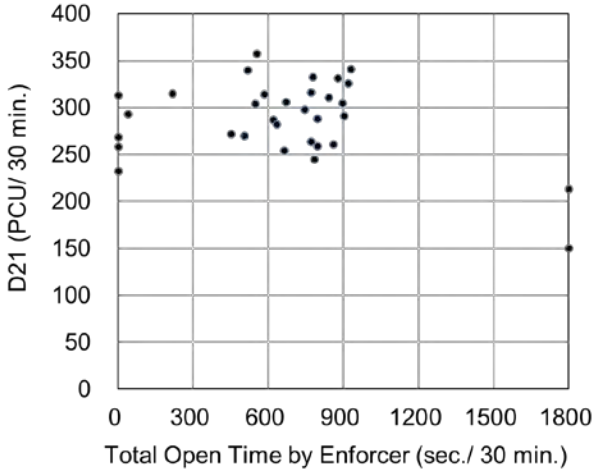
1) Analysis on the Necessity of Traffic Signal Installation at Right-Turn Pass to 1st Mactan Bridge

As already shown in Chapter 14.3, D31 and D41 heading to 1st Mactan Bridge are controlled automatically by signals; however, D21 also towards the bridge is not controlled

according to traffic regulation. However, traffic enforcers sometimes take charge of D21 heading to the bridge that, in turn, changes the permitted time to right-turn. The relation between right-turn permission time (herein after simply called “open time”) by traffic enforcer and traffic volumes of D21, D31, and D41 are then analyzed.

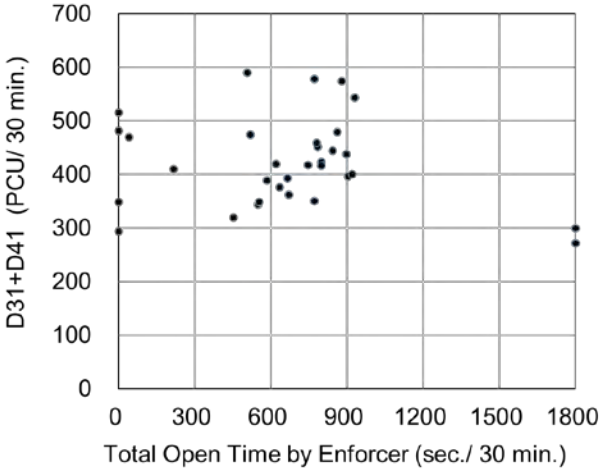
Figure 14.4.1 shows the relation between total open time by enforcer (seconds/30 min) and traffic volume of D21 (PCU/30 min). As seen in this figure, there is no relation between them. Open time is not related to the control of traffic volume of D21.

On the other hand, Figure 14.4.2 shows the relation between the total open time and traffic volume of D31 and D41 since there is a restriction of maximum traffic volume to be able to pass through the 1st Mactan Bridge. If total traffic volume of D31 and D41 is increased, the open time must be shorter to decrease the traffic volume of D21. However, this can’t be seen in the figure.



Source: JICA Project Team

Figure 14.4.1 Relation between Open Time and Traffic Volume of D21



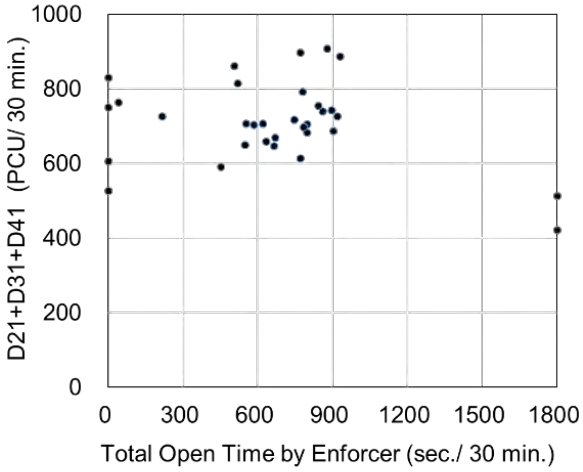
Source: JICA Project Team

Figure 14.4.2 Relation between Open Time and Traffic Volume of D31+D41

Figure 14.4.3 shows the relation between open time and total traffic volume of D21, D31, and D41. The figure shows no relation between open time and total traffic volume. Open time exists whether D21, D31, and D41 is large or small.

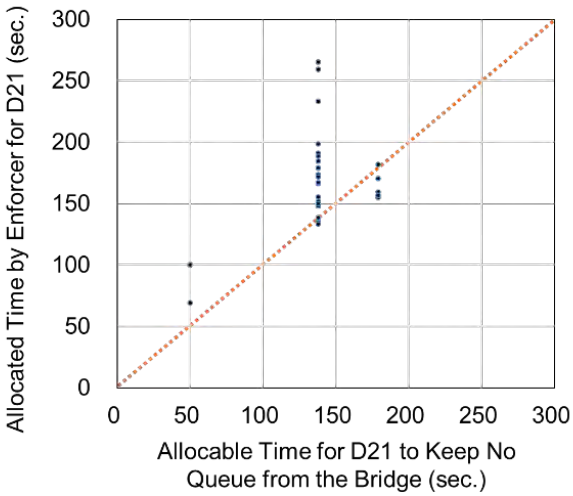
Figure 14.4.4 shows the relation between actual open time by traffic enforcers and allocable time required to prevent traffic congestion. This figure presents that the actual open time is larger than the allocable time.

According to this current situation, the installation of traffic signal is acceptable to decrease the frequency of traffic congestion.



Source: JICA Project Team

Figure 14.4.3 Relation between Open Time and Traffic Volume of D21, D31, and D41



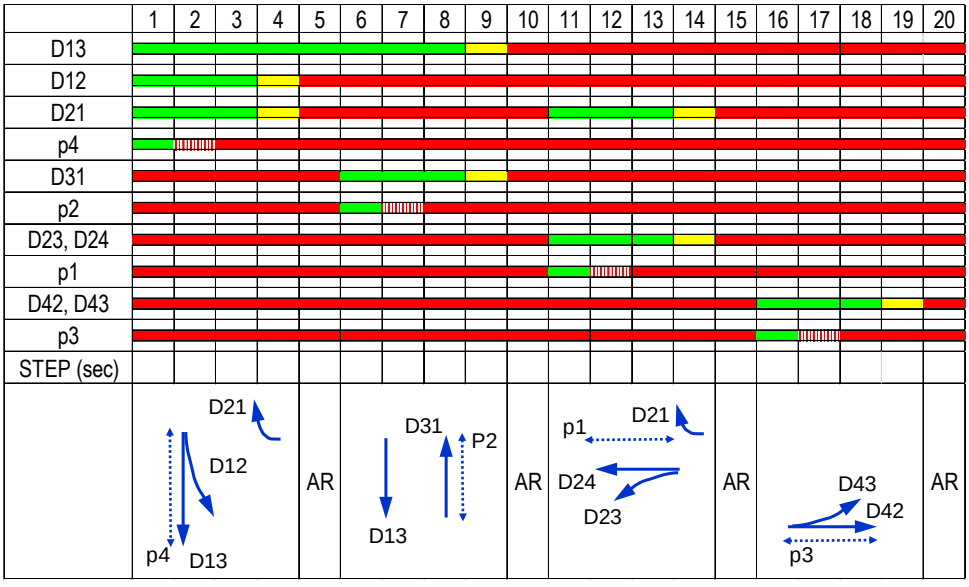
Source: JICA Project Team

Figure 14.4.4 Relation between Allocable Time and Allocated Time by Enforcer

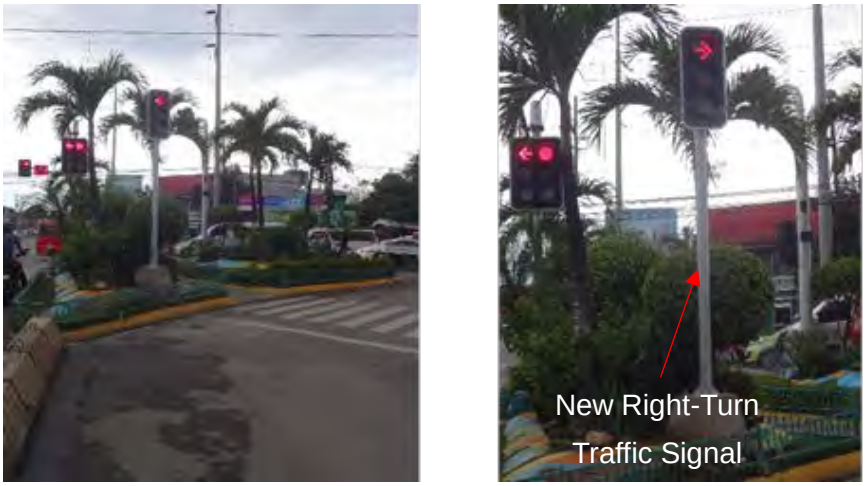
2) Traffic Signal Installation at Right-Turn Pass and Starting Operation

As shown in Figure 14.4.5, new traffic signal at right-turn pass is installed to control traffic volume to the 1st Mactan Bridge. The traffic signal phase is also set as shown in Table 14.4.1. D21 has 1st and 3rd phases; it can get green signal twice in one cycle. Through a signal phase design, replacement of 3rd and 4th phases is possible to give D21 a long green signal in one cycle. However, this phase is now considered as the alternative proposal.

Table 14.4.1 Signal Phase Design for D21



Source: JICA Project Team



Source: JICA Project Team

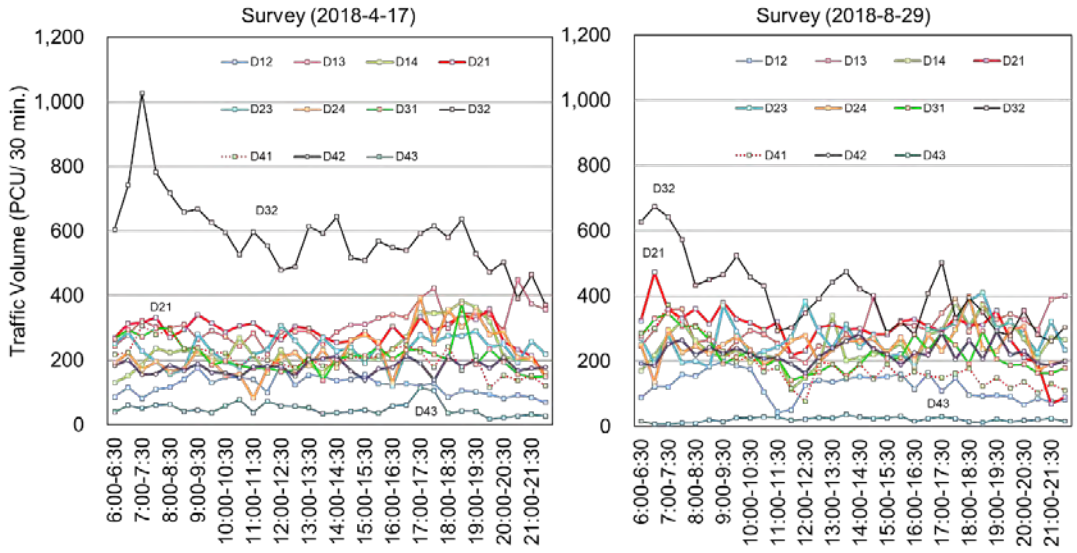
Figure 14.4.5 New Installed Right-Turn Traffic Light

14.5 Survey and its Analysis on New Traffic Signal Parameter Setting

1) Review of Traffic Signal Control No. 1

Use of the new signal parameter called traffic signal control (No. 1) started on 26 August 2018. (See Figures 14.3.34 and 14.3.35 and Table 14.4.1.) In order to evaluate its outcome, a traffic survey, which is similar to the pre-survey conducted on 17 April 2018, Tuesday, was carried out on 29 August 2018, Wednesday. The evaluation was best done on a Tuesday as well, but 28 August 2018 fell on a holiday, which is why it was moved the day after.

Figure 14.5.1 shows the results of traffic volume survey that was conducted on 17 April 2018, Tuesday. Traffic volume in some time duration is different from those before, while traffic volume of D32 was lowest among all the time lengths. D21 traffic volume was higher than before from 6:00 to 9:00 and lower from 20:00 to 22:00.



Source: JICA Project Team

Figure 14.5.1 Traffic Volume Comparison between 17 April and 29 August 2018

Table 14.5.1 shows the obtained traffic volume (in PCU). Traffic volume was used to calculate new traffic signal parameters to become more suitable to the actual traffic situation. By the way, the number of lanes for D13 is normally 2 lanes, but in the survey date, there were blocks to reduce number of lanes from 2 to 1 (see Figure 14.5.2). Accordingly, adjustment of the value of D13 was made at the calculation of traffic signal parameters by using the newly obtained traffic volume. D13 adjustment was determined as follows.

- If the (new) value taken on 29 August 2018 is bigger than the (old) value taken on 17 April 2018, then the new value must be selected.

- Determine the average, which is the sum of old and new values divided by 2, if the new value is smaller than the old.



Source: JICA Project Team

Figure 14.5.2 Traffic Situation of D13 on 29 August 2018

The adjusted value of D13 is in the rightmost column of Table 14.5.1.

Table 14.5.1 Traffic Volume by Inflow, Outflow and Time Zone (PCU/30 min)

Time	D12	D13	D14	D21	D23	D24	D31	D32	D41	D42	D43	Total	Adjusted Value of D13
6:00-6:30	88	246	169	324	270	251	277	627	285	194	15	2746	246
6:30-7:00	122	296	218	472	193	135	332	675	301	185	7	2934	296
7:00-7:30	120	357	281	358	281	295	345	642	373	253	6	3312	357
7:30-8:00	159	359	323	331	196	226	307	574	311	265	11	3062	359
8:00-8:30	154	258	263	360	201	245	311	433	305	218	10	2758	279
8:30-9:00	183	266	225	314	183	223	265	451	283	242	20	2656	288
9:00-9:30	200	216	213	381	370	252	191	465	231	223	14	2756	241
9:30-10:00	185	263	235	329	291	276	212	523	198	240	27	2779	277
10:00-10:30	176	294	196	319	215	234	232	458	218	219	26	2586	294
10:30-11:00	106	282	217	296	230	189	182	431	168	208	29	2337	282
11:00-11:30	44	255	212	322	243	214	208	293	180	211	28	2210	269
11:30-12:00	50	216	113	219	274	263	142	303	115	192	19	1906	217
12:00-12:30	126	195	150	232	383	279	155	348	77	163	22	2128	241
12:30-13:00	143	247	187	303	291	198	166	391	199	213	28	2368	268
13:00-13:30	136	242	340	312	241	235	190	444	190	239	26	2595	266
13:30-14:00	146	282	202	297	313	262	156	474	148	263	36	2581	282
14:00-14:30	153	262	210	299	242	261	190	421	191	284	29	2542	275
14:30-15:00	148	395	220	283	280	269	238	401	145	236	24	2640	395
15:00-15:30	152	282	229	282	213	223	208	287	190	221	26	2315	297
15:30-16:00	161	316	254	323	221	273	210	320	146	189	32	2445	323
16:00-16:30	114	308	181	328	193	205	284	281	168	226	15	2304	325
16:30-17:00	164	294	282	308	297	281	233	408	155	219	25	2665	313
17:00-17:30	108	348	295	289	294	231	287	503	151	286	30	2821	370
17:30-18:00	148	392	379	334	319	296	250	332	162	206	25	2843	408
18:00-18:30	96	290	309	310	386	398	192	395	177	265	14	2831	295
18:30-19:00	93	374	373	312	410	236	291	350	123	206	12	2781	374
19:00-19:30	95	328	303	355	301	231	206	291	150	292	23	2574	336
19:30-20:00	91	344	323	268	322	296	187	279	117	220	15	2460	344
20:00-20:30	67	327	269	211	284	307	191	355	137	230	18	2395	327
20:30-21:00	86	296	210	196	225	170	163	281	102	192	21	1942	373
21:00-21:30	76	390	272	69	322	194	164	262	131	188	24	2092	390
21:30-22:00	82	401	267	89	233	201	178	304	110	201	15	2081	401

Source: JICA Project Team

Table 14.5.2 shows the new traffic signal parameter calculated by using traffic volume data. The following conditions were referred to for the setting of degree of saturation required for the calculation of traffic signal parameters.

- Number of lanes for D31 is 1 for 4-wheel vehicles; however, 2-wheel vehicles go through the outside lane that is about half a lane in an actual situation. Therefore, the number of lanes was set as 1.25 for the calculation of degree of saturation for D31.

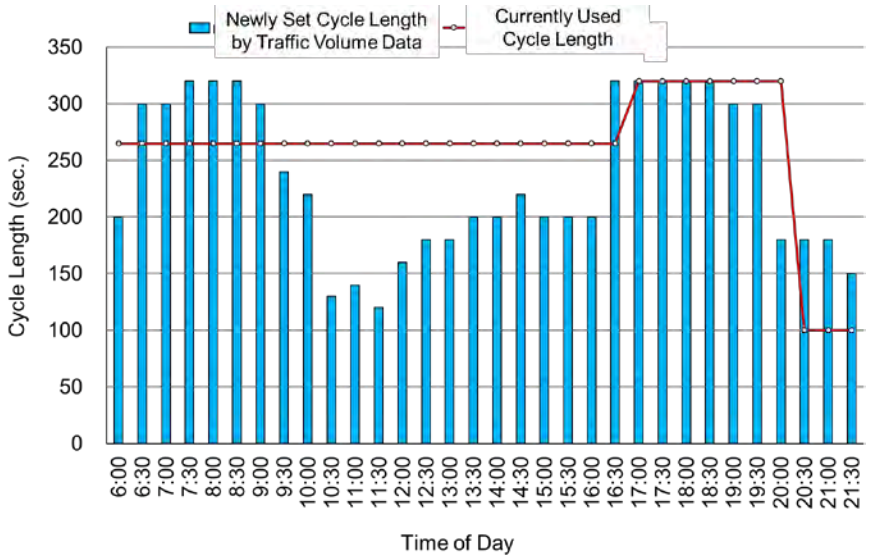
- The number of lanes for D23 is 1; however, 2-wheel vehicles use the outside lane in an actual situation. Therefore, the number of lanes for D23 was set to 1.1 for the calculation of degree of saturation.

Table 14.5.2 New Signal Control Parameter Setting by Traffic Volume Data

Time	φ1 (sec)	φ2 (sec)	φ3 (sec)	φ4 (sec)	C (sec)
6:00	27	50	62	62	200
6:30	51	91	61	97	300
7:00	46	74	83	97	300
7:30	60	80	73	106	320
8:00	53	84	80	102	320
8:30	61	76	77	106	320
9:00	54	50	111	84	300
9:30	46	46	82	66	240
10:00	45	48	62	64	220
10:30	25	26	41	38	130
11:00	20	32	47	41	140
11:30	17	21	52	30	120
12:00	29	27	77	28	160
12:30	34	31	61	53	180
13:00	33	35	58	54	180
13:30	37	34	75	54	200
14:00	37	36	64	62	200
14:30	48	49	72	51	220
15:00	41	42	59	58	200
15:30	44	42	66	47	200
16:00	38	56	52	54	200
16:30	63	68	113	75	320
17:00	59	80	98	83	320
17:30	68	70	113	70	320
18:00	46	51	140	82	320
18:30	56	80	121	62	320
19:00	54	60	101	85	300
19:30	55	62	118	65	300
20:00	30	36	69	44	180
20:30	40	47	53	40	180
21:00	36	43	62	39	180
21:30	33	39	45	33	150

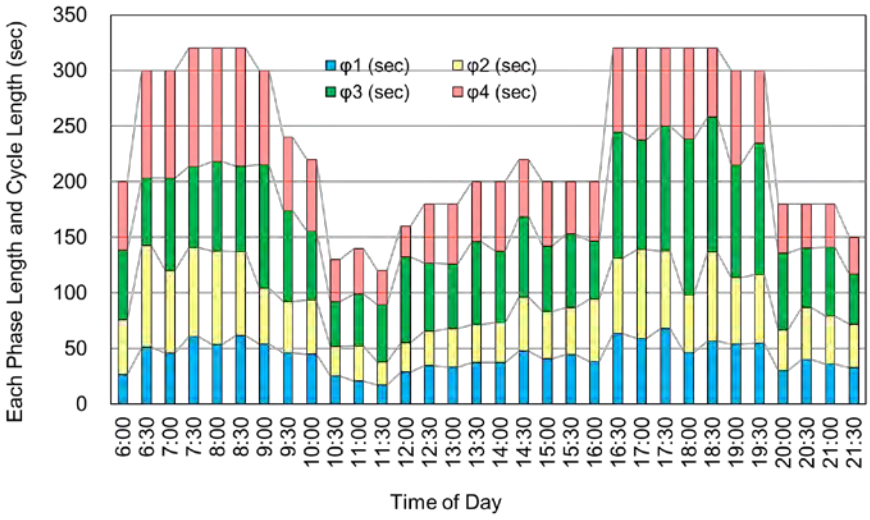
Source: JICA Project Team

Figure 14.5.3 shows the setting value of cycle length with the currently used value being operated by Lapu-Lapu City, while Figure 14.5.4 shows the new phase length at different times. These new cycle length and phase length were used for the next control parameter called traffic signal control (No. 2).



Source: JICA Project Team

Figure 14.5.3 New Cycle Length for Traffic Signal Control (No. 2) by Time of Day

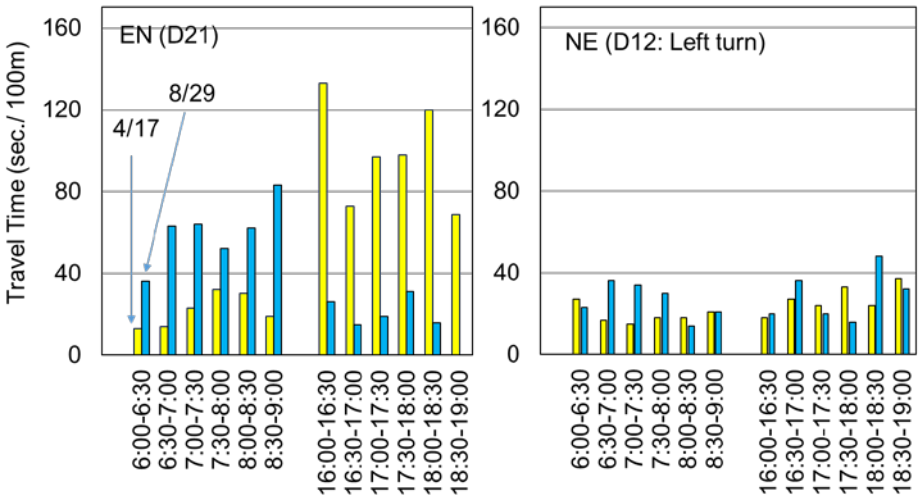


Source: JICA Project Team

Figure 14.5.4 New Cycle Length and Splits for Traffic Signal Control (No. 2) by Time of Day

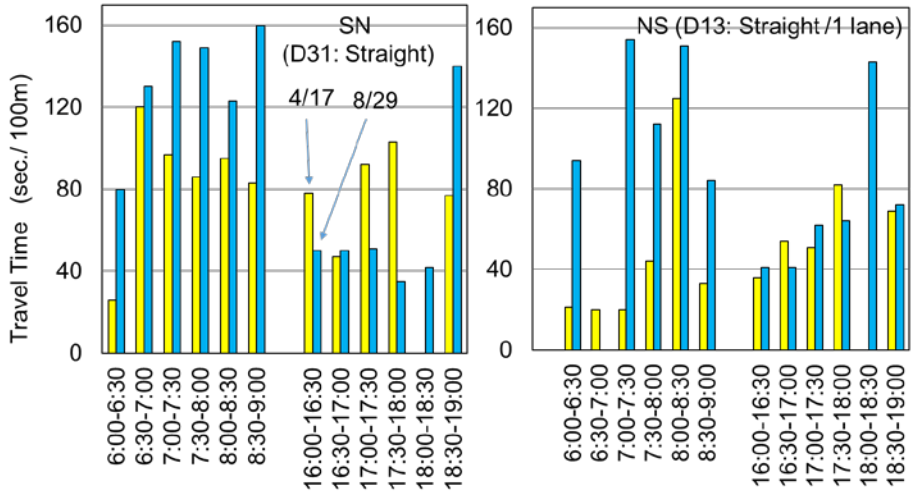
The travel survey under the traffic signal control (No. 1) went for 6 hours from 6:00 to 9:00 and 16:00 to 19:00 on the same date of traffic volume survey (29 August 2018). Origins and destinations in the travel time survey were set same as those in the17 April 2018 survey. (Refer to Figures 14.3.4 and 14.3.5.)

Figures 14.5.5 to 14.5.7 illustrate the results of travel time survey, which is the travel time between each origin and destination by a certain time period, with the 17 April 2018 survey results. Figure 14.5.5 shows the results between E and N, Figure 14.5.6 has results between N and S, and Figure 14.5.7 has results between W and E.



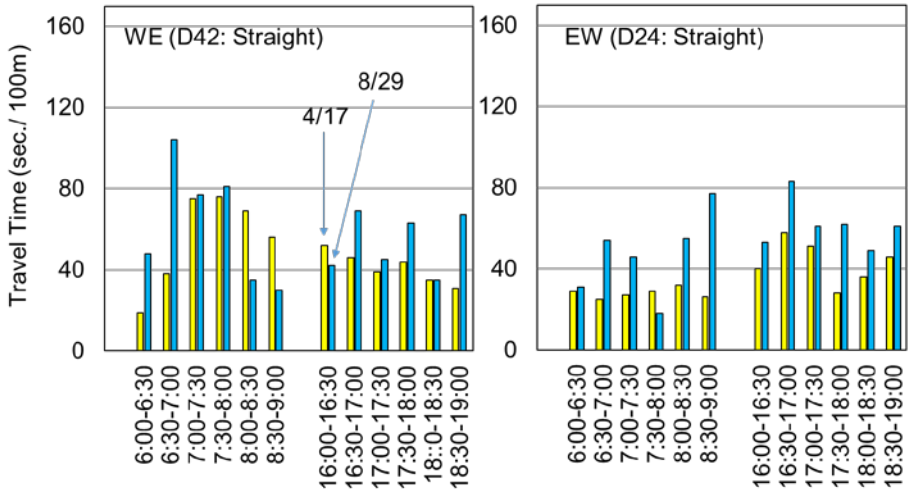
Source: JICA Project Team

Figure 14.5.5 Travel Time between E and N by Time Zone



Source: JICA Project Team

Figure 14.5.6 Travel Time between S and N by Time Zone

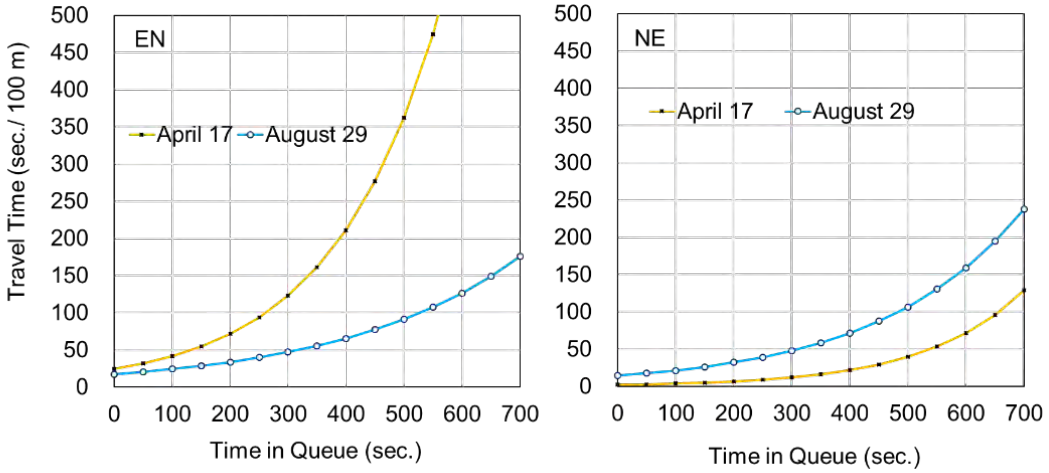


Source: JICA Project Team

Figure 14.5.7 Travel Time between W and E by Time Zone

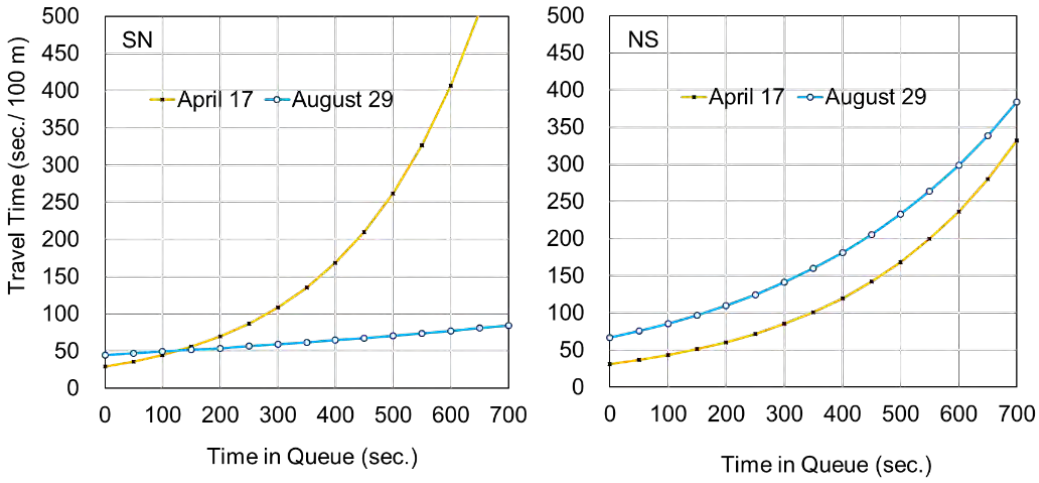
According to these results compared with the data on 17 April 2018, the travel time from E to N decreased drastically in the afternoon and the travel time difference between morning and afternoon reduced. Furthermore, the travel time between S and N increased except in some time period. However, the travel time difference between W and E were small; it is similar with the result in the April 17 survey.

