


The Republic of the Union of Myanmar
Ministry of Construction

The Republic of the Union of Myanmar

Urban Development Plan for Regional Cities

- Mandalay, Pathein and Mawlamyine -



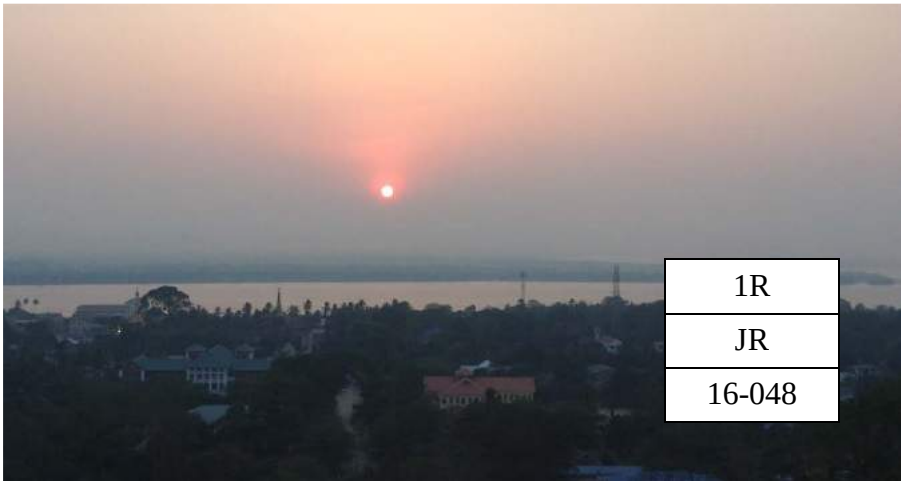

Data Collection Survey on Urban Development Planning for Regional Cities

FINAL REPORT <SUMMARY>

August 2016

JICA Study Team: Nippon Koei Co., Ltd.
Nine Steps Corporation
International Development Center of Japan Inc.



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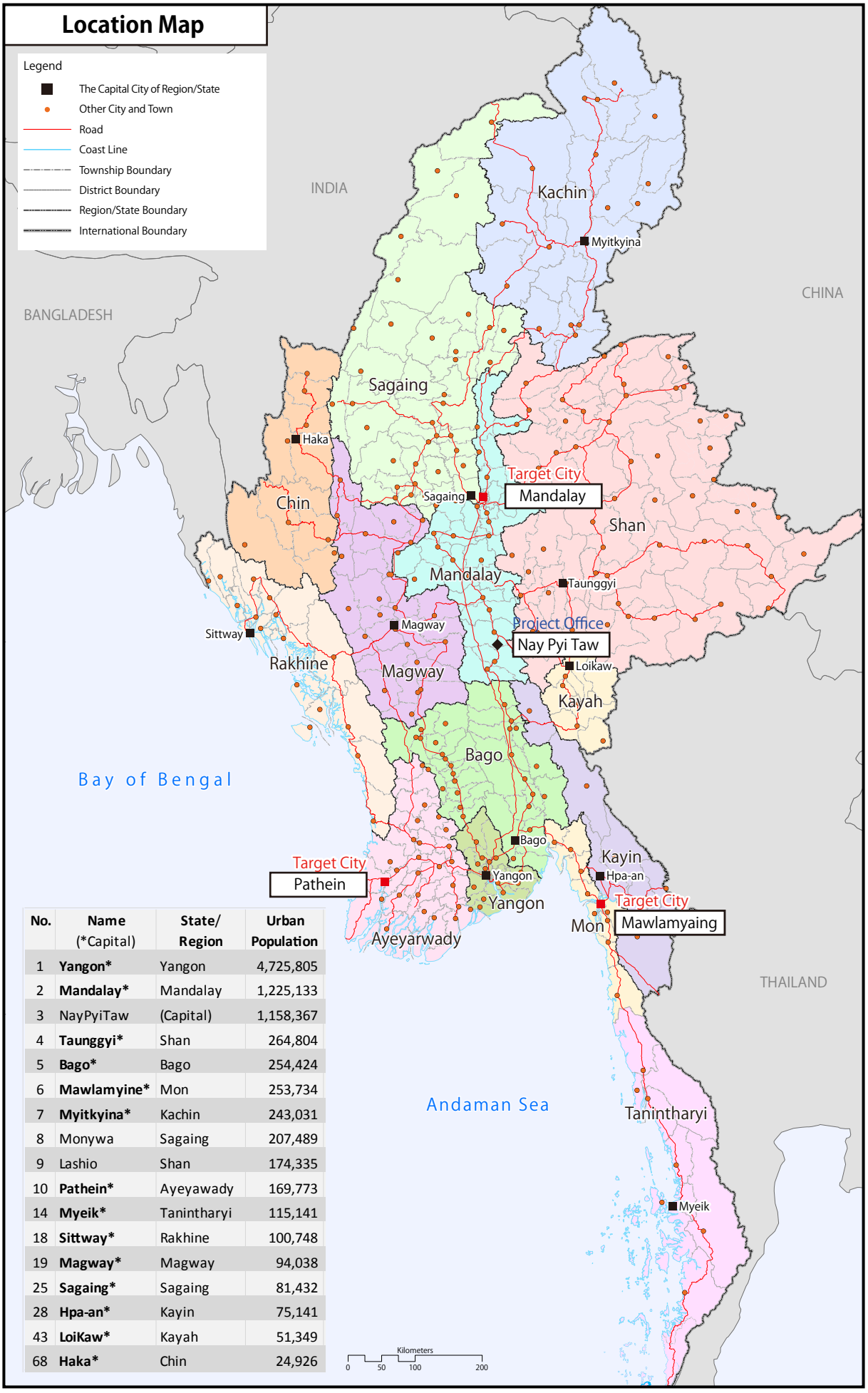
Location Map



No.	Name (*Capital)	State/ Region	Urban Population
1	**Yangon***	Yangon	4,725,805
2	**Mandalay***	Mandalay	1,225,133
3	NayPyiTaw	(Capital)	1,158,367
4	**Taunggyi***	Shan	264,804
5	**Bago***	Bago	254,424
6	**Mawlamyine***	Mon	253,734
7	**Myitkyina***	Kachin	243,031
8	Monywa	Sagaing	207,489
9	Lashio	Shan	174,335
10	**Pathein***	Ayeyawady	169,773
14	**Myeik***	Tanintharyi	115,141
18	**Sittway***	Rakhine	100,748
19	**Magway***	Magway	94,038
25	**Sagaing***	Sagaing	81,432
28	**Hpa-an***	Kayin	75,141
43	**LoiKaw***	Kayah	51,349
68	**Haka***	Chin	24,926

The Republic of the Union of Myanmar
Ministry of Construction (MOC)

The Republic of the Union of Myanmar

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Japan International Cooperation Agency (JICA)

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CONVERSION RATE (AT MARCH 2016)

1 MMK = 0.092 JPY, 1 JPY = 10.870 MMK

1 USD = 114.01 JPY, 1 JPY = 0.00877 USD

1 USD = 1239.45 MMK, 1 MMK = 0.000807

Source: JICA HP

LIST OF ABBREVIATIONS

ASEAN	Association of Southeast Asian Nations
ADB	Asia Development Bank
BCR	Building Coverage Ratio
BOT	Build Operate Transfer
BRT	Buss Rapid Transit
CBD	Central Business District
CDC	City Development Committee
C/P	Counterpart
DAO	Development Affairs Organization
DDG	Deputy Director General
DEM	Digital Elevation Model
DEPP	Department of Electric Power Planning
DEPTSC	Department of Electric Power Transmission & Control and System Control
DHPI	Department of Hydropower Implementation
DIG	Delta Industrial Group
DUHD	Department of Urban and Housing Development
ECFA	Engineering Firms Association
EIA	Environmental Impact Assessment
EPGE	Electric Power Generation Enterprise
ESE	Electricity Supply Enterprise
FASEP	Fonds d'Études et d'Aide au Secteur Privé
FAR	Floor Area Ratio
FMB	Farmland Management Body
FY	Fiscal Year
GAD	General Administration Department
GCP	Ground Control Point
GDP	Gross Domestic Products
GIS	Geographic Information System
GMS	Greater Mekong Subregion
GOM	Government of Myanmar
GPS	Global Positioning System
GRDP	Gross Regional Domestic Product
ICD	Inland Container Depot

IPP	Independent Power Producer
ITS	Intelligent Transport Systems
IWT	Inland Water Transport
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
JV	Joint Venture
LDC	Load Dispatch Center
LRT	Light Rail Transit
LTMC	Lorry and Truck Management Committee
MBMC	Mini Bus Management Committee
MCDC	Mandalay City Development Committee
MESC	Mandalay Electricity Supply Corporation
MIA	Mandalay International Airport
MIDV	Myanmar Industrial Development Vision
MIP	Myotha Industrial Park
MIMU	Myanmar Information Management Unit
MMID	Mandalay Myotha Industrial Development Public Co.,Ltd
MMK	Myanmar Kyat
MNBC	Myanmar National Building Code
MNPED	Ministry of National Planning and Economic Development
MOECAF	Ministry of Environmental Conservation and Forestry
MOEPE	Ministry of Electric Power and Energy
MOC	Ministry of Construction
MOHA	Ministry of Home Affairs
MHLW	Ministry of Health, Labour and Welfare. Japan
MIA	Mandalay International Airport
MOT	Ministry of Transport
MPA	Myanmar Port Authority
MPBND	Ministry for Progress of Border Areas and National Races and Development Affairs
MR	Myanmar Railways
MRT	Mass Rapid Transit
MSWM	Municipal Solid Waste Management
MYT Plan	The Survey Program for the National Transport Development Plan
NGO	Non-Governmental Organization
NCC	National Control Center

NCDP	National Comprehensive Development Plan
NMT	Non-motorized Transport
NPT	Nay Pyi Taw
NRW	Non-revenue water
PCCD	Pollution Control and Cleansing Department
PGM	Phy Gyi Mingalar (Truck Terminal)
PLC	Power Line Carrier
PPP	Public Private Partnership
PPTA	Project Preparatory Technical Assistance
RTAD	RTAD
SEZ	Special Economic Zone
SHM	Stakeholder Meeting
SMP	Semeikhon Port
SWM	Solid Waste Management
TA	Technical Assistant
TDC	Township Development Committee
TDAC	Township Development Affairs Committee
TDSC	Township Development Support Committee
TMC	Township Management Committee
TMuC	Township Municipal Committee
TOD	Transit Oriented Development
TPIC	Township Planning and Implementation Committee
UAGO	Union Attorney General Office
UK	United Kingdom
UFW	Un-accounted For Water
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
URDD	Urban Regional Development Division
USD	US Dollar
VMC	Vehicle Management Committee
WHO	World Health Organization
WTP	Water Treatment Plant
WWTP	Waste Water Treatment Plant
YESC	Yangon Electricity Supply Corporation
YUTRA	Yangon Urban Transportation Master Plan

PART 1

Survey & Preparation

< Summary >

Part 1: Survey & Preparation

1.1 Introduction

1.1.1 Background

Myanmar has been promoting economic deregulation after shifting the policy to emphasize reforms on international relations and economy since 2011. Along with this context, the position of Myanmar has been more powerful as new investment frontier in Asia as well as worldwide. Although Myanmar was one of the poorest countries in the Association of Southeast Asian Nation (ASEAN) before, now it can be said it has the highest growth potential. Myanmar's gross domestic product (GDP) per capita is estimated to reach to the level of middle-income countries by 2030 in case economic reforms and foreign direct investment continue steadily.

The Government of Myanmar formulated the "National Comprehensive Development Plan (NCDP)" in 2014 by Ministry of National Planning and Economic Development, which indicates the development policies of the whole country, and presents the guidelines of comprehensive development of all sectors and strategic national development goals. The "National Spatial Development Plan" and the "National Transportation Master Plan" were also formulated in 2014, by the Ministry of Construction and the Ministry of Transportation, respectively. Additionally, with respect to target cities of this project (hereafter referred to as "the Study"), there are "Urban Infrastructure Service Improvement Study (Asian Development Bank: Mandalay)" and "Comprehensive Development Plan Project for Southeast Region (Japan International Cooperation Agency: Mawlamyine)".

To accelerate economic development continuously, not only in Yangon but also in other regional cities such as Mandalay, Pathein, and Mawlamyine also have important role as regional hub. To promote the required roles of these cities, it is urgent to clarify the future development images and to formulate comprehensive urban development master plans. Based on these works, structured infrastructure development plans are also necessary to realize and implement the development potential of each city.

1.1.2 Objective

The objective of the Study is to support the Government of Myanmar in planning works of urban development master plans through conducting the following works:

i) Review of Relevant Policies and Plans, and Current Conditions;

ii) Proposal of Development Visions and Spatial and Structure Plans; and

iii) Proposal of a Roadmap of Key Projects.

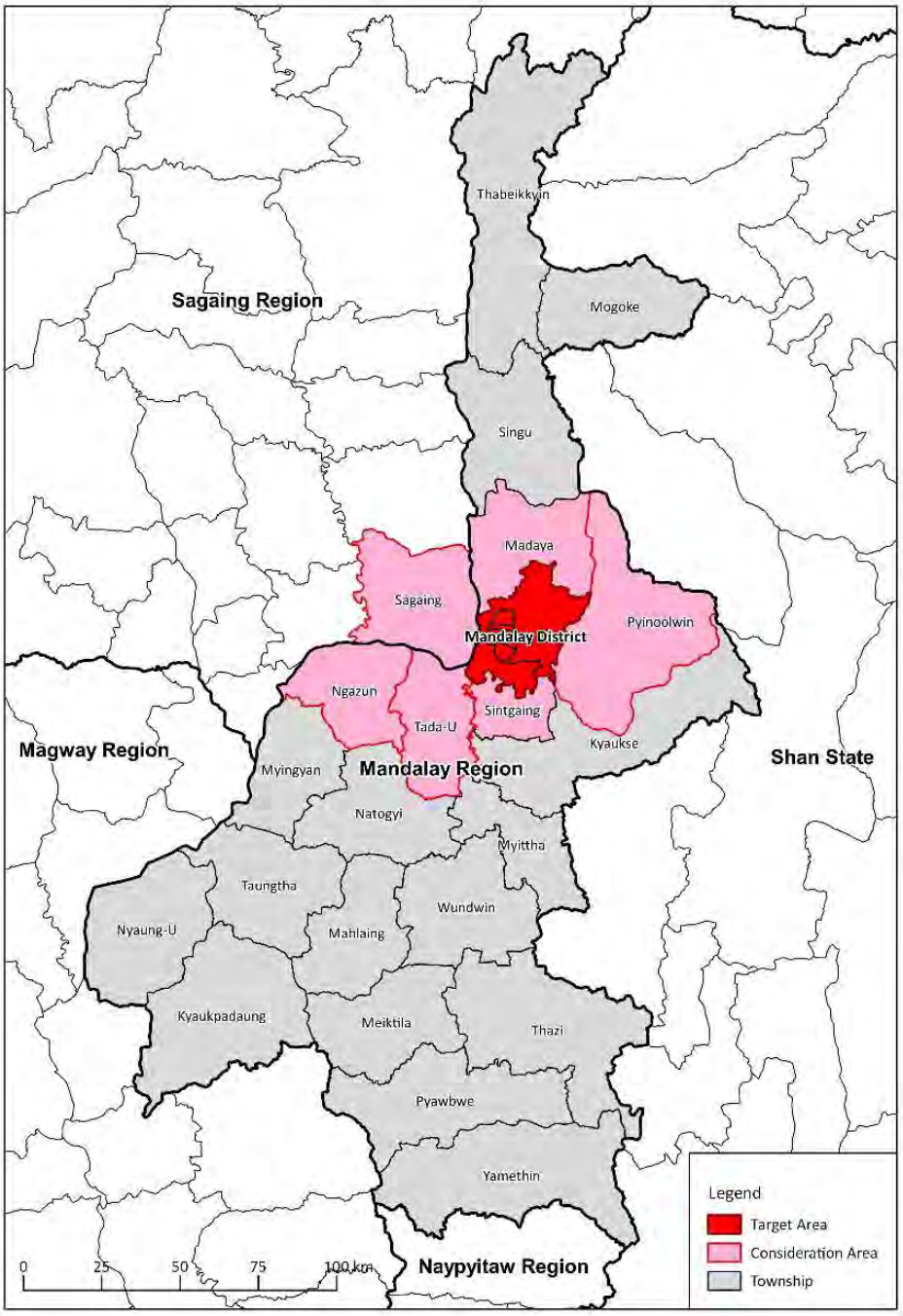
1.1.3 Study Target

The targets of the Study are the three cities, namely; Mandalay, Pathein, and Mawlamyine (hereafter referred to as the target three cities).

(1) Mandalay

Mandalay is located in the middle of Myanmar, which district is about 390 km north of Nay Pyi Taw and about 700 km north of Yangon. Mandalay District, corresponding to MCDC management area, is about 900 km^2, which stretches 46 km east and west, and 40 km north and south. The district consists of seven townships, namely: Aungmyetharzan, Chanayetharzan, Mahaaungmye, Chanmyatharzi, Pyigyidagun, Amarapura, and Patheingyi. The district belongs to Mandalay Region, which region shares border with Sagaing Region, Shan State, Kayin State, Bago Region, and Magway Region.

The red area in Figure 1.1.1 shows the planning area of this project, the whole Mandalay District, and the pink area shows the consideration area in which the planning area will be considered.



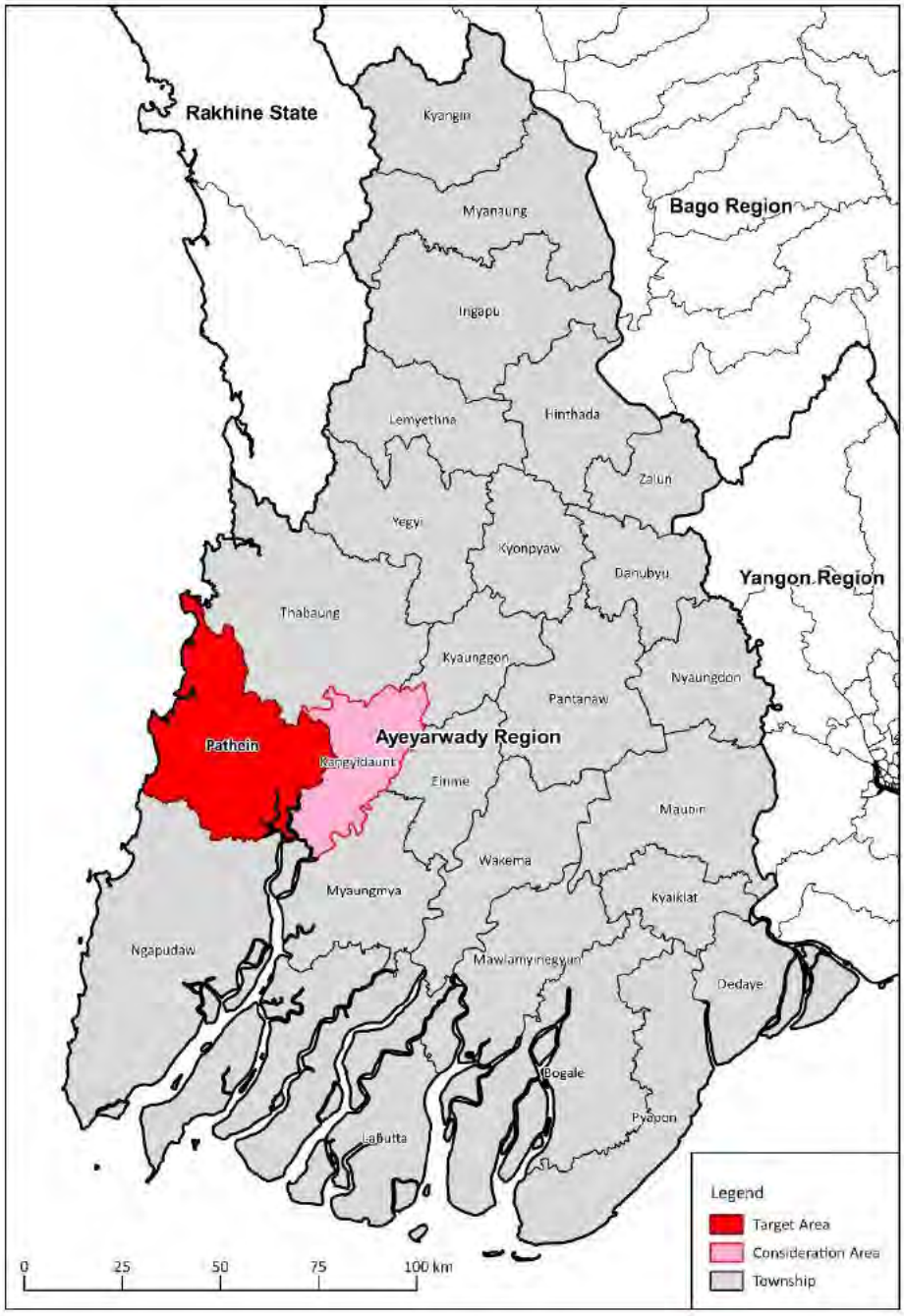
Source: JICA Study Team

Figure 1.1.1: Location Map of Mandalay District

(2) Pathein

Pathein is located in the south-west area of Myanmar, which is about 150 km west of Yangon and 40 km east from coast line. Pathein Township is about 1,450 km^2, which stretches 50 km east and west, and 68 km north and south. The township belongs to Pathein District and Ayeyawady Region, which region shares border with Rakhine State, Bago Region, and Yangon Region.

The red area in Figure 1.1.2 shows Pathein Township, which includes the planning area of this project shown in Part 2 of this report, and the pink area shows the consideration area in which the planning area will be considered.



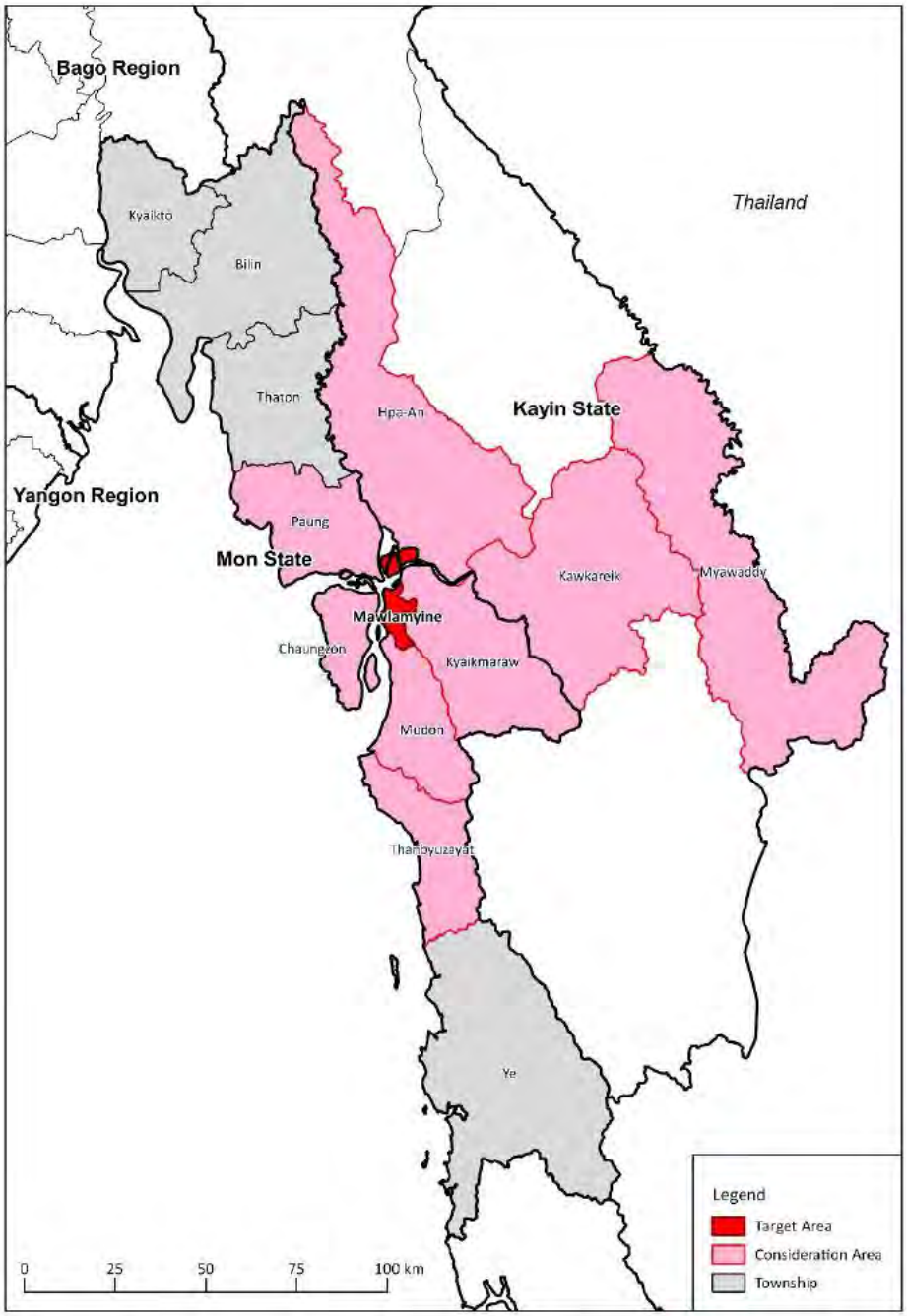
Source: JICA Study Team

Figure 1.1.2: Location Map of Pathein Township

(3) Mawlamyine

Mawlamyine is located in the south-east area of Myanmar, which is about 160 km north-east of Yangon. Mawlamyine Township is about 219 km^2, which stretches 11 km east and west, and 18 km north and south. The township belongs to Mawlamyine District and Mon State, which state shares border with Bago Region, Kayin State, and Tanintharyi Region.

The red area in Figure 1.1.3 shows the planning area of this project, the whole Mawlamyine Township, and pink area shows the consideration area in which the planning area will be considered.



Source: JICA Study Team

Figure 1.1.3: Location Map of Mawlamyine Township

1.1.4 Study Period

The study started at the end of December 2015 and completed in August by the submission of the Final Report 2016. The deliverables of the Study are shown in Table 1.1.1.

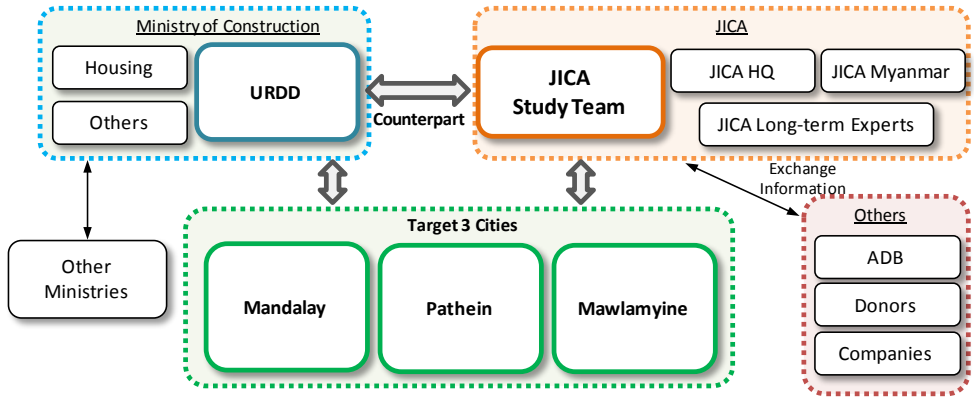
Table 1.1.1: Menu of Deliverables

Deliverable	Delivery Time	Language
Inception Report	January 2016	English, Japanese
Progress Report	April 2016 (initially March 2016)	English, Japanese (Summary)
Final Report	August 2016 (initially June 2016)	English (Full Report and Summary), Japanese (Summary), Myanmar (Summary)

Source: JICA Study Team

1.1.5 Study Implementation

The counterpart organization (hereinafter referred to as the "C/P") of the Study is the Urban Regional Development Division, Department of Urban and Housing Development, Ministry of Construction (hereafter referred to as the "URDD", "DUHD", "MOC", respectively). The main contact organizations of the three cities are the DUHD Branch Office in each region/state, and region/state governments. Additionally, Mandalay City Development Committee (hereafter referred to as the "MCDC") is also the main consultative body in Mandalay. The Study also cooperates with the main relevant organizations, such as General Administration Department (hereinafter referred to as the "GAD") and Township Development Committee (hereinafter referred to as the "TDC") in each city as shown in Figure 1.1.4.



Source: JICA Study Team

Figure 1.1.4: Main Relevant Organizations

1.1.6 Formulation Methodology

In the Study, it is necessary to conduct field survey, data collection, public involvement, and consensus building efficiently in distant target three cities. Under current movement toward democratization, the Study put more emphasis on public involvement in the process of urban development planning. The Study set two types of meetings in the Study:

- Workshop Meeting: to discuss with C/P and related organizations; and
- Seminar: to collect opinions of various stakeholders such as representatives of local communities.

Table 1.1.2: Work Process and Schedule of Field Surveys and Stakeholder Meetings

Month	Event	Venue	Main Contents
Jan	Kick-off Meeting	Nay Pyi Taw	- Explanation and basic approval of the outline of the Study - Establishment of a Planning Team with the C/P
	Field Survey (1)	3 cities	- Field survey in the field of urban, industry, environment, and social.
Feb	Field Survey (2)	3 cities	- Field survey in the field of infrastructure.
Mar	1st Workshop Meeting	3 cities	- Discussion and analysis of current conditions and issues - Additional survey by the JICA experts
Apr	2nd Workshop Meeting	Nay Pyi Taw	- Discussion of directions of target three cities - Discussion of visions, socio-economic frameworks, and policies
May	Seminar	3 cities	- Opinion collection of visions, frameworks, and policies - Proposals and selection of alternatives (SEA process)
Jun	3rd Workshop Meeting	Nay Pyi Taw	- Discussion of draft spatial and structure plans - Advices and recommendations

Source: JICA Study Team

Table 1.1.3: Summary Result of Kick-off Meeting

Title of the Meeting	Kick-off Meeting
Date and Time	19 January 2016 (Tue) 13:00-14:15
Venue	Nay Pyi Taw (the Meeting Room of MOC)
Chairperson	Director General, DUHD
Total Number of Participants	39 participants
Participated Organizations	Ministry of Construction, Department of Urban Housing Development, General Administration Department, MCDC, JICA

Source: JICA Study Team

Table 1.1.4: Summary Result of the 1st Workshop in Mandalay

Title of the Meeting	Urban Development Planning Workshop
Date and Time	18 March 2016 (Friday) at 13:00 – 17:30
Venue	Mandalay Hill Resort Hotel
Chairperson	Deputy Director General, DUHD
Total Number of Participants	36 participants
Participated Organizations	DUHD, MCDC, MORT, DOA, DMH, DLMS, DISI, DOH, DORD, ECD, Forest Department, DOP, Transport Division, GAD

Source: JICA Study Team

Table 1.1.5: Summary Result of the 1st Workshop in Pathein

Title of Meeting	Urban Development Planning 1st Workshop in Pathein
Date and Time	25 March 2016 (Friday) 13:00–17:30
Venue	Pathein Hotel, Pathein City
Chairperson	Deputy Director of URDD, MOC
Total Number of Participants	21 participants
Participated Organizations	DUHD, GAD, Forest, MOI, TDC, ECD, DRD, Planning Department

Source: JICA Study Team

Table 1.1.6: Summary Result of the 1st Workshop in Mawlamyine

Title of the Meeting	Urban Development Planning Workshop
Date and Time	22 March 2016 (Tue) 13:00 – 17:30
Venue	Shwe Myint Mo Tun Hotel, Mawlamyine City
Chairperson	Deputy Director, URDD, MOC
Total Number of Participants	27 participants
Participated Organizations	Forest, DUHD, GAD, Health, DRD, DMH, DISI, SDA, Planning Department, ECD, Archaeology Department, Education, TDC

Source: JICA Study Team

Table 1.1.7: Summary Result of Courtesy Call in Target 3 Cities

Mandalay	Title of the Meeting	Courtesy Call to Mandalay Region Government
	High Ranking Official	Commissioner, Deputy Director General, GAD, Mandalay Region

	Attendance	
	Date and Time	18 March 2016 (10:00 – 11:00)
	Venue	Meeting Room, GAD office, Mandalay
	Total Number of Participants	9 participants
	Participated Organizations	GAD, DUHD
Pathein	Title of the Meeting	Courtesy Call to Pathein Region Government
	High Ranking Official Attendance	Secretary, Ayeyarwaddy Regional Government Office
	Date and Time	25 March 2016 (10:00 -10:30)
	Venue	Meeting Room (2), GAD office, Pathien
	Total Number of Participants	13 participants
	Participated Organizations	DUHD, MNPED, TDC
Mawlamyine	Title of Meeting	Courtesy Call to Mawlamyine Region Government
	High Ranking Official Attendance	Minister of Mon State
	Date and Time	22 March 2016 (10:00 – 10:30)
	Venue	Meeting Room, GAD office, Mawlamyine
	Total Number of Participants	32 participants
	Participated Organizations	CDC, GAD, INPD, RD, NPD, Forest, MOEP, ECD, MPT, Marine, Aviation, Railway, DUHD, Irrigation, Water resource, DLMS

Source: JICA Study Team

Table 1.1.8: Summary Result of the 2nd Workshop in Nay Pyi Taw

Title of the Meeting	Urban Development Planning Workshop
Date and Time	3 May 2016 (Tuesday) at 13:00 – 17:30
Venue	Office 40, Ministry of Construction, Meeting Room
Chairperson	Deputy Director General, DUHD
Total Number of Participants	40 participants
Participated Organizations	DUHD, DAN, DH, MORAC, MOTC, Planning Department, GAD, TDC, MCDC, MES, ECD, DALMS

Source: JICA Study Team

Table 1.1.9: Summary Result of the seminar in Mandalay

Title of the Meeting	Urban Development Planning Seminar
Date and Time	9 May 2016 (Monday) at 13:00 – 17:30
Venue	Mandalay Hill Resort Hotel
Chairperson	Deputy Director General, DUHD
Total Number of Participants	67 participants
Participated Organizations	DUHD, MCDC, TDC, Planning Department, DAR, DAN, Forest Department, ECD, DMH, MTU, MU, MGH, Companies, Merchants, ChinDwin College

Source: JICA Study Team

Table 1.1.10: Summary Result of the seminar in Pathein

Title of the Meeting	Urban Development Planning Seminar
Date and Time	13 May 2016 (Friday) at 13:00 – 17:30
Venue	Pathein Hotel
Chairperson	Deputy Director, URDD
Total Number of Participants	48 participants
Participated Organizations	DUHD, GAD, TDC, DOC, DTAA, DMH, DISI, Planning Department, Forest Department, ARCCI, University, Companies, Merchants, Hotels
Minutes	(See attached file)

Source: JICA Study Team

Table 1.1.11: Summary Result of the seminar in Mawlamyine

Title of the Meeting	Urban Development Planning Seminar
Date and Time	18 May 2016 (Wednesday) at 13:00 – 17:30
Venue	Ngwe Moe Hotel
Chairperson	Deputy Director, URDD
Total Number of Participants	54 participants
Participated Organizations	DUHD, DRD, GAD, TDC, DAN, DMH, MOSBA, Planning Department, LF, CSO, DISI, DAAS, Finance Department, ECD, Hotels, ADB, TU, UNHCR

Source: JICA Study Team

Table 1.1.12: Summary Result of Courtesy Call in Target 3 Cities

Mandalay	Title of the Meeting	Courtesy Call to Mandalay Region Government
	High Ranking Official Attendance	Chief Minister, Mandalay Regional Office
	Date and Time	9 May 2016 (10:00 – 12:30)
	Venue	Meeting Room, GAD office, Mandalay
	Total Number of Participants	14 participants
	Participated Organizations	MRO, MCDC, MOEP, MOC, MOEA, MOEP, MOC
Pathein	Title of the Meeting	Courtesy Call to Pathein Region Government
	High Ranking Official Attendance	Chief Minister, Ayeyarwaddy Regional Office
	Date and Time	13 May 2016 (10:00 -12:30)
	Venue	Meeting Room , GAD office, Pathien
	Total Number of Participants	12 participants
	Participated Organizations	ARO, MOEP, MOTC, ARA, DUHD
Mawlamyine	Title of Meeting	Courtesy Call to Mawlamyine Region Government
	High Ranking Official Attendance	Chief Minister, Mawlamyine Regional Office
	Date and Time	18 May 2016 (10:00 – 12:30)
	Venue	Meeting Room, GAD office, Mawlamyine
	Total Number of Participants	14 participants
	Participated Organizations	MRO, MOBEA, MOKEA, MOPEA, MOSBA, MOALT, DUHD

Source: JICA Study Team

Table 1.1.13: Summary Result of the 3rd Workshop in Nay Pyi Taw

Title of the Meeting	Urban Development Planning Workshop
Date and Time	16 June 2016 (Thursday) at 13:00 – 17:30
Venue	Office 40, Ministry of Construction, Meeting Room
Chairperson	Director General, DUHD
Total Number of Participants	40 participants
Participated Organizations	DUHD, MORAC, MOTC, MONPF, MOHT, ECD, GAD, MCDC, TDC, The Asia Foundation

Source: JICA Study Team

Table 1.1.14: Summary Result of Courtesy Call Meeting with Mandalay Mayor

Mandalay	Title of the Meeting	Courtesy Call Meeting with Mandalay Mayor
	High Ranking Official Attendance	Mayor, Mandalay City Development Committee
	Date and Time	20 June 2016 (10:30 – 12:15)
	Venue	MCDC office, Meeting Room
	Total Number of Participants	19 participants
	Participated Organizations	MCDC, DUHD

Source: JICA Study Team

Kich-off Meeting @ NPT

1st Workshop Meeting @ Mandalay

1st Workshop Meeting @ Pathein

1st Workshop Meeting @ Mawlamyine

2nd Workshop Meeting @ NPT

1st Seminar @ Mandalay

1st Seminar @ Pahein

1st Seminar @ Mawlamyine

Source: JICA Study Team

Figure 1.1.5: Pictures of Meeting (1/2)


Courtesy Call to Mandalay Region


Courtesy Call to Ayeyarwaddy Region


Courtesy Call to Mon State


2rd Workshop @ NPT


Explanation to Mandalay Mayor

Source: JICA Study Team

Figure 1.1.6: Pictures of Meeting (2/2)

1.2 Legal and Regulatory Framework

1.2.1 Urban and Regional Development Planning Law

Since the urban development plan to be formulated in the Study shall be defined in the currently being prepared law, namely; "Urban and Regional Development Planning Law", the review of this law is the most important aspect of the Study.

Drafts of the law have been submitted from MOC to the National Attorney General Office (hereinafter referred to as "NAGO") thrice so far, and MOC received comments on it and modified it each time. Currently, MOC is under work for the modification of the 3rd comment from NAGO. The 3rd draft submission is shown in the attachment of the report. Afterward if the procedure goes smoothly, the draft will be sent to the Presidential Office. According to MOC's prospect, the draft law will proceed to the Parliament after June 2016.

The law classifies 367 cities and towns into five grades, from Grade A to Grade E, depending on those population volumes or regional roles. As per classification, Mandalay is Grade A, and Pathein and Mawlamyaine are Grade B as shown in Table 1.2.1.

Table 1.2.1: City Grade in the Draft Law

Grade	Definition	Target 3 Cities
Grade A	CDC – 3 cities	Mandalay
Grade B	District Level >20,000 pop, Township 40,000-100,000 pop (70 no)	Pathein and Mawlamyaine
Grade C	District Level < 20,000 pop, Township 20,000-40,000 pop (66 no)	
Grade D	Township 10,000-20,000 pop (68 no)	
Grade E	Township <10,000 pop (160 no)	

Source: JICA Study Team based on MOC Material

1.2.2 Other Related Laws

(1) Condominium Law

Condominium Law has been enacted, which defines to regulate the classification ownership of condominium, including foreigner's ownership, in February 2016. Target in the law is the condominium with more than six stories and/or has site area of more than 20,000 ft^2 (approximately 1,858 m^2). Foreigners are allowed to dominate up to 40% of the number of households in the target condominium. The supervisory authority of the law is the Housing Development Division, DUHD, MOC.

Since this law defines individual buildings and those ownerships, it may not be affected by the law in the urban development plan. On the other hand, this law shall encourage urban development projects by foreign investors and high-rise building construction. These should be taken into account in the planning work.

(2) National Housing Development Law

The National Housing Development Law is being prepared in similar schedule with the Urban and Development Planning Law. Current status of the law is in the phase of finalizing the draft with NAGO. The law, which consists of 15 chapters and 67 articles, aims at sustainable housing development to contribute to economic growth and living improvement. The draft law is expected to proceed to the Parliament after June 2016. The supervisory authority of the law is the Housing Development Division, DUHD, MOC, same as Condominium Law.

This law must be close relationship with the urban development plan, especially in housing supply. Because a sort of housing supply master plan may be formulated under the law, relevant information should be collected in the planning work.

(3) Myanmar National Building Code

The Myanmar National Building Code (called "MNBC") was made as its "Provisional" in 2012 supported by UN-Habitat. As the provisional consists of seven parts in total, Part 1 regulates "Planning, Environment, Administration and Legislation", including zoning classification and planning permission. Current status of the law is in the phase of public hearing to collect opinions of stakeholders. MOC intends to enact the law within 2016. The supervisory authority of the law is the Department of Building, MOC.

Since this law covers zoning and planning permission, it should be referred more in detail urban design to realize urban spatial plan. In the implementation stage after planning stage, the law will have necessary power to control individual building shape and location.

(4) Myanmar Construction Industry Development Board Law

The Myanmar Construction Industry Development Board Law has commenced its drafting work. The objective of the law is to identify building and development permission and its procedure and criteria in order to control the quality of buildings. The supervisory authority of the law is the Department of Building, MOC.

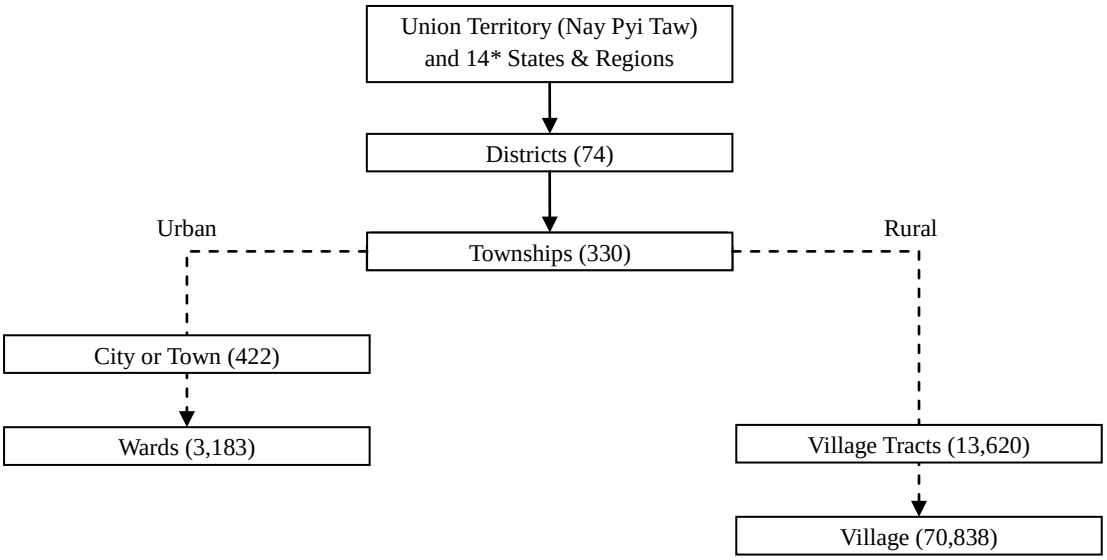
This law should be referred more in implementation stage rather than planning stage. In the plan, this law will be mentioned as one of necessary law for urban management for realizing the urban spatial plan.

1.3 Organization Framework

(1) Administrative Structure of Myanmar

Myanmar's administrative structure, shown in Figure 1.3.1, has three major layers; Union Territory (Nay Pyi Twa) and 14 regions and states as the first layer, 74 districts as the second layer, then 330 townships as the third layer. Townships are separately administrated; consisting of wards in urban area and village tracts in rural area.

The 2008 Constitution, implemented since 2011, is the current primary legal reference framework for governance of Myanmar. As stipulated in Schedule II, the municipal management and development affairs fall in the autonomous area of the region and state government. However, all other areas of governance of sub-national level are still based on the function of the union ministries which maintain offices at the state/region, district, and township levels.



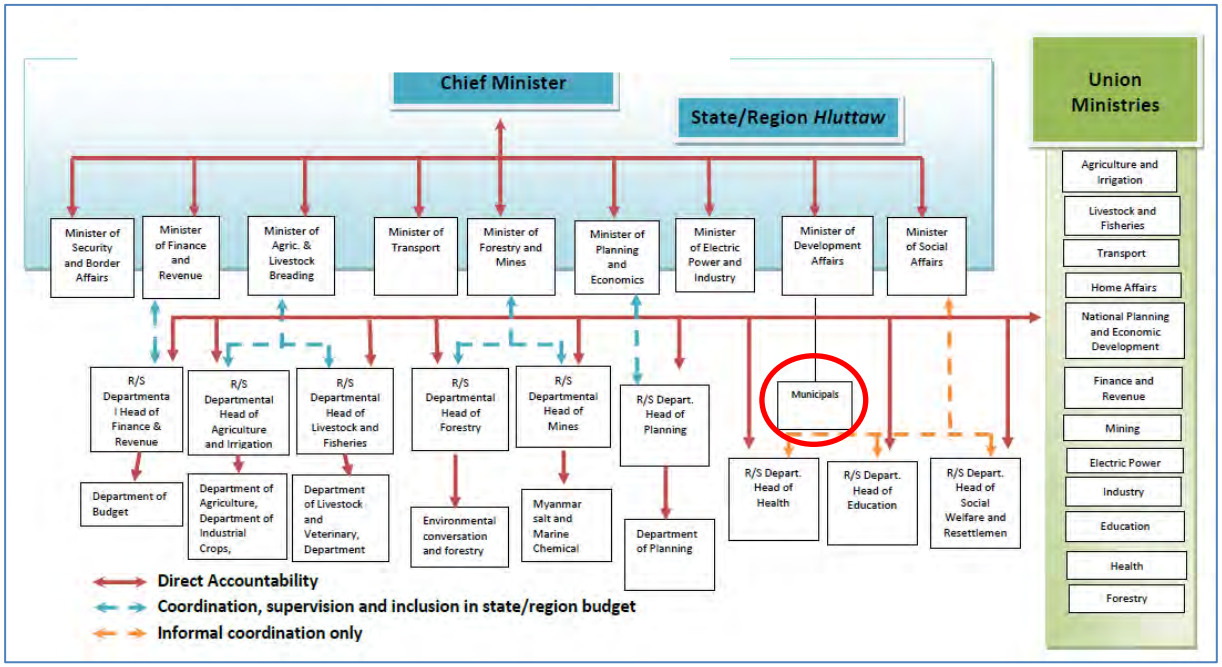
Source: General Administration Department, Ministry of Home Affairs, March 2015

Figure 1.3.1: Myanmar Administrative Structure

(2) Regional Structure of DUHD

The autonomy of the region and state government, established by series of reforms in Myanmar legislation since 2011, was the ex-President H.E.U. Thein Sein government priority to avert international sanctions and to fix Myanmar's relationship with the international community. A gradual shift of responsibilities from the union level to region and state governance has taken place since then, but not yet fully extended the transfer of responsibilities to local-level institutions. As mentioned in Section (i), it is the uniqueness of the Myanmar's sub-national governance that the chief minister and his/her supporting nine ministers at the region and state level do not have their own bureaucracy independently functioning from the Union Government as shown in Figure 1.3.2. Only exception is the municipal management and development affairs under the Ministry of Development Affairs, which are allowed to prepare a local developing plan independently. The nine ministers at the sub-national level (region and state level) are appointed by the State of Region Chief Minister, who himself/herself is appointed by the Chief Minister of the State, conditioned to the approval of the respective state or region *Hluttaw* (parliament), whereas the public administration at the sub-national level is conducted by civil servant, in the 2008 Constitution.

To further advance the decentralization in local municipal service and exercise legislative powers, followed by the Presidential Notification and new municipal laws in 2013, the sub-national government formed four committees: Township Management Committee (TMC), Township Development Support Committee (TDSC), Township Development Affairs Committee (TDAC) (in some articles, this committee is translated as Township Municipal Committee (TMuC)), and Farmland Management Body (FMB).



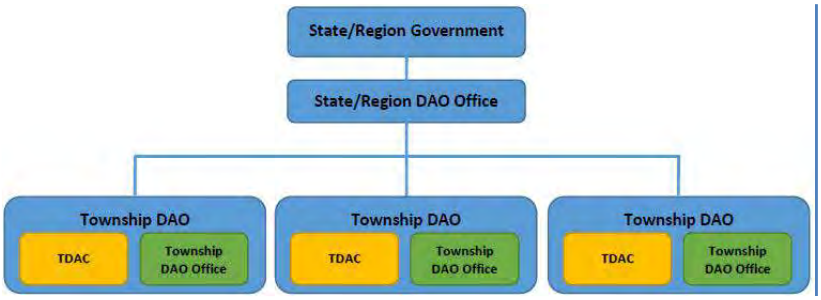
Source: Arnold M., Saw K.P.C., "Administrating the State in Myanmar; An Overview of General Administration Department", October 2014

Figure 1.3.2: Region and State Government Structure

(3) Planning Process at the Township Level[1]

The townships are not elected level of government but are local administrative divisions of the states and regions, as well as of the Union Territory, and it is the administrative unit covering the entire national territory.

The working body for the state or region minister of development affairs is the Development Affairs Organizations (DAOs). All of Myanmar's townships, outside of Yangon City, Mandalay City, and Nay Pyi Taw Union Territory, have a Township DAO Office that is under the full control of their respective state or region government. Township DAOs have two complementary entities: a Township Development Affairs Committee (TDAC) and a Township DAO Office. DAOs manage local municipal affairs at the township level. The State/Region DAO Office in the state/region capital is, in turn, mainly responsible for coordination and staff management for the whole state/region. In contrast, at the township level, TDAC and Township DAO Office work together to prioritize public works and municipal management. Figure 1.3.3 shows DAO positioning within sub-national governance.



Source: Arnold M., Aung Y T., Kempel S., et al," Municipal Governance in Myanmar, An Overview of Development Affairs Organizations", July 2015

Figure 1.3.3: DAO Positioning within Subnational Governance

[1] Arnold M, "Municipal Governmance in Myanmar",July 20015

(4) Governance in Mandalay

Municipal affairs in Yangon and Mandalay cities are organized differently than the rest of the country, as described in the previous Section (3).

Mandalay, consists of seven townships, is managed by the Mandalay City Development Committees (MCDC), which are responsible for municipal service delivery and public works (waste management, water supply, roads and bridges, parks and sports grounds, street lighting, funeral services and firefighting), city planning, urban land administration, tax collection (including business licensing and registration), public health, and urban development. The current responsibility and power belonging to municipality is routed in the 1898 Municipal Law, which introduced provisions of new electrification, expanded collection of fees for the urban services to the Municipal, as well publics works listed above.

These objectives are being implemented by the following 14 departments[2]:

1. Administration Development
2. Motor Transport and Workshop Department
3. Market and Slaughter House Department
4. Finance Department
5. Revenue Department
6. Cleaning Department
7. Playgrounds, Parks and Gardens Department
8. Building and Central Stores Department
9. Roads and Bridges Department
10. Water and Sanitation Department
11. City Planning and Administration Department
12. Public Relation and Information Department
13. Inspection Department
14. Agriculture and Livestock Breeding Department

(5) Urban Planning in Pathein and Mawlamyine[3]

Though the basic governance framework is the same with other state or region of the country, Ayeyawady Region and Mon State are reported to try different approach in planning phase of annual budget for municipal activities.

In Ayeyawady Region, new practices for "participatory planning" are taking place, these are consultations with local communities and interest groups to obtain suggestions and priorities. This is happening at the township level in Ayeyawady through line ministry institutions such as the Township Planning and Implementation Committee (TPIC). The strongest emphasis on public participation is identified in Pathein, where businessmen and "elders" or recognized leaders from the community are the prominent members. However, still, horizontal coordination has been a problem among DAO and line ministries in township planning level.

In Mon State, the state government has development affairs committees at the state/region level to mirror those at the township level, which is unique and can be only seen in Yangon and Shan. The Minister of Development Affairs serves as the state/region development affairs committee's chairperson, and the state/region director for DAO serves as the committee's secretary.

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[2] Needs to be confirmed by MCDC

[3] UNDP, "The State of Local Governance: Trends in Mon", 2014; UNDP "The State of Local Governance: Trend in Ayeyawady", 2014

Also, Township Management Committee (TMC) is emerging as the key driver for the adoption of township development plans and priorities, in consultation with the three other township committees (TDSC, TMAC, and TFMC) and relevant departments. TMC also displaced to some degree the planning role of the TPIC which has been rendered largely inactive in assisting such a mandate of the Ministry of National Planning and Economic Development (MoNPED) to correct and compile local economic data for midterm planning purpose.

1.4 Review of Existing Plans

1.4.1 Overview

The target three cities have existing urban development plans made by several organizations. MOC made plans for each city. Mandalay has plans made by ECFA (1996) and MCDC (2012). Pathein and Mawlamyine have plans made by each Township Development Committee. Below is a brief summary of each plan.

(1) Mandalay

1) ECFA Plan (1996)

Engineering Consulting Firms Association, Japan (ECFA) made a n urban master plan of Mandalay according to an agreement with MCDC in 1996. This master plan made development concepts including conceptual structure plan and implementation plan based on review of development trend in that period. The plan includes infrastructure plan such as transportation, water supply, sewage, and electricity.

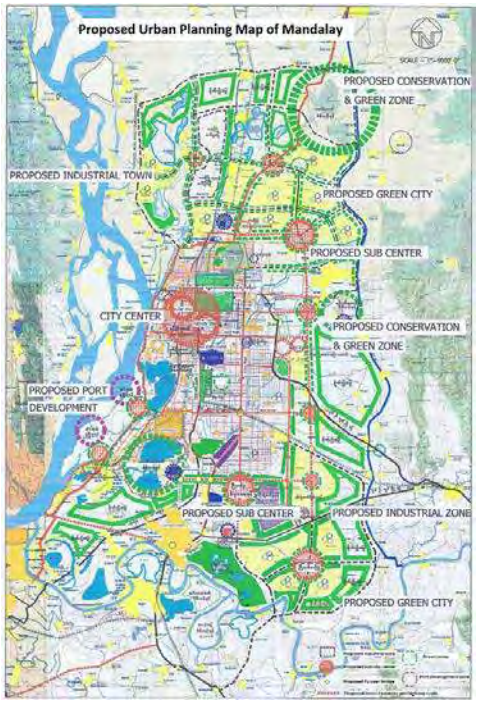
2) MCDC Plan (2012)

Basing on the plan made by ECFA above, MCDC made a 30-year city development plan in 2012, target year of which is 2040.

While the plan basically followed the structure idea of the ECFA plan, it includes new development areas with emphasizing on industrial activities such as industrial zone, trade zone and hotel zone in suburban area in south and east. It reflected demands of urban and economic expansion which increased since the ECFA plan.

3) MOC Conceptual Plan (2013)

Government of Myanmar laid down a policy on urban and regional development. It urged Region/State Government to make long term plans for urban development for their region which is considered from comprehensive points including society, economy, environment and infrastructures. To follow the policy and to complement the MCDC plan, Mandalay Region Government, and the Ministry of Transportation requested MOC to support the preparation of urban project plan. MOC completed to prepare the Mandalay Urban Development Conceptual Plan in consultation with the Mandalay Region Government, Transportation Minister, mayor, and MCDC committee members.



Source: Mandalay Urban Development Conceptual Plan, MOC

Figure 1.4.1: Structure Plan for Mandalay City in MOC Plan

(2) Pathein

1) MOC Conceptual Plan

MOC made the urban development plans of Pathein urban area in January 2014. The main contents are the current situation of Pathein urban area including urban infrastructure and social status, development plan and project implementation program including new urban area and housing project.

2) Pathein Township Development Committee Plan

Pathein Township Development Committee made the town plan in February 2012 according to Township Development Committees Law and direction of Regional Minister in Ayeyawady Region Government. The plan consists of current condition of the city and proposed development project including upgrade of urban infrastructures. Although the plan includes development projects of some area in the city, they did not include the development vision and structure plan comprehensively for the whole city.

(3) Mawlamyine

1) MOC Conceptual Plan (2013)

MOC made urban development plans of Mawlamyine City in 2013. The plan consists of current situation of the city including urban infrastructures and social status, and proposed urban development project including new urban area development and housing redevelopment project.

2) Mawlamyine Township Development Committee Plan

Mawlamyine town plan was made by Mawlamyine Township Development Committee in January 2016. The plan consists of current situation of the city including infrastructure and social status, and proposed development projects. Although the plan includes development projects of some area in the city, they do not include the development vision and structure plan comprehensively for the whole city.

1.4.2 Review of MOC Conceptual Plan

(1) General Outline of Conceptual Plan

1) Outline

The Government of Myanmar laid down the policies on urban and regional development of each state and region through systematic developing of long-term plans such as town plan, city plan, structure plan, and master plan. Therefore, the region and state governments have drawn 30-year long term plans for urban development for their regions. In doing so, comprehensive urban development design, which is drawn through conducting assessments on social, economic, transportation, infrastructure and environmental contexts, becomes a necessity. Corresponding to this necessity, the Ministry of Construction and Department of Urban and Housing Development (DUHD) gave expertise in helping for the drafting of urban project and formulation of the plan as conceptual plan.

2) Function of Conceptual Plan in the Urban Planning

The current MOC conceptual plan is formulated as a base of future preparation and detailed plan, which is expected to function as the base of spatial control for area development to individual building such as development capacity and volume of the building. From the interview with the officers of DUHD, following uses are expected as the functions of the conceptual plan.

- Indicating spatial structure of the city

- Showing basic information of the urban planning matters(Current land use, Plans of technical infrastructure network, Existing plans)
- Guiding order of implementation of urban planning projects (construction of infrastructure, development, etc.)
- For Regulation of Development and Land Use (
  - Urbanized Area, Urbanization control Area, and Non-urbanized Area
  - Location and Area of the Future Urban Development and Major Infrastructure Facilities
  - Details of Spatial Regulation
- The Referential Document for Authorization of the Future Development Project

3) Formulation Process of MOC Conceptual Plan

Following the planning process is taken into consideration for the formulation of the conceptual plan in general cases. Seven planners are engaged in the study and formulation of the conceptual plans as the main activity. Under the team leader, about ten planning members (2 planers, 7 surveyors, and 1 assistant) are organized for the study and planning, in general cases. The planning works are executed in one and a half months with

- One week for preparation of the study (in Nay Pyi Taw),
- Two weeks for field survey in the target city, and
- Three weeks for the formulation of the plans.

1.5 Fact Findings of Target Three Cities

1.5.1 Environmental and Social Status

(1) Environmental Status

1) Geographic Features of Mandalay, Pathein and Mawlamyine

Myanmar is the largest country in mainland Southeast Asia with a total of land area of approximate 678,500 km^2. It stretches 936 km from east to west, and 2,051 km from north to south. It is bound by Bangladesh and India in the northwest, PR China and Lao People's Democratic Republic in the northeast, Thailand in the southeast, and the Bay of Bengal and the Indian ocean in the southwest. Its coastline spans 1,930 km from the borders of Bangladesh and Thailand. In topography, Myanmar is mainly hills and valleys and surrounded in the north, east, and west by mountain ranges, showing gradually sloping down from north to south, northwest to east, and southeast to west, with fertile flat land in the central. The target three cities, Mandalay, Pathien, and Mawlamyine located in the central, the southeast, and the southwest of Myanmar, respectively.

(I) Mandalay

Mandalay is situated in the flat central part of Myanmar, 716 km north of Yangon, sitting on the east bank of the Ayeyawady River. It was founded in 1857 as the royal capital. It sits on the Sagain fault, a tectonic plate boundary between the India and Sunda plates. Geographically and economically, it is the hub city for international trade to India and China in the upper Myanmar, with good land transportation connections, as well as the regional center with its developed inland water port. Having the royal palace backed by 240 m high Mandalay hill on the north, this old capital starches its boundary to south along the Ayeyawady Bank.

(II) Pathein

Pathein sits in the western edge of the fertile Ayeyawady Delta, 190 km west from Yangon, and is the capital city of the third most populated Ayeyawady Region, which is the country's main crop supplier. It lies on the Pathein River which is a western branch of the Ayeyawady River, as a port city. Though distant from ocean, it is the most important delta port outside of Yangon. Pathein is known by its beautiful silver sand beaches along the coast of Bengal, namely Ngwesang Beach and Chaungtha Beach. Being the capital city, Pathein functions as a transit city that people and products can move from one place to other through various transportation methods such as river boat, road, and railroad.

(III) Mawlamyine

Mawlamyine, the capital of Mon State, locates at the mouth of Thanlwin (Salween) River in the south part of Myanmar, 300 km southeast from Yangon. Part of the state is bordered by Thailand in the south east and the Gulf of Mottama and the Andaman Sea in the west. This regional capital city sits in the Thanlwin Delta but flanked by low hills from east to west.

2) Climate Conditions of Mandalay, Pathein, and Mawlamyine

Myanmar has several climate zones ranging from the temperate region in the north to the dry zone in central Myanmar and the monsoon prone areas in the northwest, west, and south. Myanmar has a tropical wet climate with distinct seasons; summer, rainy, and winter. The summer season runs from March to the end of April. The south west monsoon winds signal the start of the rainy season in early May and ends in October and the winter season from November to February. As the typical of the tropics, during the rainy season, the weather is humid, wet, and warm.

The amount of rainfall varies per region; the coastal area receives up to 5,000 mm of rain per year while the central dry zone areas have less than 750 mm..The temperature in Myanmar likewise varies according to location. On average, its temperature is around 21°C. However, it could drop to as low as -1°C to 0°C in the northern highlands, and increase by as much as 32°C and 40°C in the coastal and central areas[4].

(I) Mandalay

Mandalay features a tropical wet and dry climate under the Köppen climate classification with noticeably warmer and cooler periods of the year. Mandalay is very hot during the months of April and May, with average high temperatures easily exceeding 35°C. It is common to see high temperatures surpassing 40°C during these two months in the city. Mandalay also features wet and dry seasons of nearly equal length, with the wet season running from May through October and the dry season covering the remaining six months. Table 1.5.1 summarizes the climate data of Mandalay from 1961 to 1990.

Table 1.5.1: Climate Data of Mandalay (1961-1990)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave Max °C	28.6	32.1	35.8	38.4	36.8	34.2	34.3	32.3	33.1	32.2	30.2	28.2
Ave Min °C	13.3	14.9	19.7	24.4	25.8	25.8	25.8	25.2	24.9	23.5	19.4	14.8

Source:
1) "World Weather Information Service – Mandalay". World Meteorological Organization. Retrieved 23 February 2013
2) "Weatherbase: Historical Weather for Mandalay, Myanmar". Weatherbase. Retrieved 23 February 2013.
3) Cappelen, John; Jensen, Jens. "Myanmar – Mandalay". Climate Data for Selected Stations (1931–1960) (in Danish). Danish Meteorological Institute. p. 188.

(II) Pathein

Pathein has a tropical monsoon climate according to the Köppen climate classification system. Pathein experiences a sustained period of extraordinary rainfall from June through August. The dry season which runs from December through April, generally sees noticeably cooler temperatures than the remainder of the year. Table 1.5.2 summarizes the climate data of Pathein.

Table 1.5.2: Climate Data of Pathien (2011)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave Max °C	33.3	35.0	36.7	35.0	32.2	33.3	30.0	30.6	30.0	32.8	32.8	30.6
Ave Min °C	17.2	19.4	21.1	23.9	25.6	25.6	24.4	24.4	24.4	24.4	21.7	20.0

Source: Pathein Township Development Committee, 2011

(III) Mawlamyine

Mawlamyine experiences a tropical climate with a lower humidity than in most parts of South East Asia. Its temperature averages between 25.6 C during January, its coolest month to 29.4 C in April, its hottest month. The rainy season is between June and October although the greatest rainfalls usually occur in July and August. The average annual rainfall in Mawlmayine is 190 inches.

Table 1.5.3: Climate Data of Mawlamyine

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave Max °C	31.6	33.2	34.4	35.0	31.8	29.3	28.4	28.2	29.4	31.3	31.8	30.7
Ave Min °C	17.1	19.8	22.8	24.7	24.3	23.6	23.3	23.3	23.5	23.4	22.0	20.1

Source: Climate Data.org (http://en.climate-data.org/)

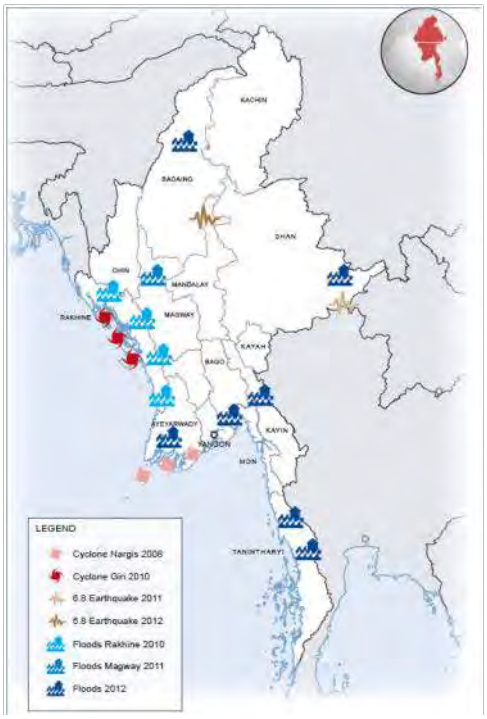
[4] Ministry of Environmental Conservation and Forestry (MOECAF), 2012

3) Natural Disaster

Myanmar faces a variety of natural and manmade hazards, and it was ranked the 42nd most at risk country in the world according to the 2012 World Risk Report. The 203 Global Climate Risk Index identified Myanmar as one of the countries most affected by severe weather disasters during the period from 1992 to 2011, due to the Myanmar's location, topography, climate, and geology. The major natural disasters in Myanmar are forest fire, landslides, earthquake, floods, drought, and cyclones.

Among all, more than 70% of disaster accounts for man-made forest fire and flooding ranked second accounting for 11%. Myanmar's long coastline and extensive river networks present a range of flood hazards across the country. The mountainous northern region is prone to fast running flash floods, especially during the monsoon season. The Ayeyawady Delta is vulnerable to widespread flooding when rivers are swollen by rain with high tide.

Droughts are generally located in what is called the dry zone, which is located in the Central Inner Burman Basin and covers parts of three divisions and about 10% of the country's total land area.



Source: OCHA (Office for the Coordination of Humanitarian Affairs)

Figure 1.5.1: Natural Disasters in Myanmar 2002-2012

Being positioned on the Bay of Bengal, Myanmar faces cyclone hazards and the accompanying threats of high winds, heavy rain, and storm surge. Cyclone season runs from April to December, but the most dangerous points of the season are pre-monsoon in April and May, and post-monsoon from October to December. Over the past 20 years, the monsoon season has been shorter in duration but more intense, resulting in greater flooding in a slightly smaller time period. Also, in recent years, each storm season has showed a tendency for cyclones to curve around and hit at lower latitudes and the frequency of the storms hitting Myanmar has increased. Recent major national disasters in Myanmar are presented in Table 1.5.4.

Table 1.5.4: Major Natural Disasters in Myanmar in Recent Years

Year	Disaster	Damage
May 2008	Cyclone Nargis	Left some 140,000 people dead and missing in the Ayeyawady Delta region. An estimated 2.4 million people lost their homes and livelihoods
Jun 2010	Flood in northern Rakhine	Total 68 people were dead and 29,000 families were affected. Over 800 houses were completely destroyed.
Oct. 2010	Cyclone Giri	At least 45 people were dead, 100,000 people became homeless and some 260,000 people were affected
Mar. 2011	6.8 earthquake in Shan	Over 18,000 people were affected. At least 74 people were dead and 125 injured. Over 3,000 people became homeless
Oct. 2011	Flood in Magway	Nearly 30,000 people were affected to varying degree.
Aug. 2012	Floods	Ayeyawady Region was the worst affected with some 48,000 people displaced. Over 136,000 acres of farmland, houses, roads and bridges were damaged
Nov. 2012	6.8 earthquake in north	At least 16 people were dead and 52 injured, with over 400 houses, 65 schools and some 100 religious building damaged

Source: Myanmar Earthquake Committee, Mandalay Earthquake Scenario Planning Summary 26 February 2015

(I) Mandalay

Mandalay locates in the center dry zone of Myanmar, sitting on the Sagain Fault, which is the most prominent active fault in Myanmar. The major concerns over natural disasters of the city are mainly

drought and earthquake, and occasional flooding in the low land. Especially, earthquake is potential most dangerous natural disaster in the region, as it hits the city and its surrounding areas historically due to the one of the most active Sagain Fault, as is shown in figure 1.5.5. The historic earthquake records are shown in table 1.5.5. The last earthquake with severe damages around Mandalay city was recorded in 2012 in Sagaing. With Magnitude 6.8, it caused several pagodas and historic buildings severely damaged and 18 death toll and over 100 injuries are report. The latest 2016 April earthquake had Magnitude 6.8 but with 130km deep epic center and caused no major damage.

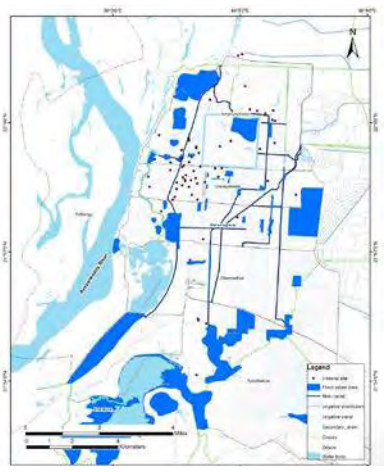
Mandalay also has some potential causes of floods such as a lack of urban drainage facility, the Ayeyawady flooding, and large river discharge from Shan Plateau to the city. Particularly, south west part of the city is prone to flooding due to the topographic features as shown in Figure 1.5.2.

(II) Pathein

Pathein lies along the Ayeyrwaddy River. On its west edge, Pathein has beautiful coast line facing to Bengal Bay. Pathein is probably the most prone to floods from the Ayeyarwady River, especially in the low land area along the river.

(III) Mawlamyine

Mawlamyine sits in the mouth of the Thanlwin River. Mawlamyine has natural protection from tsunami or high rise of sea water triggered by tropical cyclones, being sheltered by Bilugyun (Blue) Island from outer ocean. Mawlamyine is less prone to earthquakes or cyclones, but susceptible to flooding in the lower area in the north east after intensive rainfalls, due to the combination of topographic and drainage system problems as shown in Figure 1.5.2.



Source; ADB, “TA-8472 MYA: Preparing Mandalay Urban Service Improvement Project IE 131003110-06-RP-104, Issue A”, June 2015

Source; Pathien Township Development Organization

Source; JICA Study Team

Figure 1.5.2: Flood Hazard Map of Mandalay, Pathein, ad Mawlamyine

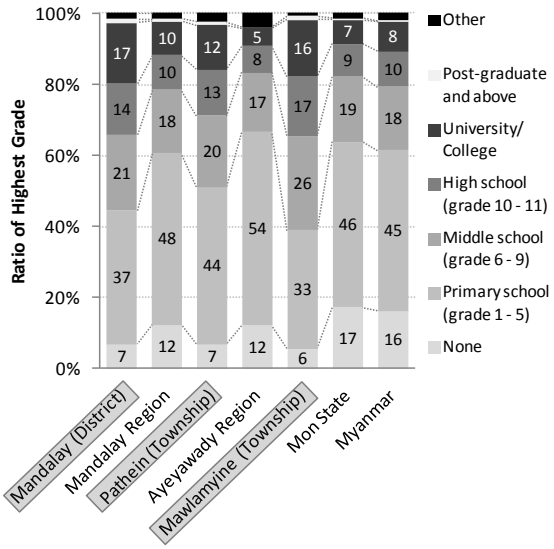
(2) Social Status

1) Education

The literacy rate in every target city is more than 95% and all these target cities are higher than the ones in the surrounding area and the entire Myanmar, which indicates that basic education prevails more widely in the cities.

The data of highest level of education of the target three cities also shows that the citizens have higher education level than surrounding area. Ratio of population of 25 years and over whose highest level of education completed under primary school in the target three cities are 10-20% lower than the rate of whole Myanmar, and those whose highest level was more than the university or college is 7-9% higher than the rate of whole Myanmar.

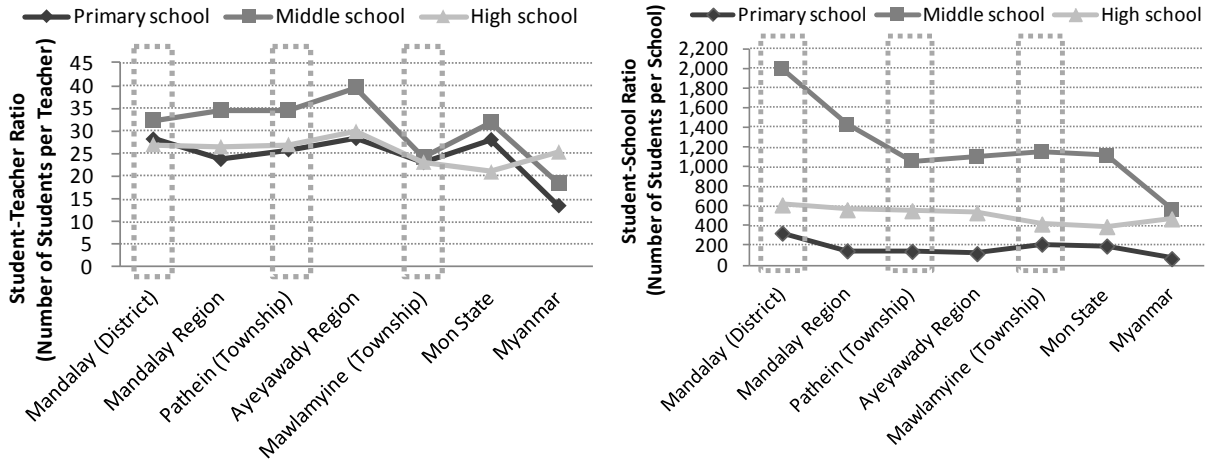
Provision of a sufficient number of teachers is one of the indicators to measure the quality of education. The ratio of student / teacher for the primary and middle schools in the target three cities are 12-16 points higher than the ratio of whole Myanmar..The regions and the state where the three cities belong also show higher numbers than Myanmar. This indicates that the supply of education staff in the regions and state is behind the whole Myanmar.



Source: JICA Study Team based on the 2014 Myanmar Population and Housing Census

Figure 1.5.3: Composition of Population who are 25 Years and Over by Highest Level of Education

Preparation of facilities for primary and middle school education is also at a lower level in each city. Especially, the number of middle school in every three cities is quite high, which is more than 1,000. The number of primary school in Mandalay District shows significantly high number, which is approximately 2,000.



(a) Student-Teacher Ratio **(b) Student-School Ratio**

Source: JICA Study Team based on the 2014 Myanmar Population and Housing Census

Figure 1.5.4: Student-Teacher Ratio and Student-School Ratio

2) Health

In Mandalay District, there are 12 large hospitals, 22 medium hospitals, 11 small hospitals, and 4 clinics. The biggest hospital, the Mandalay General Hospital, is located in the central area of Mandalay near the palace and the Mandalay Railway Station.

In Pathein Township, there are regional hospital with 250 beds, two leprosy mission clinics, and 83 private clinics. There are also traditional medicine hospital, private traditional medicine production, and traditional medicine clinics in the town. The biggest hospital, the regional hospital, is located at a few hundred meters east of Shwemawdaw Pagoda, which is around the central area of Pathein.

In Mawlamyine, there are state hospital, three rural health centers, two station hospitals, and 12 sub-health centers. The biggest hospital, the state hospital, is located near Than Lwin Garden on Upper Main Road.

3) Poverty

UNDP implemented integrated household living conditions surveys in the whole Myanmar area in 2005 and 2010. Table 1.5.5 shows the percentage of the population who were poor in Mandalay Region, Ayeyawady Region, Mon State, and the whole Myanmar. Ratio of poor population in every urban area decreased from 2005 to 2010. And poor ratio in urban area is, in general, lower than the rural area. The ratio of the urban area in 2010 is 17.5% lower than Mandalay and 10.8% lower in Ayeyawady than its rural area. On the other hand, the ratio of rural area in the Mon State is 1.8% lower than its urban area.

Table 1.5.5: Percentage of Poor Population

(unit: %)

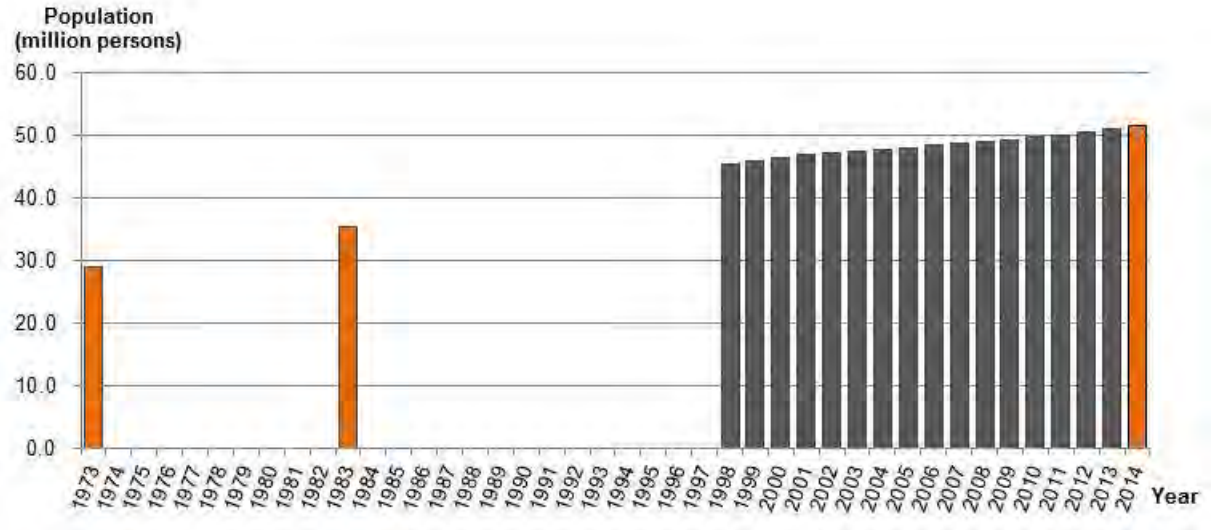
	Urban		Rural		Total	
	2005	2010	2005	2010	2005	2010
Mandalay Region	24.1	14.1	44.7	31.6	38.9	26.6
Ayeyawady Region	24.4	23.1	30.3	33.9	29.3	32.2
Mon State	22.5	17.8	21.3	16	21.5	16.3
Myanmar Total	21.5	15.7	35.8	29.2	32.1	25.6

Note: Poverty lines were set as MMK 162,136 per adult equivalent per year in 2005 and MMK 376,151 in 2010
Source: Integrated Household Living Conditions Survey in Myanmar (2009-2010), UNDP

1.5.2 Socio-economic Status

(1) National Socio-economic Development

According to the 2014 Myanmar Population and Housing Census, which was a nation-wide census conducted in 2014 for the first time in 31 years, the population of Myanmar was 51.4 million persons. The following figure shows national population of Myanmar from 1973 to 2014. Prior to the 2014 Census after 1950, a national census was conducted in 1973 and 1983, and the country's population was 28.9 million and 35.3 million respectively. The population grew 1.78 times over the last 41 years. The annual growth rate of the population has been slowing down. From 1973 to 1983, the population increased at the rate of 2.02% annually. The growth rate between 1983 and 2014 was 1.22%. Based on the estimated population by International Monetary Fund, the annual growth rate from 1998 to 2014 was 0.80%. The 2014 Census itself too estimated that the population growth rate between 2003 and 2014 was 0.89% annually, which shows that the Myanmar is currently one of the countries with the lowest population growth rate in ASEAN.



Note: Figures from 1998 to 2013 are estimated by IMF.
Source: The 2014 Myanmar Population and Housing Census; International Monetary Fund, *World Economic Outlook Database*, October 2015

Figure 1.5.5: National Population of Myanmar 1973-2014

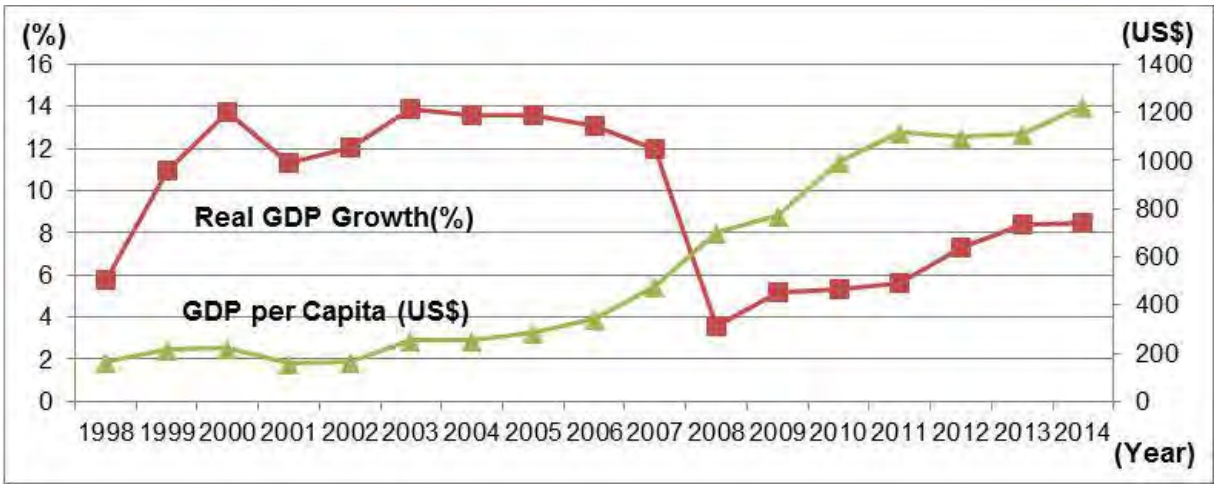
Table 1.5.6 indicates population changes of each region and state from 1983 to 2014. As regards the three regions and state where the target cities are located, Ayeyawady Region and Mandalay Region are the second and third populous regions after Yangon Region where 12% of the total population lives in each region. Mon State's share in the total population is 4.0% in 2014. The annual population growth rate of all the three regions and state during the same period underperformed the national average figure of 1.2%. However, it should be noted that Nay Pyi Taw is separately presented for 2014 in the table as Council Territory which became a new capital in 2006, though previously the area belonged to the Mandalay Region.