Figures 14.5.8 to 14.5.10 show the relation between time in queue and travel time, which are calculated using the formula obtained from the analysis. The results of the relation between time in queue and travel time from E to N drastically improved. Even if time in queue is long, travel time is not very long. At the same viewpoint, the relation from S and N also drastically improved.



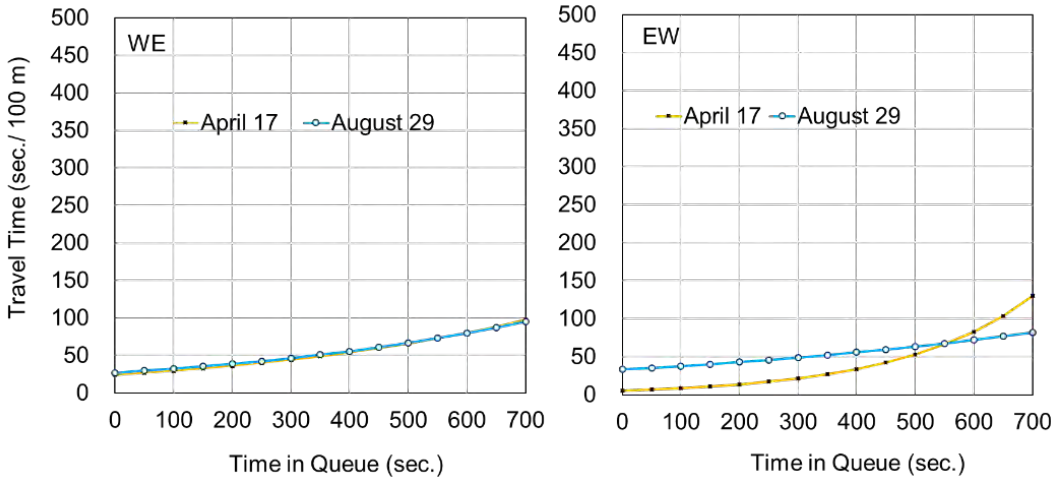
Source: JICA Project Team

Figure 14.5.8 Relation between Time in Queue and Travel Time between E and W



Source: JICA Project Team

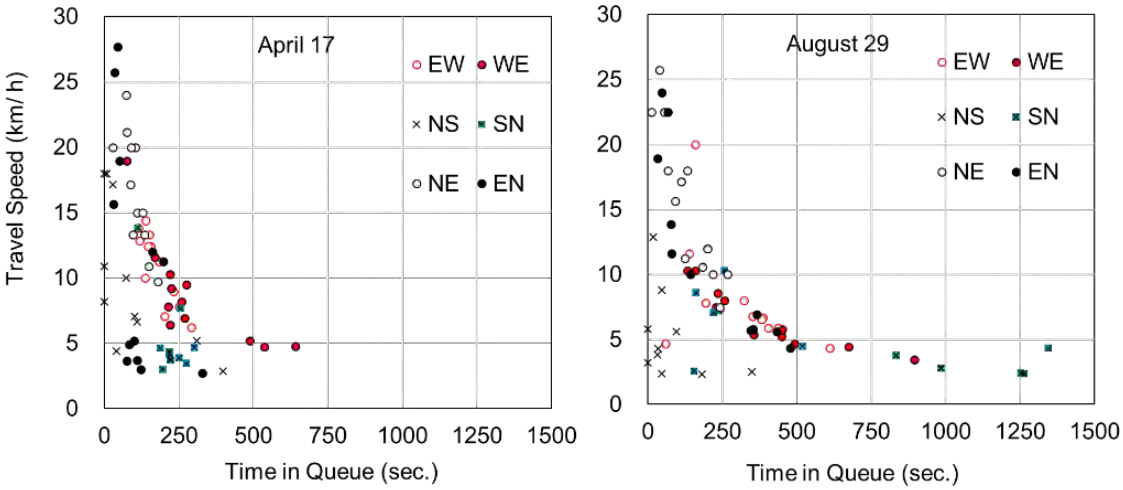
Figure 14.5.9 Relation between Time in Queue and Travel Time between S and N



Source: JICA Project Team

Figure 14.5.10 Relation between Time in Queue and Travel Time between W and E

Figure 14.5.11 shows the relation between time in queue and travel speed of all routes. Compared with the results on 17 April 2018, travel speed taken on 29 August 2018 was not so slow even if time in queue is long. In other words, there was improvement in travel speed, which can be clearly seen particularly for EW, WE, EN, and NE.



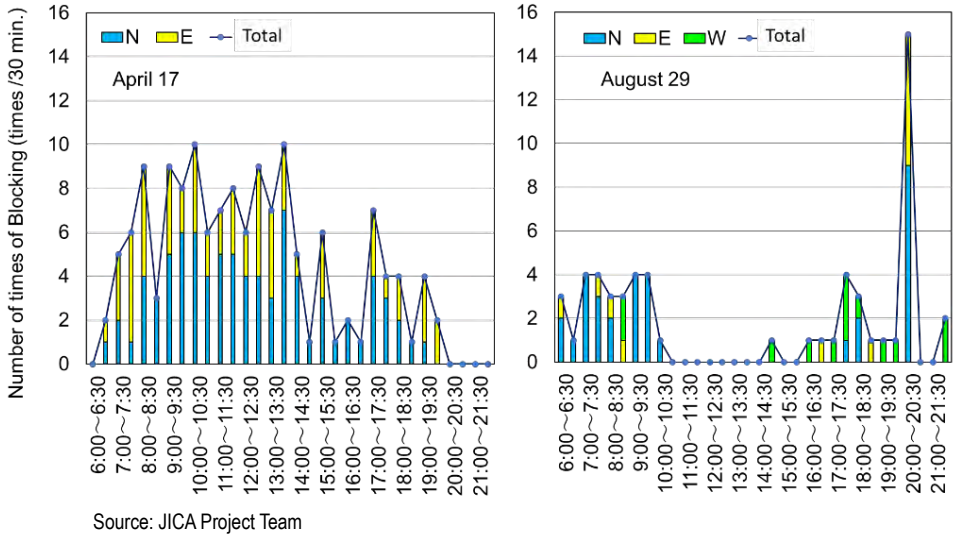
Source: JICA Project Team

Figure 14.5.11 Relation between Time in Queue and Travel Time of all OD Routes

Figures 14.5.12 to 14.5.14 show the number of blocking and total time length of blocking. The blocking situation here is defined as the queue length from the intersection on the downstream side that extends to the inside of the intersection, and another side of inflow that cannot flow into the intersection even if the green light starts.

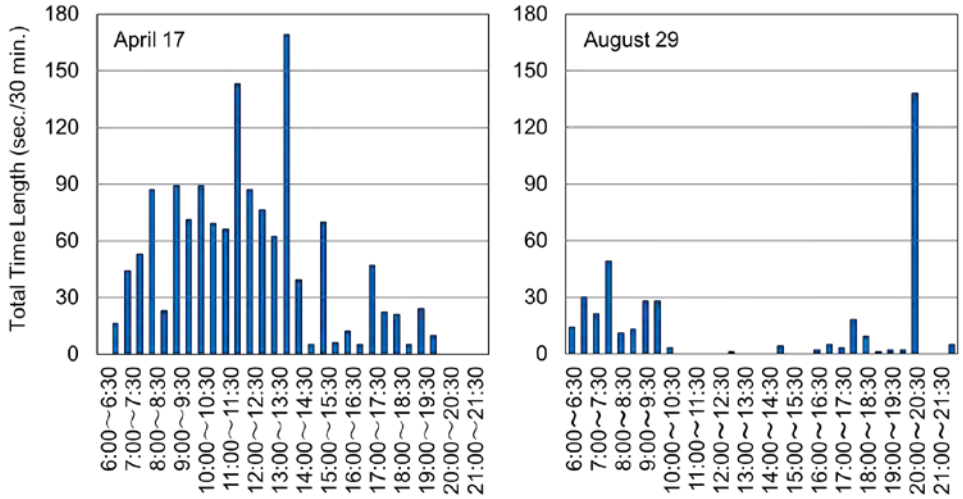
This resulted to a decrease in the number of occurrences on August 29 compared with that on April 17. This can be listed as one effect of traffic signal control (No. 1). However, in Figure 14.5.12, the number of occurrences from 20:00 to 20:30 on August 29 increased compared with that on 17 April. The reason being many violated traffic by disobeying the newly installed traffic light (D21) as seen in a video recording.

The results show the remaining traffic are mainly from D41 and D31 and generated by the slow traffic flow from 1st Mactan Bridge traffic queue. Therefore, it can be said that traffic signal control (No. 1) could reduce the bad effects from the bridge traffic queue .



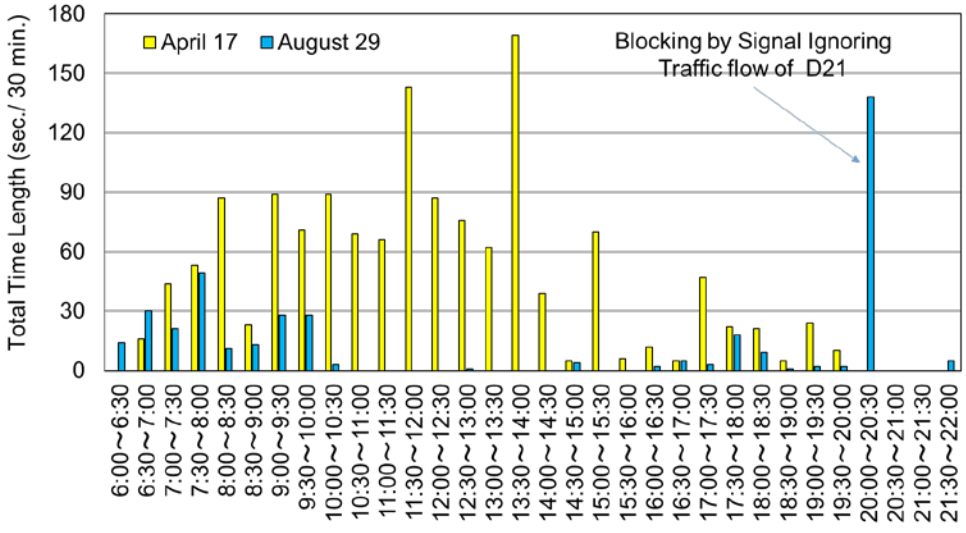
Source: JICA Project Team

Figure 14.5.12 Number of Times of Blocking by Time Zone on Traffic Signal Control (No.1)



Source: JICA Project Team

Figure 14.5.13 Total Time length of Blocking by Time Zone on Traffic Signal Control (No.1)

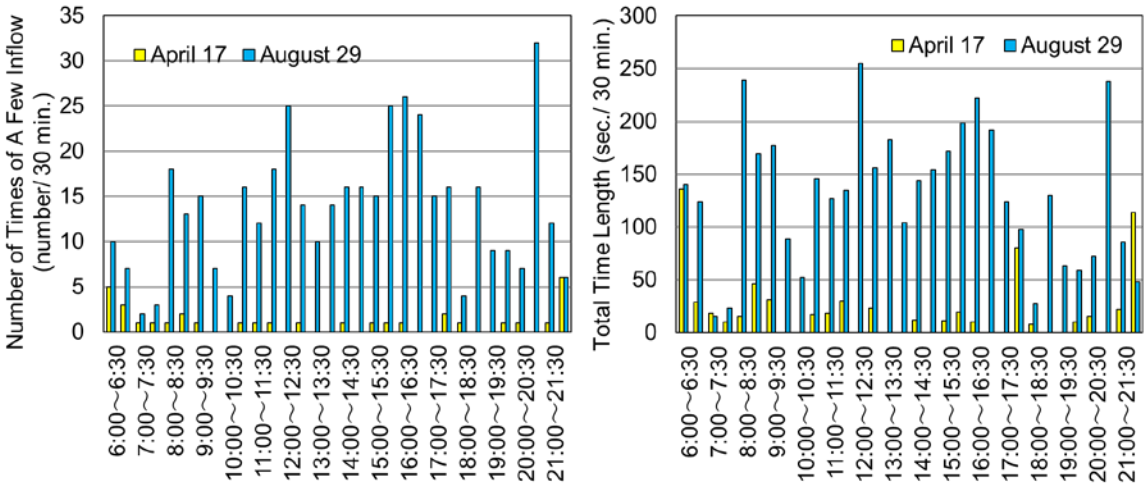


Source: JICA Project Team

Figure 14.5.14 Comparison of Total Time Length of Blocking by Time Zone between 17th April and 29 August 2018

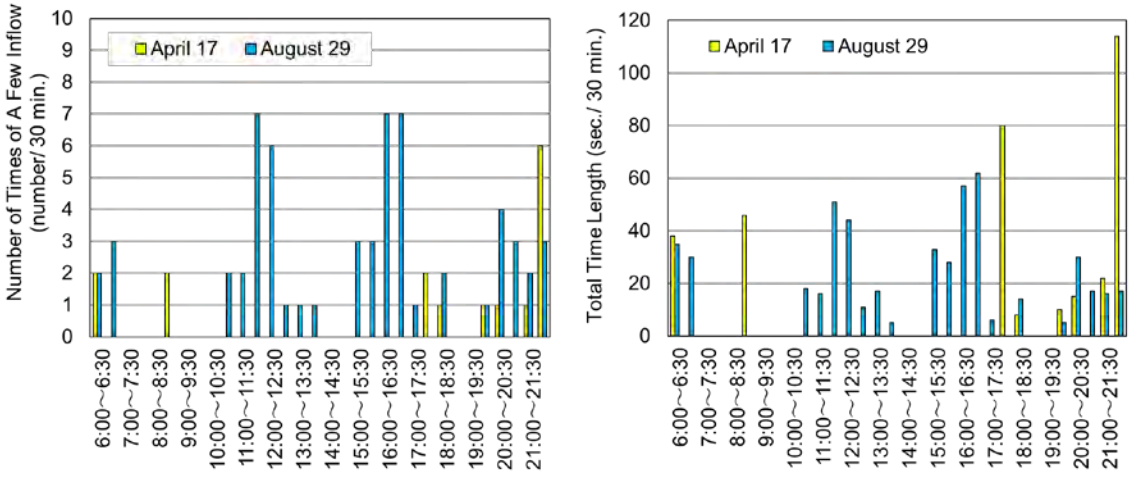
Figure 14.5.15 shows the few number of times of inflow and the total time length. The few inflow situation here is defined as when green light continues to be displayed even if there is few or no traffic inflow and the queue length at the red light side gets longer and worsens. In this figure, the number of times of a few inflow and their total time length increased on August 29 compared with that on April 17. This means there was an increase in wasted green time. Yet, it can be also said that inflow ratio increased after starting green signal that means green time could be used effectively. Shortening the total time length of green signal is highly possible and can be considered.

Figure 14.5.16 shows the number of times of a few inflow and the total time length except that related with the north approach (please take notice of the scale of vertical axis that is different with that in Figure 14.5.15.) As in the figure, the number of times of a few inflow and the total time length decreased drastically except those situations similar to the north approach. It means the possibility to shorten the green time for north approach became high.



Source: JICA Project Team

Figure 14.5.15 Comparison of Few Inflow Situation by Time Zone between 17 April and 29 August 2018



Source: JICA Project Team

Figure 14.5.16 Comparison of a Few Inflow Situation between April and August Except Occurrences Similar to North Approaches by Time Zone

2) Review of Traffic Signal Control No. 2

By using a new signal parameter as shown in Figures 14.5.3 and 14.5.4 and Table 14.5.2, the operation under new traffic signal control (No. 2) started on 9 September 2018. A traffic survey was conducted on 11 September 2018, which is the same survey conducted on 17 April 2018, to evaluate the effects of new signal control (No. 2).

A huge-scale traffic congestion along 1st Mactan Bridge occurred at around 4:30 PM. It made a long traffic queue from Mandaue area to the 1st Mactan Bridge. This situation is very unlike the normal, but this was because of a heavy rain as shown in Figure 14.5.17.

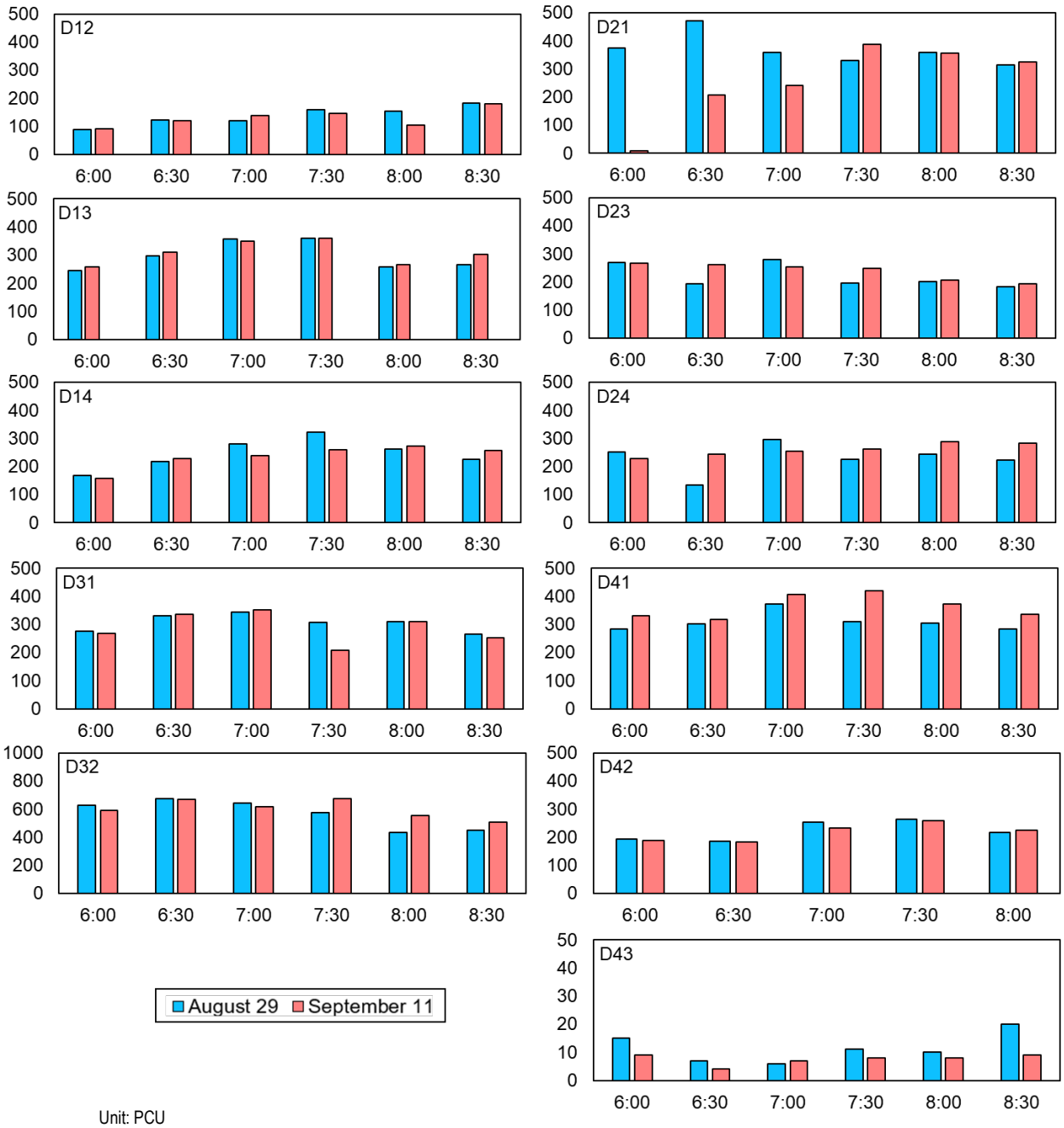


Source: Lapu-Lapu City

Figure 14.5.17 Abnormal Traffic Situation by Heavy Rain in Barangay OPAO, Mandaue City

Traffic situations between 17 April and 11 September are drastically different. It was then decided to abandon the evaluation of the effect of traffic signal control (No. 2), but the outlines of data in the morning was still described for reference in this report.

Figure 14.5.18 shows the traffic volume (PCU/30min) for 3 hours from 6:00 to 9:00 compared to the data of traffic signal control (No. 1) on 29 August 2018. Traffic volume for each direction is almost same with that from 29 August, except that of D21 from 6:00 to 7:00. The recorded traffic volume data of D21 is extremely small because the video reference was corrupted and surveyor could not count vehicles.



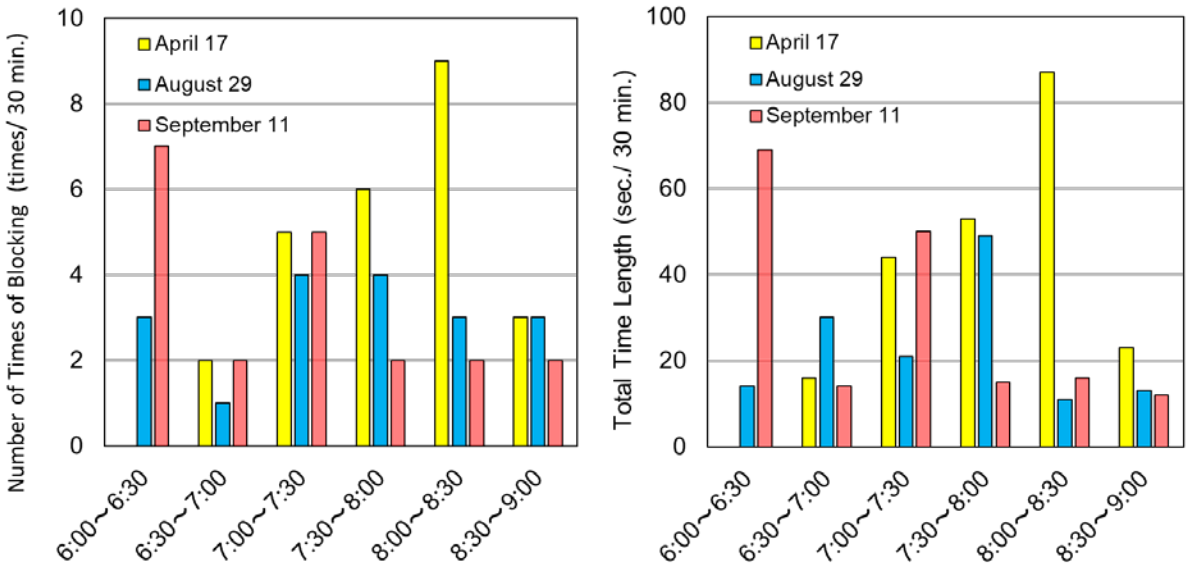
Unit: PCU

Source: JICA Project Team

Figure 14.5.18 Comparison of Traffic Volume by Inflow, Outflow, and Time Zone on 29 August and 11 September 2018

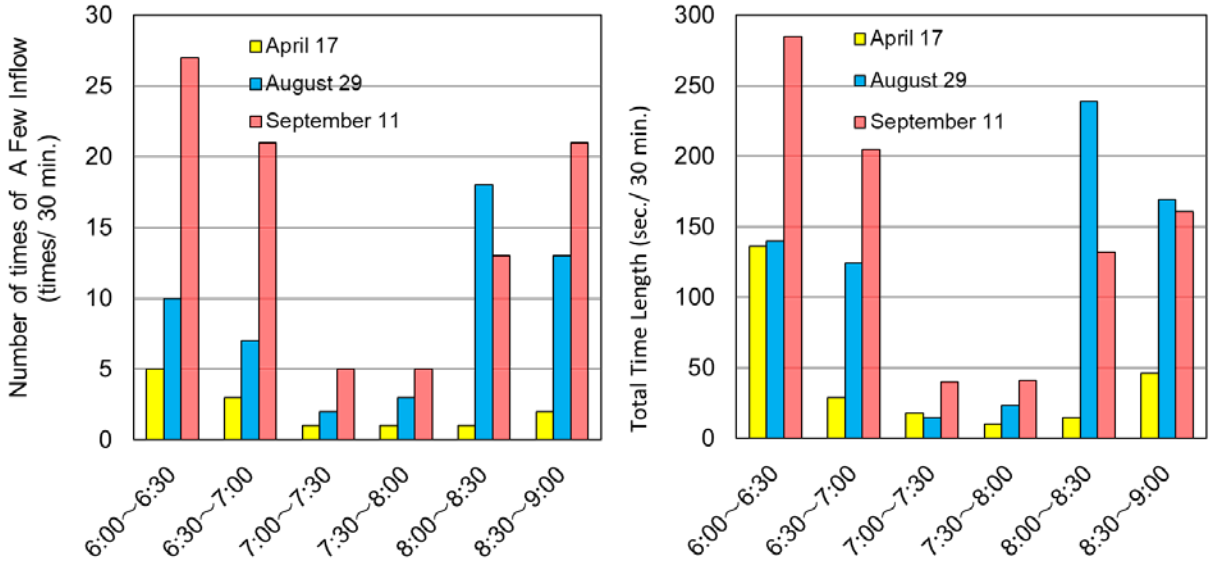
Figures 14.5.19 and 14.5.20 are the results from 6:00 to 9:00. Figure 14.5.19 shows number of times of blocking and the total time length. Figure 14.5.20 shows number of times of few inflow and total time length along with the survey results on 17 April and 29 August 2018.

The recorded number of times of blocking and total time length of blocking from 6:00 to 6:30 and 7:00 to 7:30 were the biggest among the 17 April and 29 August 2018 surveys. In other time periods, the results were almost same or slightly lower compared to those on 29 August 2018. Also, the number of a few inflow and total time length increased compared to those on 17 April and 29 August 2018.



Source: JICA Project Team

Figure 14.5.19 Comparison of Number of Times of Blocking and Total Time Length by Time Zone on 17 April, 29 August, and 11 September 2018



Source: JICA Project Team

Figure 14.5.20 Comparison of Number of Times of A Few Inflow Situation and Total Time Length by Time one on 17 April, 29 August, and 11 September 2018

3) Review of Traffic Signal Control No. 3

By using new signal parameter (see Figure 14.3.34), Figure14.3.35 and Table 14.3.8 shows the new traffic signal control (No. 3) that commenced operations on 17 September 2018, Monday. The traffic signal parameter in traffic signal control (No. 3) are basically same with that of traffic signal control (No. 2). However, the clearance time (yellow time and all-red time) was changed since there were many blocking situations even under the operation of traffic signal control (No. 2). Therefore, it was determined as a countermeasure to change the clearance interval time from 5 to 6 seconds as shown in Table 14.5.3. The clearance interval time was set 5 sec that is 4 sec at the yellow interval and 1 sec at the all-red interval for traffic signal controls (No. 1 and No. 2). This was changed to 6 sec that is 4 sec at yellow interval and 2 sec at all-red interval for traffic signal control (No. 3). If the clearance interval

time was set at a long duration, the green time would be short. However, it was considered to prevent any occurrence of blocking situation and lead to a more efficient signal control.

Table 14.5.3 Clearance Intervals in Traffic Signal Control (No. 1 and No. 2) and Traffic Signal Control (No. 3)

				Y	AR	G (D13, 31)			Y	AR	G (D21, 23, 24)			Y	AR	G (D42, 43)			Y	AR
Traffic signal control (No.1, No.2)				4 sec	1 sec				4 sec	1 sec				4 sec	1 sec				4 sec	1 sec
Traffic signal control (No3)				4 sec	2 sec				4 sec	2 sec				4 sec	2 sec				4 sec	2 sec
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
D13																				
D12																				
D21																				
p4																				
D31																				
p2																				
D23, D24																				
p1																				
D42, D43																				
p3																				
	D21 D12 p4 D13				AR	D31 P2 D13				AR	p1 D21 D24 D23				AR	D43 D42 p3				AR

Source: JICA Project Team

A traffic survey was conducted to evaluate traffic signal control (No. 3). The survey went for 6 hours in total from 6:00 to 9:00 and 16:00 to 19:00. Survey contents are similar to the survey conducted on 17 April 2018.

Figure 14.5.21 shows the results of this survey along with those from 17 April and 29 August 2018 under the traffic signal control (No. 1). The figures show there were not many differences of traffic volume among them except the following.

D13, from 17:00 to 17:30 (18 September 2018, Tuesday)

D21, from 6:30 to 7:00 (29 August 2018, Wednesday)

D32, from 7:00 to 7:30 (17 April 2018, Tuesday)

D43, all time zones (17 April 2018, Tuesday)

For D13, D21, and D32, it is important to consider the traffic volume variations in their specified time zone for the evaluation of traffic signal control. On the other hand, the rates of motorcycles in D43 on 29 August, Wednesday, and 18 September, Tuesday, drastically decreased from almost one-fifth to one-sixth of data on 17 April, Tuesday. The decrease is due to the newly opened PUJ terminal on the Approach 4 direction of according to the command center of Lapu-Lapu City. Commuters possibly use PUJ for their trips instead of *habal-habal*. In any case, D43 is right-turn on red; therefore, it is not directly related to the evaluation of traffic signal control on the pilot project.



Unit: PCU

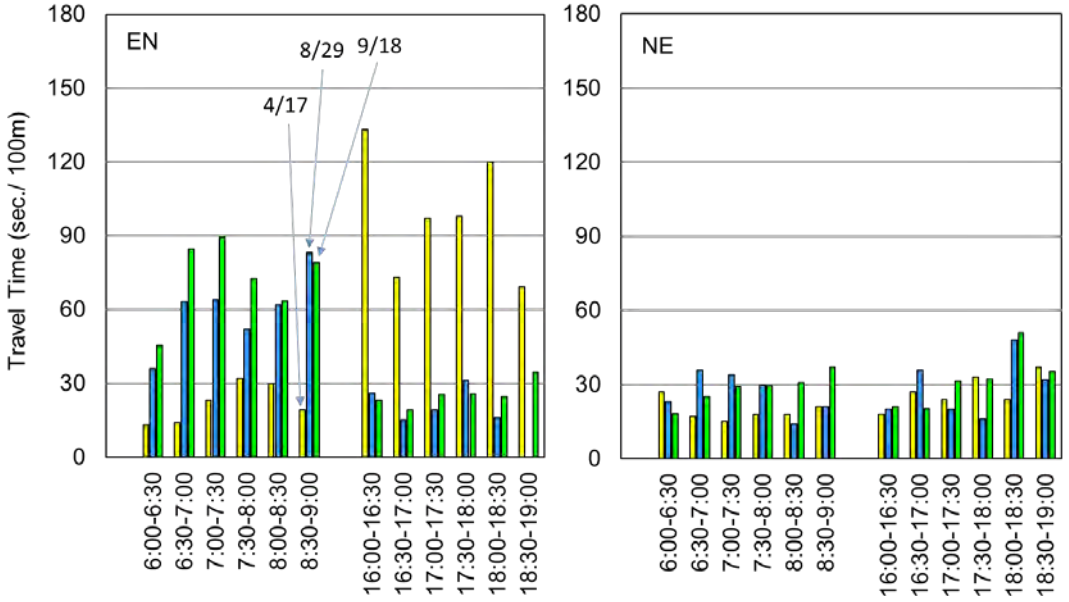
Source: JICA Project Team

Figure 14.5.21 Comparison of Traffic Volume by Time Zone on 17 April, 29 August and 18 September 2018

The travel time survey was carried out under traffic signal control (No. 3) for 6 hours from 6:00 to 9:00 and 16:00 to 19:00 on 18 September 2018, Tuesday. The content of survey is same as traffic survey on Tuesday, 17th April 2018.