Table 1.5.6: Population by Region and State in 1983 and 2014

Region/State	Population (thousand)		Proportion to the Total Population		Annual Population Growth
	1983	2014	1983	2014	
Kachin State	905	1,689	2.6%	3.3%	2.0%
Kayah State	168	287	0.5%	0.6%	1.7%
Kayin State	1,055	1,574	3.0%	3.1%	1.3%
Chin State	369	479	1.0%	0.9%	0.8%
Sagaing Region	3,862	5,325	10.9%	10.3%	1.0%
Tanintharyi Region	917	1,408	2.6%	2.7%	1.4%
Bago Region	3,800	4,867	10.8%	9.5%	0.8%
Magway Region	3,243	3,917	9.2%	7.6%	0.6%
Mandalay Region	4,578	6,166	13.0%	12.0%	1.0%
Mon State	1,680	2,054	4.8%	4.0%	0.7%
Rakhine State	2,046	3,189	5.8%	6.2%	1.4%
Yangon Region	3,966	7,361	11.2%	14.3%	2.0%
Shan State	3,717	5,824	10.5%	11.3%	1.5%
Ayeyawady Region	4,994	6,185	14.1%	12.0%	0.7%
Nay Pyi Taw	-	1,160	-	2.3%	-
Total	35,308	51,486	100.0%	100.0%	1.2%

Source: The 2014 Myanmar Population and Housing Census

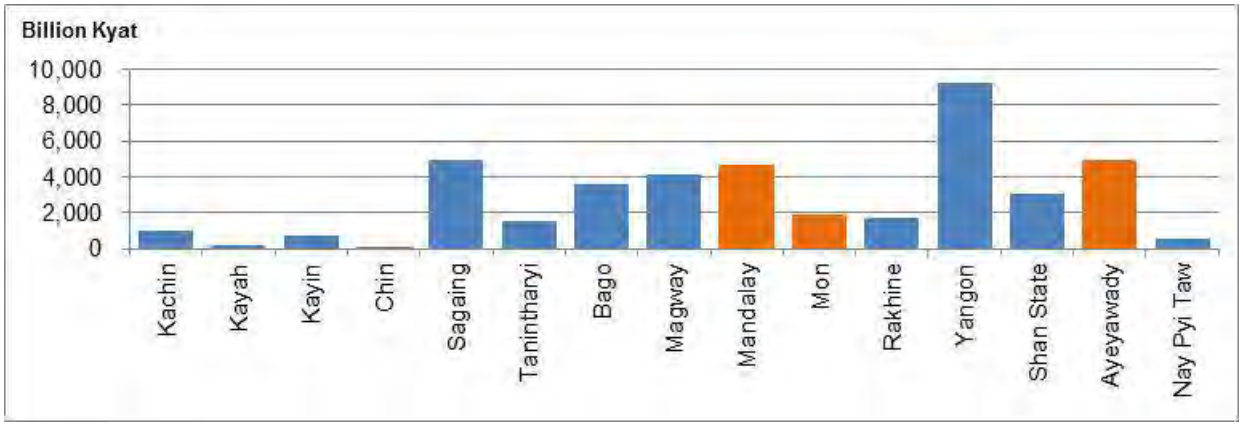
Myanmar's economic growth is continuing on an upward trend after 2011 when a liberalization process started. According to World Bank's Myanmar Economic Monitor (October 2015), Myanmar has recorded an average real GDP growth rate of 7.1% per annum from 2010/11 to 2014/15, and this is comparable to other high performing countries in the five-year period following the start of economic liberalization, such as Thailand (8.5%), China (8.2%), Vietnam (7.7%), and India (6.0%). GDP per capita was estimated to reach USD1,228 in 2014/15. Development of GDP growth and GDP per capita from 1998 t0 2014 is shown in Figure 1.5.6.



Source: International Monetary Fund, *World Economic Outlook Database*, October 2015

Figure 1.5.6: Development of GDP Growth and GDP per Capita

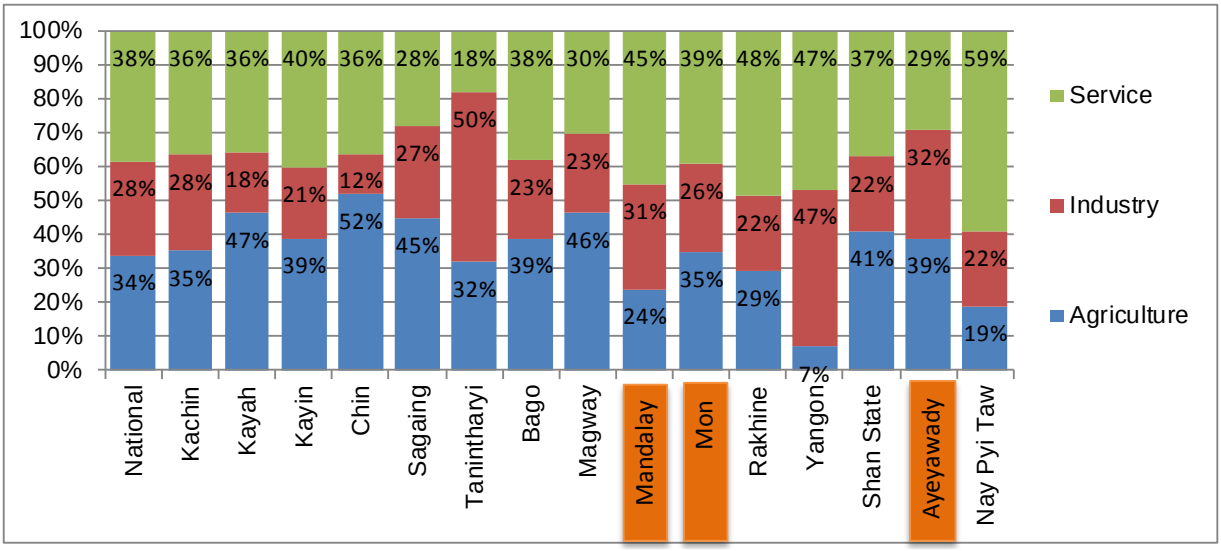
Figure 1.5.7 shows Gross Regional Domestic Product (GRDP) by region and state in 2011. Yangon, Sagaing, Ayeyawady, Mandalay, Magway were the top five contributors to the national economy, accounting for 66.3% of the national GDP when combined. GRDPs of Mandalay Region, Ayeyawady Region, and Mon State corresponded to 11.1%, 11.6%, and 4.4% of the national GDP, respectively.



Source: JICA, Preparatory Survey for the Project for Strengthening Connectivity of International Highway in Mekong Region, 2015.

Figure 1.5.7: GRDP by Region and State in 2011

Figure 1.5.8 indicates Sectoral Structure of Myanmar's GDP and GRDP by Region and State in 2012/13. Percentage composition at the national level of agriculture, industry, and service sectors were 34%, 28%, and 38% respectively. Mandalay Region had larger proportions of industry and service sectors than the national GDP, showing 24%, 31%, and 45% for agriculture, industry, and service sectors, respectively. The corresponding percentages for Ayeyawady Region are 39%, 32%, and 29%, indicating greater importance of agriculture to the regional economy. Mon State has a similar sectoral composition to the national one, with 35%, 26%, and 39% for agriculture, industry, and service sectors, respectively.



Source: Ministry of National Planning and Economic Development, *National Comprehensive Development Plan*, 2014.

Figure 1.5.8: Sectoral Structure by Region and State in 2012/13

(2) Socio-economic Development of the Target Cities

Table 1.5.7 indicates population of the regions and state comprising the target cities of the survey, divided by district and township, and also divided into urban and rural populations.

Mandalay City administered by Mandalay City Development Committee (MCDC) is currently composed of seven townships, and they also form Mandalay District. Five out of seven townships are fully urbanized areas which have long constituted the city. Amarapura Township and Patheingyi

Township were incorporated into the city in 2011 and 2015, respectively. Mandalay District with a population of 1.7 million occupies 28% of Mandalay Region in population size, and 76.4% of the district population are urban residents.

Pathein City is the urban area of Pathein Township, which is one of seven townships in Pathein District. The District has the largest population in Ayeyawady Region. The total population of Pathein Township is 287,000, out of which 170,000 or 59% of people are considered to be urban residents.

Mawlamyine City is the urban area of Mawlamyine Township, which is one of six townships in Mawlamyine District. There are only two districts in Mon State and Mawlamyine District has a larger population. Among the population of 289,000 in Mawlamyine Township, 254,000 people are urban dwellers, which shows a quite high rate of urban population.

Table 1.5.7: Population of Three Regions and State by District and Township in 2014

Region or State District/Township	Population (thousand)			Urban Population
	Total	Urban	Rural	
Union	50,280	14,878	35,402	29.6%
Yangon Region	7,361	5,161	2,200	70.1%
Mandalay Region	6,166	2,143	4,022	34.8%
Mandalay District	1,727	1,319	407	76.4%
Aungmyetharzan	266	266		100.0%
Chanayetharzan	197	197		100.0%
Mahaaungmye	241	241		100.0%
Chanmyatharzi	284	284		100.0%
Pyigyidagun	238	238		100.0%
Amarapura	238	81	157	34.0%
Patheingyi	264	13	251	4.9%
PYIN OO LWIN District	1,002	282	720	28.1%
KYAUKSE District	741	82	660	11.1%
MYINGYAN District	1,056	168	888	15.9%
NYAUNG U District	240	54	186	22.5%
YAME`THIN District	518	60	458	11.6%
MEIKTILA District	882	178	703	20.2%
Ayeyawady Region	6,185	873	5,312	14.1%
PATHEIN District	1,631	304	1,327	18.6%
Kangyidaunt	178	11	167	6.2%
Kyaungon	163	16	147	9.8%
Kyonpyaw	236	24	212	10.2%
Ngaputaw	169	11	158	6.5%
Pathein	287	170	117	59.2%
Yekyi	105	11	94	10.5%
Thapaung	154	7	147	4.5%
Ngayokaung(ST)	41	3	38	7.3%
Hainggyikyun(ST)	115	15	100	13.0%
Shwethaungyan(ST)	50	3	46	6.0%
Ngwehsaung(ST)	44	14	30	31.8%
Ngathaingchaung(ST)	89	19	70	21.3%
PHYAPON District	1,033	136	898	13.2%
MAUBIN	974	109	865	11.2%
MYAUNGMYA District	782	94	687	12.0%
LABUTTA District	627	66	560	10.5%
HINTHADA District	1,139	163	975	14.3%
Mon State	2,054	572	1,482	27.8%
MAWLAMYINE District	1,232	434	798	35.2%

Region or State District/Township	Population (thousand)			Urban Population
	Total	Urban	Rural	
Mawlamyine	289	254	36	87.9%
Kyaikemaraw	196	11	185	5.6%
Chaungzon	122	8	114	6.6%
Thanbyuzayat	171	57	113	33.3%
Mudon	191	53	138	27.7%
Ye	152	34	118	22.4%
Lamine(ST)	88	14	75	15.9%
Khawzar(ST)	23	4	19	17.4%
THATON District	822	138	684	16.8%

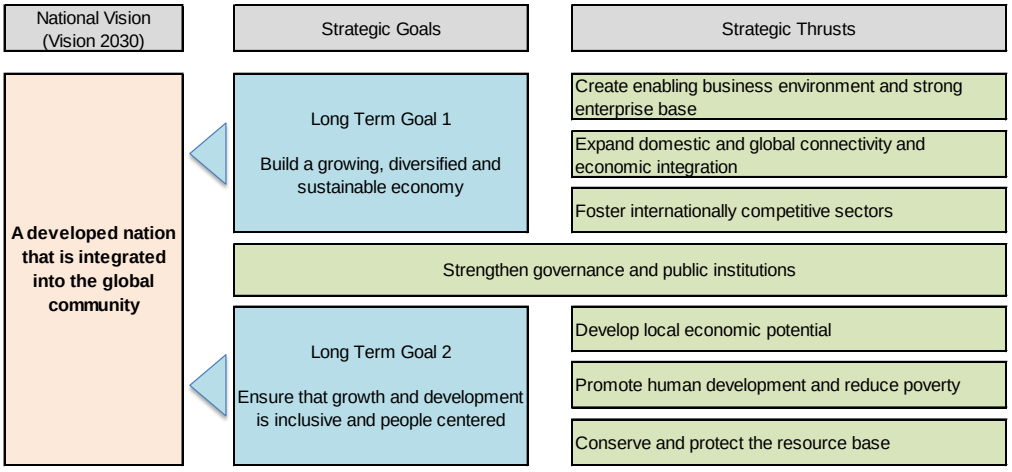
Note: ST = Sub Township
Source: The 2014 Myanmar Population and Housing Census

1.5.3 Industrial Development Status

(1) National-level Plan and Vision on Industrial Development

1) National Comprehensive Development Plan (NCDP)

National Comprehensive Development Plan (NCDP) is a twenty-year perspective of Myanmar's development toward the year 2030. Under the vision of becoming a developed nation that is integrated into the global community, NCDP provides two strategic goals and seven strategic thrusts to realize the vision through the process of reform and structural transformation (Figure 1.5.9).



Source: MNPED, National Comprehensive Development Plan, 2014.

Figure 1.5.9: NCDP Framework for Long Term Sustainable Development

As a base of Myanmar's initial industrialization process, NCDP adopts a two-polar growth strategy that focuses on further industrialization of Yangon and Mandalay. At the same time, NCDP proposes that comparative advantages of each region or state should be focal areas for investment and local pro-growth planning to mitigate social and economic disparities among regions and states as a longer-term objective of the government. It also presents potential area(s) of structural transformation of each region or state based on its comparative advantages, indicating Mandalay as "growth center", Ayeyawady as "agriculture and services", and Mon as "services and agriculture".

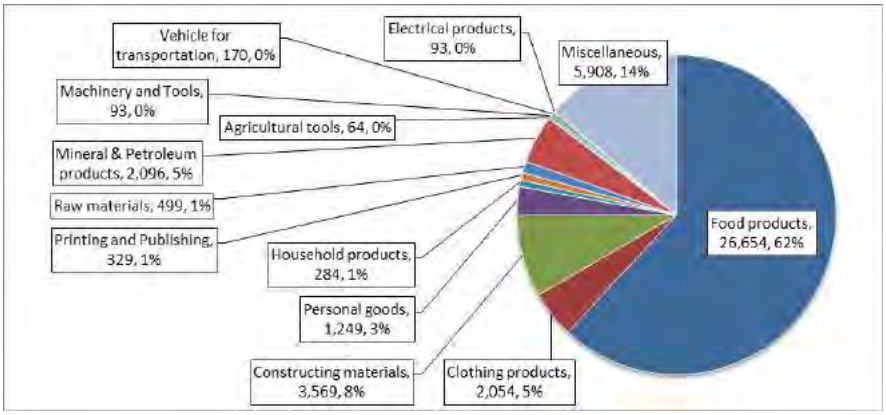
2) Myanmar Industrial Development Vision (MIDV)

Myanmar Industrial Development Vision (MIDV) is a future vision of Myanmar's industrial development, MIDV's industrial strategies and priority policies were developed in line with NCDP. As a prime approach of MIDV, "Urban-Rural Synergy Strategy" intends to create virtuous cycle between

urban and rural development to realize their simultaneous and mutual development, through development of labor intensive industries led by foreign capital in urban areas, and that of agriculture, forestry, and fishery, as well as traditional products utilizing regional or state characteristics in rural areas. MIDV indicates the importance of fostering urban manufacturing clusters since physical infrastructures are better developed and a number of benefits are expected from agglomeration such as easier collaborations with supporting services and reduced transaction costs in urban areas. MIDV illustrates some of the industries that are expected to form clusters in the coming several years, which are i) construction material, ii) food processing, iii) chemicals (fertilizer, detergent, paint, etc.), iv) plastics processing, v) textile products, and vi) labor-intensive assembly and other industries. And for rural areas, MIDV recognizes that Myanmar has a variety of local products of unique characteristics associated with individual regions and states, and has a great potential to gain the markets of huge neighboring countries such as China and India if logistics infrastructures are improved to smoothly link regions and cities in the country and abroad. MIDV also sees the potential of pioneering industrialization of traditional products and cultural heritages. It is proposed that these local products, which are rooted in sophisticated traditional cultures of individual regions and states, should explore foreign upper-end markets by making the maximum use of their traditional design and techniques. Among the examples of these local products are handicrafts such as Pathein umbrella in Ayeyawady Region and Bagan lacquerware in Mandalay Region, and traditional textiles in different regions and states including Mon State.

(2) Industrial Composition

As shown in Figure 1.5.10, s total of 43,062 industries are registered in Myanmar. Among them, industries related to “food products” are by far the largest in number accounting for 62%. Next to “food products”, “miscellaneous”, “construction materials”, “mineral and petroleum”, and “clothing products” account for 14%, 8%, 5%, and 5%, respectively.



Source: Myanmar Industry Directory 2015-16.

Figure 1.5.10: Number and Share of Industries by Category in Myanmar in 2014

Table 1.5.8 indicates the number of private industries by region and state in 2014. Mandalay Region had the greatest number of registered industries among all regions and states in Myanmar. Particularly, there were more medium and small scale industries in the region than in Yangon Region. Ayeyawady Region had the third largest number of registered industries in Myanmar after Mandalay Region and Yangon Region in 2014, and more than 80% of the total industries in the region were small scale ones. Mon State was ranked as the 8th position among 15 regions and states in terms of number of industries in 2014. More than 80% of the total industries in the state were small industries.

Table 1.5.8: Number of Registered Industries by Region and State in 2014

Region/State	Number of Industries				Share to Total
	Large	Medium	Small	Total	
Kachin State	40	109	1,061	1,210	2.8%
Kayah State	16	253	100	369	0.9%
Kayin State	97	65	757	919	2.1%
Chin State	1	5	613	619	1.4%
Sagaing Region	294	781	2,984	4,059	9.4%
Tanintharyi Region	144	92	1,064	1,300	3.0%
Bago Region	285	888	3,434	4,607	10.7%
Magway Region	155	299	2,384	2,838	6.6%
Mandalay Region	1,129	2,262	3,890	7,281	16.9%
Mon State	127	245	1,783	2,155	5.0%
Rakhine State	57	85	1,762	1,904	4.4%
Yangon Region	2,289	1,709	1,985	5,983	13.9%
Shan State	204	410	2,811	3,425	8.0%
Ayeyawady Region	458	602	4,749	5,809	13.5%
Nay Pyi Taw	87	154	343	584	1.4%
Total	5,383	7,959	29,720	43,062	100.0%

Source: Myanmar Industry Directory 2015-16.

(3) International Trade

Table 1.5.9 shows Myanmar's export composition by main commodities. "Natural gas" is the greatest export items accounting for about 30% of the total commodity export, followed by "agricultural products" such as pulses, and rice and rice products, "garment", "base metal and ores", and "precious and semi-precious minerals". On the other hand, Myanmar mainly imports "machinery and transport equipment", "manufactured goods chiefly by materials", "miscellaneous transactions and commodities", and "mineral fuels, lubricants and related materials", which constituted about 77% of the total import commodities in terms of value in 2014-15, as indicated in Table 1.5.10.

Table 1.5.9: Myanmar's Export by Type of Principal Commodities

Commodity	2013-2014		2014-2015 (p)	
	Value (USD Miliion)	Share (%)	Value (USD Miliion)	Share (%)
TOTAL EXPORTS	**11,204**	**100.0%**	**12,524**	**100.0%**
AGRICULTURAL PRODUCTS	**1,058**	**9.4%**	**1,240**	**9.9%**
Rice and rice products	134	1.2%	151	1.2%
Pulses	743	6.6%	951	7.6%
Raw rubber	72	0.6%	38	0.3%
Other Agricultural Products	109	1.0%	97	0.8%
ANIMAL PRODUCTS	**11**	**0.1%**	**8**	**0.1%**
MARINE PRODUCTS	**206**	**1.8%**	**160**	**1.3%**
Fish	158	1.4%	109	0.9%
Prawn	31	0.3%	30	0.2%
TIMBER	**898**	**8.0%**	**42**	**0.3%**
Teak	667	6.0%	36	0.3%
Hardwood	231	2.1%	6	0.0%
BASE METAL AND ORES	**107**	**1.0%**	**426**	**3.4%**
PRECIOUS AND SEMI-PRECIOUS MINERALS	**604**	**5.4%**	**280**	**2.2%**
Precious Stones and Pearls	604	5.4%	280	2.2%
GAS	**3,299**	**29.4%**	**3,707**	**29.6%**
GARMENT	**883**	**7.9%**	**1,022**	**8.2%**
OTHER COMMODITIES	**4,138**	**36.9%**	**5,639**	**45.0%**

Source: Myanmar Data 2015 (Statistical Yearbook 2015)

Table 1.5.10: Myanmar's Import by Commodity Section

Commodity Section	2013-2014		2014-2015 (p)	
	Value (USD Miliion)	Share (%)	Value (USD Miliion)	Share (%)
GRAND TOTAL	**13,760**	**100.0%**	**16,633**	**100.0%**
Food	470	3.4%	731	4.4%
Beverages and tobacco	63	0.5%	66	0.4%
Crude materials, inedible except fuel	69	0.5%	95	0.6%
Mineral fuels, lubricants and related materials	2,363	17.2%	2,563	15.4%
Animal and vegetable oils and fats	543	3.9%	557	3.4%
Chemicals	972	7.1%	1,137	6.8%
Manufactured goods chiefly by materials	2,497	18.1%	2,834	17.0%
Machinery and transport equipment	4,174	30.3%	4,748	28.5%
Miscellaneous manufactured articles	492	3.6%	1,155	6.9%
Miscellaneous transactions and commodities	2,116	15.4%	2,746	16.5%

Note: Data based on Burma Standard International Trade Classification (BSIC)
Source: Myanmar Data 2015 (Statistical Yearbook 2015)

Table 1.5.11 and Table 1.5.12 indicate the main partner countries to Myanmar's export and import. The three neighboring countries, namely China, Thailand, and India to a lesser extent, are the most important partners to Myanmar's export. Myanmar's main export items to China are natural gas, jade, rice and agricultural products, and wood products. Exports to Thailand are mostly natural gas, vegetable products including rice, and animal and animal products. To India, agricultural products and wood products are the main export items.

Table 1.5.11: Direction of Myanmar's Export by Country

Country	2013-2014		2014-2015 (p)	
	Value (USD Miliion)	Share (%)	Value (USD Miliion)	Share (%)
GRAND TOTAL	**11,204**	**100.0%**	**12,524**	**100.0%**
China,People's Rep.of	2,911	**26.0%**	4,674	**37.3%**
Thailand	4,306	**38.4%**	4,029	**32.2%**
Singapore	694	**6.2%**	759	**6.1%**
India	1,144	**10.2%**	746	**6.0%**
Japan	513	**4.6%**	556	**4.4%**
Korea,Rep.of	353	**3.1%**	370	**3.0%**
Hong Kong	489	**4.4%**	289	**2.3%**
Malaysia	109	**1.0%**	265	**2.1%**
Indonesia	60	**0.5%**	86	**0.7%**

Note: (p) provisional
Source: Myanmar Data 2015 (Statistical Yearbook 2015)

Table 1.5.12: Direction of Myanmar's Import by Country

Country	2013-2014		2014-2015 (p)	
	Value (USD Miliion)	Share (%)	Value (USD Miliion)	Share (%)
GRAND TOTAL	**13,760**	**122.8%**	**16,633**	**132.8%**
China,People's Rep.of	4,105	**36.6%**	5,020	**40.1%**
Singapore	2,910	**26.0%**	4,137	**33.0%**
Japan	1,296	**11.6%**	1,749	**14.0%**
Thailand	1,377	**12.3%**	1,679	**13.4%**

Malaysia	840	**7.5%**	744	**5.9%**
India	494	**4.4%**	595	**4.8%**
Indonesia	439	**3.9%**	551	**4.4%**
United States	80	**0.7%**	494	**3.9%**
Korea,Republic of	1,218	**10.9%**	493	**3.9%**

Note: (p) provisional
Source: Myanmar Data 2015 (Statistical Yearbook 2015)

(4) Foreign Investment

Table 1.5.13 indicates the total investment amounts of permitted enterprises in Myanmar by sector under the Foreign Investment Law. “Oil and gas” and “power” sectors account for 78% of the total cumulative investment amounts. In 2014-15, “oil and gas” is still the biggest investment sector attracting 40% of the total investment amount, followed by “transport and communication” and “manufacturing”.

Table 1.5.13: Total Investment of Permitted Enterprises by Sector under the Foreign Investment Law

Sectors	2014-2015			Cumulative Total as of March 31,2015		
	No.of Enter-prises	Foreign Investment		No.of Enter-prises	Foreign Investment	
		Value (USD Million)	Share (%)		Value (USD Million)	Share (%)
TOTAL	**211**	**8,011**	**100.0%**	**895**	**54,236**	**100.0%**
Agriculture	4	40	0.5%	17	243	0.4%
Livestock & Fishery	5	27	0.3%	34	453	0.8%
Mining	1	6	0.1%	70	2,869	5.3%
Oil and Gas	26	3,220	40.2%	141	17,593	32.4%
Manufacturing	141	1,502	18.8%	477	5,490	10.1%
Power	1	40	0.5%	8	19,325	35.6%
Transport & Communication	8	1,679	21.0%	28	3,183	5.9%
Hotel & Tourism	5	358	4.5%	57	2,158	4.0%
Real Estate Development	6	781	9.7%	29	2,278	4.2%
Industrial Estate	-	-	-	3	193	0.4%
Construction	-	-	-	2	38	0.1%
Others	14	357	4.5%	29	414	0.8%

Source: Myanmar Data 2015 (Statistical Yearbook 2015)

Table 1.5.14 shows the total investment amounts of permitted enterprises by region and state under the Foreign Investment Law. In 2014-15, a total of 211 enterprises were permitted in Myanmar with investment amounts of USD 8,011 million. The table also indicates that foreign investments have been concentrated into Yangon Region. In 2014-15, about 73% of the total enterprises and 47% of the total investment amounts were directed to the region. In Mandalay Region, on the other hand, only 7 enterprises were permitted with the increased investment of 667 million US dollars. 6 enterprises were permitted in Ayeyawady Region with the investment of 166 million US dollars, and 6 enterprises were permitted in Mon State with the investment of 326 million US dollars in the same year.

Table 1.5.14: Total Investment of Permitted Enterprises by Region and State under the Foreign Investment Law

(USD Million)

Region and State	2010-2011		2011-2012		2012-2013		2013-2014		2014-2015	
	No.of Enter-prises	Foreign Invest-ment	No.of Enter-prises	Foreign Invest-ment	No.of Enter-prises	Foreign Invest-ment	No.of Enter-prises	Foreign Invest-ment	No.of Enter-prises	Foreign Invest-ment
TOTAL	**24**	**19,999 ***	**13**	**4,644 ***	**94**	**1,419 ***	**123**	**4,107 ***	**211**	**8,011 ***
Kachin State	2	8,219	1	4,344	-	-	-	-	-	-
Kayah State	-	-	-	-	-	-	-	-	1	2
Kayin State	1	186	-	-	-	-	-	-	-	-
Chin State	-	-	1	2	-	-	-	-	-	-
Sagaing Region	3	1,396	-	-	-	-	4	201	4	144
Tanintharyi Region	7	320	-	-	3	206	2	33 *	6	601
Bago Region	1	2	1	26	5	58	7	627 *	17	460 *
Magway Region	-	-	2	123	2	39	-	-	3	234
Mandalay Region	-	-	1	26	2	65	2	82	7	667 *
Mon State	2	2,945	-	-	-	-	1	375	6	326
Rakhine State	5	6,867	1	18	-	-	-	-	5	1,618
Yangon Region	3	64 *	5	33 *	80	834 *	102	2,745 *	154	3,767
Shan State	-	-	-	-	1	199	2	33	1	17 *
Ayeyawady Region	-	-	1	73	1	20	3	11	6	166
Nay Pyi Taw	-	-	-	-	-	-	-	-	1	9

Note: * Increased in investment value.
Source: MNPED Central Statistical Organization, "Myanmar Data CD-ROM 2015", February 2016. (Originally from Directorate of Investment and Company Administration)

1.5.4 Urban Development Status

(1) History of Urban Planning

The target three cities have individually long history. Mandalay was the last royal capital of Burma (Myanmar) in the Konbaung Dynasty, the last independent Burmese Kingdom. Pathein flourished especially after the British colonization due to its huge scale of agricultural development as inland logistic hub in Ayeyarwaddy Delta. Mawlamyine was the first capital of British Burma (Myanmar) in middle of the 19th century. More explanations of the target three cities were quoted from the conceptual plans made by MOC.

(2) Regulations of Building and Land Use

1) Mandalay

According to the "Building Rules, Regulations and Procedures, and Responsibilities" issued by Building and Warehouse Department, MCDC, regulations related to building, land use, and development procedure exist in Mandalay as shown in Table 1.5.15.

It must be emphasized that the streets surrounding the palace have the regulation which control building heights along the streets up to 4 stories.

Table 1.5.15: Regulation of Building and Land Use, Development Procedure in Mandalay

Items	Specification	Exact Area or Street
Building Height Control	Not to allow high rise buildings to be more than 4 stories	26 B Street, 80 Street, 66 Street, 12 Street along the moat
High-rise Buildings Inspection	Building permission up to 12 stories check and issued by MCDC and buildings more than 12 stories will be inspected and surveyed by CQHP	-
Place to be Left in the Plot	The rest space must be 5 ft in front, 4 ft at the back, 2 ft each at both sides of the building in the downtown area.	From Shwe Ta Chaung to 72 Street, 26 Street to 35 Street
	Space must be left at 12 ft in front, 6 ft at the back, and 3 ft each at both sides of the building.	In other area of the city
MCDC Permission Proposal	Soil test report and structural design calculation are needed for the buildings which have 4 stories and more.	-
Ground Level of Building	The plinth height must be at a minimum 1.5 ft higher than the nearest road level.	-
Building Wall Height	Building wall height must be 12 ft on the ground floor and 10 ft each on the upper floors.	-

Source: JICA Study Team

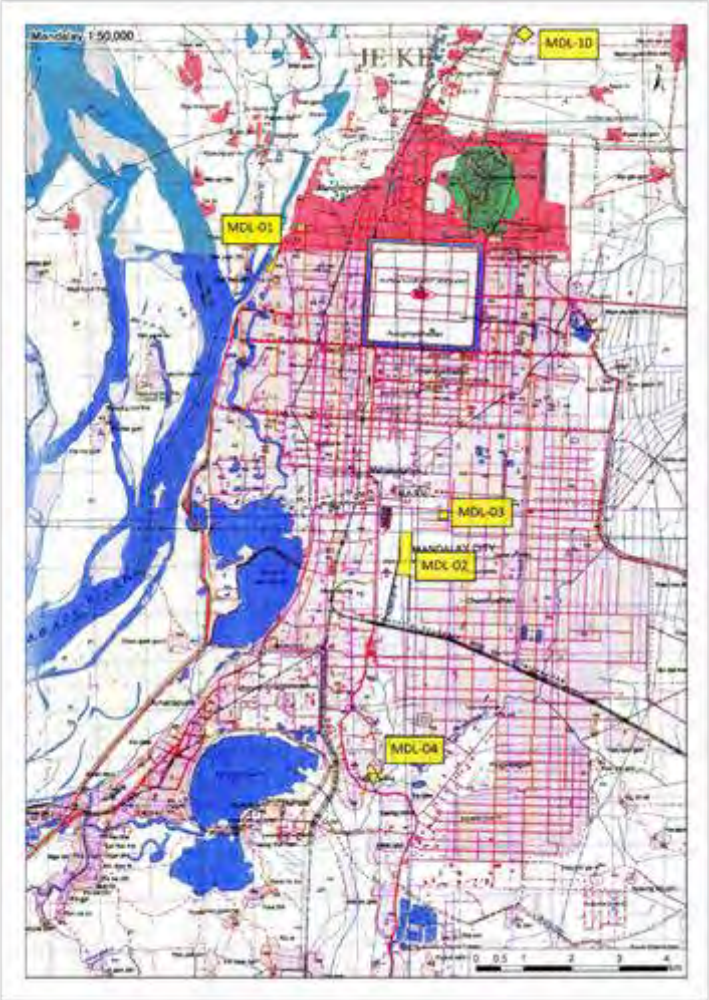
2) Pathein and Mawlamyine

In the survey conducted in March, Pathein, and Mawlamyine seem not to have any specific regulations related to building and land use.

(3) Current Urban Development Projects

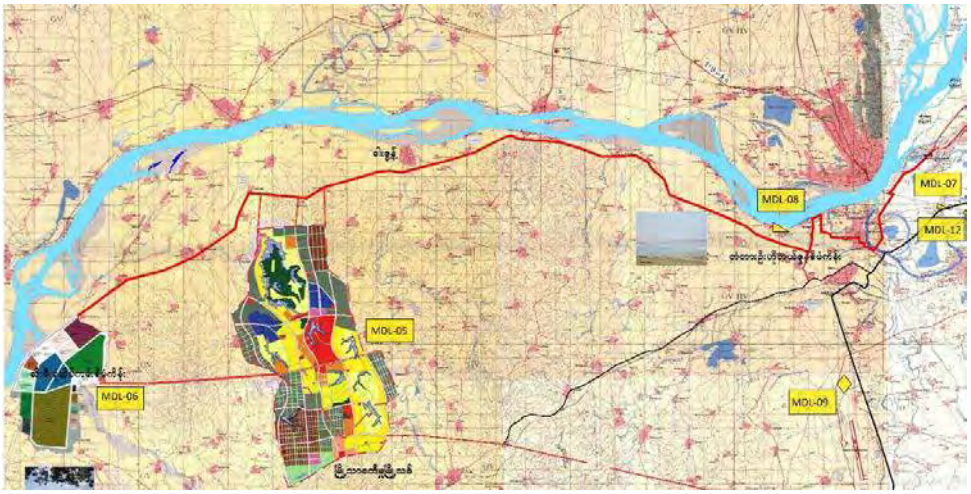
1) Mandalay

In Mandalay City, some large-scale projects are ongoing such as “Mingalar Mandalay”, “Mandalay Industrial Trade Center Project (MITC)” in existing urban area. These projects will bring its city center function southward in the future due to their volumes and facilities. Considering the suburbs of Mandalay City, Myotha Industrial Park and other unidentified projects will be triggered to expand Mandalay City’s function as one of the largest hubs of Myanmar in the context of international logistics. Figure 1.5.11, Figure 1.5.12, and Table 1.5.16 summarize the major development projects in Mandalay.



Note: The numbers in the map correspond with Table 2.8.1.
Source: JICA Study Team

Figure 1.5.11: Location of Major Development Projects in Mandalay City



Note: The numbers in the map correspond with Table 1.5.16.
Source: JICA Study Team

Figure 1.5.12: Location of Major Development Projects in Surrounding Area of Mandalay City

Table 1.5.16: List of Major Development Projects in Mandalay City and Its Surrounding Area

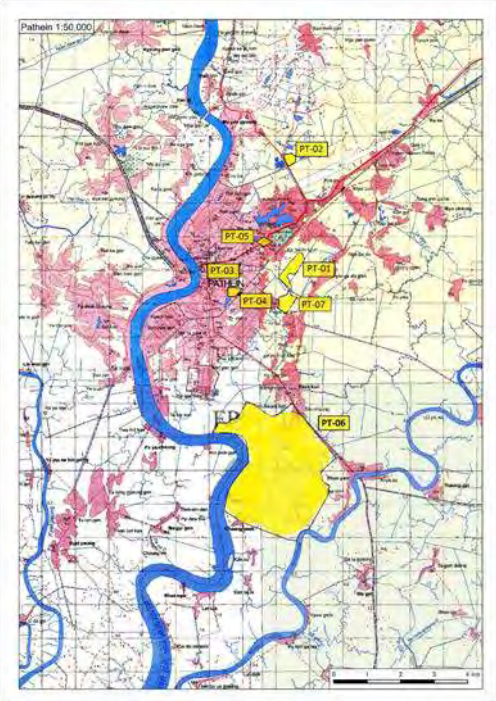
No.	Name	Development Facility	Developer	Status
MDL-01	Low cost rental housing project for squatters	Low cost housing	Myanmar Government and MCDC	Completed
MDL-02	Mingalar Mandalay CBD	Mixed-used complexes for commercial, residential, hospital, and public facilities	JV of Private Company (New Star Light Co., Ltd and C.A.D Co., Ltd) and MCDC	Under Construction
MDL-03	Mandalay City Convention Center and Commercial Complex Project	Mixed-used complexes for commercial, residential, hospital, and entertainment purpose	JV of Private Company (Mandalay Investment and Development Group) andMCDC	Under Construction
MDL-04	Mandalay Industrial Trade Center Project	Mixed-used complexes for exhibition centre, trade and industrial zones, residential, and commercial purpose	Mandalay Garden City Construction Group	Under Construction
MDL-05	Myotha Industrial Park (MIP)	Large scale industrial park (10,337 acres)	JV of Mandalay Regional Government and Mandalay Myotha Industrial Development Public Co. Ltd. (MMID)	Under Construction
MDL-06	Semeikhon Port (SMP)	Commercial river port with modern port facilities and port supportive industries	JV of Mandalay Regional Government and Mandalay Myotha Industrial Development Public Co. Ltd. (MMID)	Under Construction
MDL-07	Grand City (Jade Garden)	Mixed-used complexes including commercial purpose	Tet Lann Company, Man Amara Development Company Limited, Alpha Leo Construction Company and Aye Aye Khaing Co Ltd	Under Construction
MDL-08	Tada-U Hotel Zone	Tourism facilities	Myanmar Tourism Development Public Co.,Ltd	Under Construction
MDL-09	Whole Sales Market	Commercial facilities	Mandalay Green City Co.,Ltd	Proposed
MDL-10	Mannaykarit Housing Project	Housing	Thanti Thitsar Co.,Ltd	Under Construction
MDL-11	Special Business Zone	Business zone	NA	Proposed
MDL-12	Myit Nge Dry Port	Dry port	Joint Venture of Ministry of Transport and Communication and Private Sector	Proposed

MDL-13	Yay Taw University	University	NA	Proposed
MDL-14	Ethnic Housing	Housing	NA	Proposed
MDL-15	Upgrading High-quality Bus Terminal	Bus Terminal	NA	Proposed

Source: JICA Study Team

2) Pathein

Pathein has some ongoing housing supply projects conducted by the public sector. On the other hand, DIG, a domestic developer, has been conducting large-scale project, namely, "Mya Kyun Tar Housing Project (PT-01)", which will aim to transfer city center function eastwards through change of traffic mode from inland water to road. Figure 1.5.13 and Table 1.5.17 summarize the location and outline of the projects.



Source: JICA Study Team

Figure 1.5.13: Map of Pathein Showing Development Projects

Table 1.5.17: List of Major Development Projects in Pathein Planning Area

No.	Name	Development Facility	Developer	Status
PT-01	Mya Kyun Tar Housing Project	Housing development	Delta Industrial Group (DIG)	Under Construction
PT-02	Platinum Pathein Condominium	Luxury housing with residential villas and condominium towers	H & Co Real Estate Holding Ltd (Private Company from Singapore and Myanmar)	Under Construction
PT-03	Ocean Super Center (Pathein)	Shopping mall	City Mart Holding Co., Ltd	Under Construction
PT-04	Pyidawtar Housing Redevelopment Project	Staff housing	DUHD	Under Construction
PT-05	DUHD	Housing development	DUHD	Under Construction
PT-06	Pathein Industrial City	Industrial zone and commercial	Ayeyarwady Development Public Co., Ltd	Under Construction
PT-07	Low Cost Housing Project	Housing development	DUHD	Proposal

Source: JICA Study Team

3) Mawlamyine

In Mawlamyine Planning Area, some housing supply projects are ongoing, being conducted by the public sector. In addition, "Kyauktan Industrial Zone (MLM-04)" will be an important project to promote industrial and logistic function in Mawlamyine. Details on the major development projects on Mawlamyine planning area are shown in Figure 1.5.14 and Table 1.5.18.

Note: The numbers in the map correspond with Table 2.8.1.
Source: JICA Study Team

Figure 1.5.14: Location of Major Development Projects in Mawlamyine Planning Area

Table 1.5.18: List of Major Development Projects in Mawlamyine Planning Area

No.	Name	Development Facility	Developer	Status
MLM-01	Ocean Super Center (Mawlamyine)	Shopping Mall	City Mart Holding Co.,Ltd	Completed
MLM-02	Thanlwin Bridge (Chaung Zone)	Bridge	Joint Venture of the Government of Myanmar and the Government of Japan	Under Construction
MLM-03	Maung Ngan Staff Housing Redevelopment Project	Staff Housing	DUHD	Under Construction
MLM-04	Kyauktan Industrial Zone	Industrial Zone	The Government of Myanmar and private companies	Under Construction
MLM-05	Proposal of Pyidawtar Staff Housing Redevelopment Project	Staff Housing	DUHD	Proposal
MLM-06	Ngan Tay and Aye Tar Yar Town Expansion Project	Town Expansion	NA	Proposal
MLM-07	Proposed Mu Yaung City Expansion Project	Town Expansion	NA	Proposal

Source: JICA Study Team

1.5.5 Infrastructure Status

(1) Road and Transportation

The road network in Myanmar with a total length of approximately 150,000,000 km is covering approximately 80% of both passenger and cargo transport volume of the country.

Based on the recent rapid increase in the traffic demand under the national economic development and the following changes in the modal share of the transportation, the national transportation master plan referred as “The Survey Program for the National Transport Development Plan, 2014 (or so called “MYT Plan”) was prepared under the support of JICA and officially approved by GOM.

<Mandalay>

- < Grid-pattern Network > The road network in the city center has a grid-pattern network. Accordingly, it is quite easy not only for the citizens but also for tourists to express their destination such as "corner of roads 35 and 73". It makes exploring the city in combination of public transport and walking easy. Proper street signboard system on each street will work effectively.

- < Existing Road Capacity > Currently, traffic congestion is only observed on Sagaing-Mandalay Street. However, the capacity of other roads is going to be saturated in the near future based on the JICA Study Team’s estimation of saturation ratio. Thus, measures to increase the road capacity in the city should be addressed now.

  However, the city center is already densely built-up; and widening and new construction of roads will be quite difficult. Capacity maximization of existing roads will be urgently needed. MCDC is implementing the upgrading of the signal system and this project will be useful. It is noted that there are two types of signal lighting in Mandalay although the other cities have uniformed standard type. Citizens in Mandalay might be familiar with it but the tourists outside Mandalay might be confused on the signal direction. The types of signal should be uniformed in future.

- < New Road Network > Urbanization of Mandalay is expanding in the southeast direction. MIC and other high-tech industrial park/residential area are proposed. The new backbone road network to support the development will be necessary. The ring road network will function well not only as a new backbone but also a diversion road to avoid congestion in the city center.

- < Parking Space> The road network in Mandalay has a relatively wide width. However, the outer lane is often occupied by parked vehicles. MCDC established a guideline for commercial buildings on the necesssity to install parking space. But it is not actually materializing since there is no legal binding force. The development of controlled on-road parking and off-road parking will be required.

- < Public Transport > The busses are under operation based on the route network established by the government agency. Even only small busses (light-size truck type) are in service, no passenger queuing are observed in the city. The demand of the busses are still less within the capacity of the current system.

- < Future Public Transport > The project cost of the proposed BRT is USD 60 million but the feasibility such as financial viability has not been confirmed yet. Traffic survey should be conducted to justify the economic and financial feasibility of the proposed project.

- < Truck Terminal > Pyi Gyi Mingalar Truck Terminal is a sole logistic truck terminal in the city. The terminal has recently opened but is already getting saturated. Possible expansion or relocation in suburban area shall be considered based on the comprehensive urban planning.
- < Emergency Road Network > Mandalay has earthquake risk since the city is located in the vicinity of the Sagaing fault. Emergency road network with adequate road width under the possible blockade by debris of the building and proper connection with the emergency activity space such as hospital, open spaces, airport, and government buildings.
- <Airport Access> No public transportation is currently operated to access the international airport. The private companies, such as airline companies and taxi companies operate transit service to the airport from the Mandalay city.
- < Draft Restriction > There is a severe draft restriction during the dry season. In order to clear the shallow water way, cargo weight must be reduced and the number of ships must be increased. Safety issues in narrow water way become serious especially during the dry season.
- < Cargo Handling > There is no modern port facility in the port. Cargo is carried by manpower. Generally, the advantage of inland water transportation is the large cargo/bulk transportation and mass transit. However, the cargo size is limited by the manual transport capacity for loading and unloading. In order to utilize the inland transport further, mechanization of loading/unloading will be required.
- < New Port > Mandalay new port is being planned with modernized port facilities. Location of the port shall be determined carefully not only considering the factors of the harbor side such as the water depth but also the urban planning and connectivity with the road network.
- < Old Airport > In the vicinity of the old airport, urban development is accelerated with shopping malls, stadiums, and residences. MCDC has positioned this area as the new CBD. The old airport divided the existing city center and the new CBD. The future utilization of the old airport is a major issue on urban planning.
- < Service Level of MIA > Future demand of Mandalay International Airport will be increasing and basic infrastructure such as public transportation to access the airport shall be developed.

<Pathein>

- < Traffic Demand > Traffic congestion is not found in the city. The large demand for public transportation might not be expected.
- < Road Network > The future road network shall be proposed taking into account the new industrial area in Kyaui Tan and urban spatial planning.

- < General > The condition of Pathein Road was improved and the travel time of vehicle between Yangon and Pathein is much faster than that of the railway. However, Pathein Road only has two lanes and is passing through small towns/villages along the road. The mixture of high-speed through traffic and community traffic for small villages results to serious traffic accidents. When the level of services of the railway (i.e., speed and riding quality), the demand of the railway might be raised.
- < Abandoned Track > The railway track between Pathein Station and the river bank has not been used for a long time. DUHD, MOC proposed this abandoned railway track to be replaced by a new road.
- < Cargo Handling > Cargo handling (loading and unloading) relies on manpower only. Double handling maneuver between cargo unit and truck is conducted at the station.

<Mawlamyine>

- <On-road Cargo Handling> Traffic congestion is observed during peak hours of cargo handling on Strand Road. Provision of cargo handling space could solve this issue.
- < Public Transport > Generally, traffic congestion is not found in the city except on Strand Road mentioned above. Large-sized bus is not allow to operate for short-trip traffic in the city. It is easy to catch small-sized taxi (motorbike or light truck type) everywhere in the city. The large demand for public transportation might not be expected.
- <Bus Terminal > Mawlamyine Bus Terminal will become saturated and the expansion is planned already.
- < Truck Terminal > Zeigyo Truck Terminal is located in the built-up area and the relocation of the terminal might be considered. A possible candidate for the relocation might be the new industrial area in Kyaui Tan which is located further south from Zeigyo.
- < New Industrial Area > The future road network shall be proposed taking into account the new industrial area in Kyaui Tan and urban spatial planning.
- < New Bridge > Access road for Thanlwin (Chaungzone) Bridge in Mawlamyine City is quite narrow.
- < General > The condition of National Highway No.8 (NH No.8) was improved and the travel time of vehicles between Yangon and Mawlamyine is much faster than that of the railway. However, NH No.8 only has 2 lanes and is passing through the small towns/villages along the road. The mixture of high-speed through traffic and community traffic for small villages results to serious traffic accidents. When the level of services of the railway (i.e., speed and riding quality) upgrades, the demand of the railway might be raised.
- < Abandoned Track > Since the completion of new railway track, the section toward the old station has not been used for passengers.
- < Cargo Handling > Cargo handling (loading and unloading) relies only on manpower.

  Double handling maneuver between cargo unit and truck is conducted at the station.
- < General > It will be necessary to confirm the role of the airport and development

  priorities of the airport.

(2) Water Supply

<Mandalay>

A water supply project in Mandalay City was started in 1983 under the financial assistance of ADB and OPEC, and the operation started in 1992. In 2013, serviced population has reached 0.7 million and an average service ratio is about 57% in Mandalay City as shown in Table 1.5.19. The average total water supply is about 130,000 m^3/day.

Table 1.5.19: Water Supply Service Ratio in Each Township

Township	Population	Population Served	Ratio (%)
1. Aungmyetharzan	254,898	224,128	88%
2. Chanayetharzan	229,847	220,653	96%
3. Mahaaungmye	233,557	185,687	80%
4. Chanmyatharzi	199,519	89,317	45%
5. Pyigyidagun	157,062	7,158	5%
6. Amarapura	207,678	1,414	1%
Total	1,282,561	728,357	57%

Source: Water and Sanitation Department of MCDC

ADB is implementing the Project Preparatory Technical Assistance (PPTA) for sector of water supply, sewerage, drainage, and waste disposal in Mandalay City. AFD is engaging in French Funding Program (FASEP) based on the PPTA.

JICA made the master plan of water supply for five townships through the Study on Water Supply System in Mandalay City and in the Central Dry Zone in the Union of Myanmar (2001-2003). After that, JICA carried out supports shown below.

- Follow-up Cooperation of the Master Plan of Water Supply in Mandalay (2012)
- Improvement of Mandalay's Capacity on Water Treatment Plant Operation (2013-2016)

Fact findings and issues of Mandalay are as follows

- <Insufficient Water Supply Volume for Urban Life and Development> Pumping discharge from tube wells has been declining. There is an insufficient public water supply system in Pyigyidagun and Amarapura townships. Right now, Pyigyidagun Township has covered a water supply of 5% only, and will cover 30% and the remaining 70% after the JICA Grant Aid. The construction of new WTP which utilizes surface water, the extension of pipeline, and the upgrading of distribution reservoir will be required. Technical assistance for capacity development for the operation of rapid sand filtration system will be required due to lack of know-how. Improvement of electric supply is required in order to have stable water supply.
- <Improvement of Low Pressure in the Eastern Area> Upgrading of distribution reservoir and pumping facilities will be required. Quality of water supply is not good.
- <Deterioration and Drawdown of Groundwater> Public water supply system to industrial zone will be required in order to minimize groundwater usage. Technical assistance for groundwater management is required.
- <High NRW Ratio> Reason of NRW (pipeline's NRW 36%) will be investigated and appropriate measures will be implemented. Technical assistance for NRW reduction will be required.

<Pathein>

Currently, there is no modern water supply system in Pathein City. Residents get water from the dug well and tube well. Five bottled water factories which use the RO membrane and more than 1,000 water vendors are playing important role in drinking water supply in Pathein City.

The MHLW Project Team collected information and data and conducted discussions with the State (Regional) Cabinets and CDC in Pathein City. Based on the results of these survey and discussion, the MHLW Project Team made up proposals for the improvement of water supply management in the city.

Fact findings and issues of Mandalay are as follows

- <Drinking Water Supply to the Poor in Pathein City> Bottled water or water sold by vendors are priced beyond the means of the poor. Therefore, the poor in Pathein City rely on rainwater storage ponds as the source of drinking water, the water quality of which is absolutely not appropriate for drinking and poses danger on human life. As a countermeasure for poverty alleviation, the development of water supply system in the city is urgently needed.

- <Master Plan for Effective Water Supply System in Pathein City> Since the water supply development needs to fulfill the future water demand, it is necessary to establish the planning framework based on the population growth forecast and to decide the target year for facility development.

  Since the terrain of Pathein and the nearby area is characterized with flat land, the location of the facilities should be decided taking into consideration the possibility of minimizing the energy cost.

  Selection of water source is the most important factor in the planning of the water supply system. Water quality analysis in both the dry season and rainy season should be conducted for all possible water sources (both surface water sources and groundwater sources). Since the water supply facilities would be used for long term, the selection of water source should also take into account the possible residential, commercial, and industrial development based on the city development plan.

- <Other Issues> In Pathein, they have a plan to do water supply system through a joint venture with a Thai company. The plan is called built-own-operate (BOO) system with contract of 30 years. As a private project, this is for profit-service only. That is why MTDC also wants to do it with JICA loan with government arrangement.

<Mawlamyine>

Mawlamyine Township area (about 53 km^2) supplies water up to 22 quarters out of 40 quarters. Currently, the city has its capability to supply water of 16,400 m^3/day while water demand is nearly twice compared with the water supply. Currently, there is no treatment process (chemical utilization) in water supply process in Mawlamyine. Raw water is pumped from raw water sources to reservoir tanks and distributed to households.

Existing water supply facilities are operated in Mawlamyine City as follows:

- <Piped Water Supply Coverage Ratio> The total number of taps is only 8,500. The population connected to the Mawlamyine CDC water supply system remains as low as 18% of the total population. The promotion of tap water connected to the house is urgently needed.

- <Quality of Supplied Water and Safety of Drinking Water> Regarding the current situation on quality of raw water from the river system (Ataran-1 and Ataran-2) in Mawlamyine City, appropriate purification process is not applied throughout the system, and chlorination is not applied as disinfection.

  This indicates a risk to health as drinking water contains coliform, it is necessary to establish an appropriate water supply system with appropriate purification process.

- <Drinking Water Supply for the Poor> According to MCDC, 75% of the citizens in Mawlamyine City purchased bottled water for drinking purpose but the remaining 25% are the poor citizens who cannot purchase bottled water and they are drinking untreated water after boiling.

  The areas where many poor population reside are the low income settlement in the north eastern part of the city and village in the south western part of the city. The poor has the strong desire for the development of the water supply system. It is highly desirable to install sub-main pipes and secondary and tertiary pipes in the area in order to promote house connections.

- < Need for O&M Capacity Development and Human Resource Development of Water Supply> In the future, in the construction, operation and maintenance of purification plant and rebuilding, maintenance of piping network, necessary technical skills, and work volumes may increase remarkedly. It is necessary to continuously provide experts and technical guidance to Mawlamyine CDC, and it is necessary for Mawlamyine CDC to plan the personnel training of engineers and secure enough number of the most suitable engineers.

(3) Sewerage

<Mandalay>

There is no public wastewater treatment plant (WWTP) to treat domestic wastewater in Mandalay City. Wastewater from households, commercial, and administrative facilities in Mandalay City is treated by pit toilet or septic tank at their own place.

- < Need for Sewerage System and Appropriate Treatment Process > Local residents continue dumping their trash to the existing drainage channels resulting to emission of offensive odor that causes degradation of the water environment. To decrease the risk of waterborne infectious diseases and groundwater contamination, a new WWTP with appropriate treatment process, such as conventional activated sludge process will be required urgently. Due to the reasons that there is a lack of strategy for sewerage development and the need to materialize the sewerage system in Mandalay City at present, a comprehensive master plan will be required.

<Pathein>

There is no public WWTP to treat domestic wastewater in Pathein City. Wastewater from households, commercial, and administrative facilities in Pathein City is deposited in pit toilet or septic tank at their own place.

- < Improper On-site Treatment Facilities > Although the water injection type toilet without a septic tank has become extensively popular, toilets of this type should be changed with the septic tank. Furthermore, there are no disposal facilities but only for sludge in Pathein City, and the sludge removed from the septic tank is thrown into the existing final dumping site.

- < Need for Sewage System Project > The effective development of sewerage system is strongly required in Pathein City. However, the sewerage system project requires long time and large funds.

<Mawlamyine>

There is no public WWTP to treat domestic wastewater in Mawlamyine City. Wastewater from households, commercial, and administrative facilities in Mawlamyine City is deposited to pit toilet or septic tank at their own place.

- < Improper On-site Treatment Facilities > Although water injection type toilet without a septic tank has become extensively popular, the toilets of this type should be changed with septic tank. Furthermore, there are no disposal facilities but only for sludge in Mawlamyine City, and the sludge removed from the septic tank is thrown into the existing final dumping site.
- < Need for Sewage System Project > In order to effectively develope a sewerage system in Mawlamyine City, formulation of a master plan is strongly required in Mawlamyine City. However, the development of the sewerage system project requires a long period of time and enough funds.

(4) Sewerage

<Mandalay>

There are nine main drainage channels, three drainage pumps, two retention ponds, and many sluice gates in Mandalay City. These facilities do not have enough capacity during heavy rains.

- The intricate canal system serves as the drainage network for storm water during the rainy season.
- According to the existing and future modeled hydrological conditions, including the impact of climate change, different options to improve drainage will be assessed.
- The project will dredge canals and drains, remove hydraulic bottlenecks, and implement nonstructural measures to manage the drainage network.

<Pathein>

(I) Drainage

The capacity of the existing drainage and channel in Pathein City is not enough for heavy rains. So, low-lying areas in the city are sometimes flooded (once in a few years).

< Insufficient drainage canal > The issue points of the existing drainage canal are shown below.

- Flooding does happen regularly in some specific low areas.
- In most drainage canals which are dug manually, there is no hardness of the drainage canal lining.
- There are few gates, banks, and pumps which prevent flooding in the low-lying areas.
- Some drainage canals have accumulated soil sediments.
- Drainage canal is a dumping place for residents.

PCDC proposed to include the following contents in the study of drainage system project:

- Setting of the target year and design conditions of drainage systems;
- Reconstruction plan for the existing lines; and
- Organization and management plan.

<Mawlamyine>

The capacity of existing drainage and channel in Mawlamyine City is not enough for heavy rains. So, low-lying areas in Mawlamyine City are sometimes flooded (once in a few years).

< Insufficient Drainage Canal > Mawlamyine CDC does not have any conditions of hydrological and existing data of drainage systems in the city. Some surveys on the existing drainage will be required and some meteorological observation will be collected for improvement of the drainage system.

The issue points of the existing drainage canal are shown below.

- Some drainage canals have many accumulated soil sediments.
- Some illegal buildings are on a drainage canal.
- Some water pipes and electric cables are in the drainage and are blockage to the flow.
- Drainage canal is a dumping place for residents.
- A small cross drain at a road crossing is a bottleneck.

(5) Electricity

<Mandalay>

Generation Scenario in Accordance with the Bulk Load: In Tada-U Township (scheduled to be under MCDC area from 2020) in Kyaukse District, a hotel zone is planned with 300 hotels, and residential and commercial facilities. The planning for power supply and other electrical infrastructure facilities such as substations, transmission and distribution lines seems not been materialized yet.

In Myingyan District of Mandalay Region, Myotha Industrial Park is under construction and the location is 58 km southwest of Mandalay City and 45 km from Mandalay International Airport. The estimated load of this industrial park is about 213 MW. Myingyan Gas Power (95 MW) by AGGREKO is already commissioned and Nabu Aing Solar (150 MW) by ACO Investment Group is under construction at the same district. Another gas-fueled power plant named Myingyan CCGT (250 MW) is at the bidding stage. Power infrastructures such as substations, transmission and distribution lines for Myotha Industrial Park are assumed to be built in accordance with the progress of construction works.

Necessity of Generation Development: Looking at the current condition of generation sector at Mandalay Region, a total of 1,191 MW of existing grid connected hydropower stations and another 66 MW are under construction. There are also 530 MW of solar power plants under construction in and around Mandalay Division. Both of these types of renewable generation will penetrate a total of 1,787 MW of unstable generation into the national grid. On the other hand, the total generation capacity of Myanmar consists of a very large portion of Hydro-power plants with low capacity factor, which can also be considered as unstable generation. Although the solar power generators can act as a supplementary power source for increasing the capacity utilization rate of hydropower stations in the dry season, these renewable energy resources together is still considered as disturbance at the national grid in terms of frequency regulation services. Hence, the overall reliability and power quality would be a concern considering the industrial zone, hotel zone, and the urban area (Mandalay City). Controllable bulk power plants located very close to the load centers would have the advantage to compensate the frequency regulation as well as the reliability and power quality to some extent. The Myotha Industrial Park is already going to have such plant close to it. At least one Bulk power generator very close to or inside Mandalay District shall be able to

compensate the reliability and power quality to Mandalay District itself as well as the nearby hotel zone in Tada-U.

Potential of Generation Development: As per the required infrastructure support to establish a gas-fired power station around the urban area of Mandalay District (including the industrial zone inside it), the following points could be considered.

- The Myanmar-China Natural Gas Pipeline from Shwe Gas Station which goes through Mandalay.
- Taguntaing and Shwesaryan primary substation in Mandalay District.

Load Curve Evaluation: The vertical axis indicates the power in MW and the horizontal axis indicates the time in 24-hour format. The electricity consumption in Mandalay District is more than half of the total in Mandalay Region, which is a common scenario all year round; and thus, the load curve in Mandalay Region follows the pattern of the load curve in Mandalay District.

Primary Substation Capacity Assessment: By placing the transformer capacity, maximum % loading data of last year (May 2015), and demand forecast altogether, the reliability of the primary substations' capacity have been assessed. While the 2016 demand forecast has been considered as a 13% increase in load (according to MESC's demand forecast) and the next two years has been assumed as 15% increment of demand (according to Preparatory Survey on Distribution System Improvement Project in Main Cities, Final Report, JICA), the table shows that almost all the transformers in the primary substations will be overloaded by the year 2018. More of it, the nearest substation from the planned hotel zone in Tada-U is Tagundine Primary Substation (132/33/11 kV), and the above forecast does not consider it yet.

With the load sharing between transformers, some temporary solutions may be realized for the year 2016, but the capacity of primary transformers to serve/stand the peak demand of the year 2017 and so on is not enough.

Necessity of Off-grid IPP: The private companies that maintain the distribution business of 11~0.4 kV level, purchase electricity from MESC ranging from MMK 37~83/kWh and sells electricity to the consumers at a price ranging from MMK 35~150 /kWh, with an intention to make profit on their own. There could be a scenario, where the raise in electricity tariff by MESC leads to impose an increased electricity tariff by private companies on consumers; and thus, either consumers prefer to switch to their back-up generators or private companies loose the motivation to maintain the distribution equipment as required by standard. Either of these cases inspired the introduction of off-grid IPPs. For bulk power consumers such as industrial and commercial users, the reliability and quality of electric power are important. Introduction of off-grid IPP in urban area dedicated to ensure the supply reliability and power quality to such consumers could be a key player for market competition and thus secure a consumer friendly electricity distribution market.

<Pathein>

The peak load and the demand forecast of downtown transformer (66/11 kV, 20 MVA) are shown in Table 1.5.20.

Table 1.5.20: Peak Load and Demand Forecast of Downtown Transformer (66/11 kV, 20 MVA)

Year	Peak Load and Demand Forecast (MW)
2015	11.3
2016	13.0
2017	14.9
2018	14.6
2019	16.8
2020	11.4

Source: JICA Study Team, Preparatory Survey on Distribution System Improvement Project in Main Cities

The capacity of the newly built primary substation can facilitate the existing demand. The JICA Study Team is still doing the survey, and shall provide more statistical analysis in the next report based on the additional information to be collected.

<Mawlamyine>

Generation Potential: The required infrastructure support to establish a gas-fired power station in Mawlamyine District is as follows.

The peak load and demand growth in Mawlamyine City is shown in Table 1.5.21.

Table 1.5.21: Demand Growth Trend in Mawlamyine

Year	Peak Load (MW)	Demand Growth
2010	12.88	–
2011	14.28	10.9%
2012	17.74	24.2%
2013	21.07	18.8 %
2014	26.12	24.0 %

Source: JICA Study Team, Preparatory Survey on Distribution System Improvement Project in Main Cities

The capacity of the newly built primary substation can facilitate the present existing demand. The JICA Study Team is still conducting the survey, and shall provide more statistical analysis in the next report based on the additional information to be collected.

(6) Solid Waste Management

<Mandalay>

- < Improper Landfill > The final disposal sites are simple dumping sites without any pollution control facility (no landfill liner and no drainage of leachate). Waste is dumped on the landfill by the trucks; and waste pickers sort recyclable waste (cans, bottles, and metals) before the bulldozer pushes the waste and compact it. Rubber is sorted and burnt in an open oven. According to PCCD, another issue is the practice of backfilling of low ground level plots of land (flood prone areas) using solid waste, a cheaper way than using earth and sand. About these improper landfill works, it will pose high risk on health and high impact on the environment.
- < Shortage of Capacity on the Final Disposal Sites > The total waste collection per day has increased from 259 tons in 2005 to 779 tons in 2014. Due to this rapid growth of waste to be landfilled, the handling capacity of the final disposal sites can last only for two years.

<Pathein>

- < Improper Landfill > The final disposal sites are simple dumping sites without any pollution control facility (no landfill liner and no drainage of leachate).
- < Decrepit Facilities > Some vehicle and facilities for collecting and filling have been severely decrepit.
- < Shortage of Capacity on the Final Disposal Sites> Solid waste collection is rapidly increasing now in Pathein City. The handling capacity of the final disposal site can only accommodate a little. And Pathein CDC wants to start environmental efforts like implementation of 3Rs (recycle, reuse, and reduce).

<Mawlamyine>

- < Improper Landfill > The final disposal sites are simple dumping sites without any pollution control facility (no landfill liner and no drainage of leachate). Burning is observed in the final disposal site resulting to the release of dense smoke. Some garbage collector operates at the site, including women and children, without any safety protection (no mask and no gloves).
- < Shortage of Capacity on the Final Disposal Sites> Solid waste collection is rapidly increasing from now in Mawlamyine City. The handling capacity of the final disposal site can only accommodate a little.

1.6 Strategic Environmental Assessment (SEA)

1.6.1 General

Three alternatives of the structure plans for each target city, which reflected the review of the existing development plans and conceptual plans prepared by MOC, were developed through preliminary meeting in March and further developed and discussed at the stakeholder meeting in May in each city.

1.6.2 Scoping

This study aims to discuss alternatives for urban structure and planning issues, rather than anticipated actions for actual proposed alternative development plans. The environmental impacts are selected from the below environmental checklist.

Table 1.6.1: Environmental Checklist

Social Issues	Social Needs	Living standard
		Clean water access
		Sanitation
		Other social service
		Cultural herritage
		Involuntary resetlement
		Misdistribution of benefit and damage
		Education
		Safety & Accidents
Spatial & Physical Issues	Economy	Ecnomic boost
		New employment opportunity
		Conoribution to local economy
		Utilization of local recource
		Tourism
		Poverty reduction
	Industry	New industry
		Efficiency improvement
		Connectivity to the existing industry
	Urban infra	Stress on Existing Infra
		Relocation of existing infra
		New Infra
	Civil Work	Natural desaster
		Topographiy and geographical features
	Spatial use	Conflict on land use
		Density
		Urban sprawl/enclowchiment
	CBD	Expansion of existing CBD
		Create new CBD
	Proximity	Connectivity to the city
		To the outside
		Congestion on road
		Comprehensive development
		Trafic increase
		Trip length
Natural & Environmental Issues	Nature	Flora, Fauna and Biodiversity
		Landscape
		Recreation space
		Green belt creation
		Stress on water supply
		Groundwater
		Global warming
	Pollution	Air (quality)
		Water (quality)
		Soil contamination
		Noise&order
		Waste

Source: JICA Study Team

1.6.3 Summary of Environmental Evaluation for Alterative Urban Structures

Anticipated environmental impacts that would be caused by three alternatives of the urban structure (details to be discussed in section 4.1 in the final report part II) were evaluated in a matrix system from the point of natural and environmental impact, social impact, and economical impact. The impact categories were evaluated into positive and negative aspects. The magnitude of impact is considered following the three levels, namely, ◎, ○and △ for the positive and the negative.

Tables 1.6.2-1.6.4 shows the result summary of Environmental Evaluation of each city.

Table 1.6.2: Environmental Impact Matrix for Mandalay

Items	Option 1 "Concentration Core"	Option 2 "Suburb Core"	Option 3 "Satellite Core"
Evaluation	**-**	**-**	**BEST**
Nature	△	○	○
Social	○	△	○
Economic	○	○	○

Source: JICA Study Team

Table 1.6.3: Environmental Impact Matrix for Pathein

Items	Option 1 "Concentration Core"	Option 2 "Suburb Core"	Option 3 "Satellite Core"
Evaluation	**-**	**-**	**BEST**
Nature	△	○	◎
Social	○	△	○
Economic	○	◎	○

Source: JICA Study Team

Table 1.6.4: Environmental Impact Matrix for Mawlamyine

Items	Option 1 "Western Axis"	Option 2 "Eastern Axis"	Option 3 "Two Axis development"
Evaluation	**-**	**-**	**BEST**
Nature	△	○	◎
Social	△	◎	◎
Economic	◎	○	○

Source: JICA Study Team

1.7 Development of Topographical Map Data

1.7.1 Preparation Work

To create the basic map data for the urban development planning of the target three cities, the following works in the formulation of topographical map data were conducted.

The topographical map data for the GIS is generated on a scale of 1:10,000 based on a high resolution satellite images and existing 1:50,000 scale topographic maps. The works was executed between January-April 2016 by a Myanmar company which was awarded as a contractor through a competitive bidding following JICA's guidelines.

(1) Ground Survey

(2) Purchase of Satellite Image and DEM

The JICA Study Team purchased high-resolution of Pleiades satellite images and the advanced land observation satellite (ALOS) DEM data covered 600 km^2 (Mandalay: 330 km^2, Mawlamyine: 170 km^2, Pathein:100 km^2).

(3) Field Verification

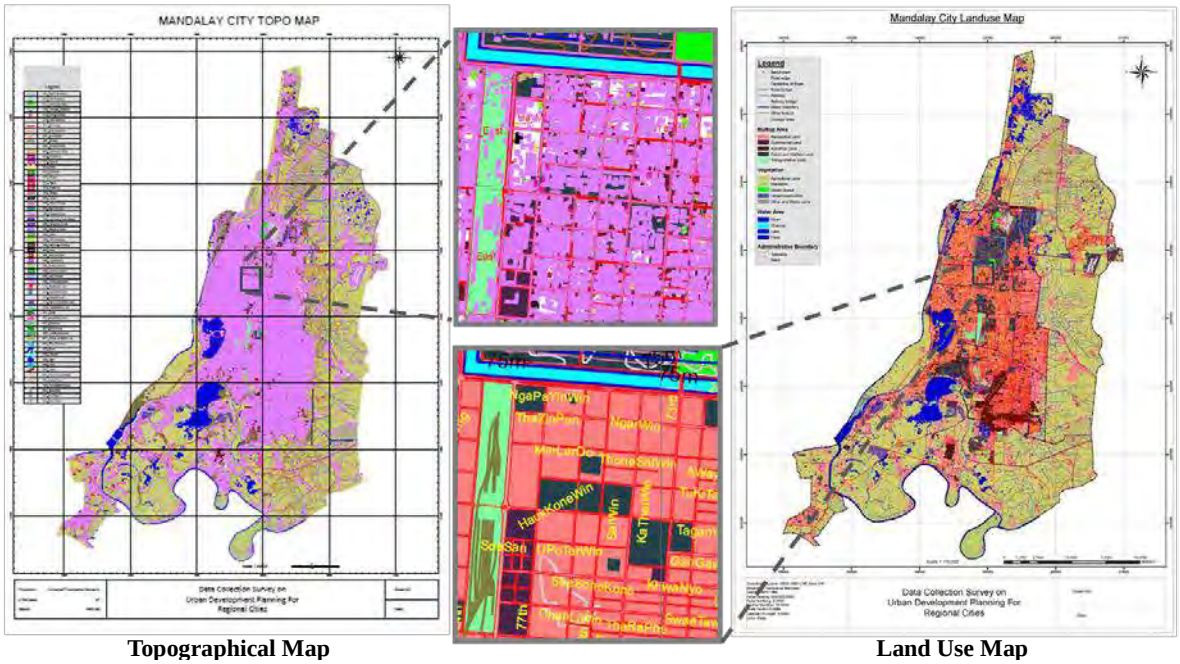
The names of places and features, which are the well-known or landmarks of the city were collected/verified using GIS enabled data collector with the global positioning system (GPS).

(4) Digitizing Based on Satellite Image and GIS Data Formulation

The topographic map data/GIS data was created by digitizing based on satellite image, collecting features/information from the existing topographic map of scale 1:50,000 and drawing contours from DEM.

1.7.2 Topographical Map and Land Use Map

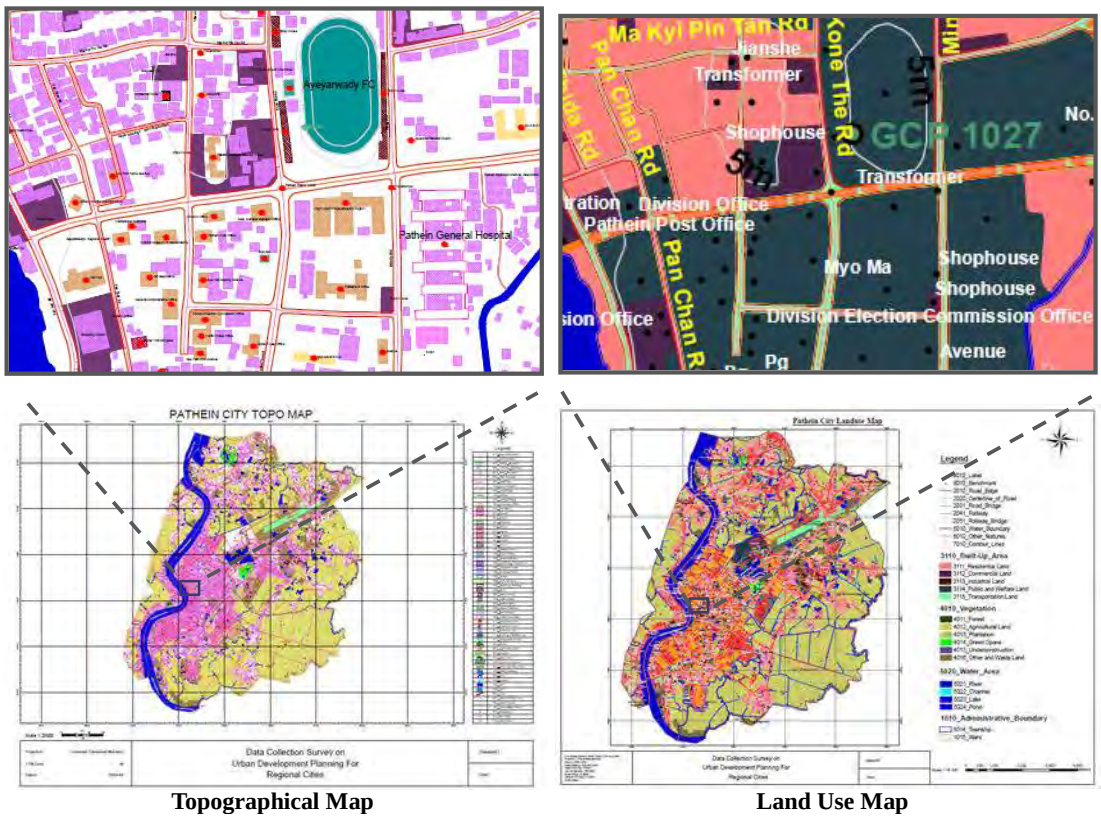
Based on the work above, JICA Study Team prepared the latest 1:10,000 scale topographical map and land use map for the target three cities. The maps are contained in Annex of this report.



Topographical Map **Land Use Map**

Source: JICA Study Team

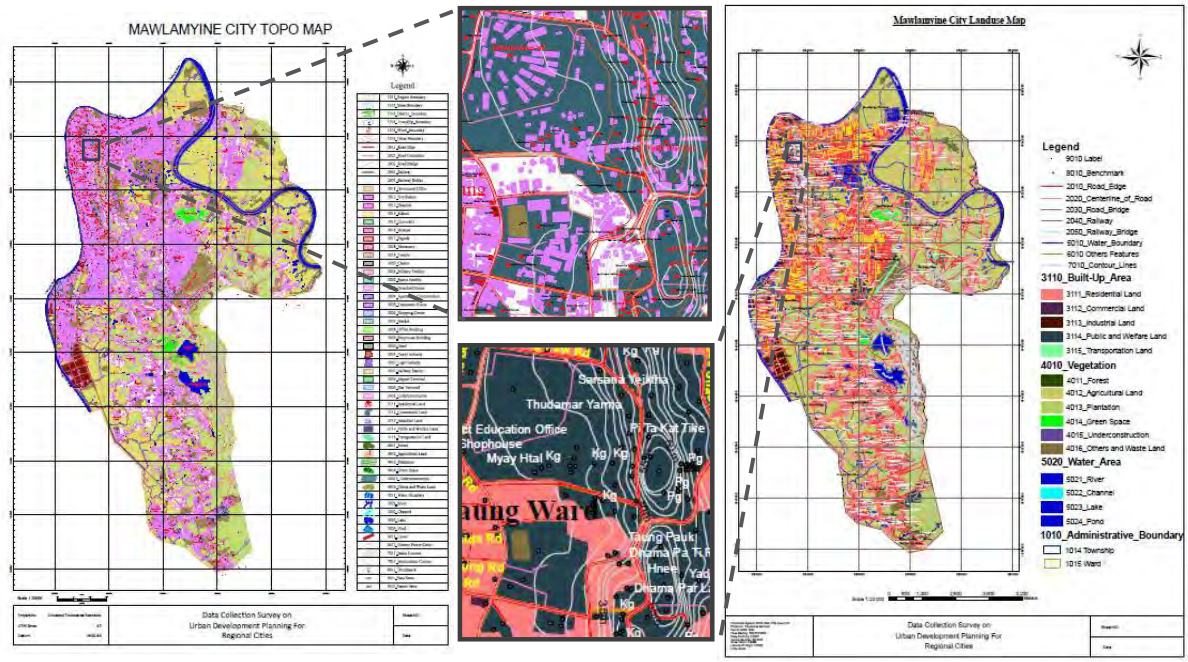
Figure 1.7.1: Topographical Map and Land Use Map of Mandalay



Topographical Map **Land Use Map**

Source: JICA Study Team

Figure 1.7.2: Topographical Map and Land Use Map of Pathein



Topographical Map **Land Use Map**

Source: JICA Study Team

Figure 1.7.3: Topographical Map and Land Use Map of Mawlamyine

PART 2

Urban Development Plans for Target Three Cities

< Summary >

Part 2: Urban Development Plans for Target Three Cities

The urban development plans for target three cities are written from the next pages in order of followings;

- Mandalay 2040 (the page sub-number is “S2-MDY-xx”)
- Pathein 2040 (the page sub-number is “S2-PTN-xx”)
- Mawlamyine 2040 (the page sub-number is “S2-MWM-xx”)

Urban Development Plan for Mandalay 2040

< Summary >

Summary: Urban Development Plan for Mandalay 2040

1 Introduction and Planning Framework

1.1 Objectives of the Plan

a) To present development visions and strategies with spatial and structure plan, targeting the year 2040;
b) To present urban and infrastructure development policies for the realization of the development visions; and
c) To propose a roadmap of key projects.

1.2 Target Year

- The target year of the plan is set in the year 2040. Benchmarks are also set to 2030 as middle-term and in 2020 as short-term.

1.3 Target Area

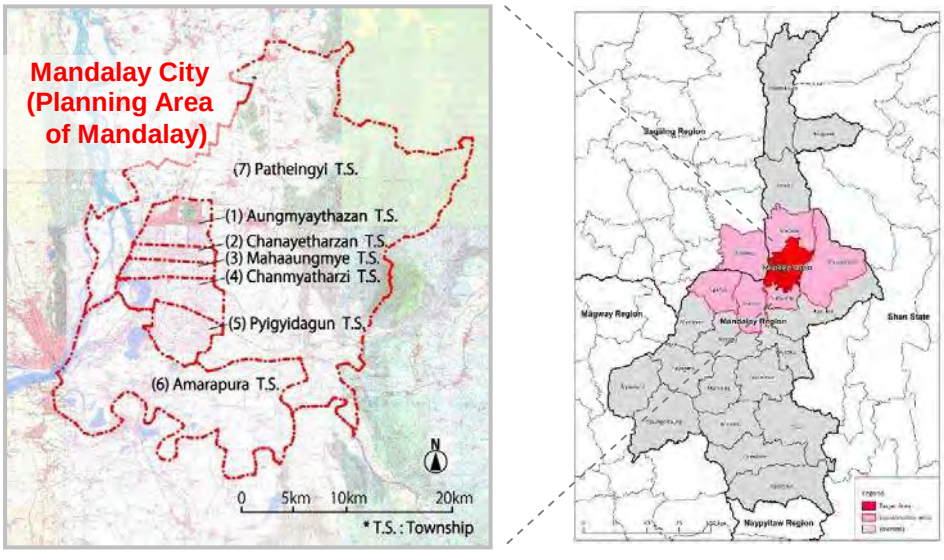
- Mandalay is located in the middle of Myanmar, which is about 390 km north of Nay Pyi Taw and about 700 km north of Yangon. Mandalay District, corresponding to the Mandalay City Development Committee (MCDC) management area, is about 900 km^2, which stretches 46 km east-west, and 40 km north-south.

- The planning area of Mandalay (hereafter, "Mandalay City") consists of the whole seven townships, namely: Aungmyetharzan, Chanayetharzan, Mahaaungmye, Chanmyatharzi, Pyigyidagun, Amarapura, and Patheingyi, belonging to Mandalay District, Mandalay Region. The total area is approximately 900 km^2. The name and area of the target townships and maps showing their locations are presented in Table 1.3.1 and Figure 1.3.1, respectively.

Table 1.3.1: Name and Area of Townships of Planning Area of Mandalay

Township	Area (km^2)
Aungmyetharzan	28.6
Chanayetharzan	13.1
Mahaaungmye	14.8
Chanmyatharzi	25.8
Pyigyidagun	25.6
Amarapura	207
Patheingyi	594
Total	909

Source: MOC Conceptual Plan and JICA Study Team

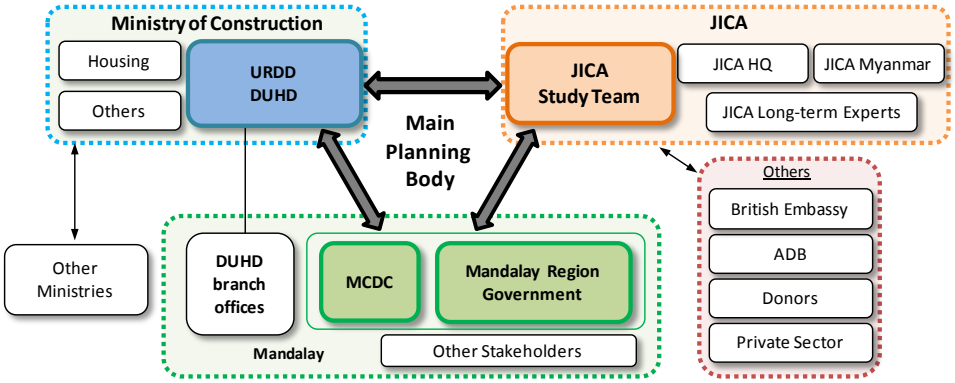


Source: JICA Study Team

Figure 1.3.1: Planning Area of Mandalay

1.4 Planning Organizations and Process

- The urban development plan of Mandalay City was prepared through close cooperation of MCDC, Mandalay Region Government, Urban Regional Development Division (URDD) of the Department of Urban and Housing Development (DUHD) under the Ministry of Construction (MOC), and the Japan International Cooperation Agency (JICA) Study Team, based on the existing conceptual plans.



Source: JICA Study Team

Figure 1.4.1: Planning Organizations

- The plan was formulated with public involvement in its planning process. There are two types of meetings as follows:
  - Workshop Meeting: to discuss with the counterpart (C/P) and related organizations; and
  - Seminar: to collect opinions of various stakeholders such as representatives of local communities.

The planning process is shown in Figure 1.4.2.