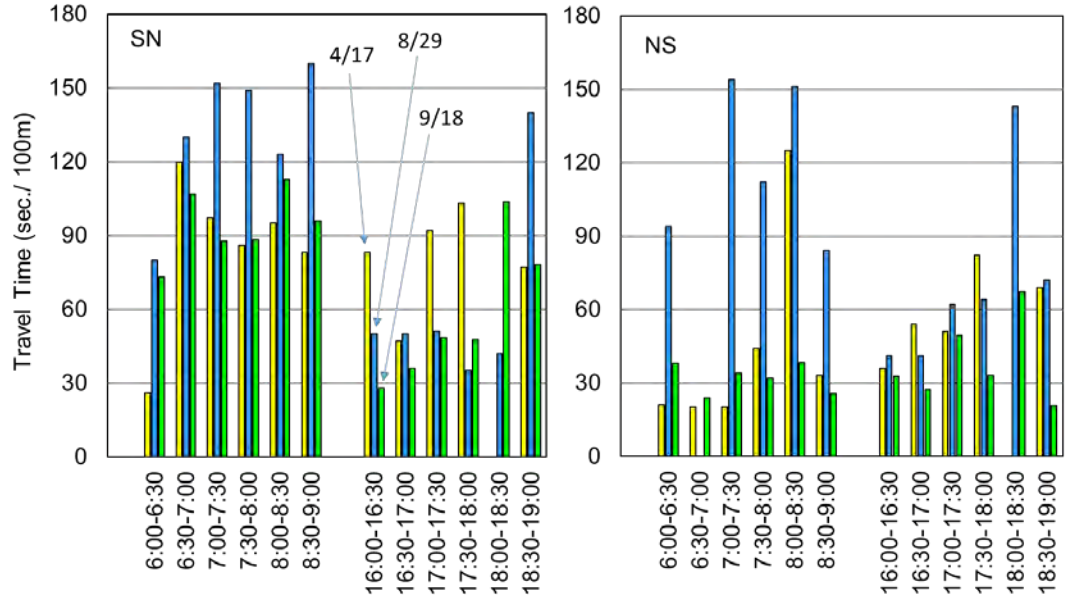
Figures 14.5.22 to 14.5.24 shows the travel time between each route together with the results under the traffic signal control (No. 1) obtained on 29 August 2018 and preliminary survey results obtained on 17 April 2018. Figure 14.5.22 shows the results for E to N and N to E, Figure14.5.23 shows the results for S to N and N to S, and Figure 14.5.24 shows

the results for W to E and E to W. According to these results, the travel time on 29 August and 18 September 2018 between E to N was longer than that on 17 April 2018 in the morning. However, travel time on 29 August and 18 September 2018 drastically reduced than that on 17 April 2018 in the afternoon. The difference of travel time between morning and afternoon was reduced. Travel times between S to N and N to S increased on 29 August and 18 September 2018 except in some time periods. The travel times on between W to E and E to W was not so different and almost same on 17 April, 29 August, and 18 September 2018 except in some time periods.



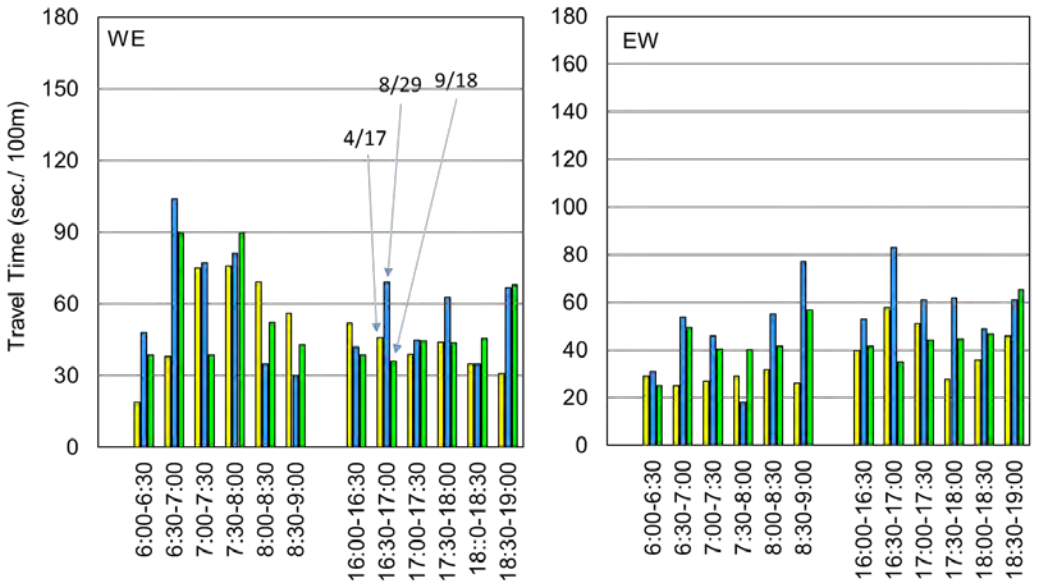
Source: JICA Project Team

Figure 14.5.22 Comparison of Travel Time between E and N by Time Zone on 17 April, 29 August, and 18 September, 2018



Source: JICA Project Team

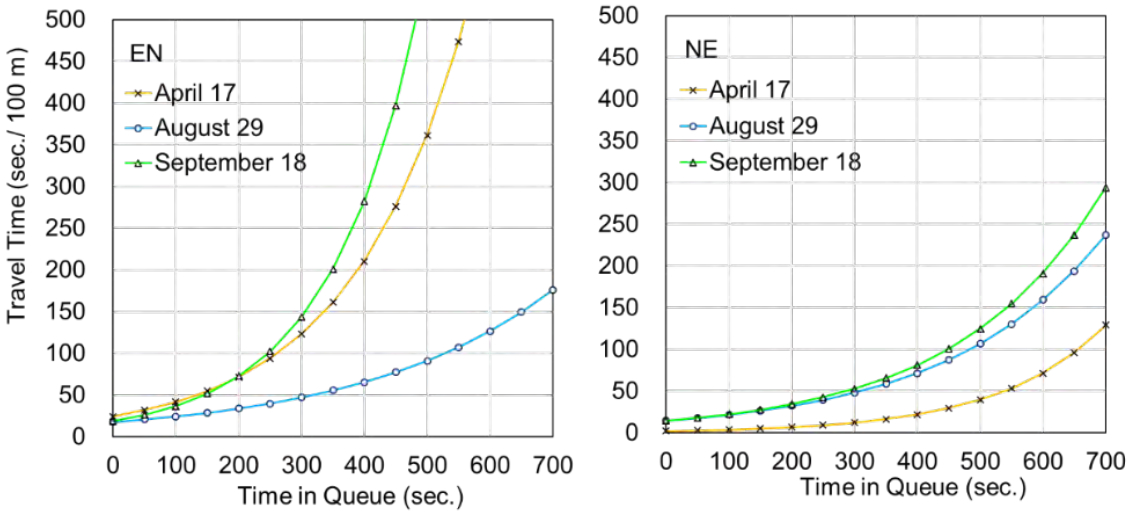
Figure 14.5.23 Comparison of Travel Time between S and N by Time Zone on 17 April, 29 August, and 18 September, 2018



Source: JICA Project Team

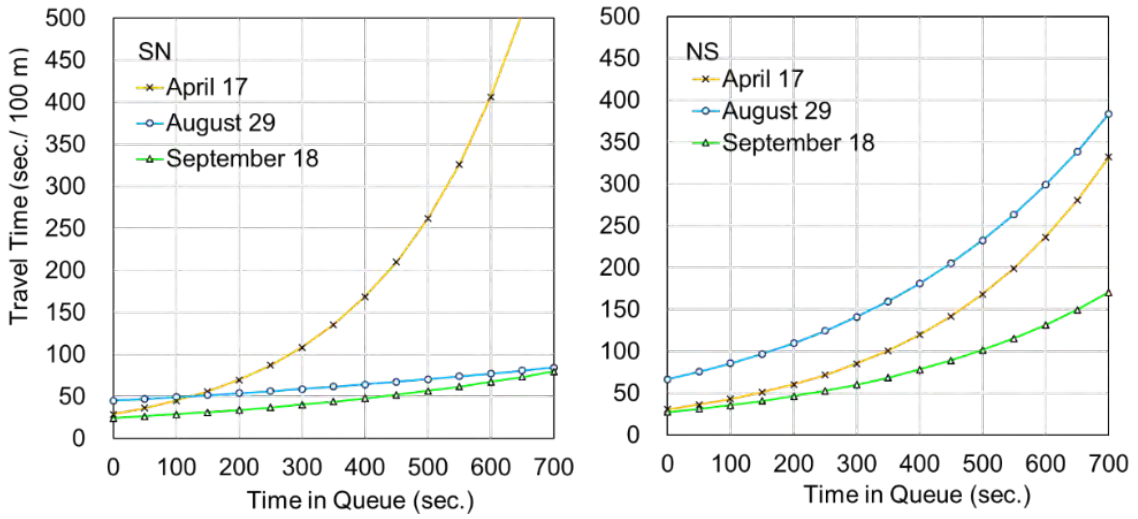
Figure 14.5.24 Comparison of Travel Time between W and E by Time Zone on 17th April, 29th August and 18th September, 2018

Figures 14.5.25 to 14.5.27 shows the relation between time in queue and travel time by using the equations obtained through data analysis. According to the result, the relation between time in queue and travel time for E to N drastically improved in comparison to that on 29 August 2018, but worse compared to that on 18 September 2018. This may be due to the red signal operation on the newly installed signal to control D21 at the corner to the bridge. On N to E, there was no large difference between 29 August 2018 and 18 September 2018. S to N results on 29 August and 18 September 2018 clearly drastically improved. N to S results on 18 September 2018 showed the most improvement than those on 29 August and 17 April 2018.



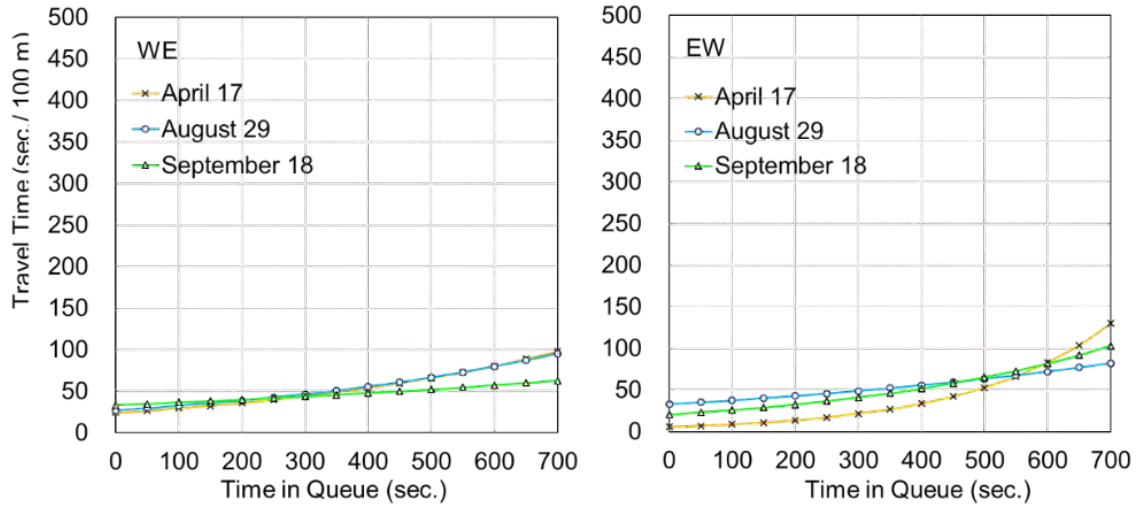
Source: JICA Project Team

Figure 14.5.25 Relation between Time in Queue and Travel Time between E and N by Time Zone on 17 April, 29 August, and 18 September 2018



Source: JICA Project Team

Figure 14.5.26 Relation between Time in Queue and Travel Time between S and N by Time Zone on 17 April, 29 August, and 18 September 2018

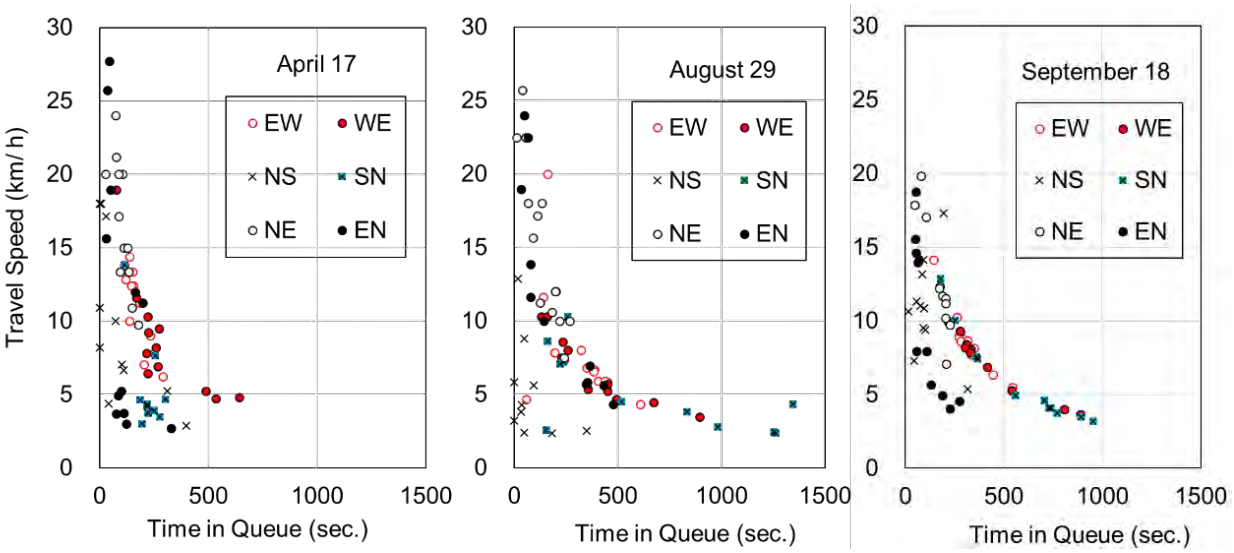


Source: JICA Project Team

Figure 14.5.27 Relation between Time in Queue and Travel Time between W and E by Time Zone on 17th April, 29th August and 18th September, 2018

Figure 14.5.27 shows the relation between time in queue and travel speed obtained on 17th April, 29 August (under the signal control (No.1)), and 18 September 2018 (under signal control (No. 3)).

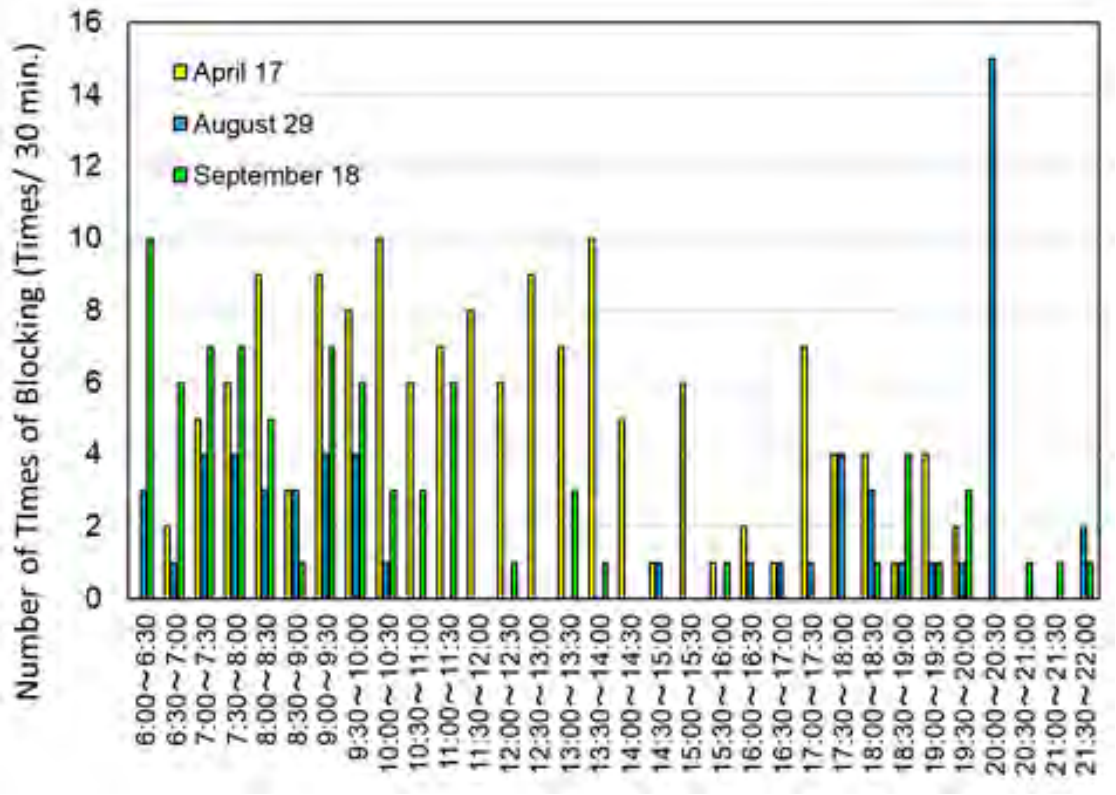
According to the results, the characteristic relation between time in queue and travel speed became clearer on 29 August and 18 September 2018 than that on 17 April 2018. Generally speaking, if the time in queue becomes long, then travel speed becomes slow. The general characteristic became clearer, meaning, the traffic flow at this intersection became more of a normal traffic flow. It will be easier to apply the normal traffic theory to the more normal traffic flow as it makes estimation easy.



Source: JICA Project Team

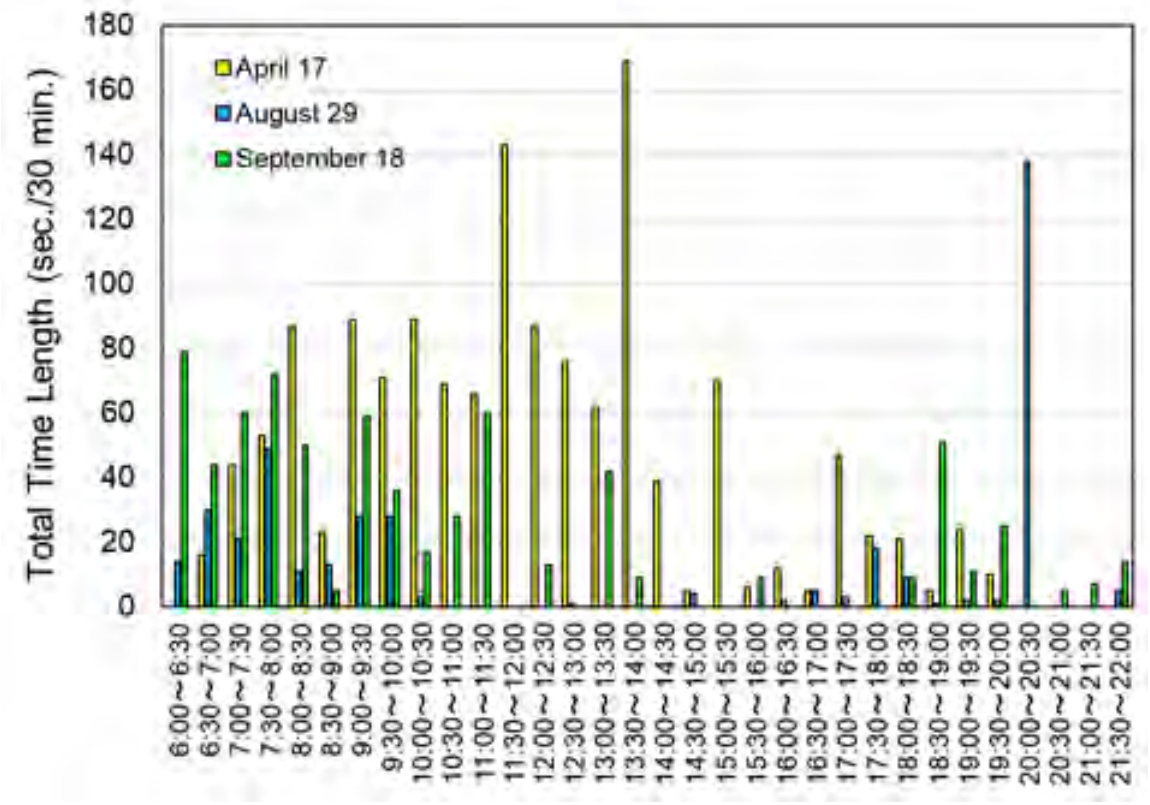
Figure 14.5.28 Relation between Time in Queue and Travel Speed by Time Zone for All Directions on 17 April, 29 August, and 18 September 2018

Figure 14.5.28 shows number of times of blocking and the total time length of blocking. According to the result, the biggest number of times of blocking was from 6:00 to 8:00 on 18 September 2018. On the other hand, at a different time duration, the biggest number of times of blocking was on 17 April 2018. The total time length of blocking was reduced at all times except before 7:00. The total time length on Tuesday, 18 September 2018 drastically reduced. For the increase in the number of times of blocking, it should be noted that there were existing vehicles that disobey newly installed traffic signal and these vehicles are from the long queue of 1st Mactan Bridge. Anyway, according to the results on signal control (No. 3), the total time length decreased, although the number of occurrences increased. Therefore, this is one of the effect of changing the clearance interval from 5 to 6 sec.



Source: JICA Project Team

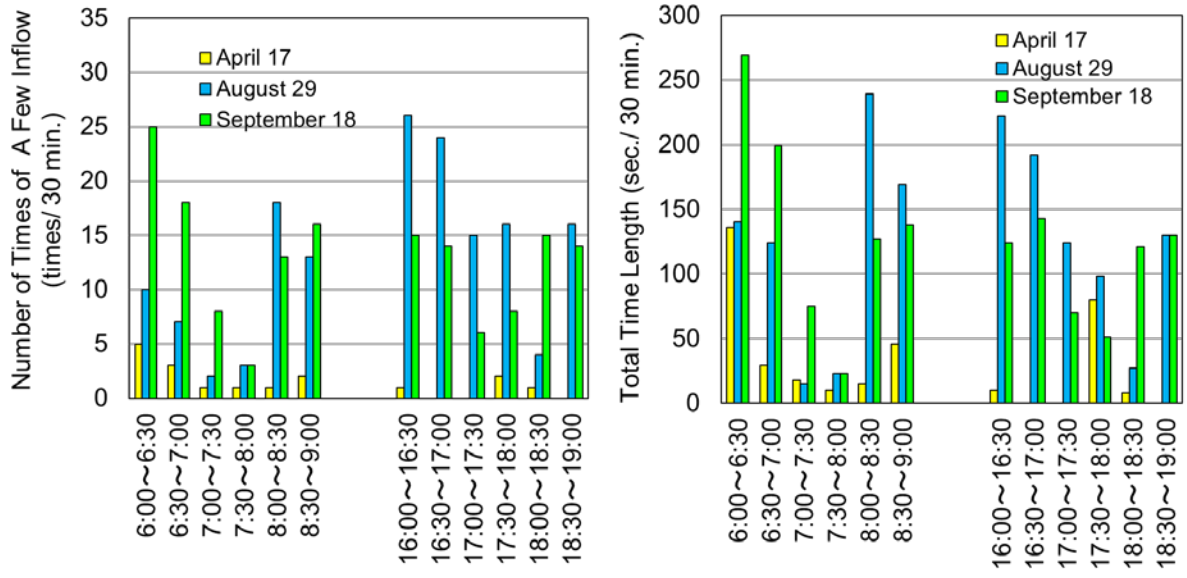
Figure 14.5.29 Number of Times of Blocking on 17 April, 29 August, and 18 September 2018



Source: JICA Project Team

Figure 14.5.30 Total Time Length of Blocking on 17 April, 29 August and 18 September 2018

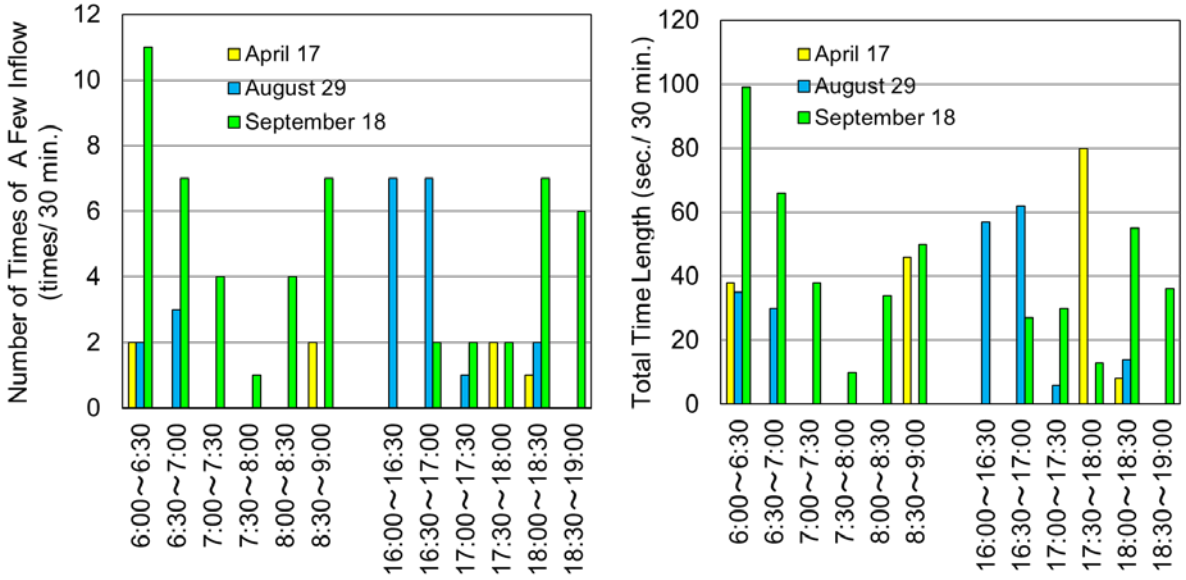
Figure 14.5.29 and Figure 14.5.30 show the number of times and total time length of a few inflow. Both number of times and total time length increased on 29 August and 18 September 2018 compared to that on 17 April 2018. This means the wasted green time became longer on both dates. However, this result can also show that traffic flow rate increased after green signal turned on, meaning, traffic flow into the intersection became more efficient. There is a likely possibility to shorten the length of green time.



Source: JICA Project Team

Figure 14.5.31 Number of Times and Total Time Length of A Few Inflow on 17 April, 29 August and 18 September 2018

Figure 14.5.32 is the result of the number of times and total time length a few inflow on 17 April, 29 August, and 18 September 2018 except the north approach since a few inflow situation was observed. The scale of the vertical axis in Figure 14.5.32 is different from Figure 14.5.31. The number of times and total time length of a few inflow drastically decreased except on the north approach. This means the possibility is high to shorten the length of green signal phase related to the north approach. At the same time, it can be pointed out that it is required to introduce a new signal control system to shorten the green time length based on the actual inflow situation such as actuated signal control system to be able to terminate green signal based on inflow situation.



Source: JICA Project Team

Figure 14.5.32 Number of Times and Total Time Length of A Few Inflow on 17 April, 29 August and 18 September 2018 Except Occurrences from the North Direction

14.6 The Results and the Recommendation to the Future

The pilot project was implemented to transfer basic knowledge and grasp the current issues on traffic signal control through field study. Basic knowledge includes method of traffic signal control and setting method of signal parameters and so on. One intersection at the 1st Mactan Bridge was selected as the target intersection as it would be easy to understand the purpose of this pilot project and evaluate effects of traffic signal control.

The 1st Mactan Bridge intersection was selected being located in a remote area from the adjacent intersections and can be regarded as an independent intersection. In addition, this intersection was affected by the traffic congestion from 1st Mactan Bridge. Elimination of traffic congestion was important before mitigation of various issues on traffic signal control. There are also many traffic occurrences that affect traffic signal control even at the independent intersection. During these situations, the most important thing is to distinguish the original cause of traffic congestion.

The summary of the pilot project implemented at the target intersection is as follows.

(i) Traffic survey to grasp the current traffic situation.

(ii) Listed issues on traffic signal control based on the result of traffic survey.

(iii) Consideration of traffic signal control to resolve the issues listed up.

(iv) Implement new traffic signal control.

(v) Analysis and evaluation of new traffic signal control.

(vi) Summary and recommendation for future plans.

Results obtained from the pilot project were summarized.

(i) It was pointed out, at the consideration of traffic signal control at the intersection, the most important is to eliminate factors of traffic congestion from the adjacent traffic facilities. In this case, it was the traffic queue from 1st Mactan Bridge.

There are 3 traffic inflows to 1st Mactan Bridge, two of which can be adjusted by traffic signal. The other traffic inflow can't be adjusted because there is no traffic light, it is right-turn on red, and manual operation is unsuitable. Therefore, new traffic signal was installed to control traffic inflow to 1st Mactan Bridge.

Review of the current countermeasures on traffic congestion has not been done. This kind of viewpoint is most important for the implementation of future countermeasures to traffic congestion. In heavily congested places, there are many opinions for countermeasures. Flyover and/or underpass are often proposed. However, as the premise, it is essential to discuss in advance the effect of countermeasures with as much detail as possible.