Source: JICA Study Team

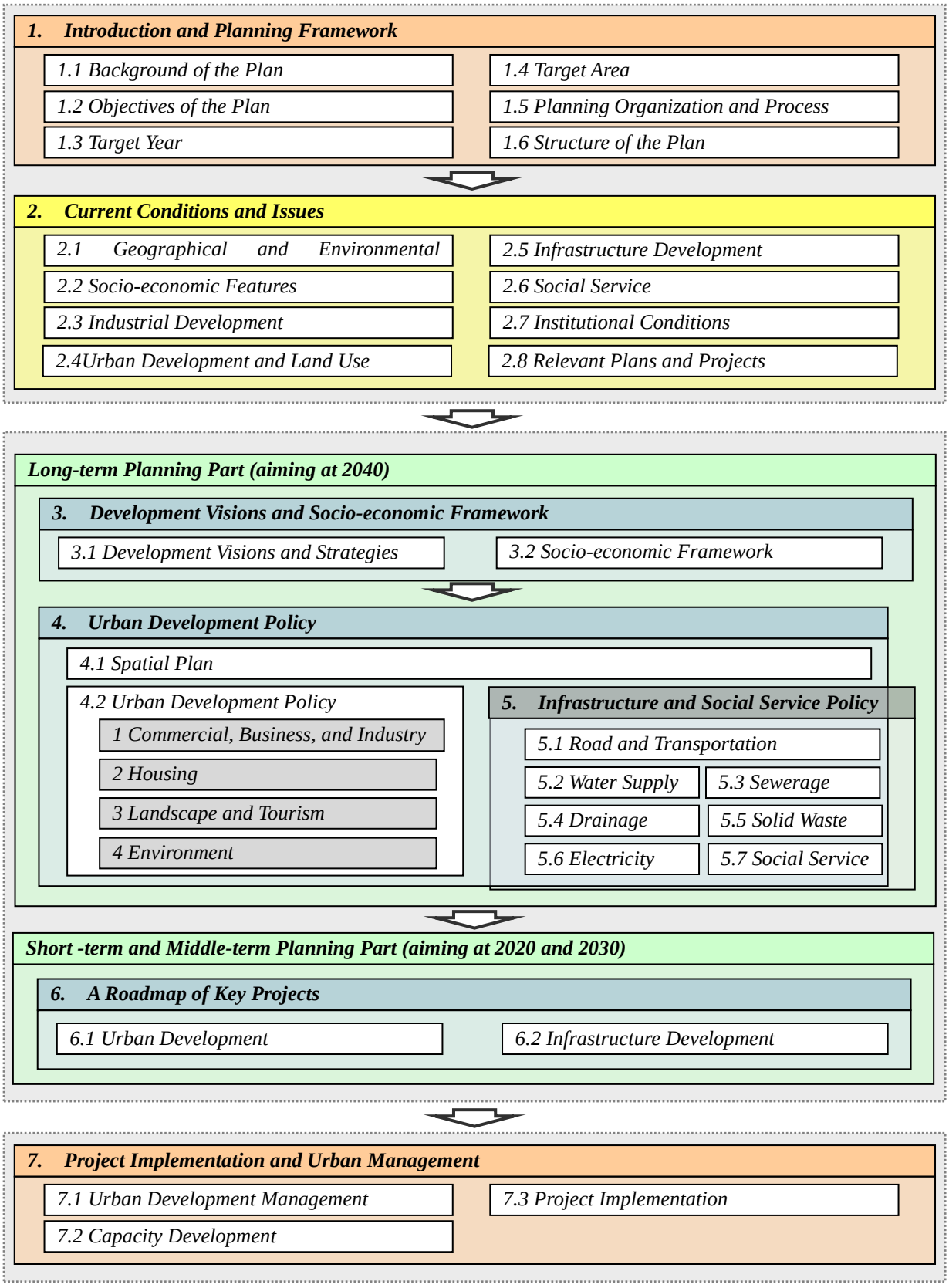
Figure 1.4.2: Public Involvement in the Planning Process

1.5 Approval of the Plan

- According to the drafted "Urban and Regional Development Planning Law" that has been examined by MOC, the city conceptual plan is defined to be formulated by MOC (union ministry) and submitted to the national urban and housing development central committee. In line with this regulation, the plan shall be approved at the national level with consensus from the regional government.

1.6 Structure of the Plan

- Referring to the existing conceptual plans and considering the general requirements of the urban development plan, the structure and basic contents of the plan are framed as shown in Figure 1.6.1. The plan shall have seven chapters and the main body of the plan shall consist primarily of two parts (long-term and short/middle-term) in order to satisfy requirements of sharing future image and encouraging actions.



Source: JICA Study Team

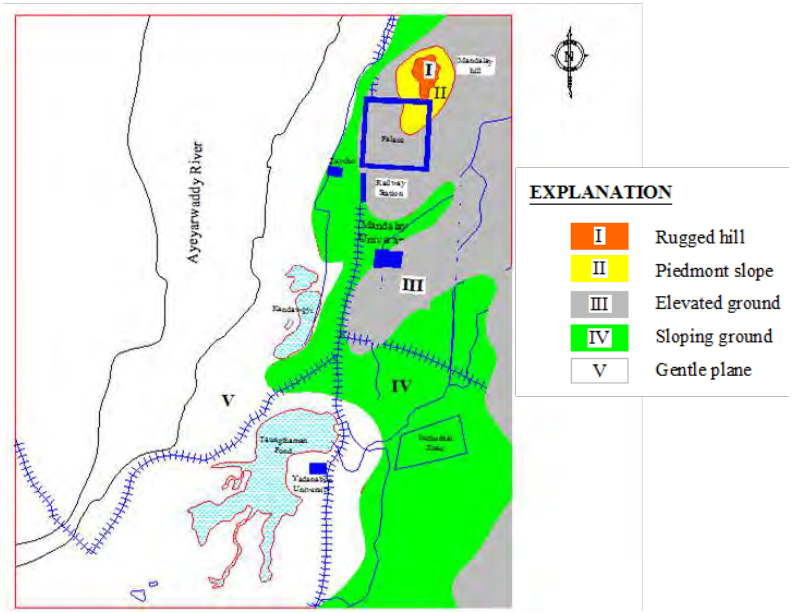
Figure 1.6.1: Structure of the Urban Development Plan

2 Current Conditions and Issues

2.1 Geographical and Environmental Features

2.1.1 Geography

- Mandalay City is situated in the flat central dry zone of Myanmar called "Central Belt", which is 716 km north of Yangon sitting on the east bank of the Ayeyarwady River. It was founded in 1857 as the royal capital. It sits on the Sagaing Fault, a tectonic plate boundary between the India and Sunda plates. The royal palace is backed by a 240 meter-high Mandalay Hill on the north. This old capital stretches its boundary to the south along the Ayeyawady bank. Geographically, Mandalay City sits on a generally sloping ground from northeast to southwest of the city, as illustrated in Figure 2.1.1.



Source: Eyn Keey, Yangon University, "Seismic Microzones of the Mandalay-Amarapura Area"

Figure 2.1.1: Geographical Outline of Mandalay

2.1.2 Natural Disaster

Earthquake

- The Sagaing Fault, where Mandalay City sits, is the most prominent active fault in Myanmar. The highest seismic zone comprises of the western part of Mahaaungmye Township, and the second highest zone consists of the western part of Amarapura, Chanmyatharzi, and Chanayetharzan townships and the westernmost part of Patheingyi Township.
- The last major earthquake was recorded back in 1956 in Sagaing with magnitude 7.0, by which several pagodas were severely damaged and more than 50 people were reported dead. Meanwhile, in April 2016, a magnitude 6.8 earthquake with an epicenter of 130 km depth occurred but no major damage has been reported. Thus, the specialists anticipate another hit by a big earthquake in the region in the near future.

Flooding

- Mandalay City may experience potential flooding due to lack of urban drainage facility, like the Ayeyawady flooding and the large river discharge from Shan Plateau to the city. Particularly, the southwest part of the city is prone to flooding due to its topographic features.

2.2 Socio-economic Features

- Mandalay City, administered by MCDC, is currently composed of seven townships that also form Mandalay District. Five out of the seven townships are fully urbanized areas which have long constituted the city. Amarapura and Patheingyi townships were incorporated into the city in 2011 and 2015, respectively. Mandalay District, with a population of 1.7 million, occupies 28% of Mandalay Region in terms of population size. About 76.4% of the district population are urban residents.

Table 2.2.1: Population of Mandalay District by Township in 2014

Region/District/Township	Population (thousand)			Urban Population
	Total	Urban	Rural	
Mandalay Region	6,166	2,143	4,022	34.8%
Mandalay District	1,727	1,319	407	76.4%
Aungmyetharzan	266	266		100.0%
Chanayetharzan	197	197		100.0%
Mahaaungmye	241	241		100.0%
Chanmyatharzi	284	284		100.0%
Pyigyidagun	238	238		100.0%
Amarapura	238	81	157	34.0%
Patheingyi	264	13	251	4.9%

Source: The 2014 Myanmar Population and Housing Census

2.3 Industrial Development

2.3.1 Industrial Activities

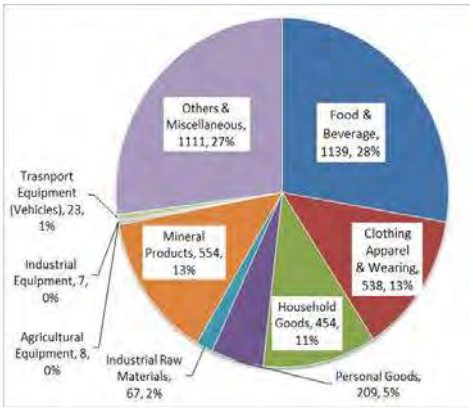
- Mandalay City is a national economic growth center with the second largest population in Myanmar. It is located at the junction of the central north-south corridor connecting Yangon, Nay Pyi Taw, and Myikyina, the northern corridor linking Lashio, Muse, and China to the east, and the corridor going to Tamu and India to the west, as envisaged by the National Spatial Development Framework. Hence, the city serves as an administrative and economic hub with industrial and commercial concentrations as well as an important tourism base with a lot of religious and cultural heritages.

- According to the “Myanmar Industry Directory 2015-16”, Mandalay Region had the greatest number of registered industries among all regions and states in Myanmar in 2014, with a total of 7,281 private industries. Particularly, there are more medium- and small-scale industries in the region than in Yangon Region. Table 2.3.1 and Figure 2.3.1 show the number of industries in Mandalay District by size and by sub-sector in 2015-16, respectively. Major types of industries are “food and beverage” (28% of the total number of industries), “others and miscellaneous” (27%), mineral products” (13%), “clothing apparel and wearing” (13%), and “household goods” (11%).

Table 2.3.1: Number of Industries by Size in Mandalay District in 2015-16

Size of Industries	Number of Industries	Number of Employees
Large	908	19,177
Medium	1,256	7,704
Small	1,946	7,935
Total	4,110	34,816

Source: Ministry of Industry, Directorate of Industrial Supervision and Inspection, Mandalay Regional Office



Source: Ministry of Industry, Directorate of Industrial Supervision and Inspection, Mandalay Regional Office

Figure 2.3.1: Number of Industries by Sub-sector in Mandalay District in 2015-16

- In Mandalay Region, there are three existing industrial zones, which were established under the supervision of the Mandalay Regional Government since the 1990s as seen in Table 2.3.2, and Yatanapon Cyber City, established in 2007, which is categorized as a "new industrial zone". One of the three industrial zones is the Mandalay Industrial Zone located in Pyigyidagun Township, in the southern part of Mandalay City. The industrial zone forms the largest scale of industrial accumulation in the country, catering to about 1,400 businesses in 2013, most of which are domestic companies in such areas as food processing, agricultural machinery, metal processing, construction materials, and auto repair[1]. It is reported, however, that the industrial zone is facing a challenge because there remain in fact much vacant lands and plots partly due to speculation of land buyers, which increases prices of the lands and is hindering business development in the city[2].

Table 2.3.2: Industrial Zones in Mandalay Region

Industrial Zone	Location	Year of Establishment	Area (Acre)	No. of factories*
Mandalay IZ	Pyigyidagun Towinship, Mandalay District	1995	1239.33	1,379
Meikhtila IZ	Meikhtila District	1995	385.45	295
Myingyan IZ	Myingyan District	1995	163.59	265
Yatanapon ICT Park	Pyi Oo Lwin District	2007	10,000	16
Myotha Industrial Park	Myingyan District	2013 (under development)	10,337	-

Note: *as of February 2013
Source: Myanmar Industry Directory 2015-16; JETRO (Yangon), 2013; Myotha Industrial Park Website

2.3.2 Foreign Investment

- Table 2.3.3 shows the total investment amounts of permitted enterprises under the Foreign Investment Law in Mandalay Region as well as in the Union in total and Yangon Region for comparison purposes. In 2014-2015, only seven enterprises were permitted, with increased investment of USD 667 million in Mandalay Region, out of the total 211 enterprises, with

[1] JETRO Yangon Office, "Data Collection of Industrial Zones in Myanmar", February 2013.
[2] Myanmar Times (Website), "Diverted industrial land hinders development for Mandalay businesses", August 4, 2014.
[http://www.mmtimes.com/index.php/business/property-news/11255-diverted-industrial-land-hinders-development-for-mandalay-businesses.html]

investment of USD 8,011 million permitted in Myanmar. According to the Mandalay Regional Government, there are currently 22 foreign direct investment (FDI) projects in the region, out of which 11 projects are in the industry sector, four are investing into hotel and tourism sector, and three are in the energy sector[3].

Table 2.3.3: Total Investment of Permitted Enterprises under the Foreign Investment Law in Mandalay Region

(Million USD)

Region	2010-2011		2011-2012		2012-2013		2013-2014		2014-2015	
	No. of Enter-prises	Foreign Invest-ment	No. of Enter-prises	Foreign Invest-ment	No. of Enter-prises	Foreign Invest-ment	No. of Enter-prises	Foreign Invest-ment	No. of Enter-prises	Foreign Invest-ment
UNION TOTAL	**24**	**19,999 ***	**13**	**4,644 ***	**94**	**1,419 ***	**123**	**4,107 ***	**211**	**8,011 ***
Mandalay Region	-	-	1	26	2	65	2	82	7	667 *
Yangon Region	3	64 *	5	33 *	80	834 *	102	2,745 *	154	3,767

Note: *Increased in investment value.
Source: MNPED Central Statistical Organization, "Myanmar Data CD-ROM 2015", February 2016. (Originally from Directorate of Investment and Company Administration)

2.4 Urban Development and Land Use

2.4.1 Urban and Housing

Central Urban Area

- The central urban area located around the palace between Nadi Canal in the east, Shwe Ta Chaung Canal in the east, and 12th street in the north. The area with grid road pattern extends up to around the Mandalay University and the old airport site. Its old downtown area consists of commercial buildings, residential buildings, and mixed buildings. The environment of the residential district is relatively in good condition and is equipped roads with enough width.

- The commercial and business buildings, which were constructed as low buildings, are reconstructed and replaced by buildings with five to six floors. Some buildings are reconstructed to seven to ten-story commercial buildings along the wide width arterial roads such as AH1 and 35th street. Most of the residential buildings and mixed-use buildings in the downtown area are flat two to three-story buildings. Some of these buildings, which face the major street with wide width grid pattern roads, are being reconstructed and replaced to apartment buildings of four to six floors.

Surroundings Area of the Old Downtown

- In the surrounding area of the old town area, the urban area is composed of flat and two to three-story buildings. These areas spread in the periphery of the central downtown as extension areas. The west side of the Shwe Ta Chaung Canal in the west of the city is a typical urban area. Most of the buildings are wooden structures and they are constructed in a narrow housing site.

New Housing and Business Development Areas

- Residential development is ongoing in the east and south of the old airport. In the east of the old airport, a residential area is under development, which is integrated with business and

[3] Presentation material of "Mandalay Region 2nd Five Year Regional Development Plan" presented by Mr. U Kyaw Kyaw Shein, Director of Mandalay Region Planning Office at Workshop on Myanmar Industrial Development Vision (MIDV) and the Next Five-Year Plan on February 2, 2016.

commercial facilities. Middle-rise apartment buildings with three to ten stories and detached housing are constructed in this area. These buildings and facilities are constructed in the planned development area and their living environment is excellent.

- In the southeast and south of the city, the new housing development area is continuously extended from the northern CBD area and it reaches to the surrounding areas of the industrial areas in the south. The residential area is formed by grid patterned streets, and RC structures with brick or wooden buildings of flat or two to three-story buildings are constructed. In some residential blocks in the southeast, five-story apartment houses are under construction. These areas are orderly developed, but there remain some issues to be improved in the condition of infrastructure.

Informal Settlements

- Barracks and shanties are observed in the city area. These are used for living and commercial purposes. Most of these structures are considered informal settlements and their formalization is necessary.

Former Agriculture Villages

- According to the expansion of the urban area of Mandalay City, some of the former villages around the urban area had been included. In these areas, a typical building is wooden flat or two-story building with rural construction style. Their living conditions and buildings are popular as those of a rural village, but functionally poor and fragile against disasters as part of the urbanized area.

2.4.2 Land Use and Regulations

Land Use

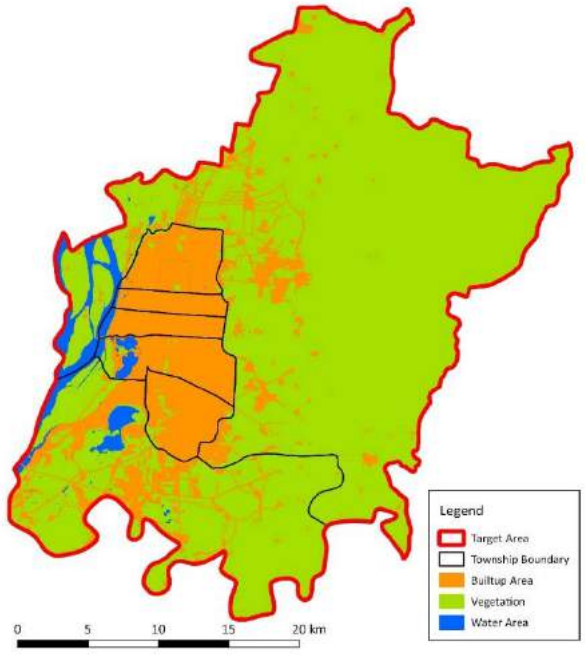
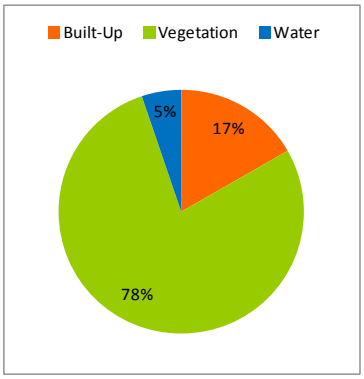


Table 2.4.1: Current Land Use (General) of Whole Mandalay City

Type	Built-Up	Vegetation	Water	Total
Area (ha)	15,165.6	71,042.8	4,746.0	90,954.3
Share	(16.7%)	(78.1%)	(5.2%)	(100.0%)

Source: JICA Study Team



Source: JICA Study Team

Figure 2.4.1: Current Land Use (General) of Whole Mandalay City

Building Regulation

- According to the "Building Rules, Regulations and Procedures, and Responsibilities" issued by the Building and Warehouse Department, MCDC, there are regulations related to building, land use, and development procedures in Mandalay City, as shown in Table 2.4.2.

Table 2.4.2: Regulations for Buildings, Land Uses, and Development Procedures in Mandalay

Items	Specification	Exact Area or Street
Building Height Control	Not to allow high-rise buildings to be more than four stories	26 B Street, 80 Street, 66 Street, 12 Street along the moat
High-rise Buildings Inspection	Building permission for up to 12 stories to be checked and issued by MCDC and buildings more than 12 stories will be inspected and surveyed by CQHP	-
Place to be Left in the Plot	The rest space must be 5 ft in front, 4 ft at the back, 2 ft each at both sides of the building in the downtown area.	From Shwe Ta Chaung to 72 Street, 26 Street to 35 Street
	Space must be left at 12 ft in front, 6 ft at the back, and 3 ft each at both sides of the building.	In other areas of the city
MCDC Permission Proposal	Soil test report and structural design calculation are needed for the buildings which have four stories and more.	-
Ground Level of Building	The plinth height must be at a minimum 1.5 ft higher than the nearest road level.	-
Building Wall Height	Building wall height must be 12 ft on the ground floor and 10 ft each on the upper floors.	-

Source: JICA Study Team

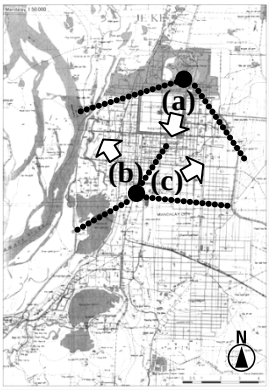
2.4.3 History, Landscape, and Tourism

- There are two 25-story buildings in Mandalay City (one of them is under construction as of May 2016), which are the highest buildings in the city. The number of stories of other existing high-rise buildings is around seven to ten stories and some new high-rise buildings around ten stories under construction can be seen in the city.

(a) Panoramic view from Mandalay Hill towards the south

(b) Panoramic view from the eighth-floor of a building towards the northwest

(c) Panoramic view from the eighth floor of a building towards the northeast



Point and Direction of the Views (a)-(c)

Source: JICA Study Team (The pictures were taken in May 2016)

Figure 2.4.2: Panoramic View and High-rise Buildings in Mandalay City

2.5 Infrastructure

2.5.1 Transport and Road

- Grid-pattern Road Network: The road network in the city center has a grid-pattern network. Accordingly, it is quite easy not only for the citizens but also for tourists to express their destination such as "corner of roads 35 and 73". It makes exploring the city through combination of public transport and walking easy. Proper street signboard system on each street will work effectively.

- Existing Road Capacity: Currently, traffic congestion is only observed on Sagaing-Mandalay Street. However, the capacity of other roads is going to be saturated in the near future based on the JICA Study Team's estimation of saturation ratio. Thus, measures to increase the road capacity in the city should be addressed now. However, the city center is already densely built-up and widening and new construction of roads will be quite difficult. Capacity maximization of existing roads will be urgently needed. MCDC is implementing the upgrading of the signal system and this project will be useful. It is noted that there are two types of signal lighting in Mandalay although the other cities have uniformed standard type. Citizens in Mandalay might be familiar with it but the tourists outside Mandalay might be confused on the signal direction. The types of signal should be made uniform in the future.

- New Road Network: Urbanization of Mandalay is expanding in the southeast direction. MIC and other high-tech industrial park/residential area are proposed and a new backbone road network to support the development will be necessary. The ring road network will function well not only as a new backbone but also as a diversion road to avoid congestion in the city center.

- Parking Space: The road network in Mandalay is relatively wide, however, the outer lane is often occupied by parked vehicles. MCDC established a guideline for commercial buildings on the necessity to put in parking space, but it is not actually materializing since there is no legal binding force. The development of controlled on-road parking and off-road parking will be required.

- Public Transport: Buses are under operation based on the route network established by the government agency. Only small buses (light-size truck type) are in service, no passenger queuing is observed in the city. The demand for buses are still less within the capacity of the current system.

- Future Public Transport: The project cost of the proposed BRT is USD 60 million but its feasibility such as financial viability has not been confirmed yet. Traffic demand should be examined to justify the economic and financial feasibility of the proposed project.

- Truck Terminal: Pyi Gyi Mingalar Truck Terminal is the sole logistic truck terminal in the city. The terminal has recently opened but is already getting saturated. Possible expansion or relocation in a suburban area shall be considered based on the comprehensive urban planning.

- Aging Railway Infrastructure: Other railway lines in the country such as signal system, station building, railway crossing, and railway track are not well maintained and updated.

- Railway Infrastructure in Urban Area: Mandalay City has a circular-like railway network in the city center; however, the circular network has not been utilized well and forwarding dead-head cars are being operated only once a day without passengers while the railway track is located in a prime location in the city.

- Port Handling Demand: Cargo-handling volume is significantly increasing and the passenger volume is decreasing year by year.

- New Port: A new port in Mandalay is being planned with modernized facilities. The location of the port shall be determined carefully, not only considering the factors of the harbor side such as the water depth but also urban planning and the connectivity with the road network.
- Old Airport in Mandalay City: In the vicinity of the old airport, urban development is accelerated with shopping malls, stadiums, and residences. MCDC has positioned this area as the new CBD. The old airport divided the existing city center and the new CBD. The future utilization of the old airport is a major issue on urban planning.
- Mandalay International Airport (MIA) in Tada-U: Renovation and upgrading of the airport facilities are being conducted by a private concessionaire. The capacity of the airport facilities will be sufficient for the future passenger demand of up to three million people per year. Stable economic development of Mandalay City and its surrounding area is expected to enhance the airport demand. The upgrading of basic infrastructure such as water supply, sewerage, and power supply is also accelerated in Tada-U Township.

2.5.2 Water Supply

- Currently, the serviced population has reached 0.7 million and the average service ratio is about 57% in Mandalay City. This situation would result to insufficient water supply service for urban life and development.
- The expansion project of the water supply system is urgently required at Pyigyidagun and Amarapura townships. Pyigyidagun Township is covered by water supply of 5% only, but in the near future, it will be covered up to 30% through a JICA Grant Aid. Construction of a new water treatment plant (WTP) which utilizes surface water, extension of pipeline, and distribution reservoir will be required for more extension. Technical assistance for capacity development for the operation of rapid sand filtration system will be required due to lack of local know-how. Improvement of electricity supply is required in order to have stable water supply.
- In the eastern area, upgrading of the distribution reservoir and pumping facilities will be required for improvement of low pressure since the quality of water supply is not good.
- Regarding the deterioration and drawdown of groundwater, a public water supply system to the industrial zone will be required in order to minimize groundwater usage by each factory's tube well. Broad-based groundwater management with regulation is required.
- Reason of high non-revenue water (NRW) (nearly 50% included in pipeline's NRW 36%) shall be investigated and appropriate measures shall be implemented. Technical assistance for NRW reduction is required.

2.5.3 Sewerage

- There is no public wastewater treatment plant (WWTP) to collect and treat wastewater in Mandalay City. Wastewater from households, commercial, industrial, and public sector in the city is disposed in pit toilets or septic tanks in their own space. There are also many households which cannot use the toilet in clean sanitary condition. Local residents continue to dump their trash to the existing drainage channels that cause offensive odor and degradation of water environment.
- To decrease the risk of water-borne infectious diseases and groundwater contamination, a new WWTP with appropriate treatment process, such as conventional activated sludge process will be required urgently. A comprehensive sewerage master plan, considering a project technique of sewerage in which low cost and moveable development according to the actual condition of the area is possible, shall be required.

2.5.4 Drainage

- There are nine main drainage channels, three drainage pumps, two retention ponds, and many sluice gates in Mandalay City. These facilities do not have enough capacity against heavy rains. So, low-lying areas located in the northwestern and southeastern areas in Mandalay City are sometimes flooded (a few times in a year).

- The intricate canal system serves as the drainage network for storm water during the rainy season, but these are not enough. Upgrading of the drainage network and pumping facilities based on the master plan shall be required. According to the existing and future modeled hydrological conditions, including the impact of climate change and urban development, various options to improve drainage will be proposed. For example, a project of dredging the canals and the drainage, a project of removing hydraulic bottlenecks, and implementation of nonstructural measures to manage the drainage network using remote control monitoring system will be appropriate.

2.5.5 Solid Waste

- The final disposal sites are simple dumping sites without any pollution control facility (no landfill liner and no drainage of leachate). Waste is dumped on the landfill site by the trucks and waste pickers sort recyclable waste (cans, bottles, and metals) before the bulldozer pushes the waste and compact it. Rubbers are sorted and are burnt in an open oven as improper method.

- According to the Pollution Control and Cleansing Department (PCCD), another issue is the practice of backfilling of low ground level plots of land (flood-prone areas) using solid waste, a cheaper way than using earth and sand. About these improper landfill works, it will pose high risk on health and high impact on the environment.

- The total waste collection per day has increased from 259 tons in 2005 to 779 tons in 2014. Due to the rapid growth of waste to be landfilled, the handling capacity of the final disposal sites can last only for four or five years. Shortage of capacity on the final disposal sites is the most serious issue.

2.5.6 Electricity

- In Mandalay City, electricity is transmitted at 230 kV, 132 kV, and distributed at 33 kV, 11 kV and .4 kV voltage levels. Thus, the district itself is supplied by five primary substations which include two 230 kV and three 132 kV substations. The electricity consumption of Mandalay City is more than half of the total of Mandalay Region and the peak hours are in the morning and in the evening. In Myanmar, as well as in Mandalay, the months of April and May are considered as the maximum demand months and also the dry season where, due to lack of water in the reservoir, the output of the hydropower plants, which are the main sources of power, are at the minimum. Frequent power shutdowns take place in Mandalay City during this period of the year due to lack of power supply, line fault, system down, and scheduled load shedding.

- Although there is no power plant in Mandalay City and/or directly connected to any of its primary substations, the existence of the Myanmar-China natural gas pipeline from Shwe Gas Station which goes through Mandalay provides the practicality to build a power plant.

- While some of the primary substations are in good condition and some are needed to be rehabilitated, all of these are running on around 80% or above loading capacity during the peak season of the year. Considering MESC's forecasted value of 15% increase in demand, it can be said that most of the primary substations will be overloaded by next summer.

2.6 Social Service

2.6.1 Education

- The literacy rate in Mandalay City is more than 95% and it is higher than the ones in the surrounding area and the whole Myanmar, which indicates basic education prevails more widely in the city.
- School attendance in Mandalay City decreases gradually after the completion of the primary education cycle and a similar trend is also true in the whole Myanmar. One of the main reasons for the gradual decrease are economic difficulty of the household, which cannot pay for opportunity cost to have their children go to school. Another reason is that some schools are located too far from home to be reached by public transport or by commuting. Preparation of facilities for primary and middle school education in Mandalay City is in lower level than the whole Myanmar. In particular, the number of students per middle school in Mandalay City is significantly higher, which is approximately 2,000. When you look at the distribution by township, Chanmyatharzi and Pyigyidagun townships where relatively new urbanized areas have a higher ratio of students per primary and middle school. It indicates that development of facilities has not caught up with increasing population recently.
- The ratio of population with highest level of education completed is under primary school in Mandalay City is at 16-17% lower than the surrounding area and the whole Myanmar. And the population ratio whose highest level of education completed is university or college level in Mandalay City is also higher than the surrounding area. It suggests that higher educated people are more concentrated in the city compared to the surrounding areas.

2.6.2 Health

- Basic health indicators of infant mortality rate, under-five mortality rate, and maternal mortality rate in Mandalay City have been in better state than the whole Myanmar, which indicates residents in Mandalay City have better access to health facilities on an average. There are, however, regional gaps of the indicators in Mandalay City.
- There are 35 hospitals, 292 clinics, 21 rural health centers, and 65 sub-rural health centers in Mandalay City. The distribution pattern varies by type of health facilities. The number of hospitals and beds are concentrated in Chanayetharzan Township and it works as the medical center of the city, while Amarapura and Patheingyi are covered by a number of rural health centers and sub-rural health centers. On the other hand, Pyigyidagun has a fewer health facilities per population and it is located far from Chanayetharzan. Bad accessibility to health services might be the cause of higher mortality rates.

2.6.3 Poverty

- The United Nations Development Programme (UNDP) implemented integrated household living conditions surveys in the whole Myanmar area in 2005 and 2010. The following table shows the percentage of population who were poor in Mandalay Region and the whole Myanmar. Ratio of poor population in both urban and rural areas of Mandalay Region decreased from 2005 to 2010. The poverty ratio in the urban area of Mandalay Region in 2010 is 14.1%, and it is 17.5% lower than the rural area.

2.7 Relevant Plans and Projects

Existing and Past Plans

Master Plan by ECFA (1996)

- The Engineering Consulting Firms Association, Japan (ECFA) made an urban master plan of Mandalay according to an agreement with MCDC in 1996. This master plan made development concepts including conceptual structure plan and implementation plan based on review of development trend in that period. The plan includes infrastructure plan such as transportation, water supply, sewerage, and electricity.

- The urban master plan of Mandalay planned three city cores in the northern area of the city: i) the existing central business district (CBD) to serve as regional business center, ii) a new CBD to serve as international business center, and iii) a new civic center to be the service area for the city population. The southern area was planned as sub-urban area consisting of regional industrial park, national heritage park, export processing zone with national highway-1, and a new access road to the international airport. This structure concept had been utilized as the basic development concept of Mandalay.

Master Plan by MCDC (2012)

- Basing on the plan made by ECFA above, MCDC prepared a 30-year city development plan in 2012, the target year of which is 2040. While the plan basically followed the structure of the ECFA plan, it includes new development areas emphasizing on industrial activities such as industrial zone, trade zone, and hotel zone in suburban areas in the south and east. It reflected demands of urban and economic expansion which increased since the ECFA plan.

Conceptual Plan by MOC (2013)

- The Government of Myanmar laid down a policy on urban and regional development. It urged the region/state government to make long-term plans for urban development for their region, which is considered from comprehensive points including society, economy, environment, and infrastructures. To follow the policy and to complement the MCDC plan, the Mandalay Region Government and the Ministry of Transportation requested MOC to support the preparation of the plan. MOC completed and prepared the Mandalay Urban Development Conceptual Plan in consultation with the Mandalay Region Government, Transportation Minister, mayor, and MCDC committee members.

- Based on the MCDC plan above, the MOC conceptual plan defined development areas in detail as shown in the Figure 2.7.1.

- One of the remarkable issues is that currently, Mandalay City does not have effective means to control urban development to realize any structure plan under the pressure of rapid urban development. Therefore, the plan has not yet been implemented.

Source: Mandalay Urban Development Conceptual Plan, MOC

Figure 2.7.1: Structure Plan for Mandalay City in MOC Plan

3 Development Visions and Socio-economic Framework

3.1 Development Visions and Strategies

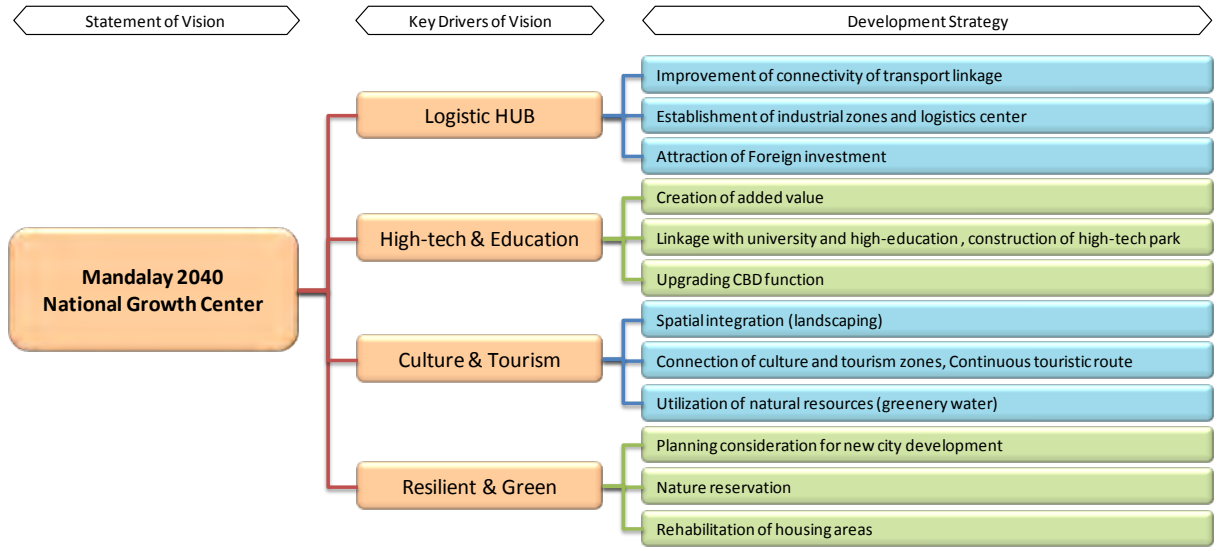
3.1.1 Development Visions

- The development vision of Mandalay City is to be the "National Growth Center", as one core city of "Two-polar Strategy". It intends that by 2040, Mandalay will be known as a successful city in the crossroads of international trade, home to an expanding, modern, and high-tech economy, and with a rich cultural history that attracts increasing numbers of international visitors.

Source: JICA Study Team

Figure 3.1.1: Development Vision for Mandalay 2040

3.1.2 Development Strategy



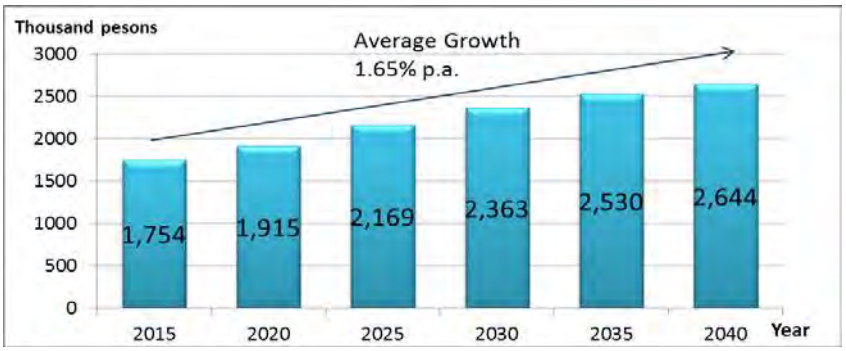
Source: JICA Study Team

Figure 3.1.2: Development Strategy in Linkage with Development Vision

3.2 Socio-economic Framework

3.2.1 Demographic Framework

- Based on the assumptions, the city population is forecasted to reach **2.64 million in 2040 from 1.75 million in 2015, showing an increase of 890,000 persons**. This corresponds to an average growth rate of 1.65% per annum from 2015-2040. Figure 3.2.1 shows the forecasted population until 2040.



Source: JICA Study Team

Figure 3.2.1: Population Forecast for Mandalay City (Mandalay District)

- MOC's conceptual plan for Mandalay City, which was developed in 2013, forecasts the population growth for 30 years (2011-2041) using three different growth rates of 1.01%, 1.8%, and 2.1%. It is understood that the above population forecast estimated by the JICA Study Team is close to the middle option of the conceptual plan in terms of annual growth rate. The Asian Development Bank (ADB) study on Mandalay Urban Services Improvement Project (June 2015) and the United Nations Human Settlements Programme's (UN HABITAT) Demographic Study of Mandalay (July 2015) have also projected annual growth rates of population until 2040 in a close range to the above forecast (ADB: 1.68%; UN HABITAT: 1.73% for moderate scenario).

3.2.2 Economic Framework

- Reflecting on the proportion of calculated productivity index of Mandalay City to that of Mandalay Region, the gross regional product (GRP) of Mandalay City was computed as shown in Table 3.2.1. The **GRP is forecasted to grow by eight times and reach MMK 18,700 billion in 2040** from MMK 2,270 billion in 2015 at constant prices. **The GRP per capita is forecasted to grow by 5.5 times arriving at over MMK 7 million in 2040** from MMK 1.3 million.

Table 3.2.1: GRP of Mandalay City (District) from 2015 to 2040

Item	2015	2020	2030	2040	Average Annual Growth Rate
Mandalay Region: GRP (Billion MMK)	6,456	10,449	23,128	44,653	8.0%
Mandalay District: GRP (Billion MMK)	2,274	3,852	9,162	18,691	8.8%
Mandalay District: Population (Thousand)	1,754	1,915	2,363	2,644	1.7%
Mandalay District: GRP per capita (Million MMK)	1.30	2.01	3.88	7.07	7.0%
Mandalay Region: GRP Index (A)	7,854	8,263	9,602	10,243	
Mandalay District: GRP Index (B)	2,767	3,046	3,804	4,288	
(B)/(A)	35.2%	36.9%	39.6%	41.9%	

Note: GRP figures forecasted are based on 2010/11 prices.
Source: JICA Study Team

4 Urban Development Policy

4.1 Spatial Plan

- Population increase of Mandalay by 2040 is 917,000. Setting 200 person/ha as appropriate population density of a new town and the required land for new town development mainly for residential function would be 45 km^2 (10,992 acre).

Table 4.1.1: Required Land for Future Population Increase

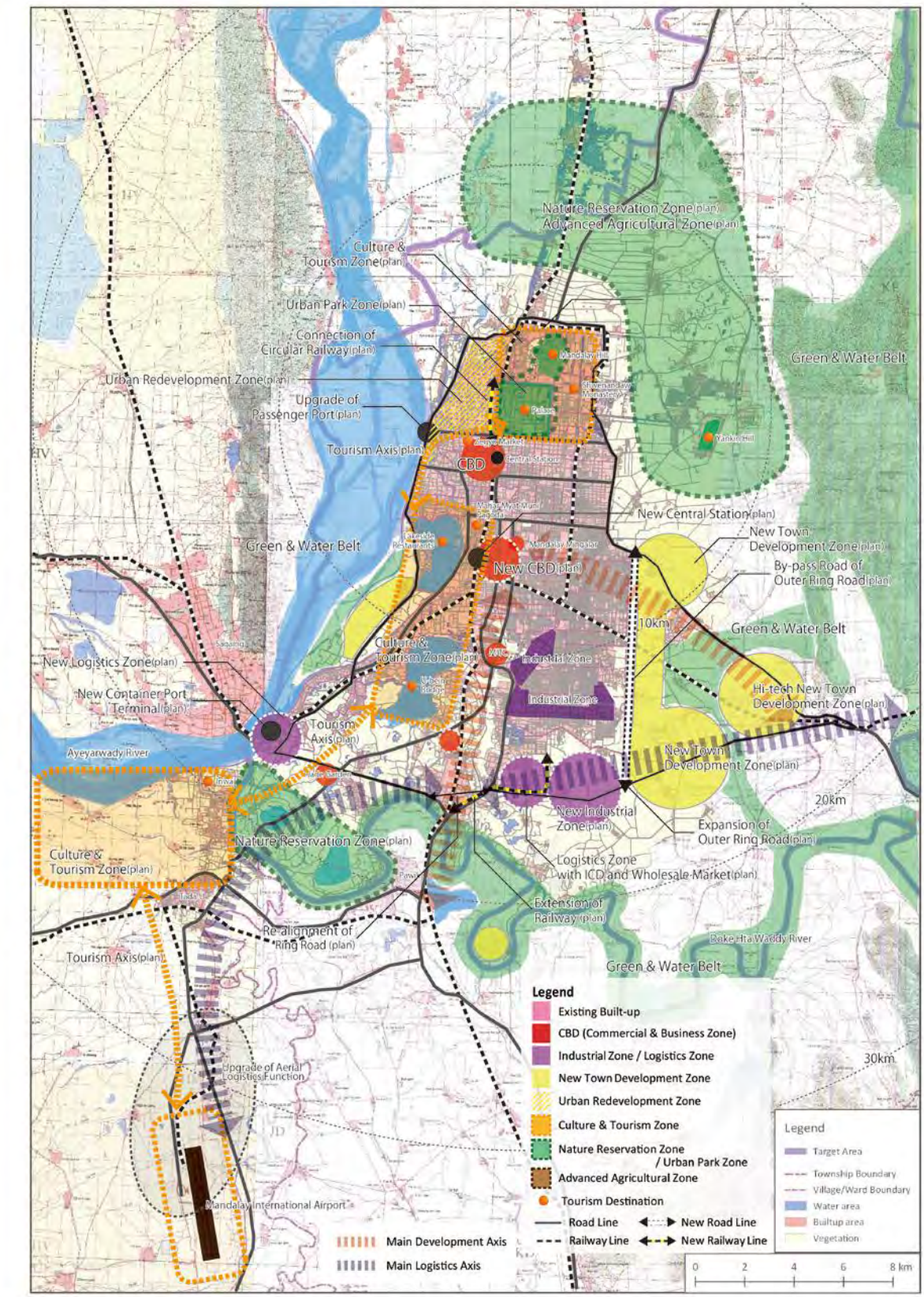
Items	Population of 2015	Population of 2040	Population Increase	Density of New Town (person/ha)	Required Land (ha)	Required L and (km^2)	Required L and (acre)
Mandalay	1,754,000	2,644,000	890,000	200	4,450	45	10,992

Source: JICA Study Team

Table 4.1.2: Proposed Zones and Contents in the Spatial Plan of Mandalay

Items / Zones	Characteristics of Zone	Proposals in the Spatial Plan
Existing Built-up (Residential and Mixed-use)	Current urbanized areas which are covered by buildings mainly for residential, commercial, and mix-use.	All area would be upgraded gradually in its environment, infrastructure, and social service.
CBD (Commercial and Business)	Current center of commercial and business area leads economic activities of Mandalay. It includes a traditional market.	Although existing CBD function must be kept in the future, it is more likely for tourism attracting foreign tourists.
Industrial Zone Logistics Zone	Industrial and logistic function must be in good connection with other focal cities and countries by roads, railways, and by water transport.	New industrial zones and logistics zones were proposed to be located south of the city. These locations have better accessibility with Yangon and China.
Urban Redevelopment Zone	In existing built-up, low-level residential areas (informal houses) seem to exist without access to proper infrastructure.	An area along the Ayeyarwady River shall be improved with proper road system and infrastructure.
New CBD (Commercial and Business Zone)	To accelerate economic growth, development of highly functioned commercial and business area is necessary.	New CBD is proposed to be located 5 km south from the current CBD utilizing the old airport area and the railway depot.
New Industrial Zone New Logistics Zone	To be a logistic hub and high-tech city, expansion of industrial and logistic function is important.	Development of a logistic hub (terminal port) along Ayeyarwady River and expanded industrial zones along the outer ring road are recommendable.
New Town Development Zone (Residential and Mixed-use)	New town includes function of not only residential but some commercial and business as mix-use.	Development of new town with an area of 45 km^2 in total is necessary in the future. Creating a “high-tech satellite city” as an eastern gateway is proposed as key project.
Culture and Tourism Zone	To encourage tourism development, promoting culture and tourism zone is recommendable to conserve and utilize historic and nature resources. Improvement of access is also necessary.	Three culture and tourism zones have been proposed, namely: “Mandalay Palace and Hill Zone”, “Two Lake Zone”, and “Inwa Zone”. Street No. 26 connecting between the river and palace passing through Zegyo Market has also good potential as tourism axis.
Urban Park Zone Green and Water Belt Zone	To upgrade urban environment, both urban parks inside the city and green and water belts surrounding the city are necessary.	Mandalay Palace and Hill must be conserved and utilized as urban park of Mandalay as symbol of the city. Hills, mountains, and rivers can function as appropriate green and water belts.
Nature Reservation Zone Advanced Agricultural Zone	Nature reservation zone and advanced agricultural zone where development activities are basically prohibited are important to avoid urban sprawl and to keep the city more compact and efficient.	Agricultural areas of northeast and river area of southwest are recommendable to be nature reservation zone of Mandalay.

Source: JICA Study Team



Source: JICA Study Team

Figure 4.1.1: Proposed Spatial Plan of Mandalay City

4.2 Urban Development Policy

4.2.1 Commercial, Business, and Industry

- The following Table 4.2.1 shows the development policies of commercial, business, and industry in Mandalay City, especially for achieving a future city to be logistic HUB and High-tech & Education. In order to execute these policies, spatial control is a common and principal measure to be taken by the local and central governments for the realization of urban development policies and projects. These control measures are expected to be executed based on the law, by-laws, and other legal frameworks.

Table 4.2.1: Development Policy of Commercial, Business, and Industry in Mandalay

Commercial, Business, and Industry Policy	1) Creation of New CBD Core 2) Satellite Town Development 3) Construction of Logistics Hub 4) Construction of New Industrial Zones 5) Restructuring of Current Central Business District 6) Restructuring of Touristic Functions

Source: JICA Study Team

4.2.2 Housing

- In accordance with the population growth, increase of migrants as workers due to new demand of industrial areas and change of living styles, corresponding housings are expected to be supplied in conformity to the city plan. Paying attention to be resilient and green as one of the key drivers of the visions is necessary viewpoint for housing development. Typical housing demands and issues for the realization of the development vision of Mandalay City are concluded in Table 4.2.2.

Table 4.2.2: Development Policy of Housing in Mandalay

Housing Policy	1) Continuation of Development in Current Housing Development Area (South of the Current City) 2) Redevelopment of Existing High-Dense Housing Area (Northwest of the City) 3) Formalization of Illegal Settlement 4) Construction of Modern Housing (New CBD and New Town Area) 5) Preparation of Housing around Industrial Areas for Workers

Source: JICA Study Team

4.2.3 Landscape and Tourism

- Unique landscape and tourism resources accumulated over the years exist everywhere around the city. To emphasize culture & tourism as one of the key drivers of the vision, landscape and tourism development is fundamental factor. The precious and various resources have large potential to attract a lot of tourists around the world. To establish a world-class culture and tourism city by utilizing and enhancing the landscape and tourism function of Mandalay City, the policies in Table 4.2.3 should be considered.

Table 4.2.3: Development Policy of Landscape and Tourism in Mandalay

Landscape and Tourism Policy	1) Heritage and Landscape Conservation 2) Tourism Zone Development 3) Connection of Culture and Tourism Zones, Continuous Touristic Route

Source: JICA Study Team

4.2.4 Environment and Agriculture

- To develop Mandalay City as culture and tourism city and resilient and green city by 2040, environmental and agricultural concerns shall be addressed in its development policy. There are four main concerns to be taken into consideration, namely: nature conservation, pollution control, living conditions, and natural hazard and agriculture.

Table 4.2.4: Development Policy of Environment and Agriculture in Mandalay

Environment and Agriculture Policy	1) Creation of Natural Reserve 2) Pollution Control 3) Building Livable Urban Settlement 4) Disaster Preparedness 5) Agriculture, Food Processing, and Logistics Promotion

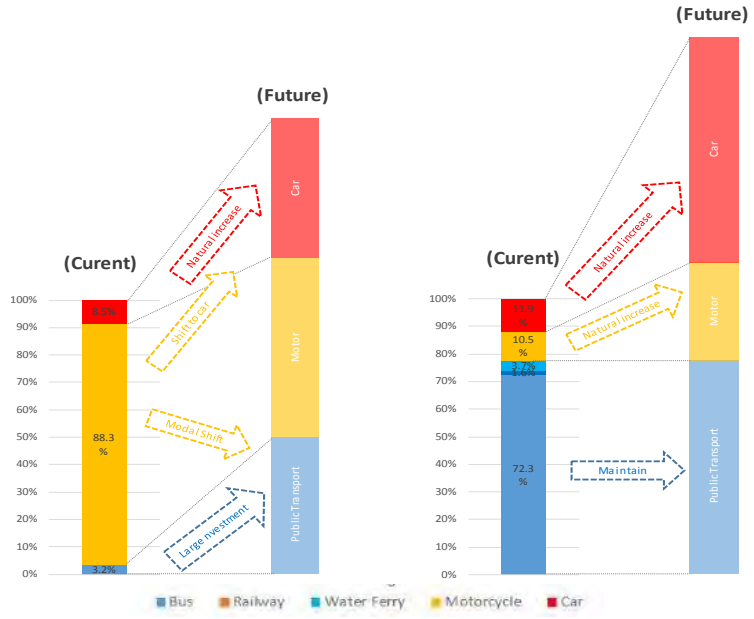
Source: JICA Study Team

5 Infrastructure Development and Social Service Policy

5.1 Road and Transportation

Road Transport

- Figure 5.1.1 proposes the preferable modal share of Mandalay compared with that of Yangon based on the estimated modal rate as mentioned above. The future targeted rate of Yangon in the figure below is referred from the result of the Yangon Urban Transportation Master Plan (YUTRA). On the other hand, the targeted rate of Mandalay is tentatively proposed by the JICA Study Team.

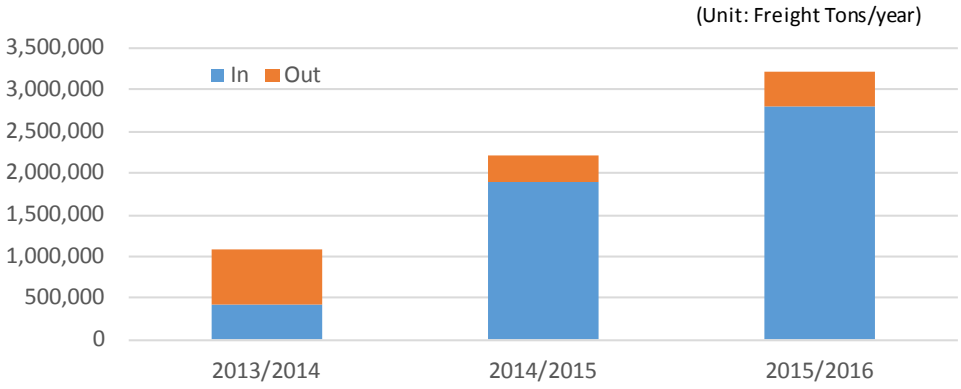


Source: JICA Study Team

Figure 5.1.1: Preferable Modal Share for Mandalay and Yangon

Port and Logistics Transport

- Figure 5.1.2 shows the cargo-handling volume of Mandalay Port showing the increasing trend at a pace of 1 million tons a year even after the completion of the expressway (Yangon-Nay Pyi Daw-Mandalay). However, the cargo handling in Mandalay Port is quite inefficient due to manpower handling and old port and shipping facilities. Modernization of the port facilities such as containerization shall be urgently required to fulfill the future cargo-handling demand.



Source: JICA Study Team based on Statistic Data of DMA

Figure 5.1.2: Cargo Handling Volume of Mandalay Port

Airport Transport

- Mandalay International Airport was opened in 2000 relocating from the old airport in the city center. The airport was designed for an annual passenger volume of 3,000,000 pax. The current annual passenger volume of the airport is still around 1,000,000 pax and has enough capacity for future demand.

Table 5.1.1: Development Policy of Road and Transportation in Mandalay

Road and Transportation Policy	1) Modal Shift to Public Transportation 2) Upgrading of Bus Service 3) Revitalization of Urban Railway Asset 4) Upgrading and Strengthening of Road Network 5) Modernization of Logistics Facility 6) Upgrading and Improvement of Aerial Logistics Function

Source: JICA Study Team

5.2 Water Supply

- The designed water supply population is set by multiplying the future population by the water supply coverage rate for the target year. Although the water supply coverage rate depends on the status of the use of wells from the position of public health or living environment, it should target the highest possible level. In this study, the water supply coverage rate has been set at 95% by referring to the report of FASEP / French Grant "Sustainable Development of Urban Infrastructure and Services in Mandalay (Aug 2015) " and the interview of MCDC. The forecast of designed water supply population for every target year is shown in Table 5.2.1.

Table 5.2.1: Served Population of Water Supply in Mandalay City Up to 2040

Year	2015	2020	2025	2030	2035	2040
Urban Area Population (thousand)	1,350	1,508	1,743	1,920	2,077	2,192
Rural Area Population (thousand)	404	407	426	443	453	452
Total Population (thousand)	1,754	1,915	2,169	2,363	2,530	2,644
Service Coverage Rate (%)	55%	71%	83%	92%	95%	95%
Served Population (thousand)	965	1,360	1,800	2,174	2,404	2,512

Source: JICA Study Team

- In this study, the specifications and demand for water supply are presumed based on the report of JICA "Preparation Study for Water Supply Development in Mandalay, Myanmar (April, 2015)" and the interview of MCDC. As a result, the demand for water supply in Mandalay City was forecasted to be about 399,000 m^3/day in 2040 and this demand is about 2.6 times that of 2015. To meet the increasing water demand, some new water sources are needed and Myitnge River is a candidate as surface water resource.

Table 5.2.2: Development Policy of Water Supply in Mandalay

Water Supply Policy	1) Rehabilitation of Existing Water Supply System 2) Extension of Water Supply System 3) Reduction of Non-revenue Water and Modernize the System 4) Increase the Production to meet with the Future Water Needs 5) Improve the Water Distribution Condition and Pressure Management

Source: JICA Study Team

5.3 Sewerage

- The demand for sewerage in the urban area of Mandalay City is forecast to be about 345,000 m^3/day in 2040. For preserving the sanitary water environment in the urban area, the development of an "efficient and advanced sewage treatment system" is required based on the increasing

sewage discharge. The forecasted demand for sewerage for each target year in the urban area of Mandalay City is shown in Table 5.3.1.

Table 5.3.1: Demand of Sewerage in Mandalay (Urban Area) Up to 2040

Year	2015	2020	2025	2030	2035	2040
Target Coverage Rate (%)	0%	23%	40%	56%	69%	83%
Covered Population (thousand)	0	438	876	1,314	1,753	2,192
Domestic Sewage (lpcd)	130	130	130	130	130	130
Non-Domestic Sewage Rate (%)	10%	10%	10%	10%	10%	10%
Infiltration and Inflow Rate (%)	10%	10%	10%	10%	10%	10%
Daily Maximum Rate	1.1	1.1	1.1	1.1	1.1	1.1
Demand for Sewerage Daily Average (m^3/day)	0	68,897	137,795	206,692	275,747	344,802
Demand for Sewerage Daily Maximum (m^3/day)	0	75,787	151,575	227,361	303,322	379,282

Source: JICA Study Team

Table 5.3.2: Development Policy of Sewerage in Mandalay

Sewerage Policy	1) Improve the Water Environment in Public Areas (River and Lake) 2) Improve the Sanitary Living Environment 3) Use the Flushing-clean Toilet 4) Develop the Beautiful City with Wealthy Water and Green

Source: JICA Study Team

5.4 Drainage

- The urban drainage situation of Mandalay City is quite complex, due to the intricate system of natural rivers and creeks, as well as man-made canals. Some parts of Mandalay City are flooded several times a year. Floods may occur from three different major causes and interacting forces:

a) Lack of urban drainage facilities, causing inundation in the low and flat areas of the city;
b) Riverine flooding from the Ayeyarwady River; and
c) Large inflows to the urban drainage system of the city from rivers descending largely from the Shan Plateau to the east of the city.

Table 5.4.1: Development Policy of Drainage in Mandalay

Drainage Policy	1) To Reduce the Frequency of Flooding on Urban Area (once every five years) 2) To Utilize the Existing Drainage as much as possible with Necessary Upgrade and Extension

Source: JICA Study Team

5.5 Solid Waste

- Based on the present collected garbage volume, the demand for solid waste management is roughly calculated. As a result, the demand for solid waste management and disposal in the urban area of Mandalay City is forecast to be about 448,000 tons/year in 2040. The 3R Policies (Reduce, Reuse, and Recycle) is required for reducing solid waste which continues to increase. Therefore, the scenarios of 3R are assumed below. The forecasted demand of solid waste for each target year based on the scenario of the 3R Policies in the urban area of Mandalay City is shown in Table 5.5.1.

a) Scenario-A: reduce 10% by reuse of available material from waste
Reuse (10% by 2040)
b) Scenario-B: in addition, reduce 10% by recycling of organic materials, etc.

Reuse (10%) + Recycle (10% by 2040)

c) Scenario-C: moreover, reduce 15% by incineration of waste.
Reuse (10%) + Recycle (10%) + Reduce (15% by 2040)

Table 5.5.1: Demand for Solid Waste in Mandalay (Urban Area) Up to 2040

Year	2015	2020	2025	2030	2035	2040
Urban Population (thousand)	1,350	1,508	1,743	1,920	2,077	2,192
Unit Volume (t/thousand-p/day)	0.56	0.56	0.56	0.56	0.56	0.56
Demand of Solid Waste (t/day)	750	844	976	1,075	1,163	1,228
Yearly Total Demand (t/year)	273,750	308,060	356,240	392,375	424,495	448,220
Scenario-A of 3R: Reuse Rate (%)	0%	2%	4%	6%	8%	10%
Scenario-A of 3R: Reuse (t/year)	273,750	301,899	341,990	368,833	390,535	403,398
Scenario-B of 3R: Recycle Rate (%)	0%	2%	4%	6%	8%	10%
Scenario-B of 3R: Recycle (t/year)	273,750	295,861	328,311	346,703	359,293	363,058
Scenario-C of 3R: Reduce Rate (%)	0%	3%	6%	9%	12%	15%
Scenario-C of 3R: Reduce (t/year)	273,750	286,804	307,791	313,508	312,428	302,549

Source: JICA Study Team

Table 5.5.2: Development Policy of Solid Waste in Mandalay

Solid Waste Policy	1) Realization of Solid Waste Management with Stability and Safety for Long Term 2) Promote 3R (Reduce, Reuse, and Recycle) 3) Guide of Environment Activity for City Beautiful Movement 4) Reduce Environmental Impact by Disposal of Hazardous Wastes Properly

Source: JICA Study Team

5.6 Electricity

- By comparing the GRP growth trend in constant price and the peak demand growth trend, a rough estimation of elasticity value equal to 1.4 has been predicted for the Mandalay district. Since both the GRP growth trends and peak power demand trends are based on limited time period of history and various conditions on data, the elasticity value may have a certain degree of deviation. But for the moment, this is assumed to be the best value of elasticity. The forecasted growth rate of peak power demand is assumed to be equal to the 'elasticity value' times the forecasted 'GRP per capita growth rate'. By considering the abovementioned data, the peak demand growth forecast for public load until 2040 is made as shown in Figure 5.6.1. The compound annual growth rate (CAGR) of this forecast is 9.80%.

Source: JICA Study Team

Figure 5.6.1: Peak Demand Forecast for Mandalay City

Table 5.6.1: Development Policy of Electricity in Mandalay

Electricity Policy	1) Distribution Loss Reduction 2) Developing Digital Database 3) Comprehensive Urban Energy and Electric Power System Development Plan 4) Upgrading and Strengthening of Primary Substations Network 5) Involvement of MESC and/or MOEPE in Urban Planning

Source: JICA Study Team

5.7 Social Service

- Benefits from the achievements of the master plan of Mandalay City including economic growth and improvement of environmental condition should be shared with all the people in the community. This means not only increasing the incomes of the poor, but also addressing the needs of the disadvantaged and excluded groups. In addition, the development should allow them to fully participate and contribute in the process of growth. To achieve inclusive development, it is key to provide equal opportunity and accessibility to social services for all the people which include all classification in any income groups. To secure the provision of social service, the following development policy should be aimed for:

Table 5.7.1: Development Policy of Social Service in Mandalay

Social Service Policy	1) Provision of Equal Opportunity for Education and Employment for All People 2) Provision of Healthy and Secure Living Environment for All People 3) Provision of Social Safety Net for All People

Source: JICA Study Team

6 A Roadmap of Key Projects

6.1 Key Projects

Table 6.1.1: List of Key Projects

Sector	Project Name	Vision (Key Drivers)			
		Logistic HUB	High-tech Education	Culture Tourism	Resilient Green
Urban Development	1. New CBD Development Project	+	++		
	2. Southern Gateway Industrial Zone Development Project	+	++		
	3. Eastern Gateway Hi-Tech City Development Project	+	++	+	
	4. Palace Park Creation Project			++	+
	5. Riverfront Area Improvement Project			+	++
Infrastructure Development	6. Bus Service Upgrading Project	++	+	+	
	7. Comprehensive Urban Transport Master Planning Project	++	+		
	8. Commuter Railway Development Project	++	+		
	9. Road Network Improvement and Disaster Road Network Development Project	+			++
	10. Traffic Control and Management Project	+	+	+	
	11. Comprehensive Parking Master Planning Project	+	+	+	
	12. Project for Mandalay Inland Port Establishment	++			
	13. New Logistic Terminal Project	++			
	14. Upgrading and Improvement of Airport Navigational Facility Project	++		+	
	15. Mandalay-Nay Pyi Taw-Yangon Expressway Improvement Project	++			
	16. Water Supply Improvement Project	+	+	+	+
	17. Water Supply Expansion Project (in Pyigyidagun Township)	+	+	+	+
	18. Mandalay Urban Services Improvement (wastewater and drainage management)	+	+	+	+
	19. Solid Waste Management Project	+	+	+	+
	20. Power Supply Capacity Improvement Project	+	+	+	+

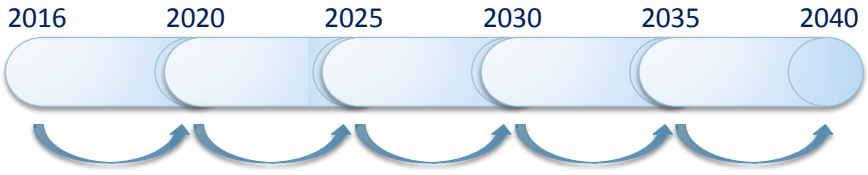
Note: ++ Strong Relation, + Relation
Source: JICA Study Team

Table 6.1.2: Implementation Schedule and Rough Cost Estimation of Key Projects

No.	Project Name	Implementation Schedule	Rough Cost Estimation (million USD)	Status*	Implemented by
		2016 / 2020 / 2025 / 2030 / 2035			
1	New CBD Development Project		250	-	-
2	Southern Gateway Industrial Zone Development Project		770	-	-
3	Eastern Gateway Hi-Tech City Development Project		490	-	-
4	Palace Park Creation Project		19	-	-
5	Riverfront Area Improvement Project		10	-	-
6	Bus Service Upgrading Project		80	-	-
7	Comprehensive Urban Transport Master Planning Project		1	-	-
8	Commuter Railway Development Project		300	-	-
9	Road Network Improvement and Disaster Road Network Development Project		30	-	-
10	Traffic Control and Management Project		20	Partially ongoing	MCDC without doner's support
11	Comprehensive Parking Master Planning Project		1	-	-
12	Project for Mandalay Inland Port Establishment		30	Ongoing (design stage)	MOTC (IWT) supported by JICA
13	New Logistic Terminal Project		—	Ongoing	MR using PPP scheme
14	Upgrading and Improvement of Airport Navigational Facility Project		15	-	-
15	Mandalay-Nay Pyi Taw-Yangon Expressway Improvement Project		30	-	-
16	Mandalay Urban Services Improvement (Water Supply)		55	Ongoing (F/S started)	MCDC supported by ADB
17	Water Supply Expansion Project (in Pyigyidagun Township)		50	-	-
18	Mandalay Urban Services Improvement (wastewater and drainage management)	MP, F/S / DD, Tendering / Construction / Operation	64	Ongoing (F/S started)	MCDC supported by ADB
19	Solid Waste Management Project		14	-	-
20	Power Supply Capacity Improvement Project		20	-	-

Note:
1) * " - " in the status column means the project is in proposal stage and its implementation body is not yet determined.
2) The rough cost of No.19) Solid Waste Management Project is counted as phase-1 only. (Referring Preparing Mandalay Urban Services Improvement Project by ADB)
Source JICA Study Team

- It is recommendable that the key projects are planned every five years through the monitoring regard on progress of conducting projects and change of circumstances. According to drafted "Urban and Regional Development Plan", a master plan shall be formulated every 5 – 10 years under the conceptual plan. In this context, re-planning of key projects shall be one of the works in master planning.



Source: JICA Study Team

Figure 6.1.1: Image of Planning Cycle for Key Projects

Table 6.1.3: New CBD Development Project

Current Status and Issues	The site of the old airport in Mandalay City is currently dysfunctional and underutilized. The site occupies a prime location in the center of Mandalay City in close proximity to the lakes, the Mahamuni Paya, the University of Mandalay as well as the IT University. The city lacks an organized and modern central business district (CBD). There is no space where the citizens of Mandalay City can go for leisure, shopping, or cultural activity. This site has a potential to be developed as a modern and well-planned CBD well serviced by the future railway station. The old railway depot can be a future extension of this CBD.
Purpose	To develop the old airport site into CBD, culture and leisure destination.
Main Scope	・ Development of a central CBD and a leisure space for citizens ・ To create a central park surrounded by malls, hotels, office towers, cultural spaces, and new cultural landmarks like art museums, libraries, and interpretation centers. ・ Strengthening the tourist potential of Mandalay City by creating a zone of hotels, street for outdoor eating, cafes, and other tourist facilities.

Source: JICA Study Team

Source: JICA Study Team

Figure 6.1.2: Images of New CBD Development Project

Table 6.1.4: Southern Gateway Industrial Zone Development Project

Current Status and Issues	In line with the proposed spatial plan, enough vacant land is available towards the southern part of the city along the Yangon-Mandalay Road for development of an industrial zone. This industrial zone will create a good network between the proposed logistics port, existing industries, and the Mandalay Airport. It can also benefit from the existing infrastructure.
Purpose	The purpose is to develop a logistics and industrial zone connected to the port and existing industries.
Main Scope	・ To develop a southern gateway to the city with industry and logistics as the main function ・ Utilize the existing road and service infrastructure along the Yangon-Mandalay Road to create an expansion to the existing industrial area ・ Create new business opportunities and jobs

Source: JICA Study Team

Table 6.1.5: Eastern Gateway Hi-tech City Development Project

Current Status and Issues	Vacant land is currently available for development of a cyber (IT) city along National Highway 3 towards the eastern part of the city. This zone will be linked with the Cyber (IT) University situated in close proximity and will have functions related to IT offices, university research parks, and residential areas.
Purpose	The purpose is the creation of a new sub-center towards the eastern part of the city, linked with National Highway 3.
Main Scope	・ Creating a self-sustainable module with integrated living, working, and university functions. ・ Creating a green city with playgrounds, green buffer, and plantation areas for the

	residents. ・ Developing world-class business and IT/cyber offices ・ Boosting business opportunities in Mandalay.

Source: JICA Study Team

Source: JICA Study Team

Figure 6.1.3: Images of Eastern Gateway Hi-Tech City Development Project

Table 6.1.6: Palace Park Creation Project

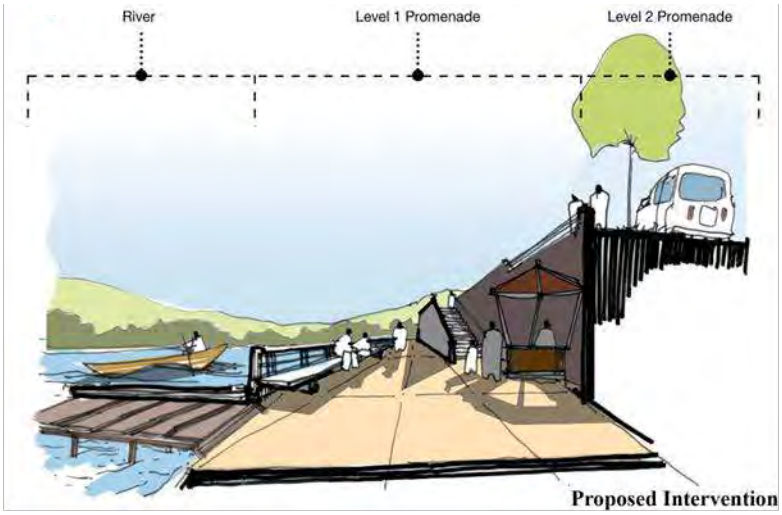
Current Status and Issues	The Mandalay Palace remains like an inaccessible island of green within the city. The land use on its edges does not respond to the palace function. There is a potential to develop the palace as a city park open to its residents, where citizens can spend their evenings. It can become a place where temporary events can be hosted and weekly heritage street markets can be organized.
Purpose	To develop the palace as a grand public park with tourist facilities and commerce in its vicinity
Main Scope	・ Creating a grand public park. ・ Creating tourist infrastructure. ・ Landscape development and creating spaces for various functions within the palace. ・ Creating spaces for heritage markets, small event spaces, open cafes, and other recreational areas. ・ Linking the palace with other parts of the city through pedestrian boulevards and trams.

Source: JICA Study Team

Table 6.1.7: Riverfront Area Improvement Project

Current Status and Issues	The land on the eastern bank of the Ayeyarwady River is low and flood-prone. There is lack of proper flood control infrastructure. There is currently no connection of the city with the river. There are no open spaces, plazas, or streets which open towards the river. Excessive boating and fishing-related activities are being done in this area. A lot of encroachment is also observed along the river.
Purpose	The purpose is to create a leisure and open space for the residents of the city, connect the city with the river and create a flood resilient community.
Main Scope	・ Creating flood control infrastructure ・ Creating open space for the citizens ・ Creating avenues for various activities like fishing, boating, and other informal activities. ・ Creating connections across the Myo Patt Road

Source: JICA Study Team



Source: JICA Study Team

Figure 6.1.4: Images of Riverfront Area Improvement Project

Table 6.1.8: Bus Service Upgrading Project

Current Status and Issues	Mandalay citizens enjoy using convenient private transportation mode such as motorcycles. Public transportation system and bus networks are available but not used properly.
Purpose	Modal shift to "public transportation system" from private transportation by developing high-quality bus services
Main Scope	・ Construction of the main backbone of large-sized bus network such as bus rapid transit (BRT) ・ Re-structuring of the existing bus network ・ Introduction of high-quality bus fleet including modernized ticketing system ・ Establishment or strengthening of the bus operation authority/corporation ・ Technical assistance (TA) to the bus operation authority/corporation

Source: JICA Study Team

Table 6.1.9: Comprehensive Urban Transport Master Planning Project

Current Status and Issues	Traffic data such as traffic counting and person-trip data is not available and the quantitative demand analysis could not be conducted. It is essential to estimate the traffic demand for the project implementation.
Purpose	Establishment of a comprehensive urban traffic master plan
Main Scope	・ Traffic surveys ・ Demand forecast ・ Preparation of term-wise development plan

Source: JICA Study Team

Table 6.1.10: Commuter Railway Development Project

Current Status and Issues	Circular-like railway track is available in the city surrounding the densely built-up central area; however, this valuable asset has not been used by citizen of Mandalay.
Purpose	Modal shift to "public transportation system" from private transportation by utilizing the existing railway track in the city
Main Scope	・ Construction of the high-quality Light Rail Transit (LRT) system ・ Network modification for existing railway service between Mandalay RS and Ye Zay RS ・ Establishment of the LRT operation authority/corporation ・ TA to the LRT operation authority/corporation

Source: JICA Study Team

Table 6.1.11: Road Network Improvement and Disaster Road Network Development Project

Current Status and Issues	Traffic congestion is observed on the main arterial road during peak hours. Urbanization and development are concentrated in the city center.
Purpose	Decentralization of the current urban center and reduce traffic congestion in the future by development of a new and strengthened road network
Main Scope	・ Upgrading of the Mandalay Ring Road (four-lane arterial with service road) ・ Construction of a new urban arterial road to back up the proposed spatial plan ・ Establish the Urban Road Design Guideline (TA)

Source: JICA Study Team

Table 6.1.12: Traffic Control and Management Project

Current Status and Issues	Traffic congestion is observed on the main arterial road during peak hours. Urbanization and development are concentrated in the city center.
Purpose	Maximization of road capacity by introducing synchronized traffic signal system and advanced traffic control center
Main Scope	・ Upgrading traffic signals and installation of new traffic signals ・ Cabling of fiber optic network ・ Minor civil works for the lane re-configuration of intersections ・ Upgrading of the traffic control center ・ TA to MCDC/Traffic Police

Source: JICA Study Team

Table 6.1.13: Comprehensive Parking Master Planning Project

Current Status and Issues	On-road parking induces road blockade reducing the capacity of the road network.
Purpose	Establishment of a comprehensive parking master plan
Main Scope	・ Parking surveys ・ Demand forecast ・ Preparation of term-wise development plan

Source: JICA Study Team

Table 6.1.14: Project for Mandalay Inland Port Establishment

Current Status and Issues	Outdated port facilities by manual cargo handling
Purpose	Improvement of the current “slow, costly, unsafe and low security” operation
Main Scope	Construction of the new port around the logistics corridor proposed in the spatial plan including jetty, trestle, container yard, warehouses, port office and cargo handling equipment

Source: JICA Study Team

Table 6.1.15: New Logistics Terminal Project

Current Status and Issues	Outdated port facilities by manual cargo handling
Purpose	Expansion of the Pyi Gyi Mingalar Truck Terminal and simplifying and speed-up of the custom clearance process
Main Scope	・ Expansion of the terminal ・ Custom clearance function in the terminal ・ Railway extension to the terminal

Source: JICA Study Team

Table 6.1.16: Upgrading and Improvement of Airport Navigational Facility Project

Current Status and Issues	Outdated airport navigational facilities for air traffic control including control tower.
Purpose	Providing the airport navigational safety operation for aircraft movements
Main Scope	・ Communication Equipment ・ Navigation Equipment ・ Surveillance Equipment ・ Weather Equipment

Source: JICA Study Team

Table 6.1.17: Mandalay-Nay Pyi Taw-Yangon Expressway Improvement Project

Current Status and Issues	Restriction of large truck use and improper geometric design and safety facility such as traffic lighting
Purpose	Improvement of traffic safety and strengthening of logistic corridor
Main Scope	・ Improvement of the alignment (horizontal/vertical) ・ Improvement of cross section especially super-elevation ・ Strengthening of pavement structure ・ Improvement of Mandalay Airport access road

Source: JICA Study Team

Table 6.1.18: Mandalay Urban Services Improvement (Water Supply)

Current Status and Issues	Depending for underground water on water source has the consumption and qualitative issue. Switching to surface water resources will require to improve the existing service areas against significant increases of demand. Comprehensive asset management system and monitoring system is needed to the suitable managing.
Purpose	This project component is aimed at increasing the access of the population of Mandalay to improved water supply services as below. ・ Improved Monitoring & System Management ・ Rehabilitation & Upgrading of the Existing Water Supply System ・ Extensions to the Existing Supply Area
Main Scope	・ Component 1: Extension of a new plant by 38,000 m3/day on land adjacent to the current No.8 water treatment plant together with the improvements of the existing tube-wells recharged by the Ayerarwaddy. ・ Component 2: Replacement of water meters, connections, pipelines and valves in the distribution system for reduction of Non-Revenue Water. ・ Component 3: Construction of 19.1km of main transmission lines and 116km of distribution systems for improvement of coverage and capacity, Installation of improved water-meters and level meters, and Rehabilitation of existing reservoirs and pumps.

Source: Preparing Mandalay Urban Services Improvement Project by ADB (June 2015)

Table 6.1.19: Water Supply Expansion Project (in Pyigyidagun Township)

Current Status and Issues	Presently, piped water supply from largely ground water is being provided only in four townships as Aungmyetharzan, Chanayetharzan, Mahaaungmye and Chanmyatharzi, and a small part of Pyigyidagun. Water supply service is very low in Pyigyidagun Township, although urban development will be expected in the area.
Purpose	Expansion project of water supply system in Pyigyidagun Township.
Main Scope	・ Water treatment plant as water source of Dohthawaddy River ・ Water reservoir, distribution pump, and pipe network.

Source: JICA Study Team

Table 6.1.20: Mandalay Urban Services Improvement (wastewater and drainage management)

Current Status and Issues	There is no piped sewerage system nor centralized wastewater treatment plant, therefore the environmental impacts are consequently high with pollution of watercourses and groundwater. There is no separate system for the discharge of storm water and urban wastewater, therefore the drainage canals in the city have to function in case of floods to discharge excess flood waters with regard to flood management.
Purpose	This project has two components as below. ・Component 1 is aimed at reducing the amount of wastewater discharged directly to the environment together with overall improvements in wastewater management. ・Component 2 is aimed at reducing the frequency of flooding from less than 6 months to 1 in 1 year locally and 1 in 2 years on main canals with reduction in mixing with wastewater effluents.
Main Scope	Component 1: Mandalay Wastewater & Septage management ・ Wastewater Interceptors and associated overflows ・ Enhanced septage removal ・ Wastewater and septage treatment and disposal ・ Improved wastewater connections Component 2: Mandalay Urban Drainage ・ Upgrade and extend of existing drainage system, and get better control and low O&M requirements ・ Improvements (cleaning and dredging) of the drainage canals, and extensions of the relevant pumping stations

Source: Preparing Mandalay Urban Services Improvement Project by ADB (June 2015)

Table 6.1.21: Solid Waste Management Project

Current Status and Issues	Waste collected by MCDC has increased over recent years, nevertheless there remains still more amounts of uncollected waste. With regard to existing disposal facilities, the remaining life of the 2 dumpsites is short. The existing dumpsites have inappropriate treatment conditions (No leachate confinement nor treatment, No biogas confinement nor treatment, No cover of the waste etc.)
Purpose	The issue of disposal facility capacity and inappropriate treatment condition will be solved. (Exclude the consideration about a contract of waste disposal signed between MCDC and ORGANICS MANDALAY LLC)
Main Scope	・ New landfill capacity 3,000,000 ton (area 25 ha) ・ Phase-1 (2015-2020): Cell creation (35%), Leachate and Gaz treatment (100%), Final cover (20%), Electricity (100%), Recirculation (30%), Road access and Electricity supply (80%) ・ Improvement existing incinerator for medical wastes (Build a confined and appropriated feeding facility, Build a confined ash collection facility, Upgrade the smoke treatment equipment, and Connect the facility to the power network)

Source: JICA Study Team

Table 6.1.22: Power Supply Capacity Improvement Project

Current Status and Issues	Currently, the overall capacity of primary substations are almost full during peak demand, and existing primary transformers will be overloaded during peak hours by 2017.
Purpose	Ensuring the supply reliability of electric power
Main Scope	・ Building new 230 kV substations and/or ・ Upgrading 132 kV substations to 230 kV substations ・ Enable well-planned cascade connections to ensure N-1 contingency condition

Source: JICA Study Team

6.2 Future Image of Mandalay 2040

- A bird's eye view of the future urban image of Mandalay was drawn in CG. The view from the southwest shows the lake at the left side and the new CBD at the right side.

Source: JICA Study Team

Figure 6.2.1: Bird's Eye View of Future Urban Image of Mandalay

7 Project Implementation and Urban Management

7.1 Urban Development Management

7.1.1 General View of Urban Development Management by Official

- Spatial control is common and principal measures to be taken by the local and central government for the realization of urban development policies and projects should be implemented. These control measures are expected to be executed based on the law, by-laws, and other legal frameworks.

- The following shows spatial control zones, which are expected to be introduced for the realization of planning items:

  a) Boundary of urbanization area: The area determines zones and spaces which can be used and developed for future development. The whole area is composed of the urbanization area, urbanization control area and development restricted area.
  b) Zoning of land use: The land use determines permitted activities for land and buildings. The planning index, such as floor area ratio (FAR), building coverage ratio (BCR), open space ratio, and maximum height of buildings, are prescribed in relation to land use zoning in many cases. It also relates to the development capacity of each area.
  c) Boundary of specific urban development project: In order to secure the land for future infrastructure facilities and urban development for public purposes, their areas are designated in advance and construction activities in these areas will be restricted.

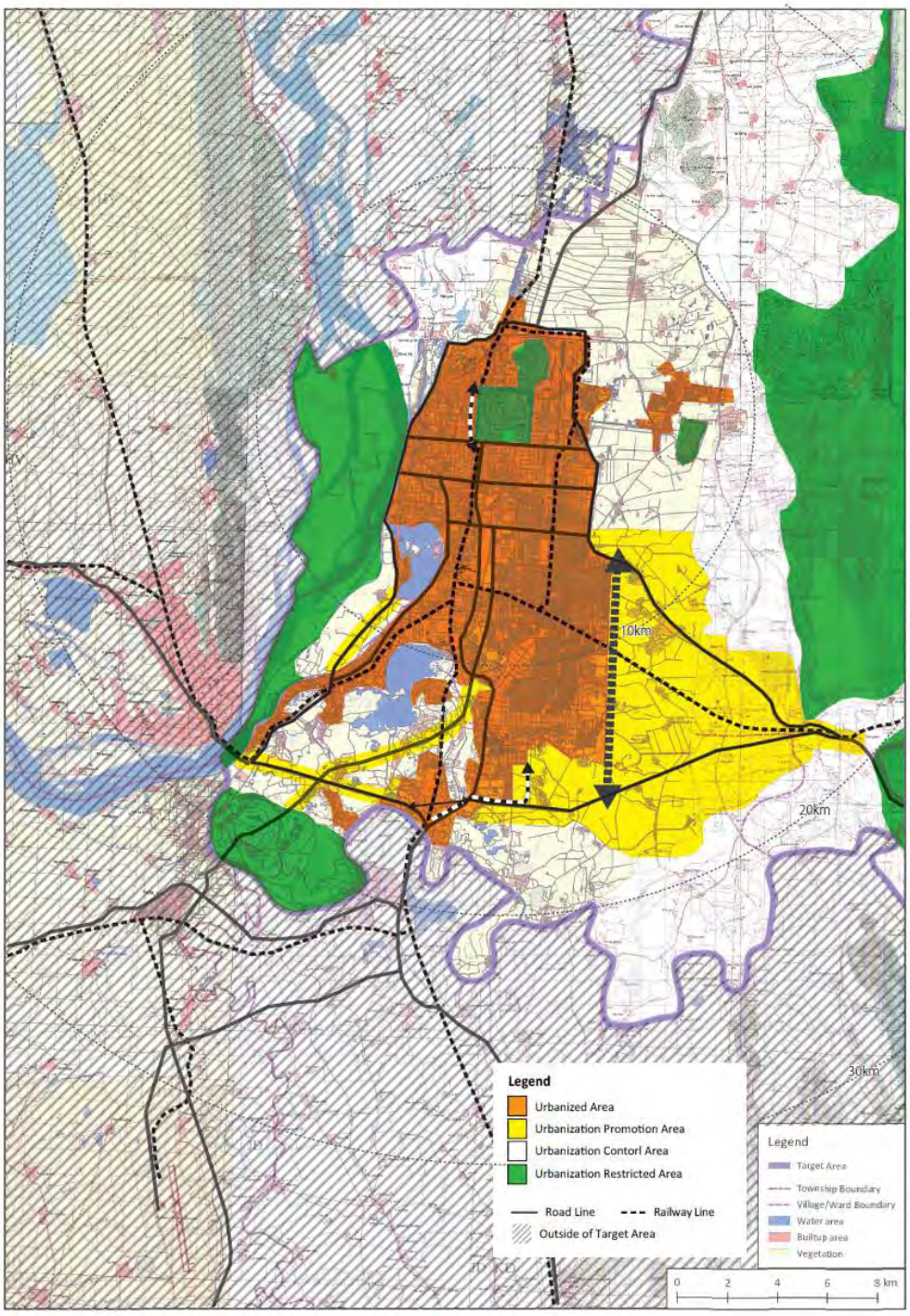
- For the enforcement of abovementioned control measures, detailed contents of planning items should be examined in the subsequent detailed planning study. Currently, the legal spatial control measures have not been formulated and under preparation in Myanmar. The contents of planning items should be adjusted to the formulation of legal systems, which will be set in the future.