(ii) The following items can verify that the traffic situation can be improved when traffic signal parameters are set to correspond to the actual traffic condition obtained through traffic survey.

- Travel time became stable and predictable to the traffic situation at some extent.
- Blocking situation in which vehicles can't flow in the intersection because of remaining vehicles at intersection was reduced.

(iii) A few inflow situations increased in the second half of green signal and it might be assumed to the traffic flow after starting green signal became more efficient than before. At the same time, it can be said that if the green signal length can be shortened, then it also possible with the cycle length as well.

It can also be said there are some possibilities to introduce the actuated traffic signal control, which terminates green time at certain conditions, such as no or a few inflow situation.

(iv) The necessity and usefulness to set traffic signal parameters to fit the actual traffic situation were understood by traffic enforcers and other workers in the same field.

(v) Selection of optimum traffic signal control method based on actual traffic situation is also important. Its implementation during the determined period of time isn't impossible.

Based on the obtained knowledge through this pilot project, future issues that may be resolved through traffic signal control by corresponding more to the actual traffic situation were listed as follows.

(i) Traffic signal control is often raised as a countermeasure to traffic congestion. In this case, the most important is to find out the cause of traffic congestion. If traffic congestion is not due to traffic signal control, then traffic signal control should be first step of countermeasure. After implementation of other countermeasures, optimization of traffic signal control should follow if necessary.

In this pilot project, the original reason of traffic congestion was the traffic queue from 1st Mactan Bridge. Therefore, the countermeasure of adjusting traffic volume on 1st Mactan bridge was considered. On the other hand, signalization around the target intersection is currently in progress. There must be a future discussion on the connectivity of several signalized intersections as a single network. At that time, the most important is still same as previously mentioned—the reason of traffic congestion should be identified first.

Reasons for traffic congestion may be very difficult to determine especially in the current situation that long cycle length are used at many intersections. To resolve this, various countermeasures should be continuously implemented until the most effective is determined.

(ii) Although signal control parameters were set based on traffic volume obtained from the traffic volume survey of this pilot project, traffic volume varies on the day of the week and season. So, current signal control parameters should be updated as early as possible.

For that purpose, collection of traffic volume data by season, day of the week, and time zone at the earliest is essential and set signal control parameters to correspond to each data.

(iii) Simultaneously, determination of how the current signal control parameters were set at other intersections is necessary as well as whether the current set value correspond to the current traffic conditions.

If the current signal control parameter does not correspond to the actual traffic situation, prompt investigation by traffic volume survey is necessary and set parameters that correspond to the current traffic situation.

For the time being, it is necessary to repeat setting traffic signal parameters based on the traffic condition.

(iv) A more advanced countermeasure is for the current traffic signal control device to have sensors or detectors etc. Administrators should use them. If the device does not have sensors or detectors, they should be installed. In short, considering an automatic method of traffic volume measurement and data collection is necessary and, consequently, automatically calculate the signal control parameters using the collected data.

(v) Maintenance policy of the equipment should be reviewed to automatically update signal control parameters with the accumulated data.

If each LGU does not have their own maintenance policy, they should consider to make it.

(vi) Traffic volume should be automatically measured by sensors and detectors to make a traffic volume database by time zone, day of the week, and season. In accordance with this database, a timely signal control parameter can be set.

(vii) Even if a traffic volume database was made, the actual traffic volume situation is not constant. Therefore, the importance of actuated traffic signal needs to be recognized and introduced.

15 CAPACITY DEVELOPMENT ACTIVITIES

1) Overview

Primary targeted participants of capacity development in this project are public officers of the planning and development offices, and transportation offices or traffic management offices (if applicable) of province, cities and municipalities in Metro Cebu area. Capacity development activities were delivered in the form of seminars, workshops and a study visit to Japan. There are on-going activities to enhance capacities of traffic enforcers at the Metro Cebu Traffic Enforcer Academy, which was initiated by the Sub-Committee on Transport and Traffic Management of the MCDCB.

Major capacity development activities were carried out in March, May and August 2018. It was initially designed and planned to have a sequential capacity development activity, such as transport plan 101, pre-study visit, study visit to Japan, and post-study visit information sharing workshops, but because of several inevitable reasons, it did not go as initially intended. The capacity development activity was also planned to complement each other with the Traffic Administration Course offered by the National Center for Transport Studies (University of the Philippines), it did not happen either.

Overall, the participation rate was not good. The total number of participants for all trainings and workshops is more or less 75 participants. It was unfortunate for the project that National Center for Transport Studies has completed its comprehensive five-day course targeting the same participants of this project just before the project carried out the capacity development activity. However, the attendance of GIS training and the lecture about the traffic demand forecast analysis lecture were quite good. It seems a hands-on training or lecture is well received by LGUs since they are directly related to the participants' daily work.

It was observed throughout the activities that the participation from municipalities far from Cebu City is not high. It was also observed that very rare participation from some specific cities and municipalities for unknown reasons. Although the total number of participants was not high as expected, it was well understood because some municipalities had a few permanent public officers in traffic management and planning and development offices. Even most of participants who work as traffic enforcers are either contractual or job order, which are six-month contract base or part-time position. Because of such situation, it is also pointed out and should be emphasized that knowledge and skills as well as the efforts of education and training cannot be retained at designated institutions unless employees feel secure in their job and position.

Although capacity assessment was not carried out as an independent survey, questionnaire surveys for participants regarding their training background and needs of training were carried out before capacity development activities. It is understood from the Detailed Planning Survey report of the Master Plan Study on Urban Transport System Development in Metro Cebu Project conducted in February 2017 and also the results of the questionnaire survey that the number of experts on traffic engineering and/or transport planning are quite limited at the LGUs. In some LGUs, the head of CPDO or engineering office holds dual position, as the head of traffic management office. Since assigning a traffic officer is not a mandatory at any LGU levels, according to the Local Government Code, it is fair to say that status of dual positions does not necessarily mean insufficiency of administrative structure of the LGUs. The results also show most of public officers do not receive formal education on transportation or urban planning related subjects nor receive structured trainings but attending only a half day to a few days training or workshops.

The DOTr released the DO in June 2017 and it envisions a restructured, modern, well-managed, and environmentally sustainable transport sector, while passengers will have reliable, safe and comfort trip. As a part of the road-based public transport reform program, the DOTr shifts the determination and provision of public transport services from the private

sector to the public sector. The current DOTr's movement, delegating the planning, implementing and monitoring local public transport will a new challenge for most LGUs, needless to say, to LGUs in Metro Cebu, as well.

Although the "Local Public Transport Route Plan Manual" became available in October 2017, as the DOTr stated in the DO, a capacity development to LGUs is inevitable for them to formulate a route planning. In the capacity development of this project also takes into account of such situations when designing the capacity development program.

Based on the manual, it is presumed that following competency/knowledge are needed for public officers in charge to carry out the route rationalization.

- Basic principles of transportation planning
- Basic principles of the linkage between transportation and land-use (urban planning)
- Traffic engineering and management
- Public transportation planning
- Data collection and management (traffic surveys, passenger surveys, etc.,)
- PUV supply and passenger demand analyses

Besides above, needed areas of capacity development identified by LGUs are a) method of traffic survey and analysis for intersection improvement, b) methodology of traffic demand analysis, c) usage of GIS software, d) spatial analysis applying GIS data, e) traffic impact assessment and/or how to evaluate a traffic impact assessment report, f) road network planning, g) traffic management, and h) traffic surveys.

2) Capacity Development Activities

Capacity development activities conducted in this project were seminars and workshops and a study visit to Japan, which was carried out in May 2018.

(1) Seminars and Workshops in Metro Cebu

The following subjects covered at seminars/workshops to accommodate the needs and requests from the LGUs.

The participants were not only managerial level officers, but also officers dealing with practical activities on urban and transportation planning and traffic management.

- Basic principles of transportation planning
- Strategy for traffic management by LGUs
- Basic principles of the linkage between transportation and land-use (urban planning), and the concept of transit oriented development (TOD) and the cases in Japan. Exercise on problems analysis regarding integrated urban and transportation development in Metro Cebu
- Strategy for integration of transport and urban planning through comprehensive land use plan (CLUP)
- Basic concept of traffic engineering and management
- Understanding the necessity of traffic demand analysis, and the methodology and designing of traffic surveys and their implementation and monitoring, and transportation forecasting (4 step models) method
- Basic concept and methodology of traffic impact assessment
- Basic principles of public transport planning
- Financing strategy for traffic management by LGUs
- Implication of GIS and urban & transportation planning
- Implication of utilization of traffic signaling system and mitigation of traffic congestion
- Empirical success practices of traffic management and public transport administration in other countries

- Pilot project (once a pilot project(s) is decided, information sharing and activities, to some extent, will be carried out with selected participants).

(2) Study Visit to Japan

A study visit to Japan was conducted from May 20th to May 26th 2018 for seven days. It was suggested by the DOTr to make it a weeklong trip not to disturb essential tasks at respective participants' office. Participants visited Tokyo, Yokohama and Kobe city. Considering the current traffic issues and institutional and planning perspectives of urban planning and transport in Metro Cebu, the program was designed to learn about the experience in City of Yokohama and Kobe City and visit various sites, including the infrastructure proposed as priority projects, such as automated guideway transport system (AGT), dual-mode bridge and traffic control center. It also highlights the empirical lecture and site visit about TOD.

- How local governments have positioned traffic policies in urban facility development plans and their mid & long-term developments plans and have maintained investments and infrastructure development over decades.
- Coordination and cooperation mechanisms among related agencies to keep up with the implementation of mid & long-term urban and transport development plans.
- Consensus building process at every step of development, i.e. planning, budgeting and implementation among related agencies in local government as well as with a regional transport council and a municipal urban plan advisory board.
- Regulations, ordinances, guidelines and other instruments formulated through planning to implementation stages to carry out urban and transport developments. (ex. Yokohama MM21 development, TOD Seishin New Town development)
- Public transport administration and involvement of local governments to TOD (Kobe)
- How city administration has overcome institutional, organizational and financial challenges on planning, government approval and the implementation.
- How large-scale residential development and mass public transport development are to be mutually imperative factors for integrated urban development, how crucial that mass public transport to be a profit-generating business to carry on residential and transport developments.

Table 15.1.1 The Schedule of the Study Visit

Date	Time	Contents
May 20th (Sun)		Flight: MNL - NRT
		Flight: CEB - NRT
May 21st (Mon)	AM	Visit: Station integrated development at Minatomirai Station (MM02)
	PM	JICA HQ courtesy call
		Visit: Public transport facilities in Shinjuku area
May 22nd (Tue)	AM	Presentation by the Study tour group: Urban transport policy in Metro Cebu
		Lecture: Urban transport policy in Yokohama City
		Lecture: Operation of Yokohama City subway
		Lecture: International cooperation through Public-Private Partnership (Introduction of Japanese corporate technology)
	PM	Visit: Sakuragicho Station (JK11/B18) - Center kita Station (B30/ G05)
		Visit: Kohoku New Town (Integrated development at around station area)
		Visit: Center kita Station - Center minami Station (B29/ G04)
		Visit: Facilities development under elevated subway at Center minami Station
May 23rd (Wed)	AM	Lecture: Urban development MP in Kobe City and comprehensive transport plan and TOD scenario
		Lecture: TOD study about Seishin New Town development project (Urban development guideline: public facilities and infrastructure improvement by development adjustment)
	PM	Visit: TOD study about road transport (Piedmont bypass and connection new town to downtown by toll expressway)
		Visit: TOD study about Seishin New Town (Residential complex, research academic town, comprehensive athletic park, industrial complex and logistic industry town)
		Visit: TOD study about Urban rapid railway and Extension of Seishin railway (Connection new town to downtown) Train: test drive Seishin raiway from Central Seishin to comprehensive athletic park)
		Visit: Large are expressway network project (Investment environment improvement: Akashi-Kaikyo Bridge and integrated improvement for industrial town and expressway)
May 24th (Thu)	AM	Lecture: TOD study about Port Island area development project (Investment environment improvement: Multi transport mode network and urban infrastructure facilities)
		Lecture: Improvement of major road and its vonstruction budget (Connection bridge to Kobe International Airport, road for all transport mode except cars and Harbor Highway)
	PM	Vice mayor of Kobe City courtesy call
		Visit: TOD study about Port island are development project (Kobe International Airport, connection bridge, urban transport system, medical industrial city, academic zone, Harbor Highway and Rokko Island)
May 25th (Fri)	AM	Lecture: Road network improvement in Kobe City (Improvement policy of urban planned roads) Town roads improvement through urban planning project (Continuous three-dimensional crossing project, downtown redevelopment project and land readjustment project)
		Lecture: Sannomiya central area in Kobe city: Improvement of public transport nodes (Traffic management: Intersection processing, bus guide system and pedestrian space improvement)
	PM	Visit: Urban transport node: Sannomiya area (Street improvement status through urban planning project) 1. Yamashita Line (Continuous three-dimensional Crossing Project) 2.Goinoike Line (Urban redevelopment project) 3. Takamatsu Line (land readjustment project))
		Reflection meeting of the study tour
May 26th (Sat)		Flight: KIX - MNL
		Flight: KIX - CEB

Source: JICA Project Team

The study visit was designed to accommodate urban planner, transportation planner, traffic engineer who are in the position of decision-making and lead urban and/or transportation planning at the planning and development office and/or transport office/ transport management office.

A pre-study visit seminar and port-study visit seminar were conducted. The study visit was carried out in May. For both seminars, a program coordinator from Kobe City was invited. For the pre-study seminar, basic information about Kobe City and its background of city development, and information about the abovementioned topics were presented for the participants to familiarize the development history and city administration's development policies and activities on urban development and transport. The post study-visit seminar was conducted in August. Although it was intended to share the experience and information with public officers who could not join the study tour, the attendance was very limited. The participants of the study visit presented their findings and made suggestions what can be applied in Metro Cebu. The program coordinator from Kobe City also presented the materials used in the study tour to provide more detailed information to the participants. Besides the post-study visit, there was a workshop about simulation on transit oriented development.

The details about the capacity development activities are attached in Appendix 2.

16 CONCLUSIONS AND RECOMMENDATIONS

16.1 Conclusions

Metro Cebu, the Study Area, is a core metropolis in the Visayas Region with a population of about 3 million, and its population is expected to increase up to 5 million by 2050. In order to maintain its functions and roles as metropolis, it is necessary to expand and improve the current urban transportation system and to facilitate various socioeconomic activities.

The current traffic congestion in Metro Cebu becomes chronic due to the insufficient urban transport infrastructure which cannot meet the increasing traffic demand every year. The current situation analysis clarified the delay of improvement and development of arterial roads, urban mass rapid transit (UMRT) and other main transport networks, mainly connecting among central areas such as Cebu City, Mandaue City and surrounding LGUs. On the other hand, increase in users of private cars and motorcycles is remarkable. In this Project, supplemental traffic surveys were carried out to update the traffic database of the Roadmap Study. The future demand and supply gap was analyzed through the demand forecast.

In the Project, while development vision of the Roadmap Study was adopted, development scenario of Metro Cebu was slightly updated based on the consideration for the recent development trends, census results, and necessity for the effective and efficient development in the appropriate areas for development. Since integration of transport development with urban development is necessary for the implementation of effective and efficient development, multi-functional road space (Complete Street) and the land use indicating both urban and transport development (TOD Mixed Use and Roadside Mixed Use) were proposed. These proposals were materialized through case study of updates on Comprehensive Land Use Plan (CLUP) for 3 LGUs.

Since it is very important for Metro Cebu Urban Transport System “to ensure mobility and accessibility" based on the current situation analysis and future urban development policy, it is set as the basic policy of urban transport development in Metro Cebu. In order to realize this policy, orientation of development and improvement of each sub-sector were analyzed as follows:

Road and Bridge: Considering the serious traffic congestions throughout Metro Cebu, following measures are particularly important;

- Increase of capacity and functions by arterial roads (e.g. national highways) widening (conversion to Complete Street).
- Separation of intra-area traffic and through traffic by the development of circumferential road and bypass roads.
- Enhancement on linkage between Mactan Island and Cebu main island through increase of traffic capacity by construction of new bridges.
- Improvement on the traffic flow at major intersections by traffic control including small scale geometric improvement as well as construction of flyover and underpass.

UMRT: Development of transit that enables efficient mass and rapid transport is indispensable along major transport corridors where traffic demand concentrates such as national highway traversing through Metro Cebu and the route connects between the center of Cebu City and Mactan Island with the airport etc.

Road-based Public Transport: Ongoing Cebu BRT should be completed and start its operation on schedule. Along with DOTr's Public Utility Vehicle (PUV) modernization program, quantitative and qualitative improvement of bus and jeepney services need be promoted. Regarding water transport and Areal Ropeway Transit (ART), feasibility for an alternative mode of bus and jeepney as well as a feeder service should be further studied.

Traffic Management: Improvements on various aspects such as optimal traffic signal control at intersections, traffic control by traffic enforcers, traffic information provision, traffic safety, etc. are necessary. Appropriate coordination among LGUs and capacity enhancement on traffic management are required to implement necessary improvements.

Following five priority projects were identified based on the comprehensive analysis through the Project and endorsed by the region and provincial governments as well as LGUs:

i) Mandaue-Lapu Lapu Link Road Bridge and Mandaue Coastal Road

ii) Metro Cebu Circumferential Road (Phase1: Segment 1)

iii) UMRT Central Line (Phase1: Central Section)

iv) UMRT Coastal Line (Phase 1)

v) Metro Cebu Area Traffic Control (ATC) System

Among the above priority projects, Preliminary Feasibility Study (Pre-F/S) was conducted for Mandaue-Lapu Lapu Link Road Bridge and Mandaue Coastal Road Project. The rationale of the project was confirmed including recommended location and mode type as a road bridge.

In order to enhance the capacity of relevant LGU officers to planning and management of urban transport, following two pilot projects were implemented for the areas where LGU is directly responsible for implementation among the projects proposed by Master Plan. Process and results of the pilot projects were shared with all LGUs in Metro Cebu.

a) Formulation of Local Public Transport Route Plan (LPTRP)

b) Improvement if Traffic Signal Control

16.2 Recommendations

Master plans and phased implementation strategies up to 2050 were formulated and proposed for the development of urban transport system in Metro Cebu. The proposed fundamental policies and targets of the proposed urban transport master plan and the development principles of each sub-sector are described in the conclusion. The phased implementation strategies (short-, medium- and long-term) are listed in Table 16.2.1 to Table 16.2.3.

Road and Bridge: In the short-term, Mandaue-Lapu Lapu link Road Bridge and Mandaue Coastal Road will be implemented in addition to the ongoing Cebu-Cordova Link Expressway (CCLEX) in order to enhance accessibility to/from Mactan Island. Construction of Metro Cebu Circumferential Road will be commenced and continued for segment 1 and 3. In the medium to long-term, Segment 2 of the Metro Cebu Circumferential Road, replacement of the 1st Mactan Bridge, Metro Cebu wide circumferential and coastal expressways will be implemented. The widening of the existing arterial roads will be carried out according to the priority (e.g. introduction of UMRT) of phased plan. As for intersection improvement, simple measures that each LGU can easily handle such as small-scale facility improvement with traffic signal control should be implemented prior to the study for large-scale grade separation projects.

UMRT: Considering the high traffic demand density, Central Line (Phase 1: Central Section) and Coastal Line (Phase 1) should be implemented in the short-term. Extension of the Central Line to the north and south as well as Coastal Line is proposed in Phase 2 to be implemented by 2040 in order to enhance the accessibility throughout Metro Cebu. Although there are some proposals of unsolicited projects, it is recommended that DOTr should take initiative to promote the development of UMRT according to the strategy proposed in this Master Plan.

Road-based Public Transport: In the short-term, smooth transfers between Cebu BRT and other public transport modes such as bus, jeepney and tricycle should be considered. Improvements for buses and jeepneys are supposed to be made according to DOTr's PUV modernization program. Introduction of ITS is also necessary in the medium to long term.

Traffic Management: ATC system covering Metro Cebu will be introduced and expanded in the short to medium term. Concurrently, coordination for operation of traffic signal control, traffic information provision, traffic safety will be continuously improved over the entire period.

Analysis on the traffic performance for the scenario of implementation of all projects proposed by the Master Plan proved the achievement of the target indicators such as reduction of future traffic congestion and securing a good travel speed. In addition, EIRR of the Master Plan indicated high economic return around 25% as a result of the economic evaluation. Moreover, analysis on the necessary investment for the implementation of the Master Plan confirmed that the required total amount did not exceed the budget of public investment for urban transport development over the planning period.

Implementing agencies are also important aspects for consideration to confirm the implementation of the Master Plan. Among the projects proposed by the Master Plan, implementing agencies of large-scale transport projects such as national roads, UMRT and other projects traversing the Metro Cebu are mainly central governments such as DPWH and DOTr. On the other hand, since planning and operation of traffic management and road-based public transport such as PUV which covering Metro Cebu are the responsibility of LGUs, a coordinating organization including all LGUs in Metro Cebu is necessary. Therefore, establishment of the Metropolitan Cebu Traffic Management Coordination Board (MCTMCB) was proposed by the Project.

MCTMCB should be established at early stage to conduct necessary planning and operation of traffic management and ATC as well as to continuously implement and monitor the projects proposed by the Master Plan based on the target indices (travel speed, congestion ratio, road LOS).

In order to promote implementation of the proposed projects by the Master Plan, approval by NEDA Infrastructure Committee (InfraCom) is also recommended similar to the Roadmap Study.

With regard to the LPTRP and improvement of traffic signal control implemented in the pilot projects, other LGUs than model LGUs are recommended to take similar measures by utilizing those process and results. Similar approaches should be taken for other LGUs than LGUs studied the updates on CLUP to promote the integrated transport and urban development through the formulation of land use plan.

Table 16.2.1 Short-term Action Plan (Projects/ Programs to be commenced by 2022)

Category	Project Name	IA*(◎), RA**(○)					
		DOTr	LTFRB	DPWH	LGUs	Province	Others
Road & Bridge	Metro Cebu Circumferential Road (Segment 1 and 3)			◎	○		
	Talisay-Naga Diversion Road			◎	○		
	Mandaue-Liloan Diversion Road			◎	○		
	Cebu Arterial Road Widening Phase 1			◎	○		
	Cebu Coastal Road Widening Phase 1			◎	○		
	Guadalupe-Lahug Diversion Road			◎	○		
	Metro Cebu Intersection Improvement Phase 1			◎/○	◎/○	○	
	Cebu-Cordova Link Expressway Bridge			○	◎		◎
	Mandaue Coastal Road			◎	○		
	Mandaue-Lapu Lapu Link Bridge			◎	○		
UMRT	UMRT Central Line (Central Section; Phase1)	◎		○	○		
	UMRT Coastal Line (Phase 1)	◎		○	○		
Public Transport	Local Public Transport Route Plan (Phase 1)	○			◎	○	○
	Fleet Replacement (Phase 1)	○	◎		○		
	Consolidation of Operators (Phase 1)	○	◎		○		
	Cebu BRT	◎			○		
Traffic Management	Traffic Signal Optimization			◎/○	◎/○		
	Area Traffic Control (ATC) System (Traffic Control Center; Phase 1)			○	◎	○	
	Proper Traffic Operation, Improvement on Traffic Behavior (Phase 1)			○	◎	○	
	Efficient Road Asset Management (Phase 1)			○	◎	○	
	Traffic Information Provision (Phase 1)			○	◎	○	
	Promotion of Public Transport (Phase 1)	○	○		◎	○	
Institution/ Others	Establishment of Metro Cebu Transport and Traffic Council	○			◎	○	
	Cebu International Container Port	◎			○		

*IA: Implementing Agency, **RA: Relevant Agency

Source: JICA Project Team

Table 16.2.2 Medium-term Action Plan (Projects/ Programs to be completed by 2040)

Category	Project Name	IA*(◎), RA**(○)					
		DOTr	LTFRB	DPWH	LGUs	Province	Others
Road & Bridge	Metro Cebu Circumferential Road (Segment 2)			◎	○		
	Cebu Arterial Road Widening Phase 2			◎	○		
	Cebu Coastal Road Widening Phase 2			◎	○		
	Metro Cebu Intersection Improvement Phase 2			◎/○	◎/○	○	
	Mactan Circumferential Road (Road Widening)			◎	○		
	Replacement of 1st Mactan Bridge			◎	○		
	Metro Cebu Coastal Road Expressway			◎	○		
	Metro Cebu Circumferential Expressway			◎	○		
UMRT	UMRT Central Line (North and South Section; Phase2)	◎		○	○		
	UMRT Coastal Line (Phase 2)	◎		○	○		
Public Transport	Local Public Transport Route Plan (Phase 2) incl. Enhancement on Feeder Services	○			◎	○	○
	Fleet Replacement (Phase 2)	○	◎		○		
	Consolidation of Operators (Phase 2)	○	◎		○		
	Smart Public Transport System incl. E-ticket service and Electric Vehicles (Phase 1)	○	◎		○		
Traffic Management	Area Traffic Control (ATC) System (Traffic Control Center; Phase 2)			○	◎	○	
	Proper Traffic Operation, Improvement on Traffic Behavior (Phase 2)			○	◎	○	
	Efficient Road Asset Management (Phase 2)			○	◎	○	
	Traffic Information Provision (Phase 2)			○	◎	○	
	Promotion of Public Transport (Phase 2) incl. Demand Control (Private Vehicular Control)	○	○		◎	○	
Institution/ Others	Operation and Management of Metro Cebu Transport and Traffic Council	○			◎	○	
	Mactan Airport 2nd Runway?	◎			○		

*IA: Implementing Agency, **RA: Relevant Agency
Source: JICA Project Team

Table 16.2.3 Long-term Action Plan (Projects/ Programs to be completed by 2050)

Category	Project Name	IA*(◎), RA**(○)					
		DOTr	LTFRB	DPWH	LGUs	Province	Others
Public Transport	Smart Public Transport System incl. E-ticket service and Electric Vehicles (Phase 2)	○	◎		○		
Traffic Management	Proper Traffic Operation, Improvement on Traffic Behavior (Phase 3)			○	◎	○	
	Efficient Road Asset Management (Phase 3)			○	◎	○	
	Promotion of Public Transport (Phase 3) incl. Demand Control (Private Vehicular Control)	○	○		◎	○	
Institution/ Others	Operation and Management of Metro Cebu Transport and Traffic Council	○			◎	○	

*IA: Implementing Agency, **RA: Relevant Agency
Source: JICA Project Team

ANNEX

1 TRAFFIC DEMAND FORECAST

1.1 Precondition

1) Transportation Mode etc.

(1) Vehicle Type Classification

Correspondence of the vehicle type classification for traffic count survey on cordon line survey, screen line survey, and OD table is shown below.

Table A1.1.1 Vehicle Type by Surveys

Traffic count	HIS	Demand forecast
-	Walking	Walk
Bicycle	Bicycle	MC
Motorcycle	Motorcycle – driver	MC
Motorcycle	Motorcycle – passenger	MC
Car / Owner-type Jeep	Car / Owner-type jeep – driver	Car
Car / Owner-type Jeep	Car / Owner-type jeep – passenger	Car
Pedicab	Pedicab	Other
Tricycle	Tricycle	Other
Taxi	Taxi	Car
Jeepney	Jeepney	Public
Multicab	Multicab	Public
GT Express / V-hire	GT Express / V-hire	Public
Minibus	Minibus w/o aircon	Public
Minibus	Minibus with aircon	Public
Standard bus	Standard bus w/o aircon	Public
Standard bus	Standard bus with aircon	Public
School / Company / Tourist bus	School bus	Public
School / Company / Tourist bus	Company bus	Public
School / Company / Tourist bus	Tourist bus	Public
Pickup / Delivery Truck	Pickup / Delivery van	Truck
Truck	Truck	Truck
Trailer	Trailer	Truck
Others	Others	Other

Source: JICA Project Team

(2) Average Number of occupancy and PCU equivalent value of represent mode

The table below shows the average number of occupancy and PCU equivalent value of represent mode.

Table A1.1.2 Average Number of Occupancy and PCU by Represent Mode

Represent mode	Average number of occupancy	PCU
Motorcycle	1.34	0.33
Car	1.81	1.00
Public	11.85	1.57
Others	1.41	0.81
Truck	2.00	2.29

Source: JICA Project Team

2) Zoning

The total number of zones is 389, of which 380 are within the study area and 9 are outside the study area. The number of zones by LGU is shown in the table below, while the zone list is shown at the end of this section.

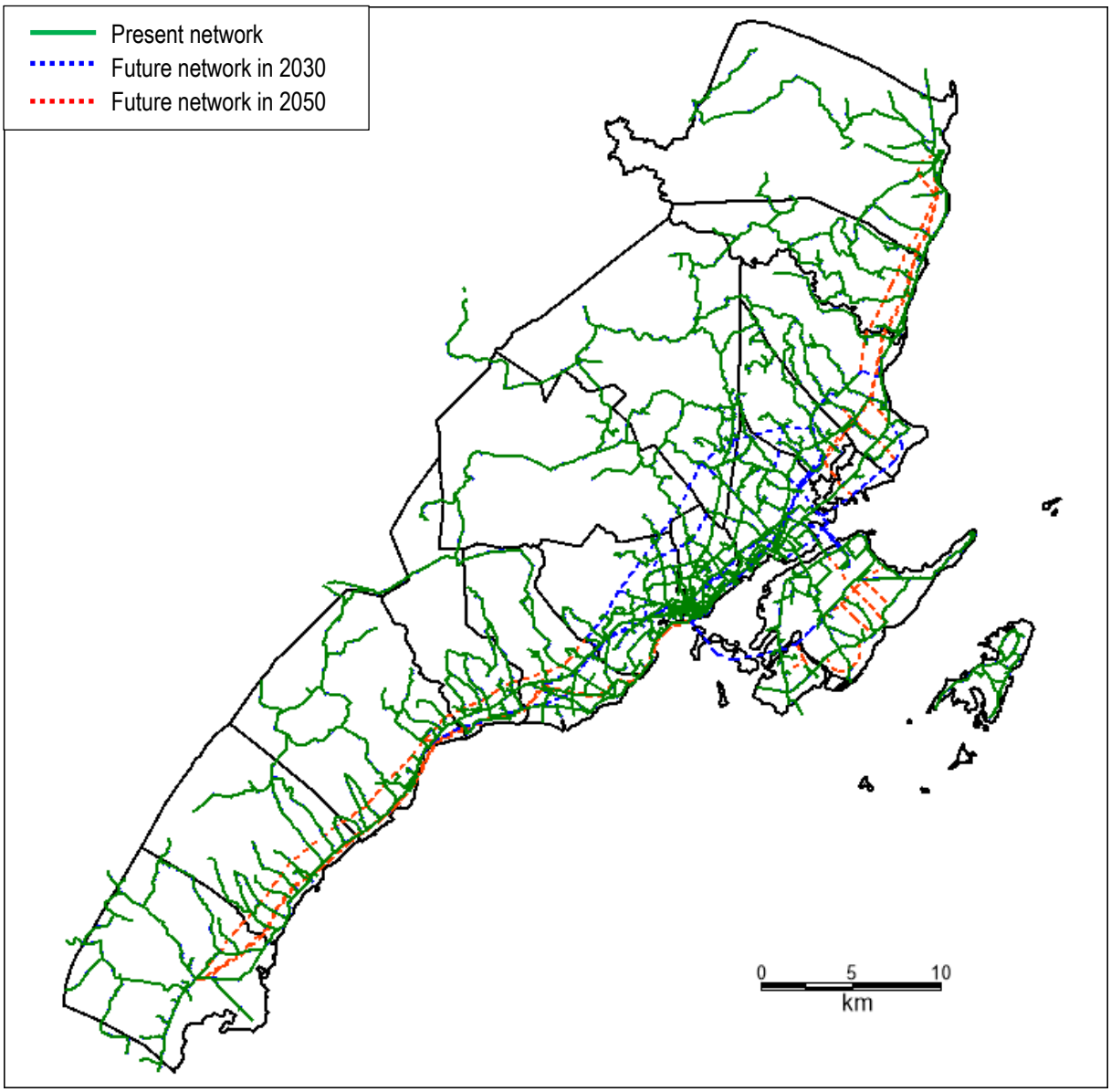
Table A1.1.3 Number of zones by LGUs

Seq	LGUs	Number of zones
1	City of Carcar	15
2	Cebu City	97
3	Compostela	17
4	Consolacion	21
5	Cordova	14
6	Danao City	43
7	Lapu-Lapu City	37
8	Liloan	14
9	Mandaue City	32
10	Minglanilla	19
11	City of Naga	28
12	San Fernando	21
13	City of Talisay	22
14	Outside of the study area	9

Source: JICA Project Team

3) Network and Road Conditions

The network used in this survey is shown in the following figure. The “current” and “do nothing” cases are the green lines; the “do all” case in 2030 is the green and blue lines; and “do all” case in 2050 is the green, blue, and red lines.

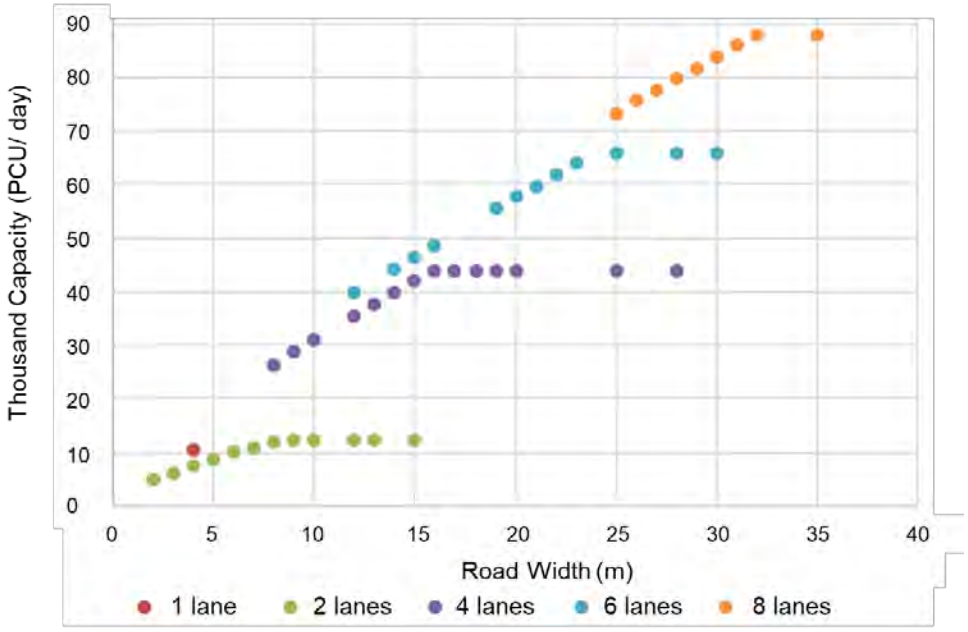


Source: JICA Project Team

Figure A1.1.1 Transport Network

(1) Road traffic Capacity

Road traffic capacity is set from the road width as follows.



Source: JICA Project Team

Figure A1.1.2 Road Capacity

(2) Speed

The maximum speed is set from the type of road and the number of lanes as follows.

Table A1.1.4 Maximum Link speed by Road Type and Number of lanes

Road Type	Trunk				Primary					Secondary				Tertiary					Other				
No. of Lanes	2	4	6	8	1	2	4	6	8	2	4	6	8	1	2	4	6	8	1	2	4	6	8
Speed	50	60	70	70	30	40	50	60	60	30	40	50	50	30	30	40	50	50	30	20	30	40	40

Source: JICA Project Team

(3) List of the Road Planning to be constructed and improved

List of the road planning to be constructed and improved is shown in Table A1.1.5.

Table A1.1.5 List of Planned Road and Bridge (up to 2030)

Project Name		Location	Implementation	Length (km)	Proposed Lanes
A. ROADS HIGHWAYS	1. Metro Cebu Circumferential Road (Segment 1)	Cebu, Mandaue, Talisay	New	29.80	2-2
	2. Metro Cebu Circumferential Road (Segment 2)	Consolacion, Liloan, Danao	New	29.80	2-2
	3. Metro Cebu Circumferential Road (Segment 3)	Naga, Minglanilla,	New	17.40	2-2
	4. Talisay-Naga Diversion Road	Talisay, Naga, Minglanilla	New	7.70	2-2
	5. Mandaue-Liloan Diversion Road	Consolacion, Liloan	New-	10.10	2-2
	6. Cebu Arterial Road Widening with Bicycle Lane	Cebu, Mandaue	Upgrade	7.31	3-3
	7. Mactan Circumferential Road (road widening)	Mactan Island	Upgrade	22.00	2-2
	8. Guadalupe-Lahug Diversion Road	Cebu City	New	1.60	2-2
	9. Metro Cebu Intersection Improvement (20 locations)	Cebu, Mandaue	Upgrade	8.45	2-2
B. BRIDGES	10. Cebu-Cordova Link Expressway Bridge	Cebu City, Cordova	New On-going	3.23	2-2
	11. Mandaue Coastal Road (viaduct)	Mandaue	New	6.20	2-2
	12.Mandaue–Lapu-Lapu Link Bridge	Mandaue, Lapu-Lapu	New	0.58	2-2
	Total			143.17	

Source: JICA Project Team

Table A1.1.6 List of Planned Road and Bridge(up to 2050)

Project Name		Location	Implementation	Length (km)	Proposed Lanes
ROADS HIGHWAYS	1. Metro Cebu Coastal Road Expressway (elevated road along existing road)	Danao to Carcar	New	79.00	3-3
	2. Metro Cebu Circumferential Expressway (elevated road along Metro Cebu Circumferential Road)	Cebu, Mandaue Talisay	New	28.80	3-3
	Total			108.80	

Source: JICA Project Team

(4) Public Transportation

The public transportation to be the subject of traffic assignment are the following.

- UMRT Central Line along the central corridor; and
- UMRT Coastal Line along the coastal corridor.

4) Intensities

(1) Value of Time (VoT) and Value of Cost (VoC) by Vehicle Type

Table A1.1.7 to Table A1.1.9 shows VoT and VoC by vehicle type.

VoT by mode of transport was calculated by dividing personal monthly income with working hours using the data from HIS survey results carried out in the Roadmap Study.

VoC was calculated using the collected costs related with vehicles during MUCEP study such as fuel costs and vehicles and tires pricing. For fares and parking costs, the results of HIS were used.

Regarding future values other than the charges described above, they were based on the current situation in consideration of future economic growth.

Table A1.1.7 VoT, VoC, etc. in 2017 (2014)

	VoT (Php/h)	VoC (Php/km)	Fare (Php/km)	Parking Cost (Php/trip)
M/C	47.6	3.19	-	6
Car	93.2	8.18	-	17
Public	48.6	13.95	1.0	-
Others	42.6	6.08	2.0	-
Truck	57.5	36.24	-	-

Source: JICA Project Team

Table A1.1.8 VoT, VoC, etc. in 2030

	VoT (Php/h)	VoC (Php/km)	Fare (Php/km)	Parking Cost (Php/trip)
M/C	89.2	5.97		11.2
Car	174.4	15.32		31.8
Public	91.1	26.12	1.0	
Others	79.8	11.38	2.0	
Truck	107.8	67.86		

Source: JICA Project Team

Table A1.1.9 VoT, VoC, etc. in 2050

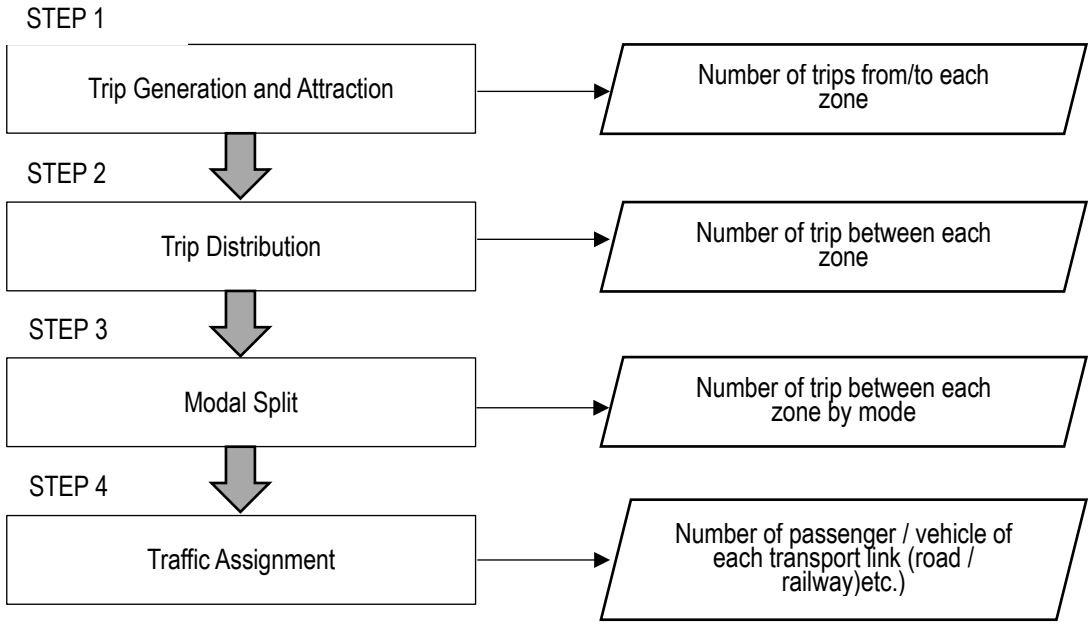
	VoT (Php/h)	VoC (Php/km)	Fare (Php/km)	Parking Cost (Php/trip)
M/C	195.5	13.09		24.6
Car	382.1	33.57		69.7
Public	199.5	57.23	1.0	
Others	174.9	24.93	2.0	
Truck	236.2	148.69		

Source: JICA Project Team

1.2 Traffic Demand Forecast Method

1) The Outline of Traffic Demand Forecast

In this survey, the demand forecast was conducted using the four-step method presented in the figure below. Regarding with trip generation and attraction as well as trip distribution, the demand forecast was made by purpose and household vehicle owned. For modal split, the demand forecast was made by household vehicle owned.



Source: JICA Project Team

Figure A1.2.1 Flow of Four-Step Model

2) Traffic Demand Forecast by each step

(1) Trip Production Forecast within Study Area

Trip rate by purpose and household vehicle owned was made and used to calculate trip generation.

Table A1.2.1 Trip Rate by Purpose and Household Vehicle Owned

	To Home	Work	School	Business	Private	Total
No Vehicle	0.80	0.43	0.37	0.05	0.08	1.73
Bicycle	0.91	0.44	0.44	0.09	0.10	1.98
Motorcycle	1.09	0.63	0.42	0.08	0.19	2.40
Car	2.70	1.26	1.10	0.24	0.85	6.14

Source: JICA Project Team

Table A1.2.2 Number of Population Trip and Trip in 2017

	Population ('000)	Trip ('000 trip/day)					Total
		To Home	To Work	To School	Business	Private	
No Vehicle	1,976.6	1,582.9	856.7	726.4	91.0	155.2	3,412.2
Bicycle	252.5	230.2	111.9	110.5	21.5	25.3	499.4
M/C	635.8	691.5	398.9	265.8	49.7	121.5	1,527.5
Car	101.1	272.6	127.4	110.8	24.0	86.1	620.9
Total	2,966.0	2,777.2	1,495.0	1,213.5	186.2	388.2	6,060.1

*This trip excludes trip from/to external zone and include walk trip

Source: JICA Project Team

Table A1.2.3 Number of Population Trip and Trip in 2030

	Population ('000)	Estimate by Trip ('000 trip/day)					Total
		To Home	To Work	To School	Business	Private	
No Vehicle	2,595.6	2,078.5	1,125.0	953.9	119.4	203.8	4,480.7
Bicycle	166.4	151.7	73.8	72.8	14.2	16.7	329.2
M/C	988.2	1,074.8	620.0	413.1	77.3	188.9	2,374.0
Car	155.5	419.1	195.8	170.4	36.9	132.5	954.7
Total	3,905.6	3,724.1	2,014.6	1,610.2	247.8	541.8	8,138.5

*This trip excludes trip from/to external zone and include walk trip

Source: JICA Project Team

Table A1.2.4 Number of Population Trip and Trip in 2050

	Population ('000)	Estimate by Trip ('000 trip/day)					Total
		To Home	To Work	To School	Business	Private	
No Vehicle	3,295.5	2,639.1	1,428.3	1,211.1	151.6	258.8	5,688.9
Bicycle	107.7	98.2	47.8	47.1	9.2	10.8	213.1
M/C	1,358.1	1,477.2	852.2	567.7	106.2	259.6	3,262.8
Car	237.3	639.6	298.9	260.1	56.3	202.2	1,457.1
Total	4,998.6	4,854.0	2,627.1	2,086.1	323.4	731.3	10,622.0

*This trip excludes trip from/to external zone and include walk trip

Source: JICA Project Team

(2) Forecast of Trip Generation and Attraction

(i) Model Formula

Based on the following linear regression equation, the trip generation and attraction were calculated by household vehicle owned and purpose. The estimated results of the model parameters are shown in the tables that follows.

Generation $Gi = \Sigma(ak\ Xki)+c$

Attraction $Aj = \Sigma(bk\ Xkj)+d$

Where,

Xki: Explanatory variable

K: Household vehicle owned and purpose

ak, bk: Parameters

c, d: Constant terms

(ii) Area intensity to adapt to specific facilities and development zone

After grasping the large-scale development that affects traffic planning, the scale was estimated from various information and was reflected in the future population by zone.

(iii) Forecasted Input Value of Trip Generation and Attraction

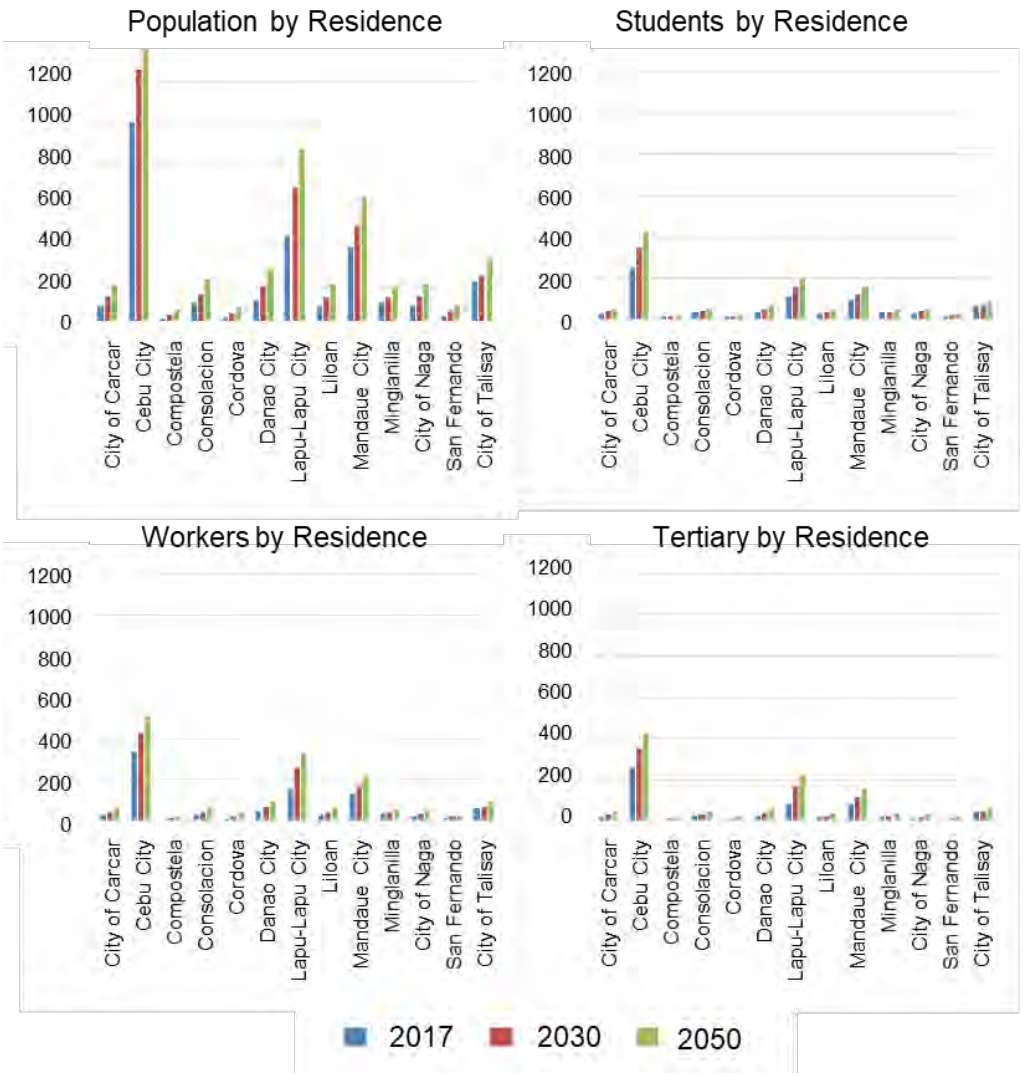
Various input values of population to forecast the trip generation and attraction are shown below.

In the forecast, various input values of population by zone were used, but shown by LGU in the following figures.



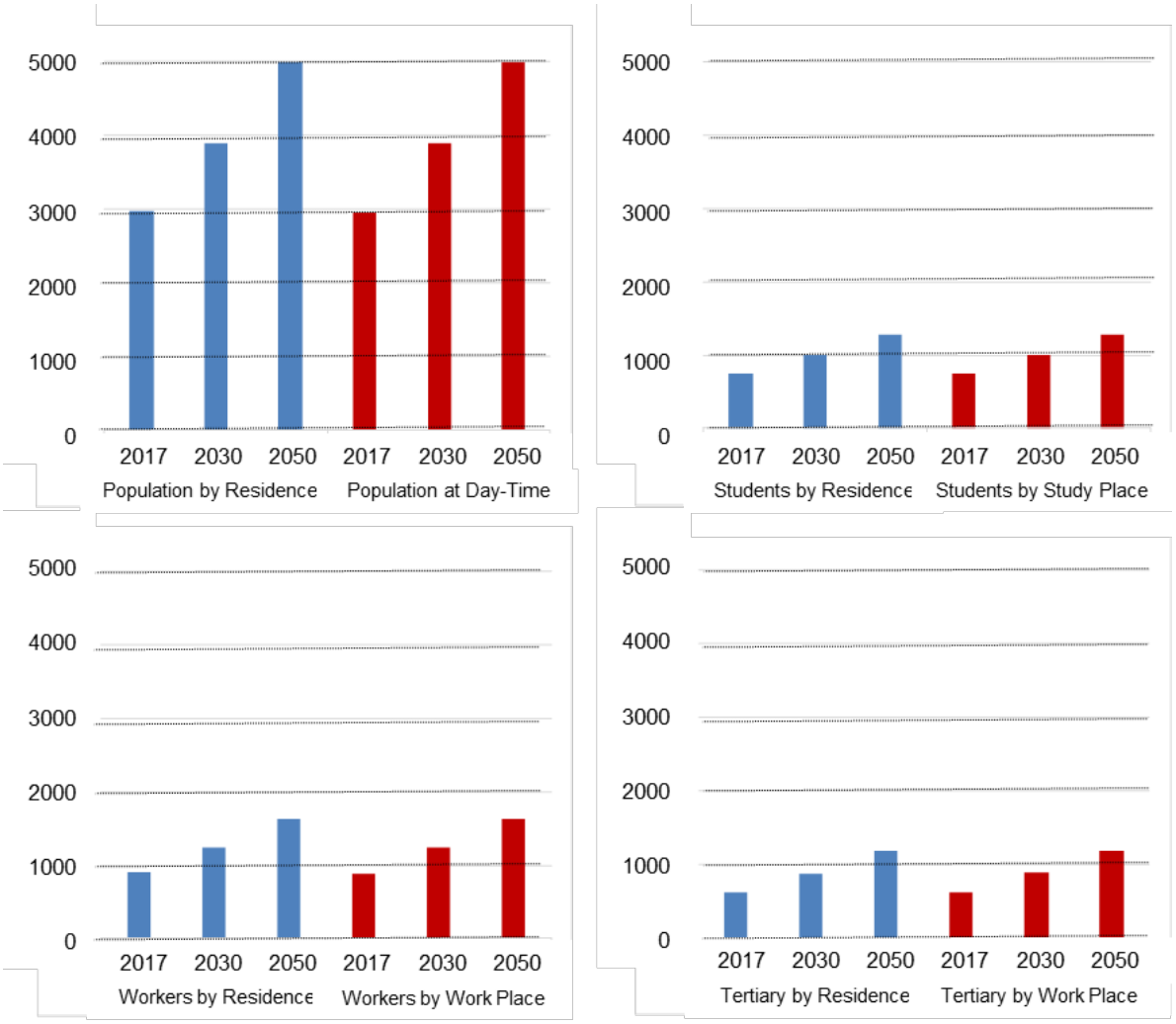
Source: JICA Project Team, Unit: Thousand persons

Figure A1.2.2 Input Population Data for Generation Model by LGUs



Source: JICA Project Team, Unit: Thousand persons

Figure A1.2.3 Input Population Data for Attraction Model



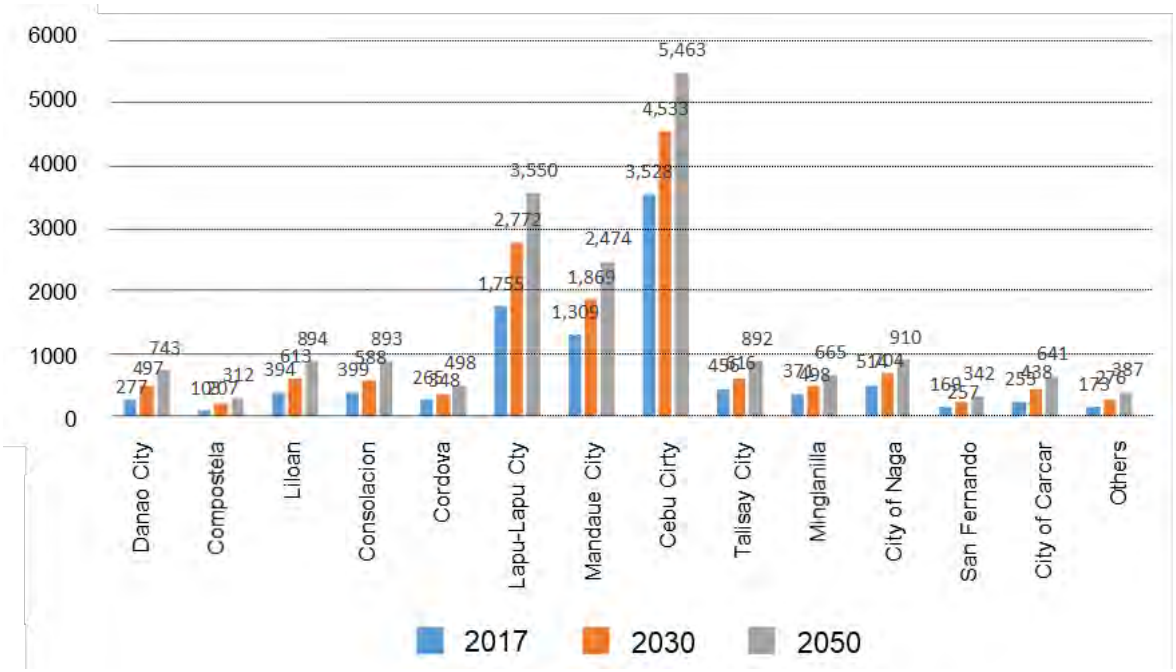
Source: JICA Project Team
Unit: Thousand persons
*These populations do not include external zone

Figure A1.2.4 Input Total Population Data

(iv) The Forecast Result of Trip Generation and Attraction

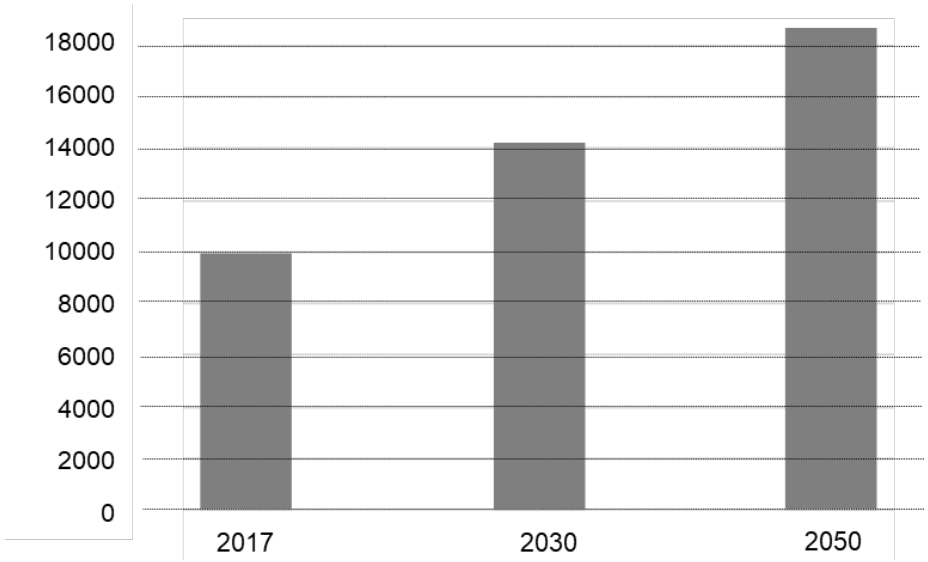
The following figures show the value of trip of generation and attraction by LGU and total amount in years 2017, 2030, and 2050.

Cebu City has the biggest value, followed by Lapu-Lapu City and then Mandaue City.



Unit: Thousand persons

Figure A1.2.5 Generation and Attraction Trip by LGU



Unit: Thousand trip/ day

*This generation and attraction trip include external zone trip

Figure A1.2.6 Total Generation and Attraction Trip including external zone

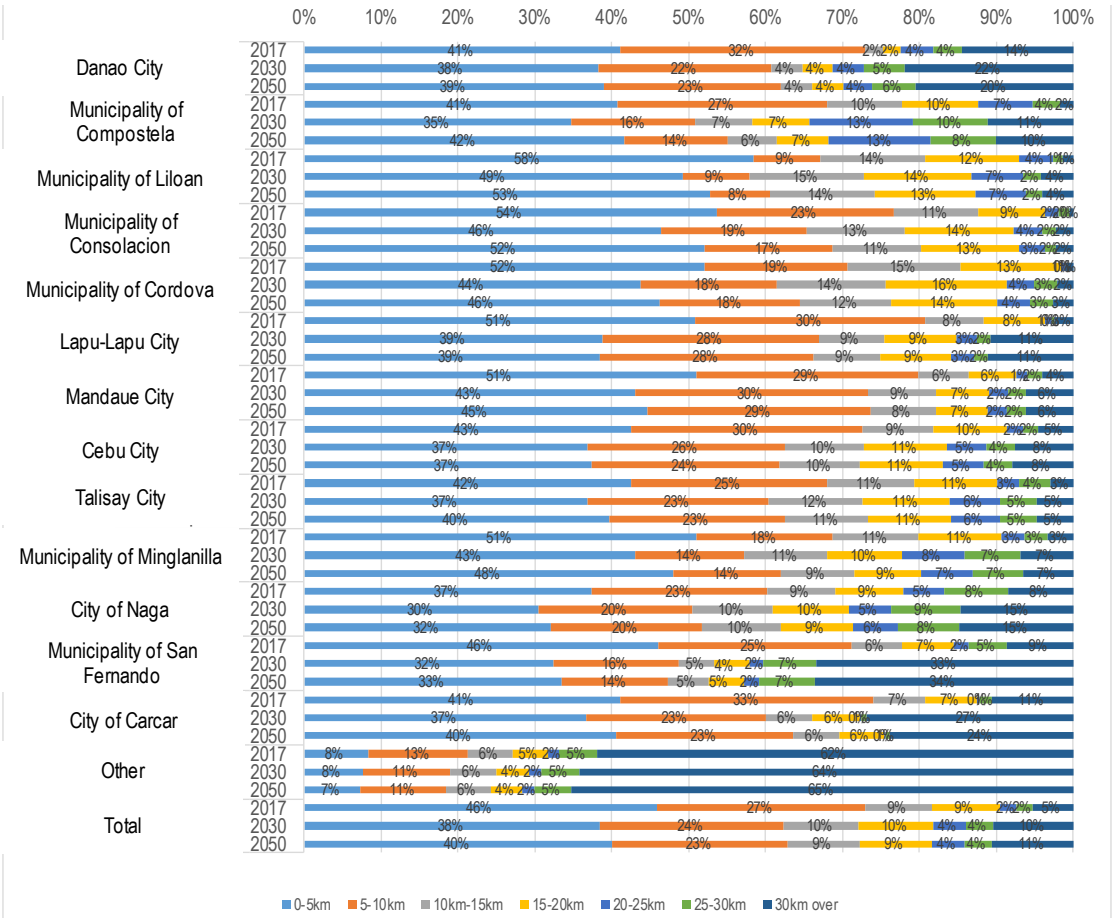
(3) The forecast of Trip Distribution

(i) The Forecast Method

Present pattern method was used for the forecast of trip distribution.