7.1.2 Application of Urban Development Management in Mandalay

Area Classifications

- To realize the spatial plan of Mandalay for 2040, development activities by private and public entities should be guided and promoted properly. This shall also contribute to avoid uncontrollable urban sprawl in Mandalay which could become a compact city. In this context, Mandalay City shall be classified into four areas in further examination of the detailed plan as follows:

  1) **Urbanized Area**, which is the current built-up area (e.g., CBDs, residential, and industrial zones). Some areas shall be targets of urban redevelopment.
  2) **Urbanization Promotion Area,** which is suitable for future urban development by 2040. These areas shall be reserved for development of new towns, CBDs, and industrial and logistics zones.
  3) **Urbanization Control Area**, in which development activities shall be controlled properly but not prohibited. The areas shall also be utilized for urban parks, tourism, and/or as green and water belts.
  4) **Urbanization Restricted Area**, in which development activities must be strictly prohibited. The areas shall be reserved for nature reservation and high-value agriculture development.



Source: JICA Study Team

Figure 7.1.1: Proposal of Area Classification for Mandalay

7.2 Capacity Development

- With a new economic policy under the new government established in April 2016, it is foreseen that further rapid economic development, especially in regionally-important cities such as Mandalay, will occur. Without appropriate development management, the city could eventually risk its valuable cultural asset, people's health, rich farmlands, and environment under uncontrolled urban development.

- MCDC is the primary organization for being responsible for Mandalay's urban development and management, although current responsibility only covers a part of what would be necessary. Thus, capacity development as an urban service provider as well as development manager is urgently required for MDCD.

- Particular urgency is identified in planning and issuing approvals and licenses for new development application. Though MCDC itself recognized the necessity of introducing a zoning policy, current development projects and their permissions are relatively randomly conducted from the viewpoint of land use purpose. Continued practice in this field might cause serious nuisance in the people's living environment or irrevocable damage on the natural environment. To avoid such future damages, it is highly recommended to introduce education or training programs on urban planning and urban management for MCDC officers. This would also enable MCDC to closely communicate with the union government officers on urban planning in a more practical level which would be necessary for strategic growth of Mandalay City for the coming decades.

7.3 Project Implementation

- In order to implement the development programs described in chapters 4, 5, and 6, and to realize balanced development as a whole, provision of support and intervention for the project and by public entities is necessary for their adequate implementation. For this purpose, the central government and local government are expected to take a role in the following implementation schemes:

7.3.1 Project Implementation by Government

- The following are considered as projects which are implemented through the government's initiative. Especially, it is necessary to consider government initiative for the implementation of unprofitable development projects.

  a) Construction of basic infrastructure facilities, and
  b) Unprofitable development project (e.g., construction of social housing and affordable housing).

7.3.2 Subsidization for Implementation

- Subsidization is effective for promotion of small-scale urban development activities which are not conducted by large-scale investors. For the development of Mandalay, the following development activities are recommended to be subsidized for their implementation:

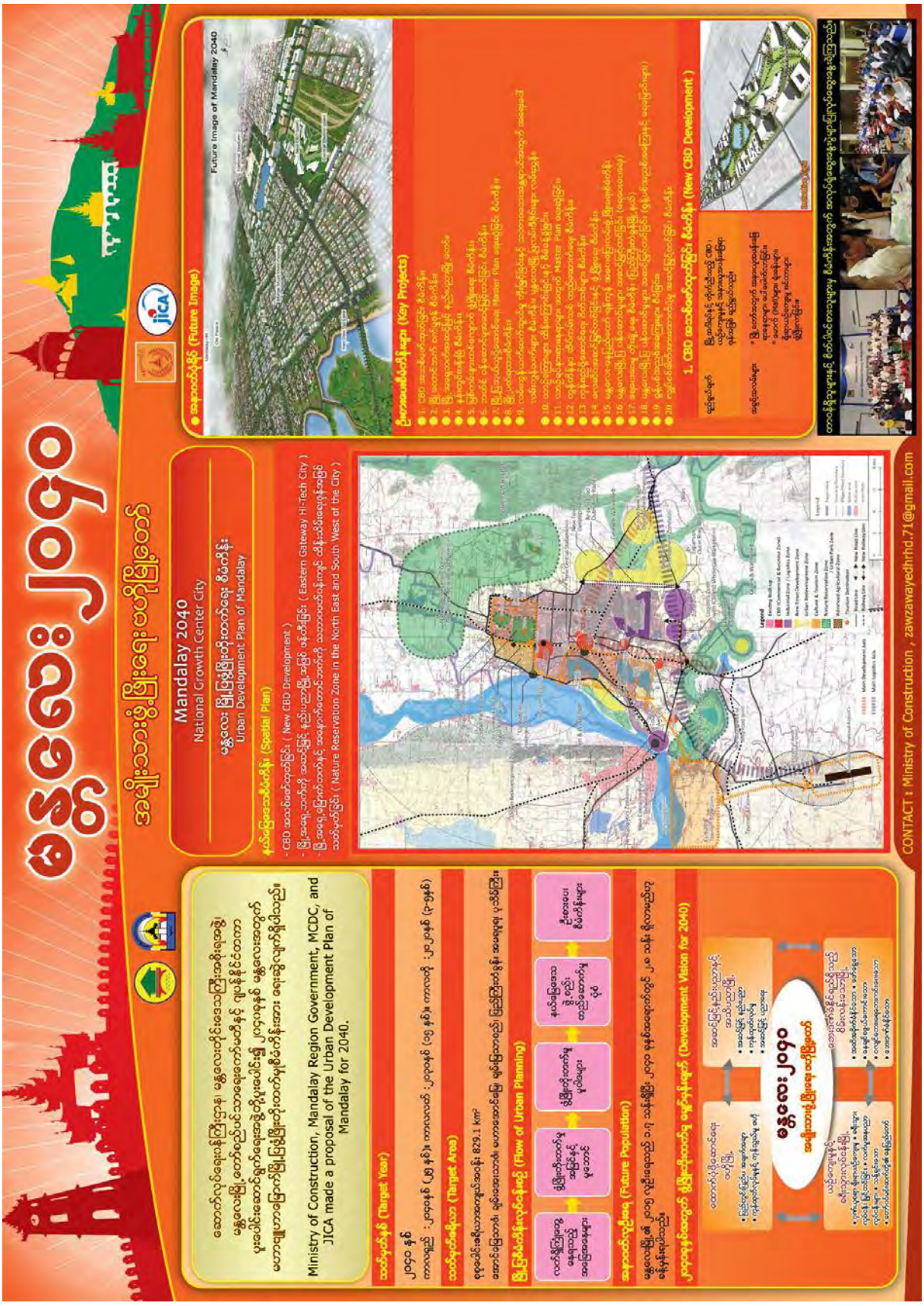
  a) Upgrading of individual buildings for disaster prevention (e.g., construction of fire-proof buildings), and
  b) Small-scale urban redevelopment project and land readjustment project (spatial improvement by introduction of collective housing).

7.3.3 Project Coordination by Government

- Generally, large-scale development with profitable business program catches the interest of private investors, and its development tends to be individually progressed without effective control. Governments' involvement in project coordination is expected for appropriate project realization and its management. Especially for the following development projects, it is necessary to coordinate the individual development project under public entities by planning, licensing, and construction in order to secure its suitability as public orientated development.

  a) New CBD development project
  b) Logistic zone development, new industrial zone development
  c) Logistic zone development around the new container port terminal
  d) New town development, hi-tech new town development

APPENDIX: POSTER



Urban Development Plan for Pathein 2040

< Summary >

Summary: Urban Development Plan for Pathein 2040

1 Introduction and Planning Framework

1.1 Objectives of the Plan

- The primary objectives of the urban development plan of Pathein 2040 are as follows:

a) To present development visions and strategies with spatial and structure plan by 2040,
b) To present urban and infrastructure development policies for the realization of the development visions, and
c) To propose a roadmap of key projects.

1.2 Target Year

- The target year of the plan is set in 2040. Benchmarks are also set in 2030 as middle-term and in 2020 as short-term.

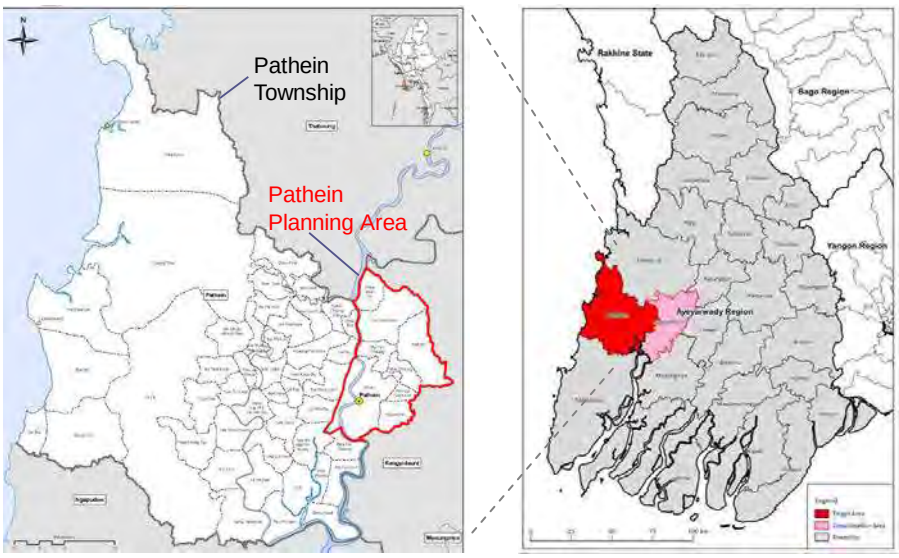
1.3 Target Area

- Pathein is located in the southwest area of Myanmar, which is about 150 km west of Yangon and 40 km east from the coast line. Pathein Township is about 1,450 km^2, which stretches 50 km east and west, and 68 km north and south.
- The planning area of the Pathein plan is the eastern side of Pathein Township from the Pathein River. The area consists of Pathein urban area, which consists of 15 wards and seven villages. The total area is approximately 160 km^2. The name and area of target urban and villages, and the map are shown in Table 1.3.1 and Figure 1.3.1.

Table 1.3.1: Name and Area of Townships of Planning Area of Pathein

Urban and Village		Area (km^2)
Urban	Pathein Urban (15 wards)	46.0
Village	Shwe Myin Tin	12.2
	Zin Pyun Kone	31.9
	Koe Su	30.8
	Ma Yan Chaung	10.8
	Myo Chaung	9.0
	Pyin Ka Doe Kone	6.9
	Pauk Kone	11.8
Total		159.4

Source: JICA Study Team

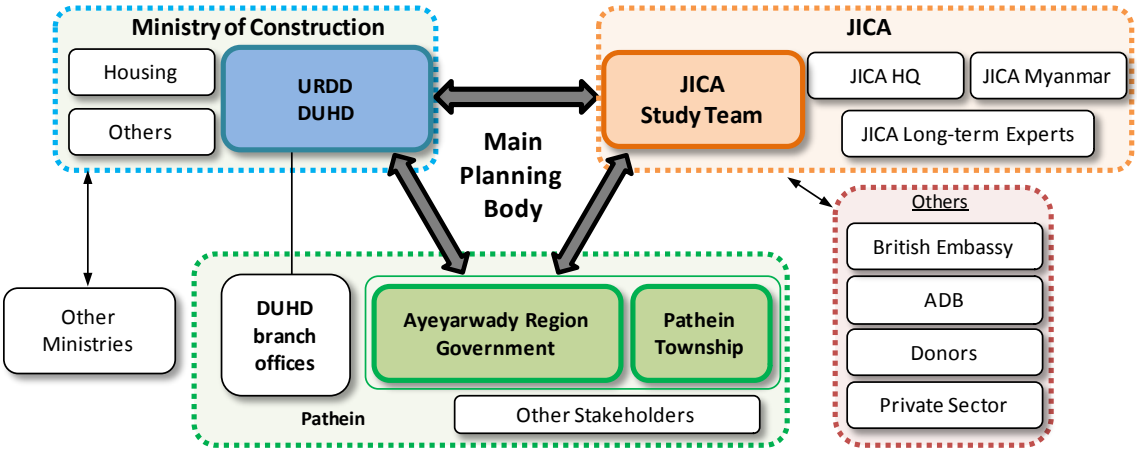


Source: JICA Study Team

Figure 1.3.1: Planning Area of Pathein

1.4 Planning Organizations and Process

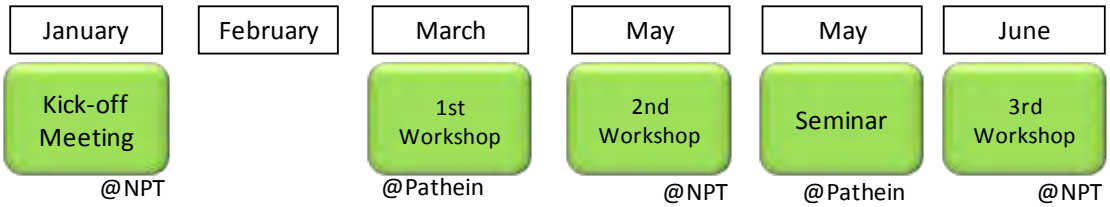
- The urban development plan of Pathein was made by close cooperation of Ayeyarwady Region Government, Pathein Township, Urban Regional Development Division (URDD) (Department of Urban and Housing Development: DUHD) of MOC, and the JICA Study Team, based on the existing conceptual plans.



Source: JICA Study Team

Figure 1.4.1: Planning Organizations

- The plan was formulated with public involvement during the planning process. There are two types of meetings as follows:
  - Workshop Meeting: to discuss with the counterpart (C/P) and related organizations; and
  - Seminar: to collect opinions of various stakeholders such as representatives of local communities.



Source: JICA Study Team

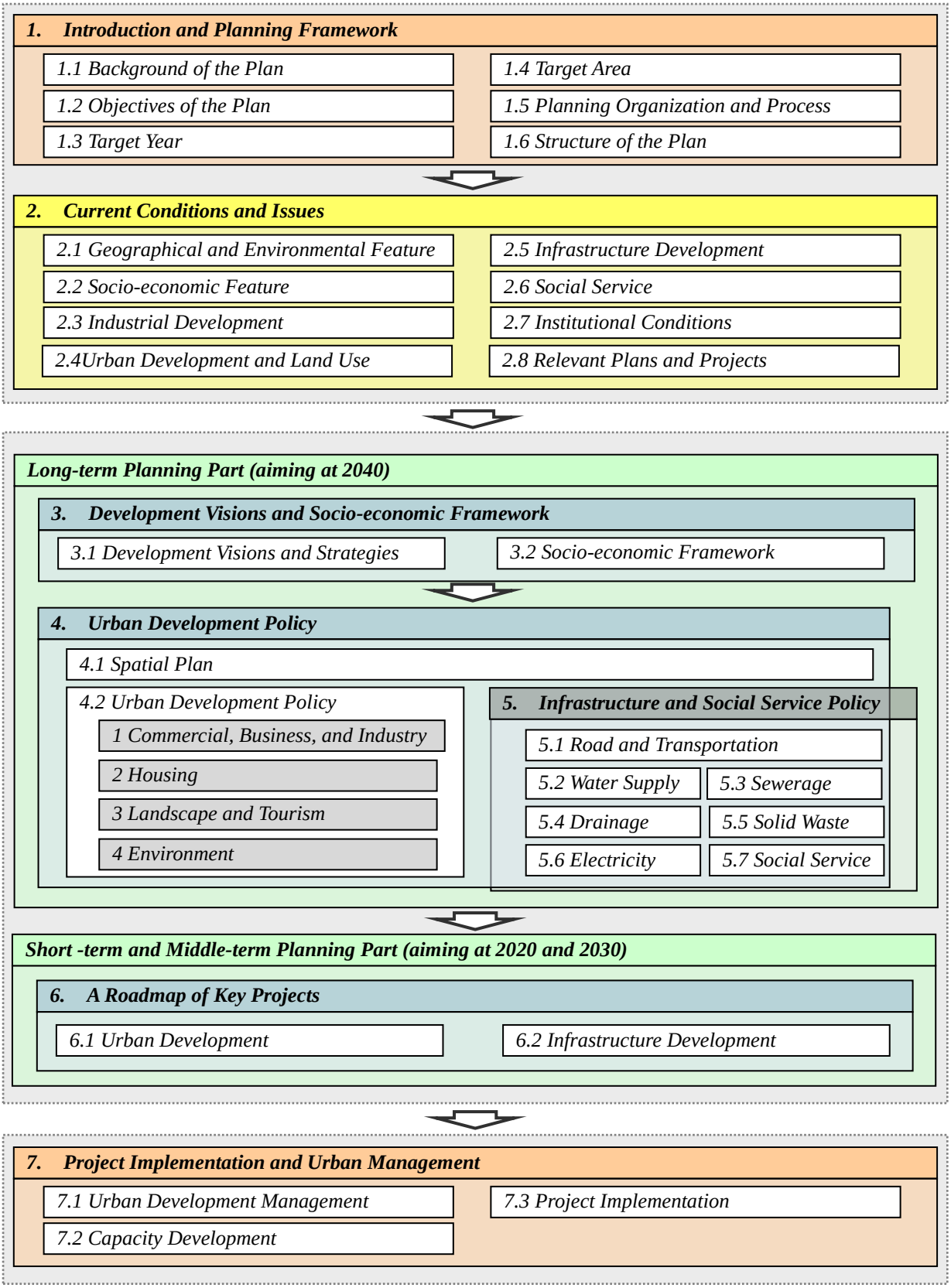
Figure 1.4.2: Public Involvement in the Planning Process

1.5 Approval of the Plan

- According to the drafted "Urban and Regional Development Planning Law" examined by MOC, the city conceptual plan was defined to be formulated by MOC (union ministry) and submitted to the national urban and housing development central committee. In line with this regulation, this plan shall be approved at the national level with consensus of regional government.

1.6 Structure of the Plan

- Referring to the existing conceptual plans and considering the general requirement of an urban development plan, the structure and basic contents of the plan are framed as shown in Figure 1.6.1. The plan shall have seven chapters. The main body of the plan shall consist mainly of two parts (long-term and short/middle-term) in order to satisfy the requirements for both sharing future image and encouraging actions.



Source: JICA Study Team

Figure 1.6.1 Structure of the Urban Development Plan

2 Current Conditions and Issues

2.1 Geographical and Environmental Feature

2.1.1 Geography

- Pathein (Bassein) is situated in the Lower Burma Delta, Ayeyarwady basin, with its tributaries such as the Chindwin, Shweli, and Myitnge rivers. Pathein, located in the western edge of the Ayeyarwady Region, is about 150 km west of Yangon, at 16°45'N, 94°45'E, 10 m, and is the capital city of the third most populated Ayeyawardy Region. The Lower Burma Delta is a level flat plain with the exception of low western hills, the extension of the Rakhine Mountain Range. It has beautiful silver sand Ngwesang Beach and Chaungtha Beach along the coast of Bengal, 40 km west from the city.

2.1.2 Natural Disaster

- The major natural disaster concerns of Pathein are mainly flooding and potentially seasonal cyclone. Pathein Township's coast line is facing Bengal Bay, which receives frequent cyclone hits during pre- and post-monsoon periods (between April and May, and between October and December, respectively). However, historically, the actual cyclone hit causing severe damages rarely happened in Pathein and it was not severely damaged since 2008 Nargis. In the historic record, the last direct hit of cyclones with over 1,000 deaths was recorded in May 1975.

- Flooding is a constant natural disaster problem in Pathein. Flooding prone areas in the city are mostly located either near the drain releasing points or low lands along branches of the Pathein River. According to the Pathein Township Development Organization, the frequency of flooding causing damages is around once a year by heavy rain or storm. Flooding starts from the drain releasing points to the Pathein River by river water flowing backwards from the drain system into the city.

2.2 Socio-economic Feature

- Pathein City is the urban area of Pathein Township, which is one of the seven townships in Pathein District. The target area of this plan covers Pathein City and seven village tracts in Pathein Township as shown in Table 2.2.1. The population of these villages ranges from 2,000 to 9,000 and the total population of the seven villages is 33,000. A total of 203,000 people live in the target area.

Table 2.2.1 Population of Target Area in Pathein Township in 2014

Township/City(Ward)/Village Tract	Population (thousand)
Pathein Township	287.1
City (Ward)	169.8
Village Tract	117.3
Shwe Myin Tin	7.9
Ma Yan Chaung	3.1
Zin Pyun Kone	8.7
Koe Su	3.9
Pauk Kone	4.4
Myo Chaung	2.0
Pyin Ka Doe Kone	3.1

Source: MOC

2.3 Industrial Development

2.3.1 Industrial Activities

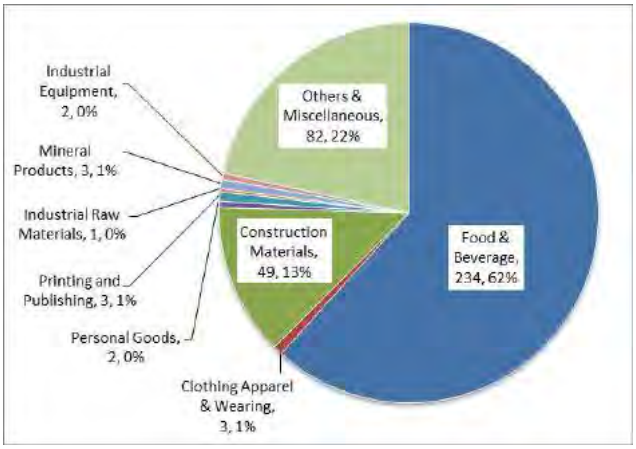
- The city of Pathein is the capital of Ayeyarwady Region which is known as the "Barn of Myanmar" for its production of a variety of crops and other agricultural products. Located in the Ayeyarwady Delta, the region is also Myanmar's major supply source of fishery products. Pathein City is a central point for trading of these products as well as interaction of people, utilizing riverine and road connections with major cities such as Yangon and other places in the country.

- According to "Myanmar Industry Directory 2015-16", the Ayeyarwady Region had the third largest number of registered industries in Myanmar after Mandalay Region and Yangon Region in 2014, with a total of 5,809 private industries. More than 80% of the total industries are small scale ones. Table 2.3.1 and Figure 2.3.1 show the number of industries in Pathein Township by size and by sub-sector in 2015-16, respectively. Major types of industries are "Food and beverage" (62% of the total number of industries), "Others and miscellaneous" (22%), and "Construction materials" (13%), in descending order.

Table 2.3.1: Number of Industries by Size in Pathein Township in 2015-16

Size of Industries	Number of Industries	Number of Employees
Large	60	5,623
Medium	77	583
Small	242	866
Total	379	7,072

Source: Ministry of Industry, Directorate of Industrial Supervision and Inspection, Ayeyarwady Regional Office



Source: Ministry of Industry, Directorate of Industrial Supervision and Inspection, Ayeyarwady Regional Office

Figure 2.3.1 Number of Industries by Sub-sector in Pathein Township in 2015-16

- In Ayeyarwady Region, there are three existing industrial zones (IZs) which were established under the supervision of the Ayeyarwady Regional Government since the 1990s as seen in Table 2.3.2. The oldest one, Pathein Industrial Zone, is located in Ward 13 of Pathein City, mostly with locally owned enterprises for products such as machinery, housewares, and food processing. Apart from the industrial zone, there are factories such as rice mill, oil mill, salt mill, and ice mill along the Nga Won River in the city.

Table 2.3.2 Industrial Zones in Ayeyarwady Region

Industrial Zone	Location	Year of Establishment	Area (Acre)	No. of Factories*
Pathein IZ	Pathein Township and Pathein District	1993	106.31	54
Hinthada IZ	Hinthada District	1995	86.21	9
Myaungmya IZ	Myaungmya District	1995	108.69	9

Note: * as of February 2013
Source: Myanmar Industry Directory 2015-16; JETRO (Yangon), 2013

- Recently, in the same area as Pathein Industrial Zone, the Pathein Industrial Park was opened by the Delta Industrial Group (DIG), which is a group of mostly Yangon-based local companies and individuals, mainly to cater to the garment industry. The industrial park project covering nearly

300 acres of land aims to invite 50-60 factories with over 2,000-3,000 laborers working in each factory[1]. The first garment factory was opened in 2013 by DIG itself. Currently, other garment manufacturers such as Hakers Enterprise and Dong Long Garment are operating too, and a total of 4,000 local people are employed[2]. More garment factories engaged in cutting, making, and packing (CMP[3]) businesses and some other industries such as communication and steel structure are planning to invest too.

- In the tourism sector, according to the conceptual plan, there are six private hotels and 44 guest houses in Pathein City, but hotels with international standard are very limited. About 25 to 30 miles to the west of Pathein City, there are two famous beach places along the Bay of Bengal, namely Ngwe Saung and Chaungtha beaches. The two places have 50 hotels and can accommodate about 5,000 visitors[4]. It is reported that a resort project including holiday villas and a five-star hotel along Ngwe Saung Beach is underway by Ayeyarwady Co., which is a consortium of 20 companies. The project is considered to be the first holiday villa project in Myanmar and planned to complete the first phase by the end of December 2017. There is another plan to build a new city in Ngwe Saung by a Hong Kong-based company, H&Co.

2.3.2 Foreign Investment

- Table 2.3.3 shows the total investment amount of permitted enterprises under the Foreign Investment Law in Ayeyarwady Region as well as the total in the Union for comparison purpose. In 2014-2015, six enterprises were permitted in Ayeyarwady Region with the investment of USD 166 million out of the total of 211 enterprises with USD 8.011 billion permitted in Myanmar.

Table 2.3.3 Total Investment of Permitted Enterprises under the Foreign Investment Law in Ayeyarwady Region

(USD in millions)

Region	2010-2011		2011-2012		2012-2013		2013-2014		2014-2015	
	No. of Enterprises	Foreign Investment	No. of Enterprises	Foreign Investment	No. of Enterprises	Foreign Investment	No. of Enterprises	Foreign Investment	No. of Enterprises	Foreign Investment
UNION TOTAL	**24**	**19,999 ***	**13**	**4,644 ***	**94**	**1,419 ***	**123**	**4,107 ***	**211**	**8,011 ***
Ayeyarwady Region	-	-	1	73	1	20	3	11	6	166

Note: * Increased in investment value.
Source: MNPED Central Statistical Organization, "Myanmar Data CD-ROM 2015", February 2016. (Originally from the Directorate of Investment and Company Administration)

- According to the Directorate of Investment and Company Administration (DICA) website, a total of seven enterprises (including both foreign and domestic companies) were permitted for investment in Ayeyarwady Region by the Myanmar Investment Commission in 2015. Among them, four investments will go to the garment industry in Pathein City by foreign companies.

[1] DIG Website [http://digayeyarwaddy.com/project]
[2] Pathein Township Second Five-Year Development Plan (2015-16 to 2020-21)
[3] The Cutting, Making, and Packing (CMP) system is a form of production on consignment in which the main raw materials (fabrics, ancillary materials, etc.) are provided by overseas buyers and imported free of charge, then cut, sewn and packed in the domestic factories, after which all of the finished products are exported. (Kudo, 2012)
[4] Pathein Township Second Five-Year Development Plan (2015-16 to 2020-21)

2.4 Urban Development and Land Use

2.4.1 Urban and Housing

- The current urban area of Pathein is composed of the following different characteristic zones. Their features and issues of urban space and buildings are described as follows:

Central Urban Area

- The central urban area of Pathein is located in Myoma Ward and Bo Tae Gone Ward. The area is composed of the riverside area and business/administration area.

- The riverside area consists of jetties for passenger, trade area, commercial area, and logistics area of water cargo. Most of the commercial and business buildings in this area are flat and low and medium-rise buildings with two to four stories. Some are reconstructed and replaced with five- to six-floor buildings. These buildings are built of reinforced concrete, bricks, and mixed structure. They are durable enough to survive natural disasters and fire accidents. Because of high agglomeration of trading facilities in the area, public spaces such as parking and loading are not sufficient in the area and traffic is congested as a result.

- Business and administration functions are located in the hinterland of the water front area. Administrative offices, cultural facilities, and sports facilities are located in this area. Their density is relatively lower than the riverside area and the urban environment in the area is well regulated and kept in good condition. But there is little space for development, which corresponds to functional expansion in the future.

Surrounding Areas of the Old Downtown

- Residential areas composed of residential buildings, small commercial buildings, and mixed-use buildings, extended in Bo Tae Gone Ward, Yodayar Gone Ward, Mayan Cho Ward, and Aung Chan Thar Ward surround the abovementioned central area. They form the old city area as a whole.

- Most of the buildings are flat or two-storey building and their development density is low. The urban environment of these areas is quite good with sufficient road and specific problems are not observed in these areas.

Outer Area of the Old City Area

The following characteristic land uses are observed in the surroundings of the abovementioned old city area:

- In the north and south of the old downtown along the Pathein River and Strand Road, there are rows of buildings of warehouses and they compose the logistics area. Most of these buildings are used for food provisions and reserves. A small number of food processing facilities is also located in the area.

- In the northeast of the old city area between the airport, there are green open spaces. The area is composed of golf links, the Kanthozin Lake, public park, and the Pathein University, which generates well established urban recreation space with education and touristic function.

Planned Development Area

- There are several planned housing developments in the periphery of the old city area (Ohmar Darni Ward, Papa Wadi Ward, Yaekyi Oo Ward). In these areas, housing sites with regular grid pattern roads for detached housing are prepared and provided. The area is developed in the former paddy field and roads in the area are raised as an embankment. But many housing lots are not reclaimed and wooden rural style housings, which are similar to those in agricultural village and

paddy field, are constructed there. There are insufficient infrastructure facilities such as water supply, wastewater facilities, and drainage in these areas. In addition, the road width in these areas is not enough for traffic of automobiles, so the residents depend on bike, bicycle, and light vehicles for transportation. From these views, the areas have issues to be improved as a present-day residential area.

Recent Housing Development Areas

- Residential developments are under construction recently in the southeast of Koethein Ward, Kimnalin Kyun Ward, and Myat Toe Ward. In these development areas, buildings are constructed in the housing lots, which are reclaimed like the district road. The roads have enough width for automobiles. In addition to detached housings for individual families, apartment housings with five stories are constructed by several housing developers. These development areas are located near the industrial area in the northeast of the city, and they are expected to supply modern type housings for young families and migrant workers.

Western Bank of the Pathein River

- There is frequent water transport service between the west bank of the Pathein River and the center of Pathein City. It carries commuting persons, shoppers, and carriers of agricultural products. In the surrounding area of the jetty, there is a village with commercial and residential buildings. And some sites along the river are equipped with their own pier and are used for industrial functions.

2.4.2 Land Use and Regulations

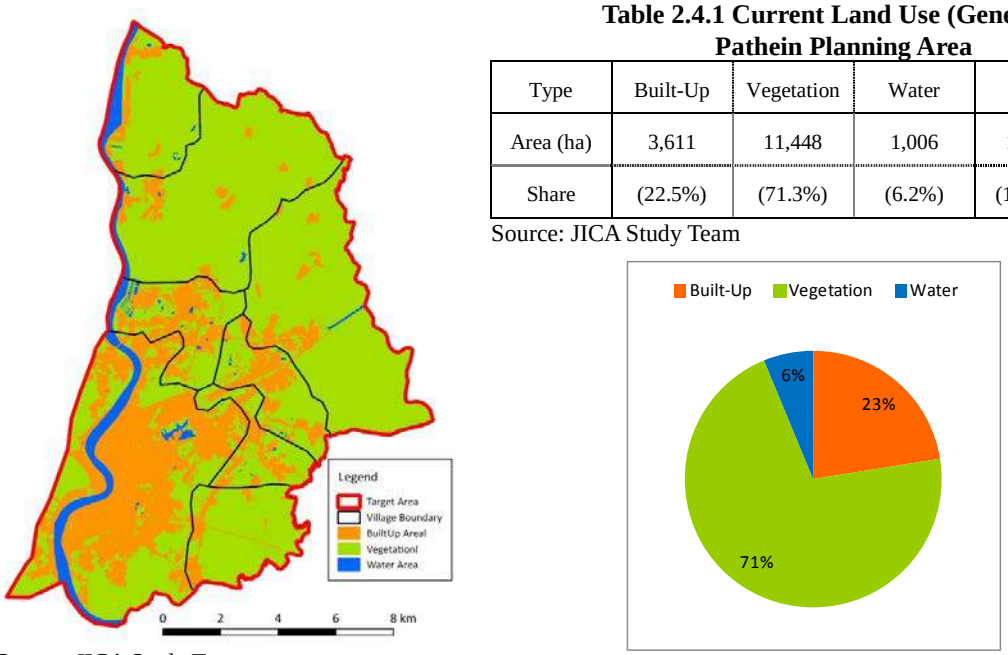
Land Use

- A land use pattern was developed based on the analysis of the 2015 satellite imagery that covers only the urban area, and using the 2012 imagery for other areas. Land use for built-up shares 22.5% of the Pathein planning area, especially in the urban area. Generally, vegetation area dominates with 71.3% of the land use of Pathein planning area. Table 2.4.1 and Figure 2.4.1 show the current land use of Pathein planning area.

Table 2.4.1 Current Land Use (General) of Pathein Planning Area

Type	Built-Up	Vegetation	Water	Total
Area (ha)	3,611	11,448	1,006	16,064
Share	(22.5%)	(71.3%)	(6.2%)	(100.0%)

Source: JICA Study Team



Source: JICA Study Team

Figure 2.4.1 Current Land Use (General) of Pathein Planning Area

Building Regulation

- According to the interview survey, Pathein does not have any specific regulations related to building and land use.

2.4.3 History, Landscape, and Tourism

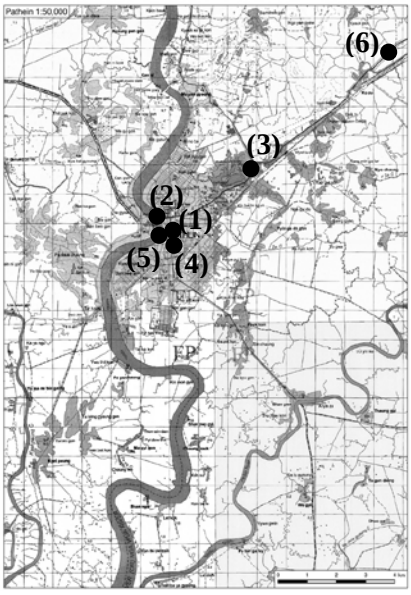
- Since Pathein City is quite flat like the the delta area of Ayeyarwady River, there is no topographical landmark such as mountain or hill. Waterfront of rivers and lakes feature unique character of the city. Chaungtha Beach and Ngwesaung Beach facing the Bay of Bengal have tourism potential in close relationship with Pathein City as transport hub connecting with Yangon. Figure 2.4.2 shows photos of unique characteristics of Pathein City.

Shwemokhtaw Pagoda (1)
This historical pagoda is located at the city center as a landmark of the city.

Riverside Plaza (2)
Facing the Pathein River, there is a plaza which has an open space for the public.

Lakes (3)
In the city center, there are two large lakes which provide amenity space.

City Center Townscape (4)
In the city center, relatively low-rise buildings can be seen.



Location of the Places in the Pictures
(* No.7 is out of the map)

Pathein River and Jetty (5)
Along the Pathein River, there are jetties for cargos and passengers.

Paddy Fields in Countryside (6)
Huge area of paddy fields surrounds the city of Pathein as the delta area.

Chaungtha Beach (7)
From 1.5 hours distance from Pathein by car, there are two popular beaches.

Source: JICA Study Team

Figure 2.4.2 Characteristics of Pathein City

2.5 Infrastructure

2.5.1 Transport and Road

- Road Traffic Demand: Traffic congestion is not observed in the city. The large demand for public transportation might not be expected.
- Road Network: The future road network shall be proposed taking into account the new industrial area in Kyaui Tan and the proposed urban spatial planning.
- Public Transportation: Considering the city size and narrow streets in the urban area, small size vehicles (such as paratransit cars) will be suitable for the public transportation of the city.
- Truck and Bus Terminals: Accessibility of the existing truck and bus terminals might be improved by widening the access road. Relocation based on the proposed new urban center will be an option in case road widening cannot be implemented.
- Abandoned Railway Track: The railway track between Pathein Station and the river bank has not been used for a long time. The DUHD, MOC proposed this abandoned railway track to be replaced by a new road.
- Cargo Handling: There is no modern port facility. Cargo is carried manually. Generally, the advantage of inland water transportation is the large cargo/bulk transportation and mass transit. However, the cargo size is limited by the manual transport capacity for loading and unloading. In order to utilize the inland transport further, mechanization of loading/unloading will be required.

2.5.2 Water Supply

- Currently, there is no modern water supply system in Pathein City. Residents get domestic water by using dug-well and tube-well. Also, five bottled water factories are playing important role in drinking water supply in Pathein City.
- On the Myanmar Three Cities Water Supply Management Improvement Project (March 2013), the Ministry of Health, Labor, and Welfare (MHLW) Project Team of Japan collected information and data in Pathein City.
- Based on the results of these survey and discussion, the MHLW Project Team made proposals for the improvement of water supply management in the city. Since water supply development needs to fulfill the future water demand, it is necessary to establish the planning framework based on the population growth forecast and to decide the target for development of water supply system as master plan. Since the terrain of Pathein and the nearby area is characterized by flat land, the location of the facilities should be decided taking into consideration the possibility of minimizing the energy cost.
- Selection of water source is the most important factor in the planning of the water supply system. Water quality analysis during both the dry season and rainy season should be conducted for all possible water sources (both surface water and groundwater sources). Also, since water supply facilities would be used for much long term, the selection of water source should be considered based on the land use of residential, commercial, and industrial for the urban development plan.
- As other matter, they have a plan to develop water supply system with a joint stock company in Thailand. The proposal is called build-own-transfer (BOT) concession with long-term contract. This is the concept of giving priority to private benefit in water tariff. But it should provide highly convenient and profitable contents to residents or local residents without high tariff.

2.5.3 Sewerage

- There is no public wastewater treatment plant (WWTP) to collect and treat domestic wastewater in Pathein City. Domestic wastewater is discharged without appropriate treatment to street drainage, and finally flows into rivers and ponds. Also, there are many households which cannot use toilet with clean sanitary conditions. These mainly cause water pollution.
- Although water injection type toilet without a septic tank has become extensively popular, toilet of this type should be changed with proper septic tank or connected to sewerage system. Furthermore, there are no night soil treatment plants for human waste in Pathein City, and excreta or excess sludge removed from a pit toilet or septic tank is thrown into the existing final dumping site without stabilization pond system.
- A sewerage system project is strongly required in Pathein City. However, the sewerage system project requires long time and large funds.

2.5.4 Drainage

- The capacity of the existing drainage and channel in Pathein City is not enough for heavy rains. So, low-lying areas in the city are sometimes flooded every year.
- Most drainage canals which are dug manually do not have the hardness for drainage canal lining. There are not enough gates, banks, and pumps which prevent flooding in the low-lying areas.
- Some drainage canals have accumulated soil sediments, and many plants are growing at the bottom that inhibits the flow.

2.5.5 Solid Waste

- The final disposal sites are simple dumping sites without any pollution control facility (no landfill liner and no drainage of leachate). The improper landfill will pose high risk on health and high impact on the environment.
- Some collecting vehicles and filling facilities are severely decrepit. Solid waste is collected by Pathein City Development Committee (CDC) truck and dumped to the Nan Thar Kone final disposal site.
- Collected solid waste is rapidly increasing in Pathein City, making the capacity of the final disposal sites insufficient. So, Pathein CDC shall start the 3R policy (recycle, reuse, and reduce) for environmental efforts.

2.5.6 Electricity

- In Pathein District, at the transmission level, the voltages are 230 kV and 66 kV. The input of the newly established Pathein primary substation (230/66/11 kV, 50 MVA x 2), in order to supply Pathein District, comes from Athoke Power Substation with a 230 kV transmission line. There are six outgoing active feeders and one spare feeder on the 66 kV secondary side of the substation.
- The target area of this study is supplied by the 66 kV Myatto Substation (3 X 10 MVA, 66/11 kV and 1 X 10 MVA, 66/33 kV). Among the four 66 kV transformers, one 66/11 kV is used to supply the industrial load, two 66/11 kV are used to supply the other loads in the target area, and the 66/33 kV transformer is used to supply the Ngaputaw area which is located outside the target area.
- The electricity distribution of the target area is done by 11 kV distribution system.
- The capacity of the Myatto Substation's transformers was assessed based on the latest available loading data and the Electricity Supply Enterprise (ESE) demand forecast. According to the

assessment, the No.1 and No.2 power transformers will be overloaded during peak season by the year 2017. Cascading connections on the secondary side of the transformers are not available at this moment. Hence, load sharing between transformers is also impossible.

2.6 Social Service

2.6.1 Education

- The literacy rate in Pathein urban area is more than 96% and it is higher than that in the surrounding area and whole Myanmar, which indicates basic education prevails more widely in the urban area.
- Preparation of facilities for primary and middle school education in Pathein Township is in lower level than that of entire Myanmar. In particular, the number of students per middle school in Pathein Township is especially higher, which is beyond 1,000. And there is a tendency that facilities are insufficient in new urbanized areas with increasing number of housing and children.
- Provision of a sufficient number of teachers is one of the indicators to measure the quality of education. The ratio of student/teacher on primary and middle school in Pathein Township are nine and six points higher than the ratio of whole Myanmar.
- Ratio of population whose highest level of education completed is under primary school in Pathein Township is 10-15% lower than that of the surrounding area and whole Myanmar. And population ratio whose highest level of education completed is more than a university or college degree in Pathein Township is also higher than that of its surroundings. It suggests higher educated people are more concentrated in the city compared to the surrounding area.