(ii) The Distribution of Trip Length

The distribution of trip length by LGU is shown in following figure. The short trip share is high.

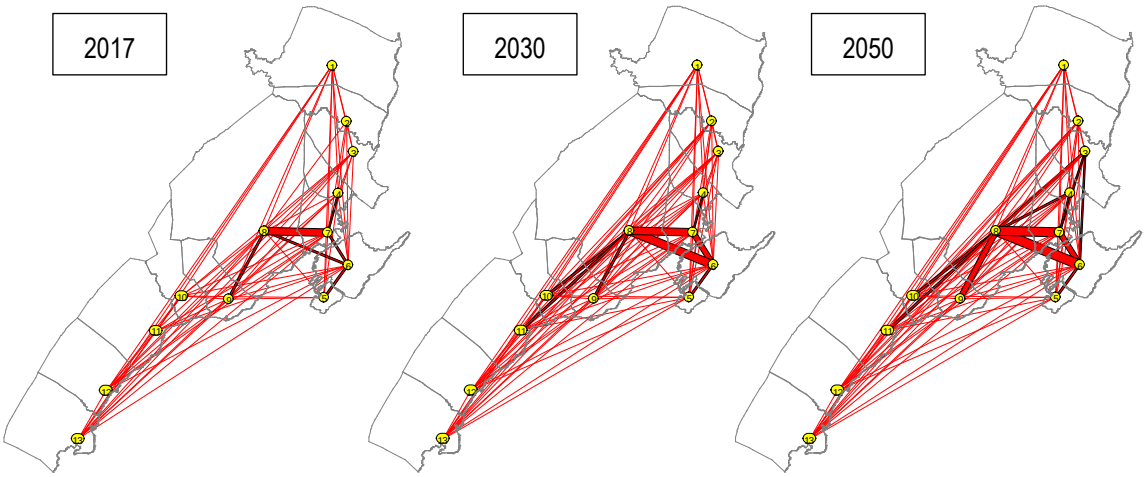


*Share of total includes extremal zone Source: JICA Project Team

Figure A1.2.7 Distribution of Trip Length by LGUs

(iii) Desire Line Diagram

Desire line diagram for years 2017, 2030 and 2050 is shown below. Traffic volume between Cebu City and Mandaue City and between Cebu City and Lapu-Lapu City are large in all cases. In 2050, the traffic volume between Cebu City and Talisay City would be large.



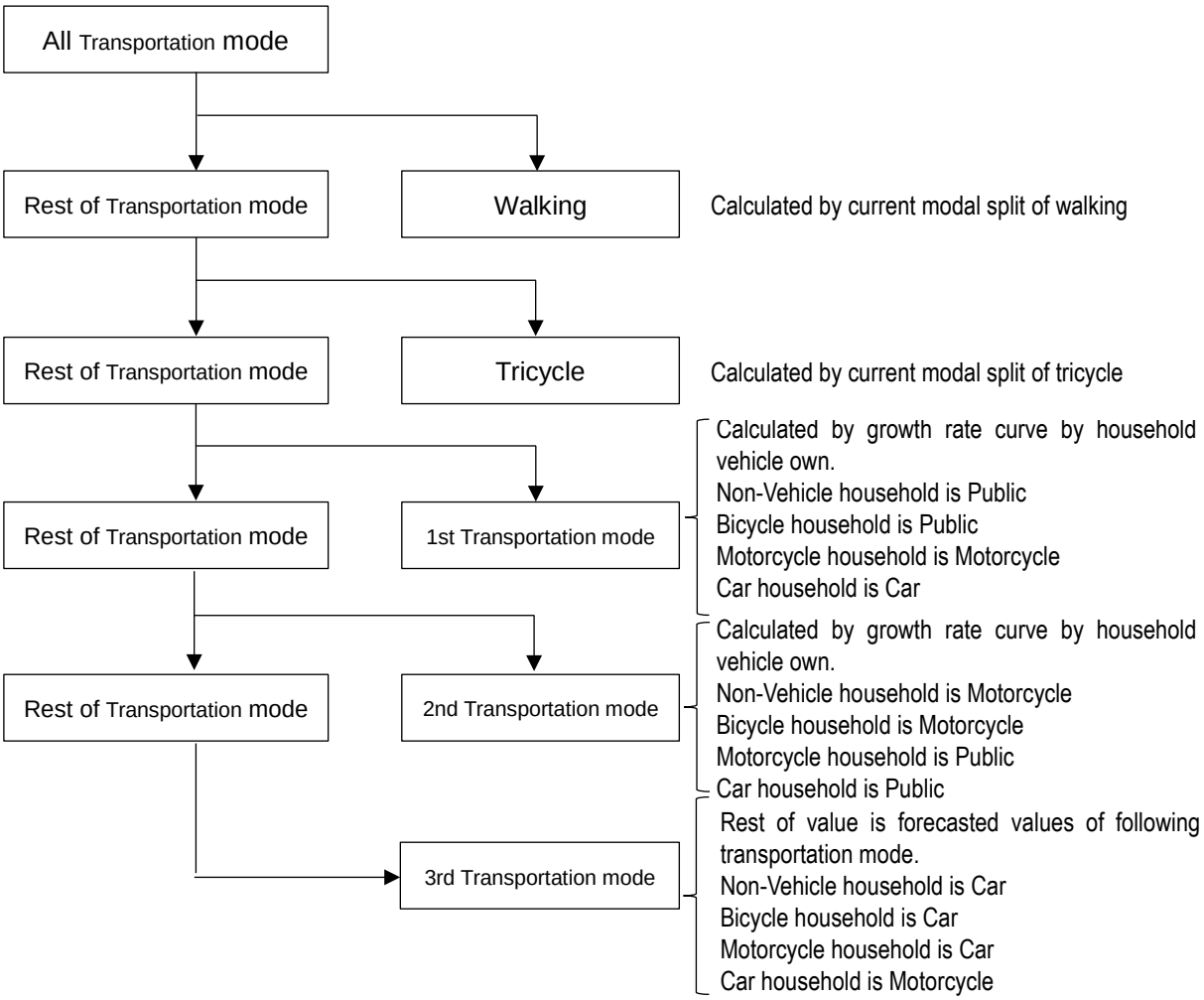
Source: JICA Project Team

Figure A1.2.8 Trip Distribution

3) The Forecast of Trip by Modal Split

(1) The Process of Transportation Mode Choice

To forecast trip by modal split, trip by walking was calculated from the current modal split of walking. Future trip by all transportation modes and trip by tricycle were calculated using the same method. For the rest of the trips, modal split of each transportation mode was calculated from the growth rate curve by household vehicle owned and mode as shown below.



Source: JICA Project Team

Figure A1.2.9 Procedure of Modal Share Demand Forecast

(2) Adapted Model and the Result of Parameter Estimation

Estimation of trip by transportation mode was made by using the following growth rate curve formula. The estimated parameters are shown in the following table.

Growth rate curve: $p = 1 \div (1 + \mathrm{Exp}(b + \Sigma aX))$

Where,

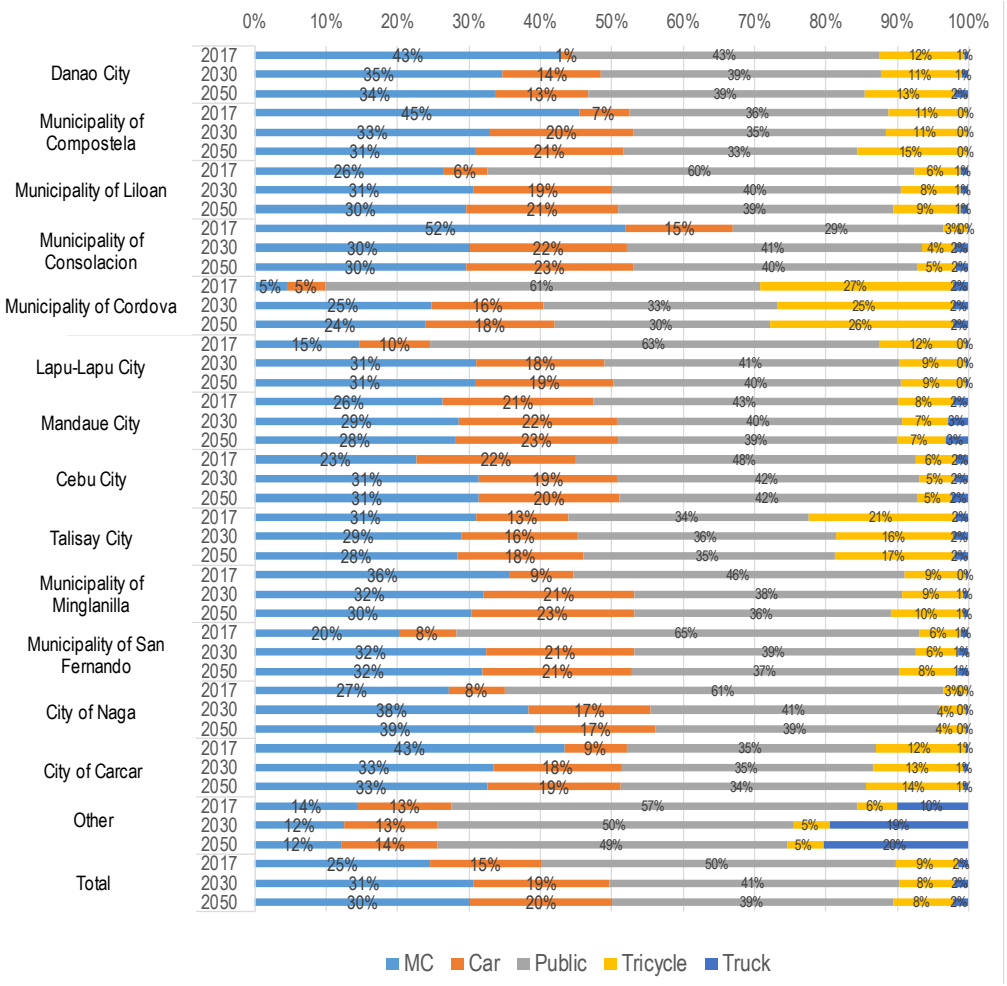
a, b: Parameters

X: Generalized cost

(The costs of the trip and time of trip converted into costs.)

(3) Estimation Result of Modal Share

The modal share by year and LGUs is shown in the following figure.



*Share of total includes extremal zone

Source: JICA Project Team

Figure A1.2.10 Modal share by LGUs

4) Network Allocation

(1) The Outline of Forecast Method of Network Allocation

The traffic assignment was made by user equilibrium assignment.

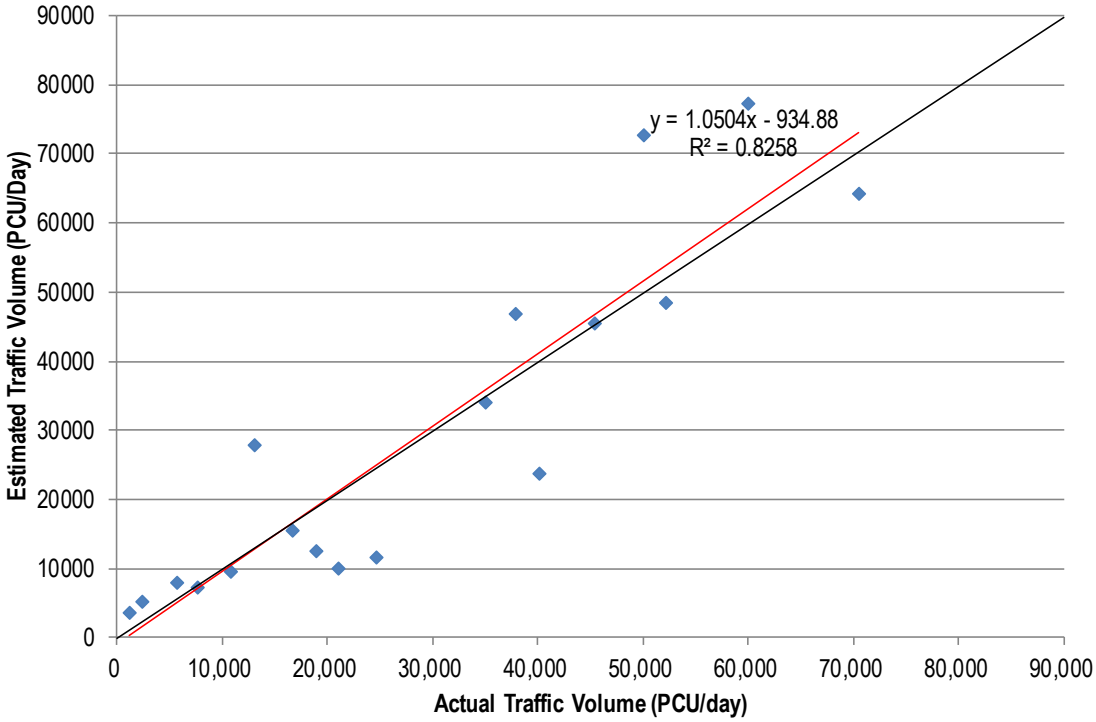
(2) The Quantity-Velocity Formula Used for Road Assignment

The velocity was calculated by Q-V formula. Q-V formula is a default of JICA STRADA.

(3) Recreation Result of Actual Status

The comparison of the traffic volume between screen line survey and recreation results is shown in the figure below.

The multiple correlation coefficient is 0.83, so that the reproducibility is high.



Source: JICA Project Team

Figure A1.2.11 Relationship between Actual Traffic Volume and Estimated Traffic Volume

(4) Forecast of Allocation Case

As shown in the table below, the forecast was done through “do nothing” and “do all” cases and cases where individual roads and railroads are.

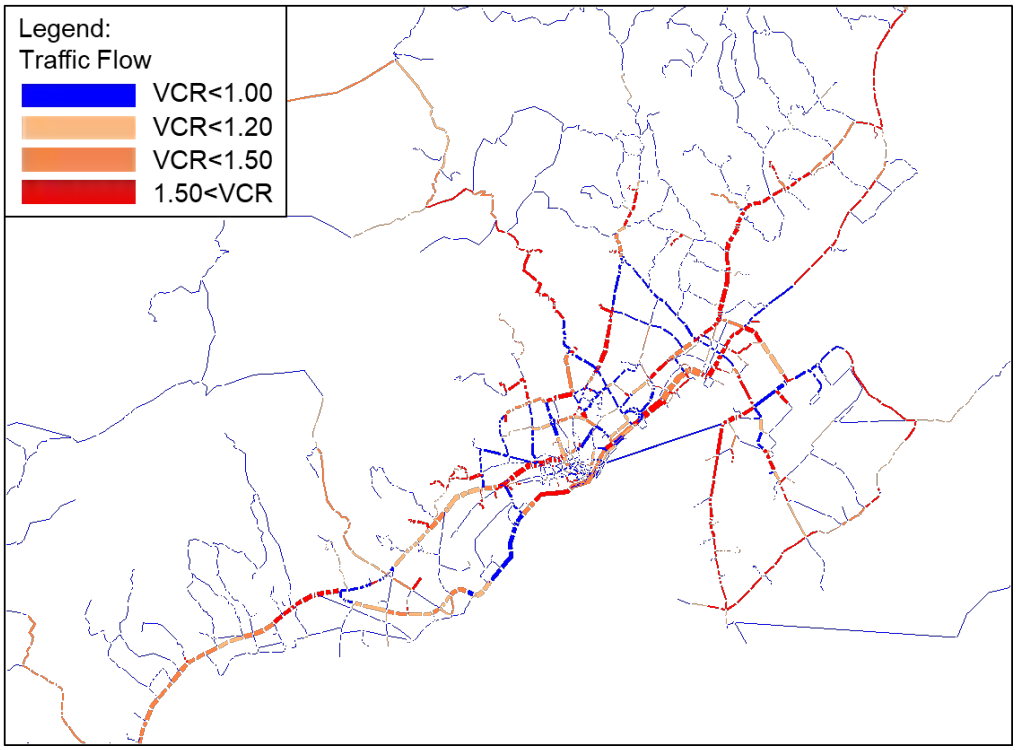
Table A1.2.5 Demand Forecast Case

		Year 2017	Year 2030	Year 2050
Do nothing	(WO)	✔	✔	✔
Wo1	Mandaue–Lapu-Lapu link bridge & Mandaue Costal Road		✔	✔
Wo2	Wo + Metro Cebu Circumferential Road		✔	✔
Wo3	Wo + UMRT Central Line		✔	✔
Wo4	Wo + UMRT Coastal Line		✔	✔
Wo5	Wo + Traffic Control System in CBD		✔	✔
DO all			✔	✔

Source: JICA Project Team

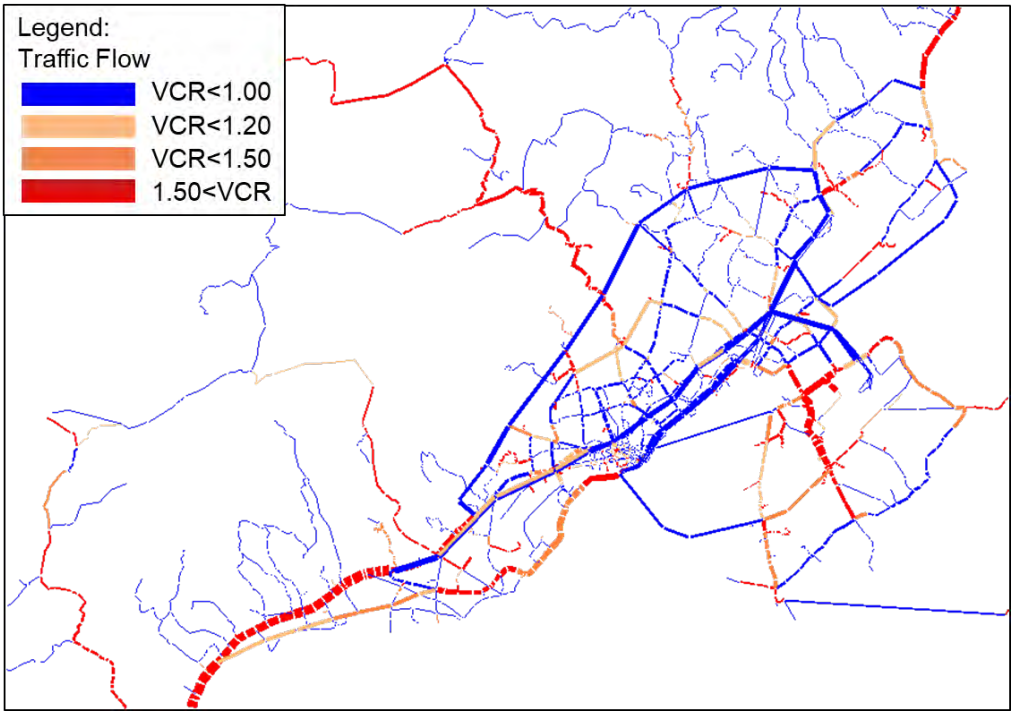
(5) The Result of Future Demand Forecast

The results by case are shown in following figures.



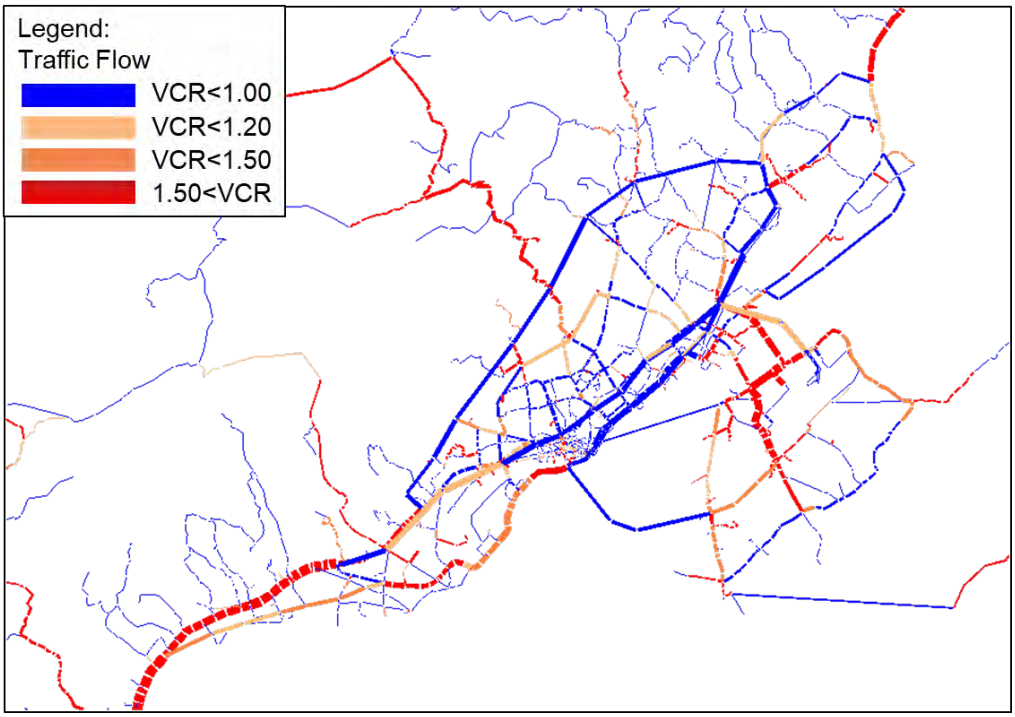
1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.12 Existing Traffic Volume by Link in 2017



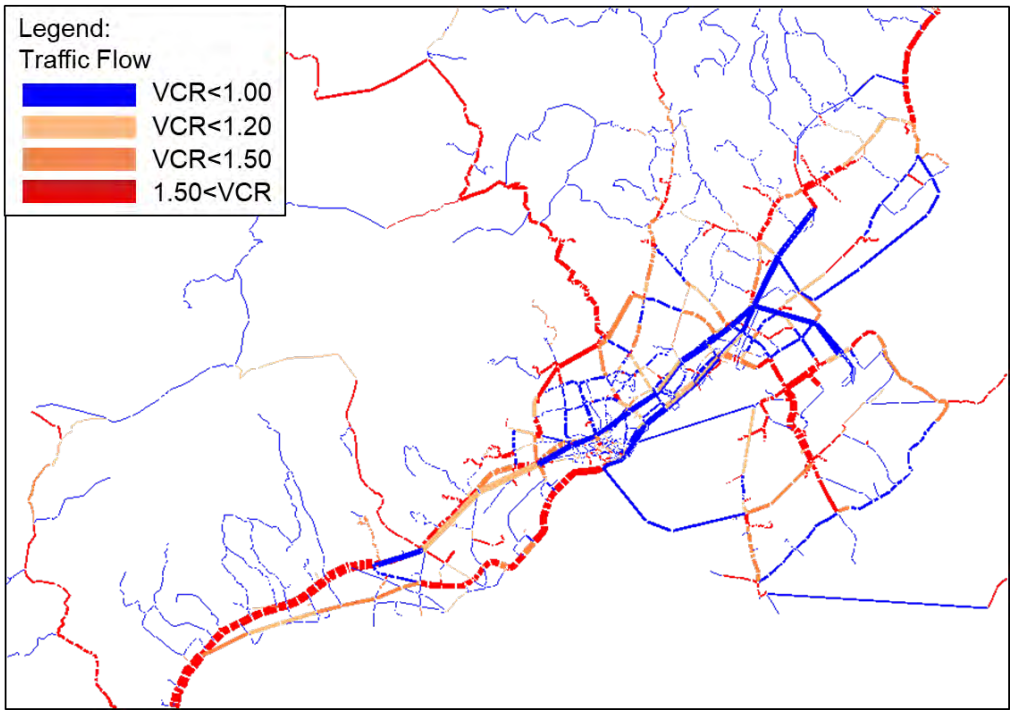
1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.13 Do All Traffic Volume by Link in 2030



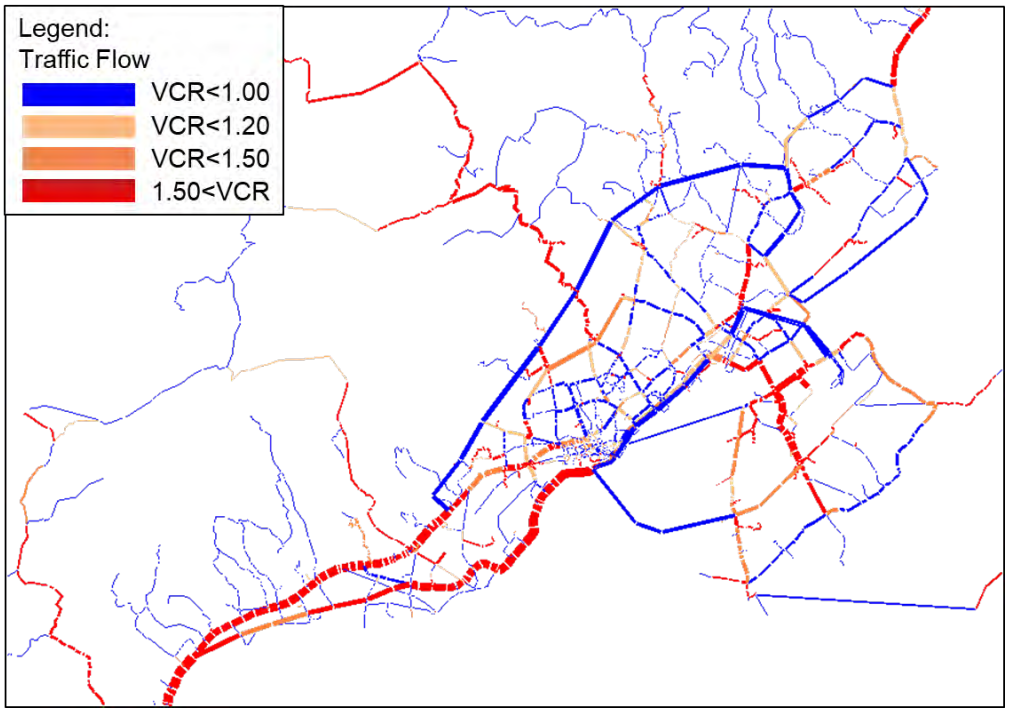
1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.14 Traffic Volume by Link with WO1 in 2030



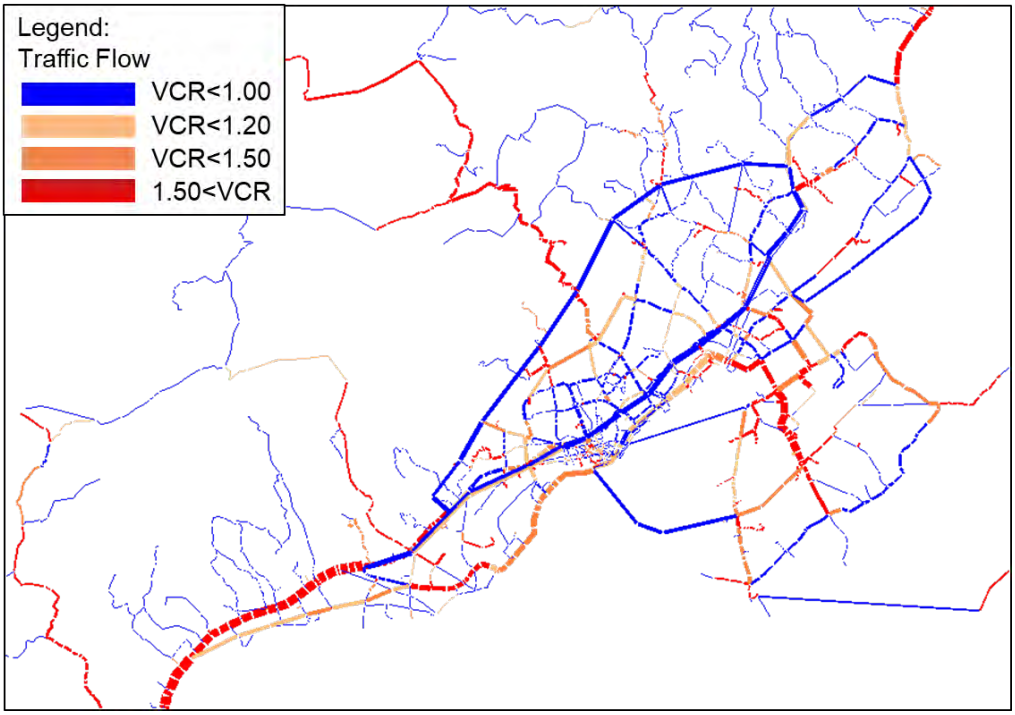
1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.15 Traffic Volume by Link with WO2 in 2030



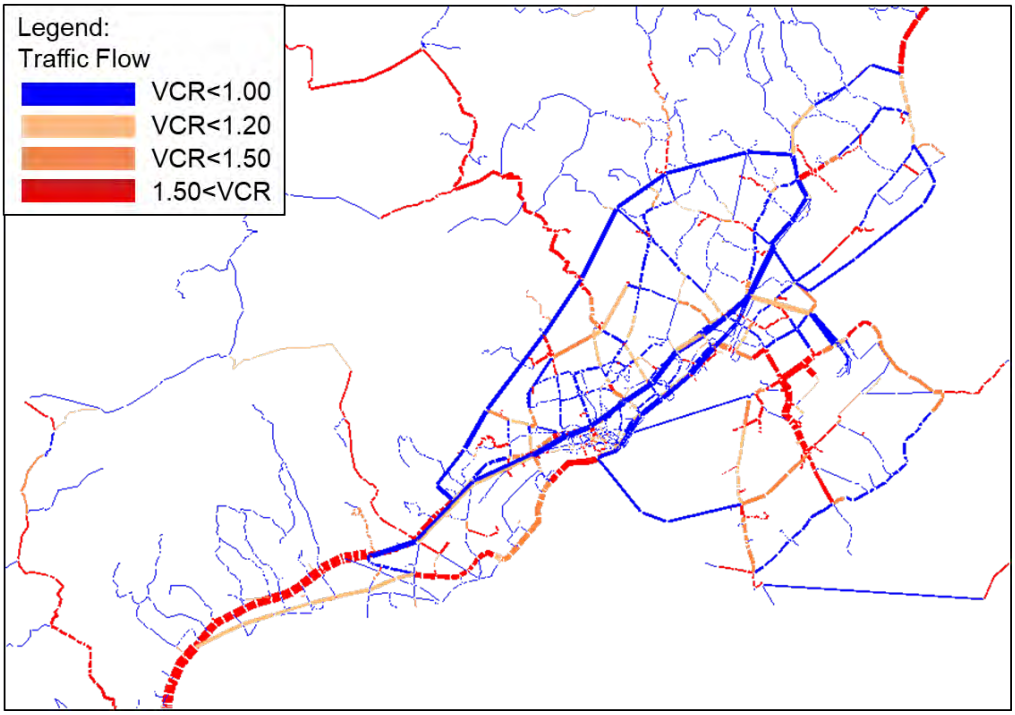
1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.16 Traffic Volume by Link with WO3 in 2030



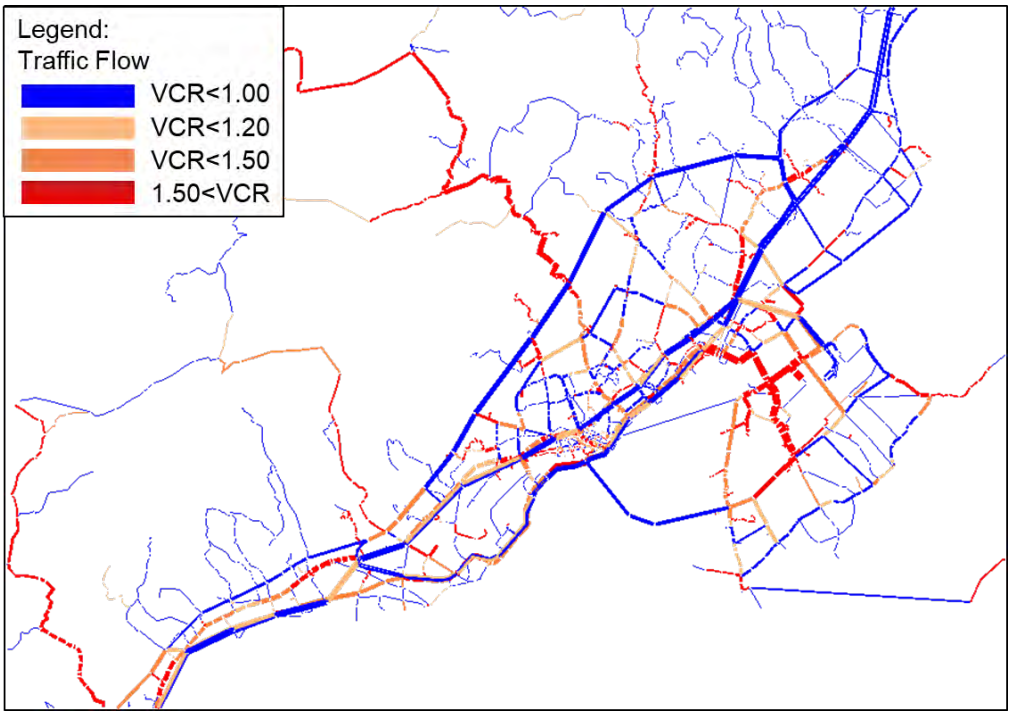
1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.17 Traffic Volume by Link with WO4 in 2030



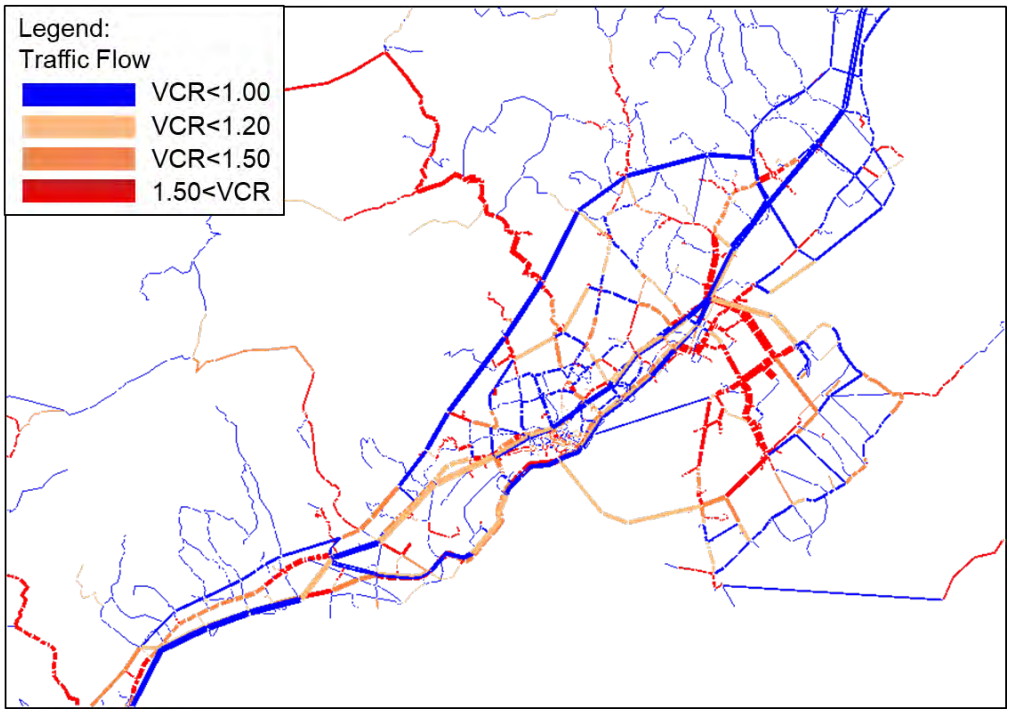
1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.18 Traffic Volume by Link with WO5 in 2030



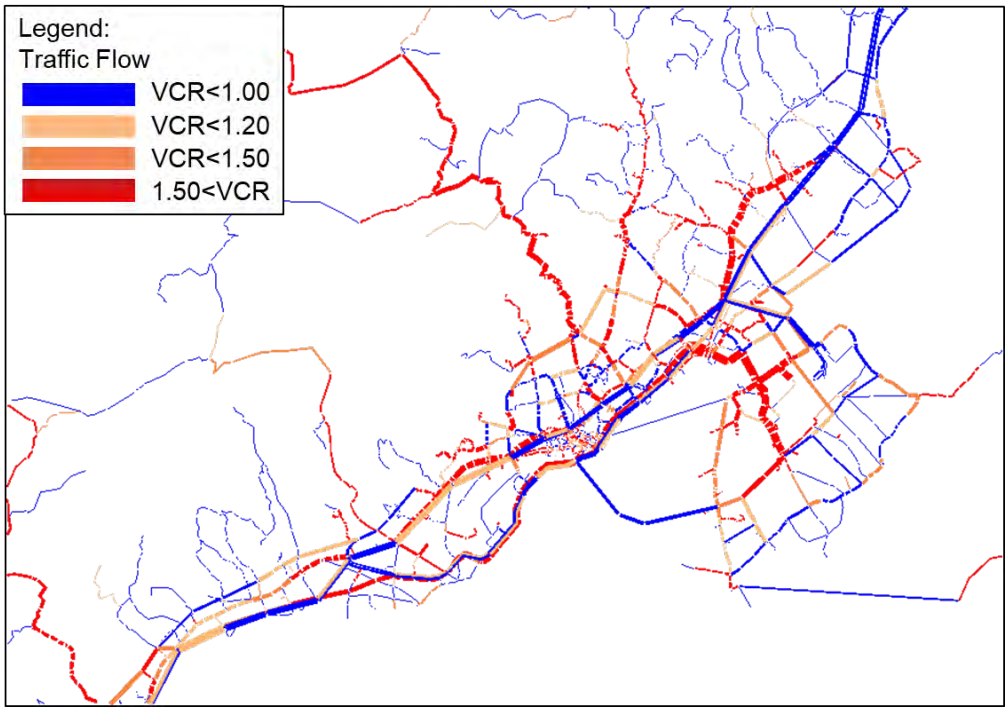
1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.19 Traffic Volume by Link with All in 2050



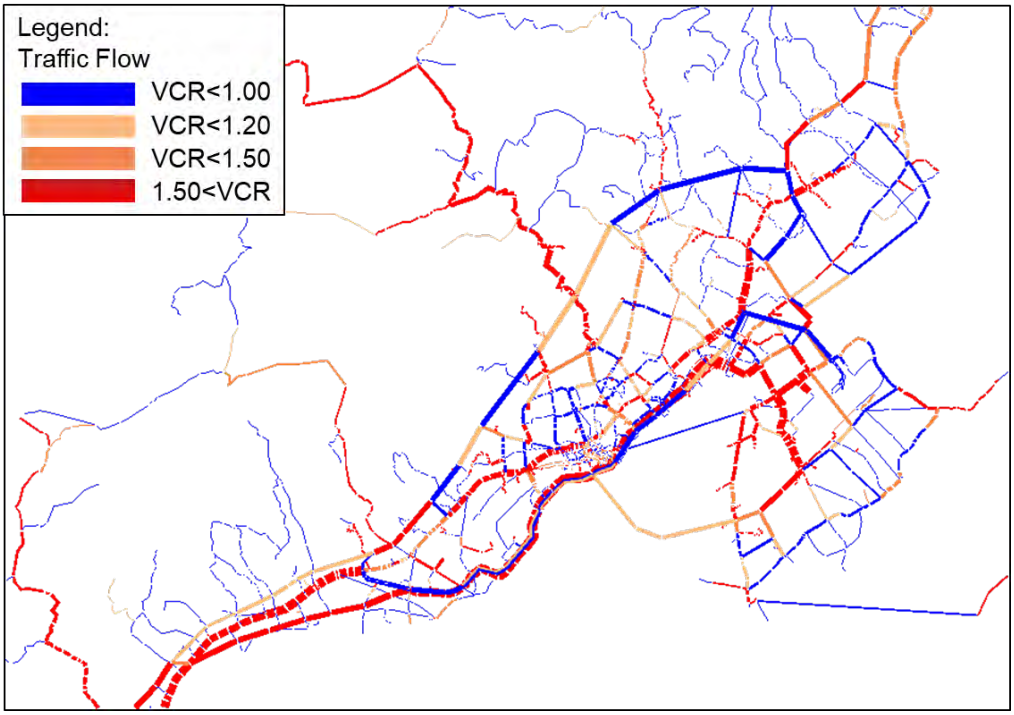
1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.20 Traffic Volume by Link with WO1 in 2050



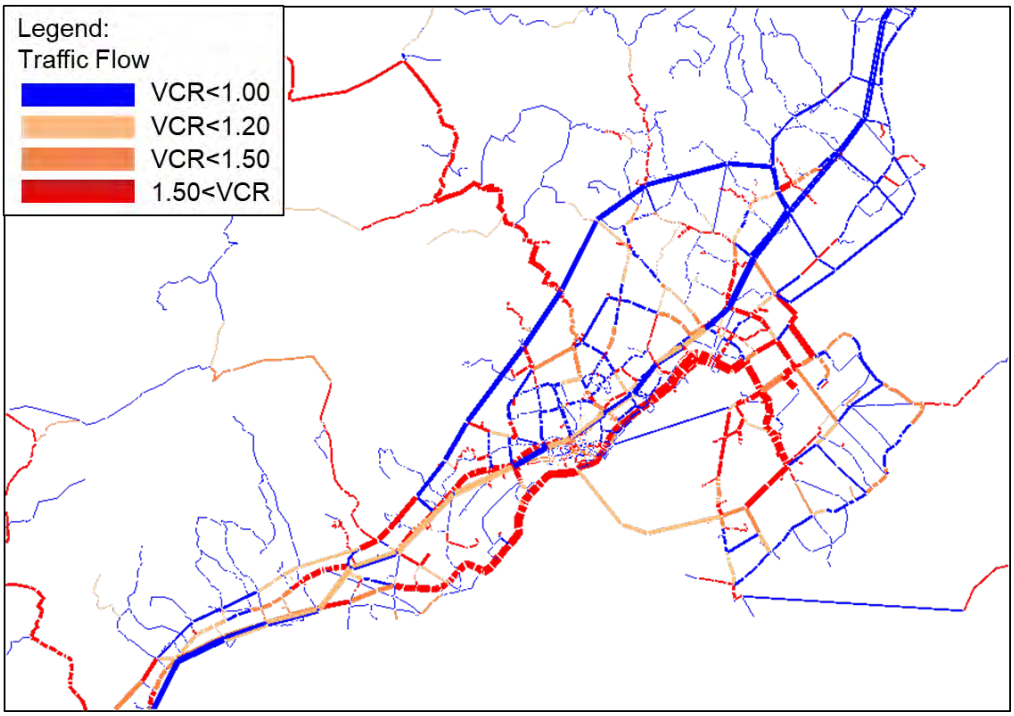
1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.21 Traffic Volume by Link with WO2 in 2050



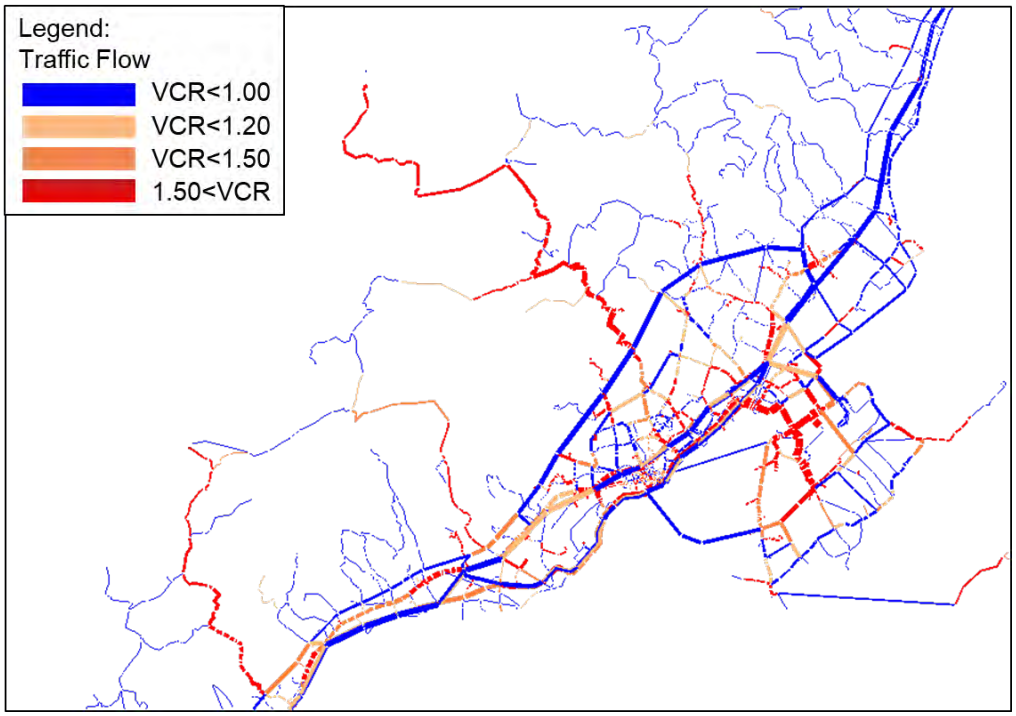
1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.22 Traffic Volume by Link with WO3 in 2050



1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.23 Traffic Volume by Link with WO4 in 2050



1 mm = 50000 PCU
Source: JICA Project Team

Figure A1.2.24 Traffic Volume by Link with WO5 in 2050

(6) Other Index

The index results of each case were shown in following table.

Table A1.2.6 Indicator by Result of Demand Forecast 1

		Person Trips		VoC (Php1,000)		VoT (Php1,000)	
		Private	Public	Private	Public	Private	Public
2017		1,975,518	2,782,495	271,850	101,252	287,181	354,731
2030	All	3,668,440	3,439,873	389,935	81,553	291,298	173,745
	WO1	3,668,440	3,439,873	395,033	82,935	296,736	177,153
	WO2	3,668,440	3,439,873	409,055	84,950	316,430	186,447
	WO3	3,668,440	3,439,873	422,628	87,409	321,375	186,786
	WO4	3,668,440	3,439,873	401,088	83,340	303,535	177,926
	WO5	3,668,440	3,439,873	394,396	82,228	295,592	176,164
2050	All	4,874,010	4,458,714	493,780	98,419	351,795	214,644
	WO1	4,874,010	4,458,714	502,204	99,756	363,596	219,298
	WO2	4,874,010	4,458,714	524,090	103,440	385,311	231,866
	WO3	4,874,010	4,458,714	609,455	114,229	454,369	249,590
	WO4	4,874,010	4,458,714	519,158	101,221	377,392	220,971
	WO5	4,874,010	4,458,714	501,502	99,360	358,285	217,228

Source: JICA Project Team

Table A1.2.7 Indicator by Result of Demand forecast 2

		PCU*km		PCU*hr		Pax*km	
		Private	Public	Private	Public	Private	Public
2017	CBD	8,217	4,083	1,706	1,143	18,157	25,271
2030	All	18,681	4,831	1,664	557	45,158	30,299
	WO1	18,720	4,826	1,694	569	45,197	30,260
	WO2	18,432	4,724	1,802	596	44,500	29,539
	WO3	20,233	5,042	1,821	595	49,392	31,663
	WO4	19,229	4,879	1,728	570	46,614	30,566
	WO5	18,685	4,803	1,689	564	45,142	30,105
2050	All	21,757	5,835	2,096	719	49,811	36,040
	WO1	21,932	5,807	2,161	736	50,263	35,819
	WO2	21,644	5,782	2,291	772	49,502	35,501
	WO3	26,979	6,322	2,639	824	64,019	38,916
	WO4	22,967	5,893	2,228	739	53,030	36,342
	WO5	21,781	5,801	2,135	727	49,894	35,803

Source: JICA Project Team

Table A1.2.8 Indicator by Result of Demand forecast 3

		Pax*hr		Average Travel Speed		
		Private	Public	PCU	Pax	V/C
2017	CBD	3,926	6,508	4.3	4.2	0.92
2030	All	4,276	3,187	10.6	10.1	1.11
	WO1	4,357	3,250	10.4	9.9	1.13
	WO2	4,636	3,420	9.7	9.2	1.23
	WO3	4,713	3,426	10.5	10.0	1.19
	WO4	4,455	3,264	10.5	10.0	1.13
	WO5	4,338	3,232	10.4	9.9	1.14
2050	All	5,135	3,939	9.8	9.5	1.12
	WO1	5,302	4,025	9.6	9.2	1.15
	WO2	5,609	4,255	9.0	8.6	1.25
	WO3	6,609	4,580	9.6	9.2	1.36
	WO4	5,497	4,056	9.7	9.4	1.17
	WO5	5,229	3,987	9.6	9.3	1.15

Source: JICA Project Team

1.3 Reference Material 1 (Zone List)

Table A1.3.1 Zone List 1

LGU	No.	Barangay
City of Carcar	1	Bolinawan
City of Carcar	2	Buenavista
City of Carcar	3	Calidngan
City of Carcar	4	Can-asujan
City of Carcar	5	Guadalupe
City of Carcar	6	Liburon
City of Carcar	7	Napo
City of Carcar	8	Ocana
City of Carcar	9	Perrelos
City of Carcar	10	Valencia

LGU	No.	Barangay
Cebu City	51	Luz
Cebu City	52	Mabini
Cebu City	53	Mabolo
Cebu City	54	Malubog
Cebu City	55	Pahina Cen
Cebu City	56	Pahina San
Cebu City	57	Pamutan
Cebu City	58	Pardo (Pob
Cebu City	59	Pari-an
Cebu City	60	Paril

LGU	No.	Barangay
City of Carcar	11	Valladolid
City of Carcar	12	Poblacion
City of Carcar	13	Poblacion
City of Carcar	14	Poblacion
City of Carcar	15	Tuyom
Cebu City	16	Adlaon
Cebu City	17	Agsungot
Cebu City	18	Apas
Cebu City	19	Babag
Cebu City	20	Bacayan
Cebu City	21	Banilad
Cebu City	22	Basak San
Cebu City	23	Binaliw
Cebu City	24	Bonbon
Cebu City	25	Budla-an (Pob
Cebu City	26	Buhisan
Cebu City	27	Bulacao
Cebu City	28	Buot-Taup
Cebu City	29	Busay (Pob
Cebu City	30	Calamba
Cebu City	31	Cambinocot
Cebu City	32	Capitol Si
Cebu City	33	Carreta
Cebu City	34	Central (Pob
Cebu City	35	Cogon Ramo
Cebu City	36	Day-as
Cebu City	37	Duljo (Pob
Cebu City	38	Ermita (Po
Cebu City	39	Guba
Cebu City	40	Hippodromo
Cebu City	41	Kalubihan
Cebu City	42	Kalunasan
Cebu City	43	Kamagayan
Cebu City	44	Camputhaw
Cebu City	45	Kasambagan
Cebu City	46	Kinasang-a
Cebu City	47	Labangon
Cebu City	48	Lahug (Pob
Cebu City	49	Lorega (Lo
Cebu City	50	Lusaran

LGU	No.	Barangay
Cebu City	61	Pasil
Cebu City	62	Pit-os
Cebu City	63	Pulangbato
Cebu City	64	Pung-ol-Si
Cebu City	65	Punta Prin
Cebu City	66	Quiot Pard
Cebu City	67	Sambag I (
Cebu City	68	Sambag II
Cebu City	69	San Antoni
Cebu City	70	San Jose
Cebu City	71	San Nicola
Cebu City	72	Santa Cruz
Cebu City	73	Sawang Cal
Cebu City	74	Sinsin
Cebu City	75	Sirao
Cebu City	76	Suba Pob.
Cebu City	77	Sudlon I
Cebu City	78	Sapangdaku
Cebu City	79	T. Padilla
Cebu City	80	Tabunan
Cebu City	81	Tagbao
Cebu City	82	Talamban
Cebu City	83	Taptap
Cebu City	84	Tejero (Vi
Cebu City	85	Tisa
Cebu City	86	To-ong Par
Cebu City	87	Zapatera
Cebu City	88	Sudlon II
Cebu City	89	Cebu Busin
Cebu City	90	Basak Pard
Cebu City	91	Basak Pard SRP
Cebu City	92	Cogon Pard
Cebu City	93	Cogon Pard SRP
Cebu City	94	Guadalupe North
Cebu City	95	Guadalupe South
Cebu City	96	Inayawan
Cebu City	97	Inayawan SRP
Cebu City	98	Mambaling
Cebu City	99	Mambaling SRP
Cebu City	100	San Roque West

Source: JICA Project Team

Table A1.3.2 Zone List 2

LGU	No.	Barangay
Cebu City	101	San Roque East
Cebu City	102	Tinago West
Cebu City	103	Tinago East
Cebu City	104	North Recl SW
Cebu City	105	North Recl NW
Cebu City	106	North Recl Portside
Cebu City	107	Pier 1, Cebu Port-
Cebu City	108	Pier 2, Cebu Port-
Cebu City	109	Pier 3, Cebu Port-
Cebu City	110	Pier 4, Cebu Port-
Cebu City	111	Pier 5, Cebu Port-
Cebu City	112	Pier 6, Cebu Port-
Compostela	113	Bagalnga
Compostela	114	Basak
Compostela	115	Buluang
Compostela	116	Cabadianga
Compostela	117	Cambayog
Compostela	118	Canamucan
Compostela	119	Cogon
Compostela	120	Dapdap
Compostela	121	Estaca
Compostela	122	Lupa
Compostela	123	Magay
Compostela	124	Mulao
Compostela	125	Panangban
Compostela	126	Poblacion
Compostela	127	Tag-ube
Compostela	128	Tamiao
Compostela	129	Tubigan
Consolacion	130	Cabangahan
Consolacion	131	Cansaga
Consolacion	132	Casili
Consolacion	133	Danglag
Consolacion	134	Garing
Consolacion	135	Jugan
Consolacion	136	Lamac
Consolacion	137	Lanipga
Consolacion	138	Nangka
Consolacion	139	Panas
Consolacion	140	Panoypoy
Consolacion	141	Pitogo
Consolacion	142	Poblacion
Consolacion	143	Poblacion
Consolacion	144	Polog
Consolacion	145	Pulpogan
Consolacion	146	Sacsac
Consolacion	147	Tayud
Consolacion	148	Tilhaong
Consolacion	149	Tolotolo
Consolacion	150	Tugbongan
Cordova	151	Alegria
Cordova	152	Bangbang
Cordova	153	Buagsong
Cordova	154	Catarman
Cordova	155	Cogon
Cordova	156	Dapitan
Cordova	157	Day-as
Cordova	158	Gabi
Cordova	159	Gilutongan
Cordova	160	Ibabao
Cordova	161	Pilipog
Cordova	162	Poblacion
Cordova	163	San Miguel
Cordova	164	Cordova Port
Danao City	165	Baliang
Danao City	166	Bayabas
Danao City	167	Binaliw
Danao City	168	Cabungahan
Danao City	169	Cagat-Lama
Danao City	170	Cahumayan
Danao City	171	Cambanay
Danao City	172	Cambubho
Danao City	173	Cogon-Cruz
Danao City	174	Danasan
Danao City	175	Dungga
Danao City	176	Dunggoan
Danao City	177	Guinacot
Danao City	178	Guinsay
Danao City	179	Ibo
Danao City	180	Langosig
Danao City	181	Lawaan
Danao City	182	Licos
Danao City	183	Looc
Danao City	184	Magtagobto
Danao City	185	Malapoc
Danao City	186	Manlayag
Danao City	187	Mantija
Danao City	188	Masaba
Danao City	189	Maslog
Danao City	190	Nangka
Danao City	191	Oguis
Danao City	192	Pili
Danao City	193	Poblacion
Danao City	194	Quisol
Danao City	195	Sabang
Danao City	196	Sacsac
Danao City	197	Sandayong
Danao City	198	Sandayong
Danao City	199	Santa Rosa
Danao City	200	Santican

Source: JICA Project Team

Table A1.3.3 Zone List 3

LGU	No.	Barangay
Danao City	201	Sibacan
Danao City	202	Suba
Danao City	203	Taboc
Danao City	204	Taytay
Danao City	205	Togonon
Danao City	206	Tuburan Su
Danao City	207	Danao Port-
Lapu-Lapu City	208	Agus
Lapu-Lapu City	209	Babag
Lapu-Lapu City	210	Baring
Lapu-Lapu City	211	Buaya
Lapu-Lapu City	212	Calawisan
Lapu-Lapu City	213	Canjulao
Lapu-Lapu City	214	Caw-oy
Lapu-Lapu City	215	Cawhagan
Lapu-Lapu City	216	Caubian
Lapu-Lapu City	217	Ibo
Lapu-Lapu City	218	Looc
Lapu-Lapu City	219	Mactan
Lapu-Lapu City	220	Maribago
Lapu-Lapu City	221	Marigondon
Lapu-Lapu City	222	Pajac
Lapu-Lapu City	223	Pajo
Lapu-Lapu City	224	Pangan-an
Lapu-Lapu City	225	Poblacion
Lapu-Lapu City	226	Punta Enga
Lapu-Lapu City	227	Pusok
Lapu-Lapu City	228	Sabang
Lapu-Lapu City	229	Santa Rosa
Lapu-Lapu City	230	Subabasbas
Lapu-Lapu City	231	Talima
Lapu-Lapu City	232	Tingo
Lapu-Lapu City	233	Tungasan
Lapu-Lapu City	234	San Vicent
Lapu-Lapu City	235	Bankal
Lapu-Lapu City	236	Bankal MEPZ 2
Lapu-Lapu City	237	Basak NW
Lapu-Lapu City	238	Basak East
Lapu-Lapu City	239	Basak South
Lapu-Lapu City	240	Basak MEPZ 2
Lapu-Lapu City	241	Gun-ob
Lapu-Lapu City	242	Gun-ob MEPZ 2
Lapu-Lapu City	243	Cargo Port-
Lapu-Lapu City	244	MCIA-
Liloan	245	Cabadianga
Liloan	246	Calero
Liloan	247	Catarman
Liloan	248	Cotcot
Liloan	249	Jubay
Liloan	250	Lataban

LGU	No.	Barangay
Liloan	251	Mulao
Liloan	252	Poblacion
Liloan	253	San Roque
Liloan	254	San Vicent
Liloan	255	Santa Cruz
Liloan	256	Tabla
Liloan	257	Tayud
Liloan	258	Yati
Mandaue City	259	Alang-alan
Mandaue City	260	Bakilid
Mandaue City	261	Banilad
Mandaue City	262	Basak
Mandaue City	263	Cabancalan
Mandaue City	264	Cambaro
Mandaue City	265	Canduman
Mandaue City	266	Casili
Mandaue City	267	Casuntinga
Mandaue City	268	Cubacub
Mandaue City	269	Guizo
Mandaue City	270	Ibabao-Est
Mandaue City	271	Jagobiao
Mandaue City	272	Labogon
Mandaue City	273	Maguikay
Mandaue City	274	Mantuyong
Mandaue City	275	Opao
Mandaue City	276	Pakna-an
Mandaue City	277	Pagsabunga
Mandaue City	278	Tabok
Mandaue City	279	Tawason
Mandaue City	280	Tingub
Mandaue City	281	Umapad
Mandaue City	282	Centro North
Mandaue City	283	Centro South
Mandaue City	284	Looc North
Mandaue City	285	Looc South
Mandaue City	286	Subangdaku NW
Mandaue City	287	Subangdaku SE
Mandaue City	288	Tipolo NW
Mandaue City	289	Tipolo SE
Mandaue City	290	Pier 7, Mandaue Port-
Minglanilla	291	Cadulawan
Minglanilla	292	Calajo-an
Minglanilla	293	Camp 7
Minglanilla	294	Camp 8
Minglanilla	295	Cuanos
Minglanilla	296	Guindaruha
Minglanilla	297	Linao
Minglanilla	298	Manduang
Minglanilla	299	Pakigne
Minglanilla	300	Poblacion

Source: JICA Project Team

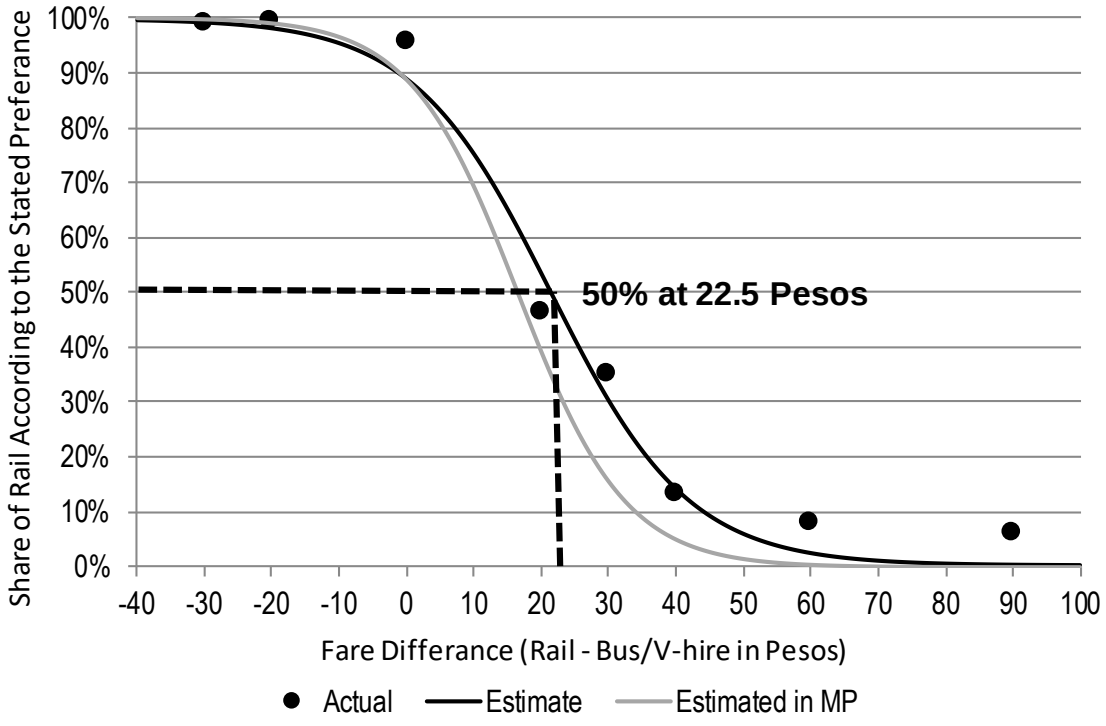
Table A1.3.4 Zone List 4

LGU	No.	Barangay
Minglanilla	301	Poblacion
Minglanilla	302	Poblacion
Minglanilla	303	Poblacion
Minglanilla	304	Tubod
Minglanilla	305	Tulay
Minglanilla	306	Tunghaan
Minglanilla	307	Tungkop
Minglanilla	308	Vito
Minglanilla	309	Tungkil
City of Naga	310	Alfaco
City of Naga	311	Bairan
City of Naga	312	Balirong
City of Naga	313	Cabungahan
City of Naga	314	Cantao-an
City of Naga	315	Central Po
City of Naga	316	Cogon
City of Naga	317	Colon
City of Naga	318	East Pobla
City of Naga	319	Inoburan
City of Naga	320	Inayagan
City of Naga	321	Jaguimit
City of Naga	322	Lanas
City of Naga	323	Langtad
City of Naga	324	Lutac
City of Naga	325	Mainit
City of Naga	326	Mayana
City of Naga	327	Naalad
City of Naga	328	North Pobl
City of Naga	329	Pangdan
City of Naga	330	Patag
City of Naga	331	South Pobl
City of Naga	332	Tagjaguimi
City of Naga	333	Tangke
City of Naga	334	Tinaan
City of Naga	335	Tuyan
City of Naga	336	Uling
City of Naga	337	West Pobla
San Fernando	338	Balud
San Fernando	339	Balungag
San Fernando	340	Basak
San Fernando	341	Bugho
San Fernando	342	Cabatbatan
San Fernando	343	Greenhills
San Fernando	344	Lantawan
San Fernando	345	Liburon
San Fernando	346	Magsico
San Fernando	347	Poblacion
San Fernando	348	Panadtaran
San Fernando	349	Pitalo
San Fernando	350	San Isidro
San Fernando	351	Sangat
San Fernando	352	Poblacion
San Fernando	353	Tabionan
San Fernando	354	Tananas
San Fernando	355	Tinubdan
San Fernando	356	Tonggo
San Fernando	357	Tubod
San Fernando	358	Ilaya
City of Talisay	359	Bulacao
City of Talisay	360	Cadulawan
City of Talisay	361	Cansojong
City of Talisay	362	Dumlog
City of Talisay	363	Jaclupan
City of Talisay	364	Lagtang
City of Talisay	365	Lawaan I
City of Talisay	366	Linao
City of Talisay	367	Maghaway
City of Talisay	368	Manipis
City of Talisay	369	Mohon
City of Talisay	370	Poblacion
City of Talisay	371	Pooc
City of Talisay	372	San Isidro
City of Talisay	373	San Roque
City of Talisay	374	Tabunoc
City of Talisay	375	Tangke
City of Talisay	376	Tapul
City of Talisay	377	Biasong
City of Talisay	378	Camp IV
City of Talisay	379	Lawaan II
City of Talisay	380	Lawaan III

Source: JICA Project Team

1.4 Reference Material 2 (The Willingness to Pay by the Public Transport User Survey)

Half the passengers would choose the rail service assuming it is faster by 10 minutes and more expensive by Php22.5 than bus or v-hire as shown in Figure A1.4.1. Those willing-to-pay has increased, compared with the result of the Roadmap Study (RM) (Php16.5).



Source: JICA Project Team

Figure A1.4.1 Stated Share of a Rail Service as a Function of the Fare Difference

1.5 Reference Material 3 (The List of Traffic Demand Forecast Data)

Table A1.5.1 List of Traffic Demand Forecast Data

	Item	Base Year/ Case		Folder Name	File Name	Sheet
Network	Road Network	Both	Do nothing	Network	MP2017_CBD_B120.int	
		2030	Wo1	Network	FRR2030_WO1.INT	
		2030	Wo2	Network	FRR2030_WO2.int	
		2030	Wo3	Network	FRR2030_WO3.int	
		2030	Wo4	Network	FRR2030_WO4.int	
		2030	Wo5	Network	FRR2030_WO5.int	
		2030	Do all	Network	FRR2030_All.int	
		2050	Wo1	Network	FRR2050_WO1.INT	
		2050	Wo2	Network	FRR2050_WO2.int	
		2050	Wo3	Network	FRR2050_WO3.int	
		2050	Wo4	Network	FRR2050_WO4.int	
		2050	Wo5	Network	FRR2050_WO5.int	
		2050	Do all	Network	FRR2050_All.int	
	Setting of Road Capacity	-		Network	Capacity_Cebu.xls	

	Item	Base Year/ Case		Folder Name	File Name	Sheet
	Setting of Link Speed	-		Network	Link_Speed.xlsx	
Population	Population (outside of study area)	2017		Population Trip Generation and Attraction	Cebu_Socio_MP2017_ver22.xlsx	2017
		2030		Population Trip Generation and Attraction	Cebu_Socio_MP2017_ver22.xlsx	2030
		2050		Population Trip Generation and Attraction	Cebu_Socio_MP2017_ver22.xlsx	2050
	Population (inside of study area) By Household Car Ownership	2017		Population Trip Generation and Attraction	Socio4.xlsx	2017
		2030		Population Trip Generation and Attraction	Socio4.xlsx	2030
		2050		Population Trip Generation and Attraction	Socio4.xlsx	2050
Trip Generation	Trip Generation By Purpose, Household Car Ownership	2017		Population Trip Generation and Attraction	Model_MP.xlsx	Control
		2030		Population Trip Generation and Attraction	Model_MP.xlsx	Control
		2050		Population Trip Generation and Attraction	Model_MP.xlsx	Control
Trip Generation and Attraction	Trip Generation and Attraction (inside of study area) By Purpose, Household Car Ownership	2017	No Vehicle	Population Trip Generation and Attraction	V1_2017.gad	
		2017	Bicycle	Population Trip Generation and Attraction	V2_2017.gad	
		2017	Motorcycle	Population Trip Generation and Attraction	V3_2017.gad	
		2017	Car	Population Trip Generation and Attraction	V4_2017.gad	
		2030	No Vehicle	Population Trip Generation and Attraction	V1_2030_ver22.gad	
		2030	Bicycle	Population Trip Generation and Attraction	V2_2030_ver22.gad	
		2030	Motorcycle	Population Trip Generation and Attraction	V3_2030_ver22.gad	
		2030	Car	Population Trip Generation and Attraction	V4_2030_ver22.gad	
		2050	No Vehicle	Population Trip Generation and Attraction	V1_2050_ver22.gad	
		2050	Bicycle	Population	V2_2030_ver22.gad	

	Item	Base Year/ Case		Folder Name	File Name	Sheet
				Trip Generation and Attraction		
		2050	Motorcycle	Population Trip Generation and Attraction	V3_2030_ver22.gad	
		2050	Car	Population Trip Generation and Attraction	V4_2030_ver22.gad	
Distribution	Distributed Trip (inside of study area) By Purpose, Household Car Ownership	2017	No Vehicle	Trip by Distribution/ Mode	V1P_2017.aod	
		2017	Bicycle	Trip by Distribution/ Mode	V2P_2017.aod	
		2017	Motorcycle	Trip by Distribution/ Mode	V3P_2017.aod	
		2017	Car	Trip by Distribution/ Mode	V4P_2017.aod	
		2030	No Vehicle	Trip by Distribution/ Mode	V1P_2030.aod	
		2030	Bicycle	Trip by Distribution/ Mode	V2P_2030.aod	
		2030	Motorcycle	Trip by Distribution/ Mode	V3P_2030.aod	
		2030	Car	Trip by Distribution/ Mode	V4P_2030.aod	
		2050	No Vehicle	Trip by Distribution/ Mode	V1P_2050.aod	
		2050	Bicycle	Trip by Distribution/ Mode	V2P_2050.aod	
		2050	Motorcycle	Trip by Distribution/ Mode	V3P_2050.aod	
		2050	Car	Trip by Distribution/ Mode	V4P_2050.aod	
	Distributed Trip (inside of study area) By Household Car Ownership	2030		Trip by Distribution/ Mode	V_2030.aod	
		2050		Trip by Distribution/ Mode	V_2050.aod	
Mode Split	Parameter File of Mode Split	No Vehicle		Trip by Distribution/ Mode Split	MS_G1.tmp	
		Bicycle		Trip by Distribution/ Mode Split	MS_G2.tmp	

	Item	Base Year/ Case		Folder Name	File Name	Sheet
		Motorcycle		Trip by Distribution/ Mode Split	MS_G3.tmp	
		Car		Trip by Distribution/ Mode Split	MS_G4.tmp	
	Zone-to-Zone Impedance	2017		Trip by Distribution/ Mode Split	Dist2017.iod	
		2030		Trip by Distribution/ Mode Split	Dist2030.iod	
		2050		Trip by Distribution/ Mode Split	Dist2050.iod	
	Cost Matrices File Mode Split	2017		Trip by Distribution/ Mode Split	GC2017.iod	
		2030		Trip by Distribution/ Mode Split	GC2030.iod	
		2050		Trip by Distribution/ Mode Split	GC2050.iod	
	Walking Rate	-		Trip by Distribution/ Mode Split	Walk_Rate.iod	
	Projection Result of Trip by Mode Split Walking	2017		Trip by Distribution/ Mode Split	Walk_V4.aod	
		2030		Trip by Distribution/ Mode Split	Walk_2030.aod	
		2050		Trip by Distribution/ Mode Split	Walk_2050.aod	
	Utilization Rate of Tricycle	-		Trip by Distribution/ Mode Split	Trcl_Rate.iod	
	Projection Result of Trip by Mode Split (Tricycle)	2030		Trip by Distribution/ Mode Split	V_2030_Trcl.aod	
		2050		Trip by Distribution/ Mode Split	V_2050_Trcl.aod	
	Current trip by Mode Split (inside of study area) 4 Choices including Tricycle	2017	No Vehicle	Trip by Distribution/ Mode Split	MS_V1.aod	
		2017	Bicycle	Trip by Distribution/ Mode Split	MS_V2.aod	
		2017	Motorcycle	Trip by Distribution/ Mode Split	MS_V3.aod	
		2017	Car	Trip by Distribution/	MS_V4.aod	

	Item	Base Year/ Case		Folder Name	File Name	Sheet
				Mode Split		
	Projection Result of Trip by Mode Split (inside of study area) * OD table to be Model of Mode Split	2030		Trip by Distribution/ Mode Split	V_2030wowtr.aod	
		2050		Trip by Distribution/ Mode Split	V_2050wowtr.aod	
	Projection Result of Trip by Mode Split (inside of study area) 3 Choices	2030	No Vehicle	Trip by Distribution/ Mode Split	V2030_V1.aod	
		2030	Bicycle	Trip by Distribution/ Mode Split	V2030_V2.aod	
		2030	Motorcycle	Trip by Distribution/ Mode Split	V2030_V3.aod	
		2030	Car	Trip by Distribution/ Mode Split	V2030_V4.aod	
		2050	No Vehicle	Trip by Distribution/ Mode Split	V2050_V1.aod	
		2050	Bicycle	Trip by Distribution/ Mode Split	V2050_V2.aod	
		2050	Motorcycle	Trip by Distribution/ Mode Split	V2050_V3.aod	
		2050	Car	Trip by Distribution/ Mode Split	V2050_V4.aod	
	Projection Result of Trip by Mode Split (outside of study area, airport, port and Truck)	2030		Trip by Distribution/ Mode Split	Ext2030.aod	
		2050		Trip by Distribution/ Mode Split	Ext2050.aod	
	Projection Result of Trip by Mode Split (total)	2017		Trip by Distribution/ Mode Split	MP2017.aod	
		2030		Trip by Distribution/ Mode Split	OD2030ver3.aod	
		2050		Trip by Distribution/ Mode Split	OD2050ver3.aod	
Traffic assignment	Traffic assignment Parameter File (PAR)	2017	Do nothing	Traffic Assignment	MP2017.PAR	
		2030	Do nothing	Traffic Assignment	MP2017.PAR	
		2030	Wo1	Traffic Assignment	FRR2030_WO1.PAR	
		2030	Wo2	Traffic Assignment	FRR2030_WO2.PAR	
		2030	Wo3	Traffic Assignment	FRR2030_WO3.PAR	

	Item	Base Year/ Case		Folder Name	File Name	Sheet
		2030	Wo4	Traffic Assignment	FRR2030_WO4.PAR	
		2030	Wo5	Traffic Assignment	FRR2030_WO5.PAR	
		2030	Do all	Traffic Assignment	FRR2030_All.PAR	
		2050	Do nothing	Traffic Assignment	MP2017.PAR	
		2050	Wo1	Traffic Assignment	FRR2050_WO1_r.PAR	
		2050	Wo2	Traffic Assignment	FRR2050_WO2.PAR	
		2050	Wo3	Traffic Assignment	FRR2050_WO3.PAR	
		2050	Wo4	Traffic Assignment	FRR2050_WO4.PAR	
		2050	Wo5	Traffic Assignment	FRR2050_WO5.PAR	
		2050	Do all	Traffic Assignment	2050_All.PAR	
	Traffic assignment Result (IRE)	2017	Do nothing	Traffic Assignment	2017.IRE	
		2030	Do nothing	Traffic Assignment	2030_DN.IRE	
		2030	Wo1	Traffic Assignment	2030_WO1.IRE	
		2030	Wo2	Traffic Assignment	2030_WO2.IRE	
		2030	Wo3	Traffic Assignment	2030_WO3.IRE	
		2030	Wo4	Traffic Assignment	2030_WO4.IRE	
		2030	Wo5	Traffic Assignment	2030_WO5.IRE	
		2030	Do all	Traffic Assignment	2030_All.IRE	
		2050	Do nothing	Traffic Assignment	2050_DN.IRE	
		2050	Wo1	Traffic Assignment	2050_WO1.IRE	
		2050	Wo2	Traffic Assignment	2050_WO2.IRE	
		2050	Wo3	Traffic Assignment	2050_WO3.IRE	
		2050	Wo4	Traffic Assignment	2050_WO4.IRE	
		2050	Wo5	Traffic Assignment	2050_WO5.IRE	
		2050	Do all	Traffic Assignment	2050_All.IRE	

Source: JICA Project Team

2 Capacity Development

The JICA Project Team conducted capacity development seminars and workshops for the stakeholders. The outline and the list of seminar materials are shown below.

2.1 Urban Transport Planning and Management

JICA Project Team conducted urban transport planning and management seminars and workshop as shown in the following table. Continuously, the list of seminar materials was also shown.

Table A2.1.1 Program of Capacity Development Seminars on Urban Transport Planning and Management

No.	Date & Time	Lecturer	Session	Particulars
March 15, 2018				
A-01	09:00–10:00	Ms. A. Nakagawa	Urban Development and Transportation Planning	Explanation of the highlights of the Roadmap Study results in terms of urban planning and discussed the issues on integration of transport planning and urban planning using case studies of integrated transport and urban planning.
A-02	10:15–12:00	Mr. S. Rene	Introduction to Transportation Planning	Basics of transportation planning. The rise and fall of transport planning in the Philippines. Urban transportation problems. Four-Step Model. Road hierarchy. What LGUs can do? New technologies and impact on urban mobility.
(cont.)	13:00–14:45	Mr. S. Rene	Introduction to Transportation Planning	
A-03	15:00–16:30	Ms. L. Madrona	Introduction to Traffic Engineering and Management	Introduction of the basic principles and fundamentals on traffic engineering and traffic management.
March 19, 2018				
B-01	08:30–12:00	Mr. S, Rene	Introduction to Public Transportation	What is public transport? Family of transport modes. Components of a good PT system. PUVMP of DOTr. Emerging role of LGUs in Philippine public transport. JICA's MCUT role/involvement in Metro Cebu.
B-02	13:00–16:30	Dr. P. Cal	Mobility Management	Discuss the various Transportation System Management and Transportation Demand Management measures applicable to mobility management, e.g. land use planning, traffic restraint, non-motorized transport, etc.
March 20, 2018				
C-01	08:30–12:00	Dr. P. Cal	Institutional Framework	Discussed laws and regulations that affect transportation planning and traffic management such functional matrix of entities in the transport sector, public service act, RA 4136, Local Government Code, etc., including the need for a local traffic code, TIA Ordinance, and Local TPTM Administration.

No.	Date & Time	Lecturer	Session	Particulars
C-02	13:00–14:30	Mr. K. Hamada	Pre-Study Visit Seminar (1) "Urban Development Master Plan for Kobe City"	How to establish maximum welfare society with minimum expenditure by Inclusive Development Master-Plan based on Transit Oriented Development of New Towns and New Islands in Kobe City. Land-use plan, transportation network plan, and economic, education, health, and social plans.
C-03	15:00–16:30	Mr. K. Hamada	Pre-Study Visit Seminar (2) "Urban Management for Implementation of Master Plan in Kobe City"	Discussed financial and administrative framework. Public developer method. Bond doctrine applied for PPP policy. Use of public enterprise account and public corporations as auxiliary institutions.
March 22, 2018				
D-01	08:30–11:00	Mr. K. Hamada	Pre-Study Visit Seminar (3) "Development Management and Control for Establishing Infrastructure System"	Lecture focused on the following topics: - Urban planning is legal plan based on Urban Planning Law including land-use, urban infrastructures/facilities and legal urban development plan. - Urban rapid railway, road/street network shall be authorized in urban planning. - Large development in urban planning area shall be controlled by development guideline based on Urban Planning Law. - Developer must provide transit/road system for resident and industry in planning area.
D-02	11:00–12:00	Mr. T. Saito	Traffic Signal and Control	Discussed the basics of traffic signal control, such as why traffic signal is needed, and demonstrated various ways to control traffic with traffic signal and how to set-up traffic signal effectively.
D-03	13:00–16:00	Ms. L. Madrona	Traffic Engineering and Management	Orientation of the participants on how to conduct the traffic engineering field surveys and how to prepare sample data analysis for the data collected from the field work.
August 7, 2018				
13:30–13:50		Mr. K. Hamada	Summary of Study Visit in Kobe	The workshop aimed to share the results of the study visit to Japan as the first step to learn how to reflect on the local settings in Metro Cebu. Two participants of the study visit presented the contents of the study visit as well as their lessons learned.
13:50–14:40		Ms. Perla Tumulak Amar	Study Visit Report (1)	
15:00–15:50		Mr. Glenn A. Soco	Study Visit Report (2)	
August 8 and 9, 2018				
13:30–16:30		Mr. K. Hamada	Introduction of road development using land readjustment methodology: Hands-on exercise	Participants learned about "land re-adjustment planning" methodology used in Japan through hands-on exercise. An area close to the planned the 4th bridge and coastal road in Mandaue City was used to make a land re-adjustment plan. In order to open new arterial roads and to widen existing arterial roads, as well as to open collector roads connecting to the arterial roads, the participants prepared a business plan (land readjustment/ conversion plan). Future land value after land readjustment becomes higher with

No.	Date & Time	Lecturer	Session	Particulars
				additional public infrastructure and facilities (roads, parks, and etc.) than existing land value. The aim was to learn how to formulate a "development plan" with developing necessary roads and public facilities without heavily relying only on conventional land acquisition method.
January 22, 2019				
9:30-10:15		Ms. L. Madrona	Strategy for Traffic Management by LGUs	Importance of traffic management by LGUs was highlighted due to the significant roles of LGUs. Participants learned how to manage the local traffic issues by utilizing their own resources.
10:15-11:00		Ms. A. Porciuncula	Financing Strategy for Traffic Management by LGUs	Participants learned the relevant laws and regulations as well as the structure of financing scheme to implement Area Traffic Control System.
11:00-11:45		Ms. A. Nakagawa	Strategy for Integration of Transport and Urban Planning through CLUP	The integration of transport and urban planning is essential to ensure the sustainable growth of Metro Cebu. Participants learned it through updates on CLUP based on the case studies.

Source: JICA Project Team

Table A2.1.2 List of Seminar Materials on Urban Transport Planning and Management

Presented Date	Name of Files
15 March 2018	A01_Urban Development and Transportation Planning
15 March 2018	A02_Introduction to Transport Planning (AM)
15 March 2018	A02_Introduction to Transport Planning (PM)
15 March 2018	A03_Introduction to Traffic Engineering and Management
19 March 2018	B-01_Introduction to Public Transportation
19 March 2018	B-02_Mobility Management
20 March 2018	C-01_Institutional Framework
20 March 2018	C-02_Urban Development Master Plan for Kobe City
20 March 2018	C-03_Urban Management for Implementation of Master Plan in Kobe City
22 March 2018	D-01_Development Management and Control for Establishing Infrastructure System
22 March 2018	D-02_Traffic Signal Control
7 August 2018	07_01_Urban Development Master Plan & Integrated Transportation Plan
	07_02_Kobe City Urban Development Guidelines
	07_03_Urban Development Guidelines _example
	Outline _Study Tour
8 August 2018	08_01_City Development & Management WG
	08_02_Urban Development Guidelines _Seishin New Town Development
9 August 2018	09_01_Urban Planning _Land Readjustment
	09_02_Land readjustment _Land use _Replotting
	20180809_Workshop and Exercise Maps
22 January 2019	01_Strategy for Traffic Management by LGUs

	02_Financing Strategy for Traffic Management by LGUs
	03_Strategy for Integration of Transport and Urban Planning through CLUP
	04_Summary of the Master Plan

Source: JICA Project Team

2.2 GIS Training

GIS training seminars were also conducted by the JICA Project Team as shown in the following table. The seminar materials are listed subsequently.

Table A2.2.1 Program of GIS Training Seminars

Date & Time	Lecturer	Session	Particulars
Basic Course 1st Session, 12 April 2018			
9:00–12:00 13:00–16:30	Ms. L. Lunas	GIS in Transportation and QGIS Application Performing Basic QGIS Operations Performing Basic QGIS Operations – Symbology and Print Composer Performing Basic QGIS Operations – Table Operations: Sorting/ Filtering/ Selection by Attribute/ Location	Introduced basic GIS Concepts, to familiarize with QGIS application (interface, symbology and printing maps).
Basic Course 2nd Session, 1 April 2018			
9:00–12:00 13:00–16:30	Ms. L. Lunas	Modifying Geometry and Simple GIS tools Thematic Maps Attribute Table Calculations Georeferencing	Familiarization of spatial data and table manipulation such as digitizing, and prepared thematic simple thematic maps and geo-reference jpeg maps.
Advanced Course 1st Session, 18 April 2018			
9:00–12:00 13:00–15:00	Ms. L. Lunas	GIS in Transportation and QGIS Applications Transportation Thematic Maps and Expressions Road Proximity Analysis Evacuation Planning	Introduced how to make transportation thematic maps and its expressions and familiarized road proximity analysis and evacuation planning.
Advanced Course 2nd Session, 19 April 2018			
9:00–12:00 13:00–15:00	Ms. L. Lunas and Ms. C. Watanabe	Data Verification Using Google Street View GIS in Transportation and QGIS Applications Traffic Volume Jeepney Route Assessment	Introduced Google street view for data verification and learned applications on traffic volume analysis and jeepney route assessment.
Advanced Course 3rd Session, 20 April 2018			
9:00–12:00 13:00–15:00	Ms. L. Lunas and Ms. C. Watanabe	Traffic Related Incidents Road Improvement Prioritization Outputs	As part of the outcome of this series of seminars, attendees made and presented the maps they created.

Source: JICA Project Team

Table A2.2.2 List of Seminar Materials on GIS Training

Presented Date	Name of Files
12 April 2018	QGIS Basic Day 1_1, QGIS Basic Day 1_2, QGIS Basic Day 1_3, QGIS Basic Day 1_4
13 April 2018	QGIS Basic Day 2_1, QGIS Basic Day 2_2, QGIS Basic Day 2_3, QGIS Basic Day 2_4
18 April 2018	QGIS Advanced Day 1_1, QGIS Advanced Day 1_2, QGIS Advanced Day 1_3, QGIS Advanced Day 1_4
19 April 2018	QGIS Advance Day 2_1, QGIS Advance Day 2_2, QGIS Advance Day 2_3, QGIS Advance Day 2_4
20 April 2018	QGIS Advance Day 3_1, QGIS Advance Day 3_2, QGIS Advance Day 3_3

Source: JICA Project Team

2.3 Traffic Demand Forecast

JICA Project Team conducted a traffic demand forecast seminar as shown in the following table. The seminar material is listed subsequently.

Table A2.3.1 Program of Traffic Demand Forecast Seminar

Date & Time	Lecturer	Session	Particulars
Orientation Seminar, 16 April 2018			
13:30–15:00	Mr. M. Komori	Introduction of Traffic Demand Forecast	1. Why do we need to forecast travel demand? 2. How to forecast travel demand? 3. What kind of survey are necessary for travel demand forecast? 4. Preliminary results of the supplemental traffic surveys conducted by the Study team.

Source: JICA Project Team

Table A2.3.2 List of Seminar Materials on Traffic Demand Forecast

Date of Presentation	Name of Files
16 April 2018	Demand Forecast

Source: JICA Project Team

2.4 Pilot Projects

JICA Project Team conducted seminars and workshops related with the Pilot Projects as shown in the following table. The seminar materials are listed subsequently.

Table A2.4.1 Program of Seminars and Workshops related with Pilot Projects

Date & Time	Lecturer	Session	Particulars
Orientation Seminar, 18 May 2018			
13:30–15:00	Ms. L. Madrona	Introduction of Outline of Improvement of Traffic Signal Control	JICA Project Team shared the fundamental skills and knowledge of transport management (especially for the improvements on intersection operation/ management and on LPTRP) as well as practical lessons learnt from these pilot projects through this open training seminars.
15:00–16:30	Ms. L. Madrona	Introduction of Outline of Local Public Transport Route Plan (LPTRP)	
Site Observation and Seminar for Traffic Signal Control, 7 September 2018			
11:00–12:30	Mr. T. Ong	Common Problems Encountered in Traffic Management Systems	Explained common problems on traffic management systems in Philippines through supplier's experiences.

Date & Time	Lecturer	Session	Particulars
13:30–16:00	Dr. T. Saito	Progress Report on Traffic Signal Control	Reported the progress situation on traffic signal control and discussed with stakeholders on how they can overcome current problems.
Workshop for LPTRP 1st Session, September 18th 2018			
13:30–16:00	Ms. L. Madrona and Mr. S. Rene	Main Issues on LPTRP in Metro Cebu and Present Public Transport Situation	Introduced current main issues on LPTRP in Metro Cebu and presented public transport situation. Discussed with stakeholders on the extraction of their requirements on new routes.
Workshop for LPTRP 2nd Session, 18 September 2018			
13:30–16:00	Ms. L. Madrona and Mr. S. Rene	Proposed LPTRP	Explained the new proposed PUV routes plan. Made an agreement with stakeholders.
Evaluation Meeting and Seminar for Traffic Signal Control, 18 September 2018			
13:30–16:00	Dr. T. Saito	Final results, findings, and recommendations on Traffic Signal Control	Reported final results, findings, and recommendations to stakeholders and discussed with them on how to introduce optimized control to their areas.

Source: JICA Project Team

Table A2.4.2 List of Seminar Materials on Pilot Projects

Presented Date	Name of Files
18 May 2018	01_Orientation Seminar _Improvement of Traffic Signal Control
	02_Orientation Seminar _LPTRP
7 September 2018	03_Site Observation _Mr. Tim
	04_Site Observation _Dr. Saito
18 September 2018	05_WS1_Issues-LPTRP
	06_WS2_Present PT Situation 3LGUs
20 September 2018	07_WS3_Proposed LPTR Plans
2 October 2018	08_Evaluation Meeting _Mr. Tim
	09_Evaluation Meeting _Dr. Saito

Source: JICA Project Team