2.6.2 Health

- Basic health indicators such as infant mortality rate, under-five mortality rate, and maternal mortality rate in Pathein Township worsened or did not improve in recent years. The health indicators are mostly worse than those of whole Myanmar.
- There are seven hospitals, eight clinics, eight rural health centers, and 43 sub-rural health centers in Pathein Township. There are some construction projects in Pathein urban area like the new Ayeyarwady General Hospital which is being upgraded (under construction) with 500 beds, and Ayeyarwady United Specialist Centre. Most of the hospitals are located in urban areas, and rural areas are mainly covered by rural/sub-rural health centers.

2.6.3 Poverty

- The United Nations Development Programme (UNDP) implemented integrated household living conditions surveys in whole Myanmar in 2005 and 2010. Ratio of poor population in urban area slightly decreased from 2005 to 2010. And the ratio of the urban area in Ayeyarwady in 2010 was 10.8% lower than the rural area.

2.7 Relevant Plans and Projects

2.7.1 Existing and Past Plans

Conceptual Plan by MOC

- The Government of Myanmar laid down a policy on urban and regional development. It urged regional/state governments to make long-term urban development plans for their region that consider comprehensive points including society, economy, environment, and infrastructures. To follow the policy, Ayeyarwady Region requested MOC to support the preparation of the plan. The MOC made the urban development plan of Pathein urban area in January 2014, which consists of the current situation of the city including urban infrastructures and social status, and proposed urban development project including new urban area development and housing redevelopment project. Figure 2.7.1 shows the proposed project location for Pathein in the MOC plan. Although the plan includes some future development projects, it does not include future development vision, future structure plan, and land use plan.

Source: Pathein Urban Development Conceptual Plan, MOC

Figure 2.7.1 Proposed Project Location for Pathein in the MOC Plan

Pathein Town Plan by Pathein Township Development Committee

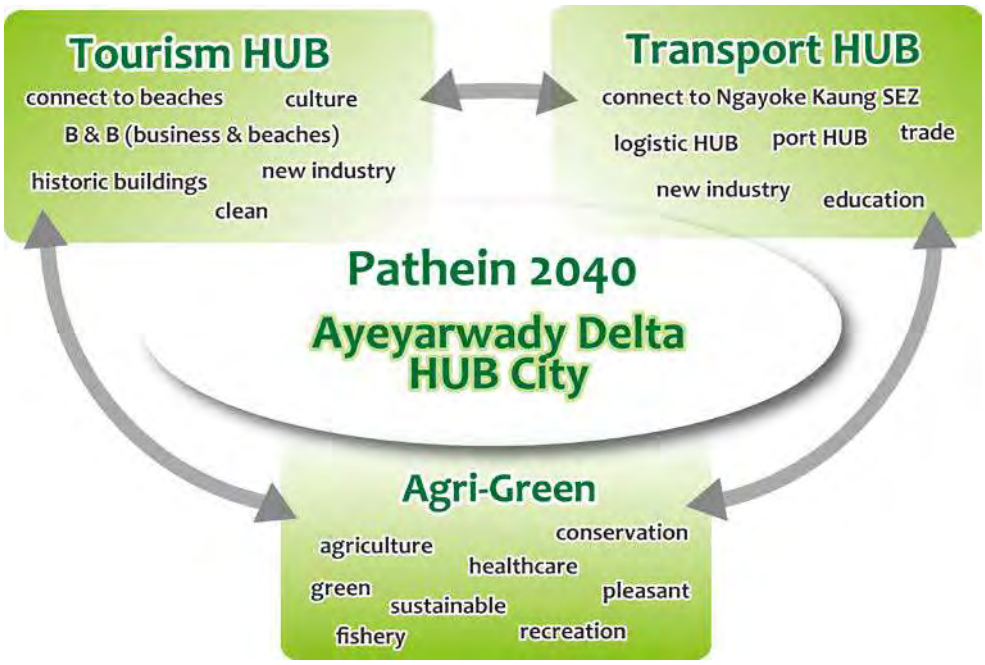
- Pathein Township Development Committee made the town plan in February 2012 according to the Township Development Committees Law and direction of the regional minister in Ayeyarwady Regional Government. The plan consists of current condition of the city and proposed development project including upgrade of urban infrastructures. Although the plan can be used to introduce current conditions of Pathein urban area, it is not used as future comprehensive development plan.

3 Development Visions and Socio-economic Framework

3.1 Development Visions and Strategies

3.1.1 Development Visions

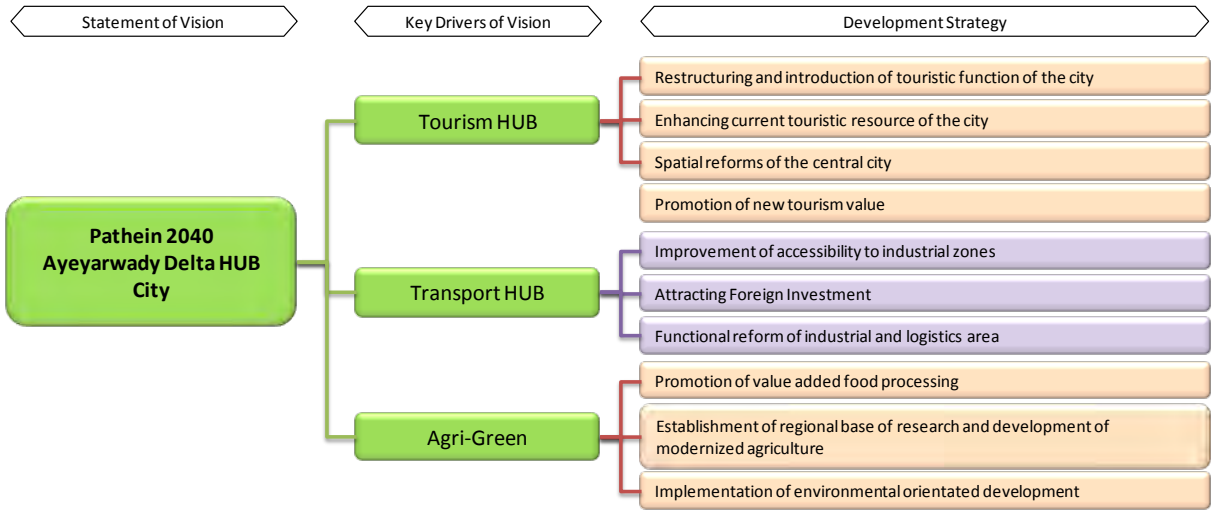
- The development vision of Pathein was established as "Ayeyarwady Delta Hub City". It intends that by 2040, Pathein will be known as the key hub city in Western Myanmar, which acts as a business and logistics center for the regions' economy with a developing role as a hub for tourism. Figure 3.1.1 describes the development vision for Pathein 2040.



Source: JICA Study Team

Figure 3.1.1 Development Vision for Pathein 2040

3.1.2 Development Strategy



Source: JICA Study Team

Figure 3.1.2 Development Strategy in Linkage with the Development Vision

3.2 Socio-economic Framework

3.2.1 Demographic Framework

- Based on the assumptions, the city population is forecasted to reach 237,000 in 2040 at a growth rate of 1.15% (2015-2040) per annum. Since this study's target area for Pathein includes the seven village tracts located to the east of Pathein City, the combined population of the city and the tracts are calculated. The target population is forecasted to reach **273,000 in 2040 from 211,000 in 2015, showing an increase of 62,000 persons**. This corresponds to the average annual growth rate of 1.03% during 2015-2040. Figure 3.2.1 shows the forecasted population until 2040.

Source: JICA Study Team

Figure 3.2.1 Population Forecast of Target Area (Pathein City + Seven Village Tracts)

- The MOC's conceptual plan for Pathein City developed in 2014 forecasts the population growth for 20 years at an annual growth rate of 1.6%. In view of the fact that the past population growth of Pathein City and Ayeyarwady Region both showed slow pace of 0.53% and 0.69% per annum, respectively from 1983 to 2014.

3.2.2 Economic Framework

- Reflecting on the proportion of calculated productivity index of the target area to that of Ayeyarwady Region, the GRP of the target area was computed as shown in Table 3.2.1. **The GRP is forecasted to grow by 4.5 times and reach MMK 1,435 billion in 2040** from MMK 316 billion in 2015 at constant prices. **The GRP per capita is forecasted to grow by 3.5 times reaching over MMK 5 million in 2040** from MMK 1.5 million.

Table 3.2.1 GRP of Target Area from 2015 to 2040

Item	2015	2020	2030	2040	Average Annual Growth Rate
Ayeyarwady Region: GRP (MMK in billions)	6,334	8,190	12,788	24,690	5.6%
Pathein Township/Urban + Seven Villages: GRP (MMK in billions)	316	420	699	1,435	6.2%
Pathein Township/Urban + Seven Villages: Population (thousands)	211	226	249	273	1.0%
Pathein Township/Urban + Seven Villages: GRP per capita (MMK in millions)	1.50	1.86	2.81	5.26	5.2%
Ayeyarwady Region: GRP Index (A)	6,914	7,203	7,491	7,748	
Pathein TS/Urban + Seven Villages: GRP Index (B)	344	370	410	450	
(B)/(A)	5.0%	5.1%	5.5%	5.8%	

Note: The GRP figures forecasted are based on 2010/11 prices.
Source: JICA Study Team

4 Urban Development Policy

4.1 Spatial Plan

- In light of the past trends and considerations of logistics function and some large-scale development projects, the urbanization of Pathein is likely to extend outward, especially eastwards in connection with Yangon through the national road, rather than other directions. On the other hand, connectivity with the two beaches located west is also enhanced in the field of tourism development as the future trend.

- The CBD, which is the center of Pathein including the traditional market and Shwe Moke Htaw Pagoda, has limited potential for future expansion of its central business function due to absence of surplus land for new development, complicated land ownership, and less accessibility outwards such as Yangon. To be the regional growth center of Ayeyarwady Delta, development of a new CBD, which leads the business and economic activities of the region with better function of hub with Yangon and tourist beaches, is necessary. Transferring the central station to east, creating new CBD with new central station, and regenerating the old station site are recommendable.

- Population increase of Pathein (urban and seven villages located east side of the Pathein River) by 2040 is 62,000. Setting 100 person/ha as appropriate population density of a new town, the required land for a new town development mainly for residential function would be 6.2 km^2 (1,531 acres) as shown in Table 4.1.1. The required lands have been allocated in the spatial plan shown in Table 4.1.2 and Figure 4.1.1.

Table 4.1.1 Required Land for Future Population Increase of Pathein

Items	Population of 2015	Population of 2040	Population Increase	Density of New Town (person/ha)	Required L and (ha)	Required L and (km^2)	Required L and (acre)
Pathein	211,000	273,000	62,000	100	620	6.2	1,531

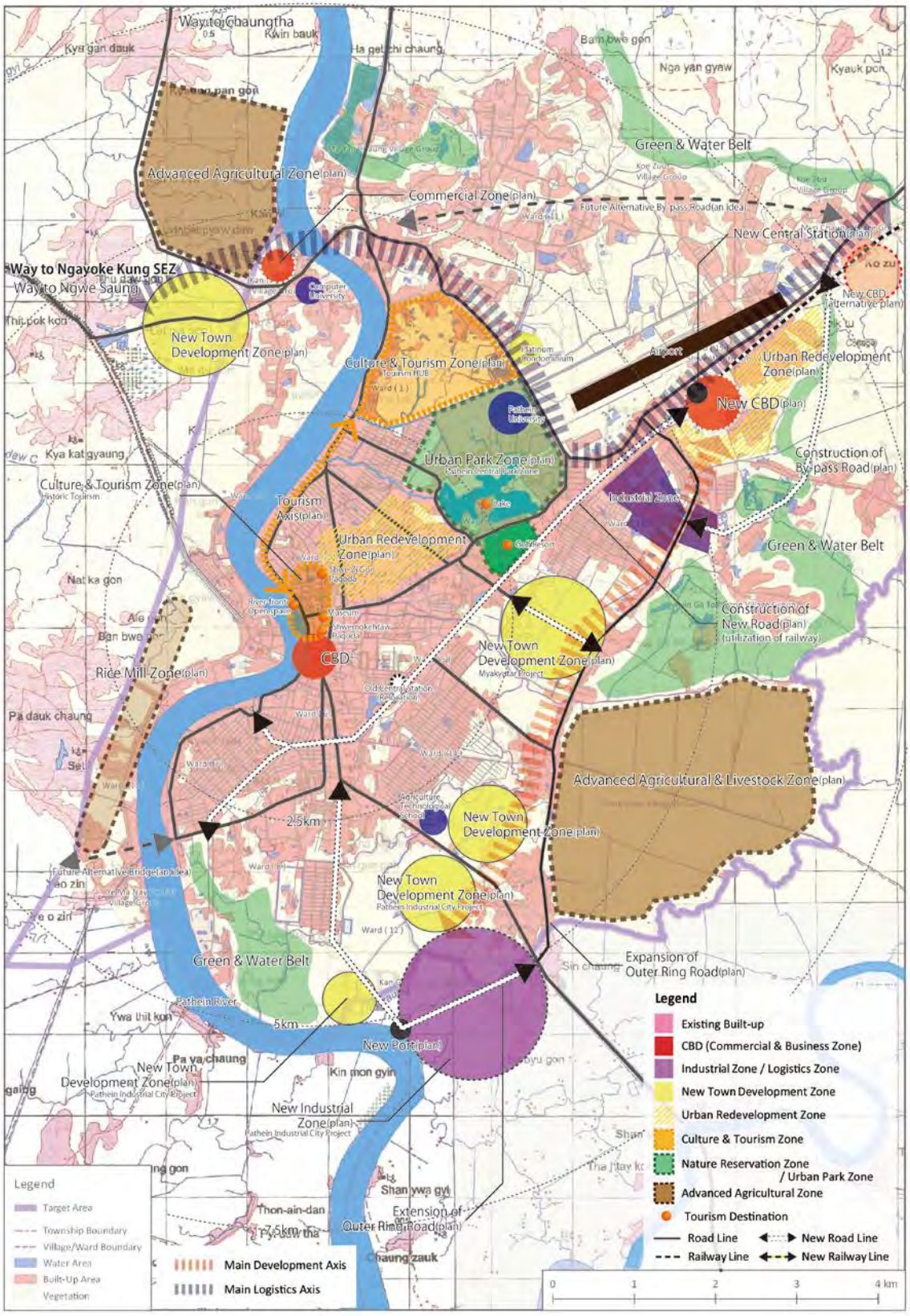
Source: JICA Study Team

Table 4.1.2 Proposed Zones and Contents in the Spatial Plan of Pathein

Items / Zones	Characteristics of Zone	Proposals in the Spatial Plan
Existing Built-up (Residential and Mixed-use)	Current urbanized areas that are covered by buildings mainly for residential, commercial, and mixed-use.	All area would be upgraded gradually in its environment, infrastructure, and social service especially at west old town.
CBD (Commercial and Business)	Current center of commercial and business area leading economic activities of Pathein. It includes a traditional market.	Although existing CBD function must be kept in the future, it is likely more for tourism and traditional culture attracting foreign tourists.
Industrial Zone Logistics Zone	Industrial and logistic function must be in good connection with other focal cities and beaches by roads, railways, and inland water.	Currently, an industrial zone exists and several factories are operating. In the zone, industrial activities should be encouraged by inviting more factories in the short-term.
Urban Redevelopment Zone	In existing built-up, low density residential areas in the city center seem to exist without access to proper infrastructure.	An area between the CBD area and lakes area shall be promoted as higher density to accommodate more residents with proper road system and infrastructure.
New CBD (Commercial and Business Zone)	To accelerate economic growth, development of highly functioning commercial and business area is necessary.	A new CBD is proposed, located 5 km east from the current CBD transferring the central station in it. The place has better connectivity with Yangon and two resort beaches.
New Industrial Zone New Logistics Zone	To be a tourism and logistics hub, expansion of industrial and logistic function is important.	A new industrial zone located south of the city named Pathein Industrial City Project, was proposed and currently under

		construction by a local developer. These locations have better accessibility through inland water.
New Town Development Zone (Residential and Mixed-use)	The new town functions not only as residential but also for commercial and business as mixed-use.	Development of a new town with an area of 6.2 km^2 in total is necessary in the future. Currently, a new town development named Myakyutar Project is ongoing in the center of city. Some more development shall be required south of the city or west of the Pathein River.
Culture and Tourism Zone	To encourage tourism development as tourism hub, promoting culture and tourism zone is recommendable to conserve and utilize historic and nature resources. Improvement of accessibility is also necessary.	Main culture and tourism zones were proposed, namely, tourism hub zone and historic tourism zone. Tourism hub zone is intended to promote business linkage with the two resort beaches.
Urban Park Zone Green and Water Belt Zone	To upgrade urban environment, both urban parks inside the city and green and water belts surrounding the city are necessary.	The area consisting of two lakes, golf resort, and the campus of Pathein University must be conserved and utilized as urban park zone of Pathein as green core of the city. The Pathein River and surrounding paddy fields can function as appropriate green and water belts.
Advanced Agricultural Zone	In the advanced agricultural zone, urban development activities are basically prohibited to avoid urban sprawl and to keep the city more compact and efficient.	Two advanced agricultural areas of northwest and southeast are recommendable for realizing agri-green city as a key driver.

Source: JICA Study Team



Source: JICA Study Team

Figure 4.1.1 Proposed Spatial Plan of Pathein

4.2 Urban Development Policy

4.2.1 Commercial, Business, and Industry

・ Table 4.2.1 shows the development policy of commercial, business, and industry in Pathein City, especially for achieving a future city to be tourism hub and transport hub. In order to execute these policies, spatial control is common and principle measures must be taken by the local and central government for the realization of urban development policies and projects. These control measures are expected to be executed based on the law, by-laws, and other legal frameworks. Concrete measures are described in Chapter 7.1.2 of this report.

Table 4.2.1 Development Policy of Commercial, Business, and Industry in Pathein

Commercial, Business, and Industry Policy	1) Construction of industrial zone along the outer bypass 2) Creation of new touristic zone in the north of the city 3) Improvement of touristic environment in the city center 4) Construction of a new CBD and redistribution of urban function 5) Development of remote area

Source: JICA Study Team

4.2.2 Housing

・ In accordance with the population growth, increase of migrant workers for the new industrial areas, and change of living styles, corresponding housings are expected to be supplied in conformity to the city plan with respect on the key driver of Agri-green. Typical housing demands and issues for the realization of the development vision of Pathein City are concluded as shown in Table 4.2.2.

Table 4.2.2 Development Policy of Housing in Pathein

Housing Policy	1) Continuity of current housing developments 2) Improvement of planned residential development area 3) Improvement of the inner urban area 4) Housing development around industrial areas and along the outer bypass road for workers

Source: JICA Study Team

4.2.3 Landscape and Tourism

・ Pathein planning area aims to play an important role as tourism hub city, the key driver. The following are pointed out as strong advantages on the touristic industry of the city. Utilizing the opportunity and potential in the regional context, the city is expected to offer visitors a complementary attraction to the world-class beach resorts to the west, and a tourist infrastructure that also caters for national and international business. Under such development concept, the following policies in Table 4.2.3 are highly recommended to be considered.

Table 4.2.3 Development Policy of Landscape and Tourism in Pathein

Landscape and Tourism Policy	1) Enhancing current touristic resource of the city 2) Promotion of new tourism value 3) Tourism zone development

Source: JICA Study Team

4.2.4 Environment and Agriculture

- To develop Pathein as tourism hub and agri-green city by 2040, the environmental concerns to be addressed in its development policy are a) nature conservation, b) pollution control, c) living conditions, and d) natural hazard. Table 4.2.4 shows the environmental policies in Pathein.

Table 4.2.4 Development Policy of Environment and Agriculture in Pathein

Environment and Agriculture Policies	1) Careful control of the urban sprawl 2) Pollution precaution 3) Building livable urban settlement 4) Flooding preparedness

Source: JICA Study Team

5 Infrastructure Development and Social Service Policy

5.1 Road and Transportation

5.1.1 Demand Analysis

Road Transport

- Traffic survey data is not available and quantitative demand analysis could not be conducted. According to the visual observation, there is no congestion on the road network in Pathein even during morning/evening peak hours. Cargo handling activities on the road, i.e., loading and unloading on the road, induce traffic blockade on Strand Road and streets around the market near Strand Road.

Table 5.1.1 Development Policies of Road and Transportation in Pathein

Road and Transportation Policies	1) Provision of urban development axis 2) Provision of logistic/industrial development axis 3) Provision of public transportation

Source: JICA Study Team

5.2 Water Supply

- Designed water supply population was obtained by multiplying the future population by the water supply coverage rate of the target year. Although water supply coverage rate is different according to the status of use of wells, from the position of a public health or a living environment, it should target the highest possible level. In this study, the water supply coverage rate was set at 80% by referring to the interview with Pathein CDC. The forecast of designed water supply population for every target year is shown in Table 5.2.1.

Table 5.2.1 Served Population of Water Supply in Pathein City Up to 2040

Year	2015	2020	2025	2030	2035	2040
Urban area population (thousands)	178	192	203	214	226	237
Seven villages population (thousands)	33	34	35	35	36	36
Total population (thousands)	211	226	238	249	261	273
Service coverage rate (%)	0%	10%	30%	52%	70%	80%
Served population (thousands)	0	23	71	129	183	218

Source: JICA Study Team

Table 5.2.2 Development Policies of Water Supply in Pathein

Water Supply Policies	1) Review of the water supply master plan in Pathein City 2) Phased development of water supply facilities 3) Capacity development for management ability of water supply system

Source: JICA Study Team

5.3 Sewerage

- The demand of sewerage in the urban area of Pathein was forecasted to be about 27,000 m^3/day in 2040. For preserving the sanitary water environment in the urban area, development of "efficient and advanced sewage treatment system" is required based on the increase of sewage discharge. The forecasted demand of sewerage for each target year in the urban area of Pathein is shown in Table 5.3.1.

-

Table 5.3.1 Demand of Sewerage in Pathein (Urban Area) Up to 2040

Year	2015	2020	2025	2030	2035	2040
Target coverage rate (%)	0%	0%	24%	41%	56%	64%
Covered population (thousands)	0	0	57	103	146	174
Domestic sewage (l/c/d)	130	130	130	130	130	130
Non-domestic sewage rate (%)	10%	10%	10%	10%	10%	10%
Infiltration and inflow rate (%)	10%	10%	10%	10%	10%	10%
Daily maximum rate	1.1	1.1	1.1	1.1	1.1	1.1
Demand for sewerage Daily average (m^3/day)	0	0	8,935	16,233	23,029	27,433
Demand for sewerage Daily maximum (m^3/day)	0	0	9,829	17,856	25,332	30,176

Source: JICA Study Team

Table 5.3.2 Development Policies of Sewerage in Pathein

Sewerage Policies	1) Improve the water environment in public water areas 2) Improve the sanitary living environment 3) Use the flushing-clean toilet 4) Develop the beautiful city with wealthy water and green

Source: JICA Study Team

5.4 Drainage

- There are a total of nine creeks in the town that are used for drainage in Pathein City. The capacity of the existing drainage and channel in the city is not enough during heavy rains. So, low-lying areas in the city are sometimes flooded every year. The issues of the existing drainage are as follows:

  - Flooding does happen in some specific low-lying areas at the northwest of the city and around creeks at southern area;
  - Some drainage canals have accumulated soil sediments and many plants are growing at the bottom that inhibits flow;
  - There are few gates, banks, and pumps which prevent flooding in the low-lying areas.

Table 5.4.1 Development Policies of Drainage in Pathein

Drainage Policies	1) To reduce the frequency of flooding in the urban area 2) The existing drainage should be used as much as possible but shall be upgraded and extended

Source: JICA Study Team

5.5 Solid Waste

- Considering present collected garbage, the demand of solid waste is roughly calculated by unit volume (0.56 t/thousand-p/d) of another project. As a result, the demand of solid waste in urban area of Pathein was forecasted to be about 49,000 ton/year in 2040. The 3R Policies (reduce, reuse, and recycle) is required to reduce solid wastes that continuously increase. Therefore, the scenarios of 3R are assumed as shown below. The forecasted demand of solid waste for each target year based on the scenario of the 3R policies in the urban area of Pathein is shown in Table 5.5.1.

  - Scenario-A: 10% reduction by reusing available material from waste
    Reuse (10% by 2040)
  - Scenario-B: in addition, 10% reduction by recycling organic material
    Reuse (10%) + Recycle (10% by 2040)
  - Scenario-C: moreover, 15% reduction by incineration of waste
    Reuse (10%) + Recycle (10%) + Reduce (15% by 2040)

Table 5.5.1 Demand of Solid Waste in Pathein (Urban Area) Up to 2040

Year		2015	2020	2025	2030	2035	2040
Urban population (thousands)		178	192	203	214	226	237
Unit volume (t/thousand-p/day)		0.56	0.56	0.56	0.56	0.56	0.56
Demand of solid waste (t/day)		100	108	114	120	127	133
Yearly total demand (t/year)		36,500	39,420	41,610	43,800	46,355	48,545
Scenario-A of 3R:	Reuse rate (%)	0%	2%	4%	6%	8%	10%
	Reuse (t/year)	36,500	38,632	39,946	41,172	42,647	43,691
Scenario-B of 3R:	Recycle rate (%)	0%	2%	4%	6%	8%	10%
	Recycle (t/year)	36,500	37,859	38,348	38,702	39,235	39,321
Scenario-C of 3R:	Reduce rate (%)	0%	3%	6%	9%	12%	15%
	Reduce (t/year)	36,500	36,700	35,951	34,996	34,117	32,768

Source: JICA Study Team

Table 5.5.2 Development Policies of Solid Waste in Pathein

Solid Waste Policies	1) Realization of solid waste management with stability and safety for long term 2) Promote 3R (reduce, reuse, and recycle) 3) Build a sound material cycle society 4) Reduce environmental impact by proper disposal of hazardous wastes

Source: JICA Study Team

5.6 Electricity

- The demand forecast for the target area made by the JICA Study Team considered 20% growth in the short term and 17.3% in the medium term based on the 66 kV transformers' peak load (13 MW) data dated 7 May 2016. The forecast result till 2030 is shown in Figure 5.6.1. The CAGR of this forecast is 18.07%. With the current data, long-term forecast would not be wise.
- In order to get a more precise result in the future, many other modern approaches using weather forecast and artificial intelligence could be used depending on the available data.

Source: JICA Study Team

Figure 5.5.1 Peak Demand For Pathein Township

Table 5.6.1 Development Policies of Electricity in Pathein

Electricity Policies	1) Distribution loss reduction 2) Developing digital database 3) Comprehensive urban energy and electric power system development plan 4) Upgrading and strengthening of 66 kV substation network 5) Involvement of ESE and/or MOEPE in urban planning

Source: JICA Study Team

5.7 Social Service

- Benefits from the achievements of the master plan of Pathein Planning Area including economic growth and improvement of environmental condition should be shared with all the people in the community. This means not only increasing the incomes of the poor, but also addressing the needs of the disadvantaged and excluded groups. In addition, the development should allow them to fully participate and contribute in the process of growth. To achieve inclusive development, it is key to provide equal opportunity and accessibility to social services for all the people which

include all classification in any income groups. To secure the provision of social service, the following development policy should be aimed for:

Table 5.7.1 Development Policies of Social Service in Pathein

Social Service Policies	1) Provision of equal opportunity of education and employment for all people 2) Provision of healthy and secured living environment for all people 3) Provision of social safety net for all people

Source: JICA Study Team

6 A Roadmap of Key Project

6.1 Key Projects

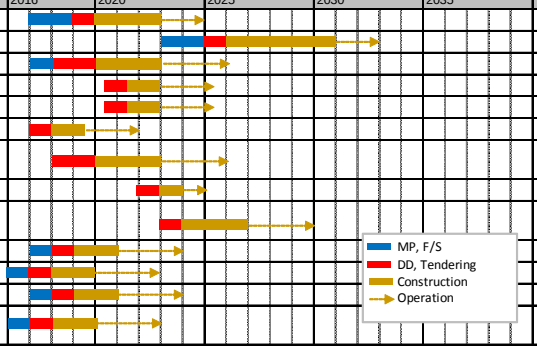
Table 6.1.1 List of Key Projects

Sector	Project Name	Vision (Key Drivers)		
		Tourism HUB	Logistic HUB	Agri-green
Urban Development	1. New CBD Development Project	++	+	
	2. Tourism Hub Development Project	++		+
Infrastructure Development	3. Road Network Restructuring Project	++	++	
	4. Central Railway Relocation Station		++	
	5. Public Transportation Introduction Project		+	+
	6. Port Facilities Improvement Project		++	
	7. New Port Construction and Warehouses Relocation Project		++	
	8. Pathein Airport Improvement Project	+	++	
	9. Access-controlled Highway Project (Study)	++	++	
	10. Water Supply Development Project	+	+	+
	11. Drainage Improvement Project	+	+	+
	12. Solid Waste Management Project	+	+	+
	13. Power Supply Capacity Improvement Project	+	+	+

Note: ++ Strong Relation, + Relation
Source: JICA Study Team

Table 6.1.2 Implementation Schedule and Rough Cost Estimation of Key Projects

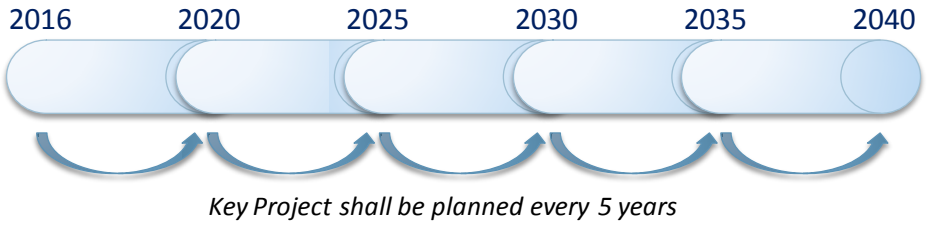
No.	Project Name	Implementation Schedule	Rough Cost Estimation (million USD)	Status*	Implemented by
		2016 2020 2025 2030 2035			
1	New CBD Development Project		61	-	-
2	Tourism Hub Development Project		230	-	-
3	Road Network Restructuring Project		15	-	-
4	Central Railway Relocation Station		10	-	-
5	Public Transportation Introduction Project		0	-	-
6	Port Facilities Improvement Project		10	-	-
7	New Port Construction and Warehouses Relocation Project		—	-	-
8	Pathein Airport Improvement Project		10	-	-
9	Access-controlled Highway Project (Study)		—	-	-
10	Water Supply Development Project		6	-	-
11	Drainage Improvement Project		1	-	-
12	Solid Waste Management Project		5	-	-
13	Power Supply Capacity Improvement Project		3	-	-



Note: * " - " in the status column means the project is in proposal stage and its implementation body is not yet determined.
Source JICA Study Team

- It is recommendable that the key projects are planned every five years through the monitoring regard on progress of conducting projects and change of circumstances. According to drafted "Urban and Regional Development Plan", a master plan shall be formulated every 5 – 10 years

under the conceptual plan. In this context, re-planning of key projects shall be one of the works in master planning.



Source: JICA Study Team

Figure 6.1.1 Image of Planning Cycle for Key Projects

1. New CBD Development Project

Table 6.1.3 New CBD Development Project

Current Status and Issues	Vacant land is currently available for development of a new CBD in the vicinity of the proposed railway station. The concept is to create a walkable CBD next to the railway station. The edges of the CBD would be iconic office towers while the inner buildings would be smaller offices. A green shaded pedestrian spine would connect the entire length of the CBD and the railway station through a plaza on the upper level.
Purpose	The purpose is to develop a new CBD for the city and maximize business and commerce activities in the city.
Main Scope	・ Development of offices, business centers, and malls near the existing industrial zone ・ Development of hotels ・ Development of leisure center ・ Development of a central activity zone for the residents

Source: JICA Study Team

Source: JICA Study Team

Figure 6.1.2 Images of the New CBD Development Project

2. Tourism Hub Development Project

Table 6.1.4 Tourism Hub Development Project

Current Status and Issues	A large number of tourists pass through Pathein everyday on their way to Ngwe Saung Beach. This tourist potential can be developed upon creation of a tourism zone in the northwestern part of the city. This hub will boost the economic growth of the city and create employment opportunities for the residents.
Purpose	To create a tourist and cultural zone that will boost the economic activity in Pathein and trigger further development.
Main Scope	・ Creating tourist facilities ・ Developing cultural activities ・ Developing the Strand Road and riverfront edge ・ Relocation of existing warehouses ・ Creating leisure activities for citizens

Source: JICA Study Team

Source: JICA Study Team

Figure 6.1.3 Images of the Tourism Hub Development Project

Table 6.1.5 Road Network Restructuring Project

Current Status and Issues	・ There is no congestion on the main roads of the city except parts of Strand Road and narrow secondary streets around the market. ・ Most of the arterial roads in the city have very narrow carriageway without sufficient road shoulder. Additional arterial axis roads will be required to back up the proposed urban and logistic/industrial area. ・ There is an abandoned (unused) old railway track and part of the track was replaced.
Purpose	Restructuring of the road network to suit the proposed urban spatial plan.
Main Scope	・ Upgrading of the outer skirts road from “Pathein Industrial City” to the “Pathein Industrial Zone” ・ Construction of the new alignment to bypass the proposed CBD area ・ Provision of the additional urban arterial road on the abandoned railway corridor ・ Improvement of the existing arterial roads ・ Pedestrian facilities on the road network

Source: JICA Study Team

Table 6.1.6 Outline of Relocation of Central Railway Station

Current Status and Issues	・ The existing old railway track from the central station to the Ayeyarwady River has not been used. The central station is located in the densely built-up area. Access roads are quite narrow and there is no space for further station development. ・ Additional arterial axis roads will be required to back up the proposed urban and logistic/industrial area.
Purpose	・ Relocation of the central station to the proposed CBD to improve convenience of railway users. ・ Provision of ROW for the axis road instead of the abandoned railway track.
Main Scope	・ Relocation of the central station to the proposed new CBD ・ Demolition of the abandoned railway track in order to provide ROW for the road construction ・ Transit facility for other public transport system such as buses and taxi

Source: JICA Study Team

Table 6.1.7 Public Transportation Introduction Project

Current Status and Issues	・ Lack of public transport ・ Narrow streets in the city center ・ Construction of new industrial areas
Purpose	Provision of public transport for industrial workers and tourists
Main Scope	・ Mode selection study (paratransit type vehicles will be suitable for narrow streets and current demand) ・ Less or no emission vehicles might be preferable ・ Construction of bus stops ・ Provision of sidewalk with at least 1.5 m width

Source: JICA Study Team

Table 6.1.8 Port Facilities Improvement Project

Current Status and Issues	Old port infrastructure is still being used in jetties. No parking space is provided for loading/unloading around jetties; and traffic congestion is induced by cargo handling works on Strand Road.
Purpose	Ease traffic congestion on Strand Road
Main Scope	Construction of parking space for cargo handling activity

Source: JICA Study Team

Table 6.1.9 New Port Construction and Warehouses Relocation Project

Current Status and Issues	・ Port facilities such as jetties, warehouses, and port-related offices are located in the current CBD area. ・ New industrial area named “Pathein Industrial City” in the southern area of the city is under development.
Purpose	Relocation of the port facilities to the southern area based on the proposed urban spatial plan
Main Scope	・ Construction of the new port in the south ・ Relocation of warehouses to the southern area around the new port/industrial area

Source: JICA Study Team

Table 6.1.10 New Port Construction and Warehouses Relocation Project

Current Status and Issues	・ Cancelation of international pre-flight service in 2015 ・ Budget constraint and damaged airport infrastructure
Purpose	Proper maintenance and repair of airport infrastructure
Main Scope	・ Overlaying of the runway ・ Replacement/improvement of damaged/old facilities

Source: JICA Study Team

Table 6.1.11 Access-controlled Highway Project (Study)

Current Status and Issues	・ Pathein Road is a “community road” and also a “logistic road”, and induces safety risk to vulnerable villagers along the road. ・ There are several deep port plans and tourism development plan in and around Pathein City, and the logistic/tourism axis will be required.
Purpose	・ Improvement of traffic safety on the existing two-lane road between Pathein and Yangon ・ Provision of high-standard axis road to accelerate the development of the delta area
Main Scope	Feasibility study for the access-controlled highway between Pathein and Yangon

Source: JICA Study Team

Table 6.1.12 Water Supply Development Project

Current Status and Issues	There is no modern water supply service in Pathein City although many households have their own dug-wells; but the water quality of most of these wells is not good and not suitable for drinking purpose.
Purpose	Development project of water supply system in central urban area
Main Scope	・ Water treatment plant with Pathein River as the water source ・ Water reservoir, distributing pump, and pipe network

Source: JICA Study Team

Table 6.1.1314 Drainage Improvement Project

Current Status and Issues	There are nine creeks that are used for drainage in Pathein City. The capacity of the existing drainage and channel in the city is not enough for heavy rains. Some creeks have accumulated soil sediments, and many plants are growing at the bottom that inhibit flow.
Purpose	Improvement of the bottom of creeks will increase flow capacity.
Main Scope	・ Cleaning and dredging on the bottom of creek ・ Improving the creeks by concrete/bloc or masonry structure

Source: JICA Study Team

Table 6.1.1516 Solid Waste Management Project

Current Status and Issues	The existing dump site will reach full capacity in the near future. Solid waste management facilities are severely old.
Purpose	Creating a clean city with a sound material-cycle through 3R (reduce, reuse, and recycle) policy and its execution.
Main Scope	・ Improve the capacity of maintenance equipment. ・ Set up 3R policy and execute a training program for solid waste management.

Source: JICA Study Team

Table 6.1.17 Outline of Power Supply Capacity Improvement Project

Current Status and Issues	Current overall capacity of some 66 kV transformers are almost full during peak demand. And these transformers will be overloaded during peak hours by 2017.
Purpose	Ensuring the supply reliability of electric power
Main Scope	・ Installation and rehabilitation of 66 kV substations and/or ・ Upgrading 66 kV substations to 132 kV substations with higher loading capacity ・ Enable well-planned cascade connections to ensure N-1 contingency condition

Source: JICA Study Team

6.2 Future Image of Pathein 2040

- A bird's eye view of future urban image of Pathein was drawn using computer graphics. The view from northwest is the culture and tourism zone in front and the new CBD at the back.

Source: JICA Study Team

Figure 6.2.1 Bird's Eye View of Future Urban Image of Pathein

7 Project Implementation and Urban Management

7.1 Urban Development Management

7.1.1 General View of Urban Development Management by Official

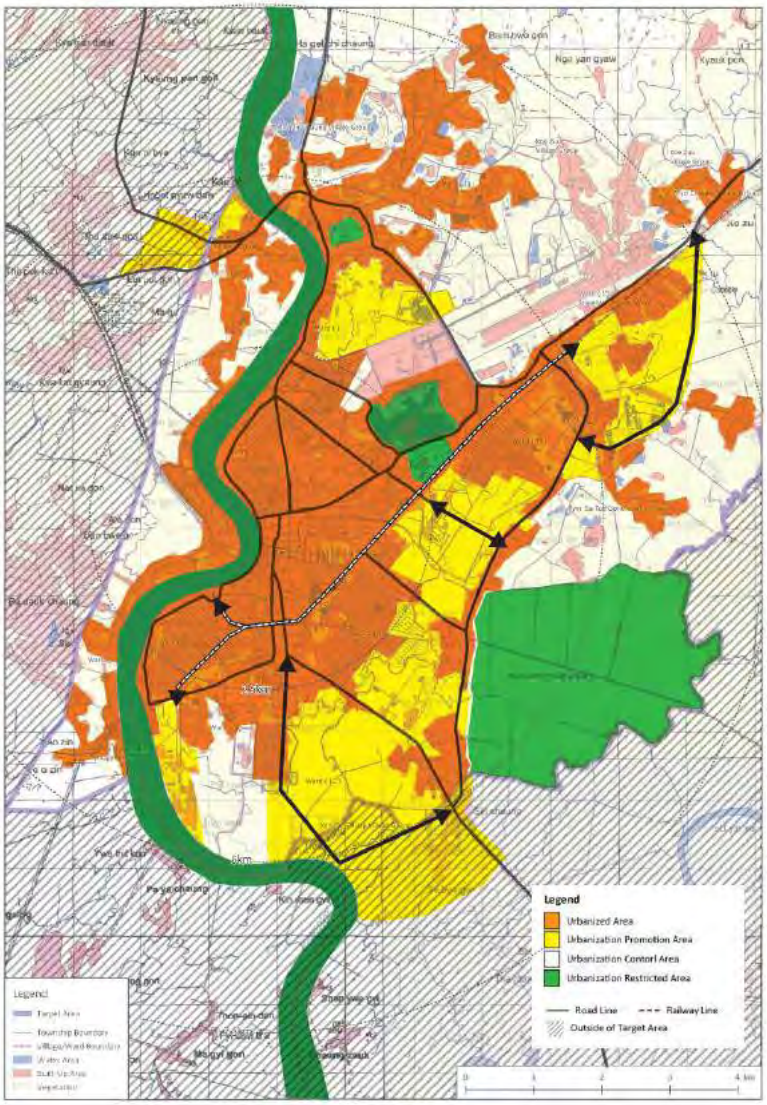
- The spatial control and principal measures to be taken by the local and central government for the realization of urban development policies and projects are common. These control measures are expected to be executed based on the law, by-laws, and other legal frameworks.
- The following are spatial control zones which are expected to be introduced for the realization of planning items:
    - Boundary of urbanization area: These are areas which can be used for future development. The area is composed of urbanization area, urbanization control area, and development restricted area.
    - Zoning of land use: The land use determines permitted activities on land and buildings. The planning indexes, such as floor area ratio (FAR), building coverage ratio (BCR), open space ratio, and maximum height of building, are in many cases prescribed in relation with land use zoning. It also relates the development capacity of each area.
    - Boundary of specific urban development project: In order to secure the land for future infrastructure facilities and urban development for public purpose, their areas are designated in advance and construction activities in these areas will be restricted.
- In enforcing the abovementioned control measures, detailed contents of planning items should be examined in the following detailed planning study. Currently, the legal spatial control measures are not yet formulated and under preparation in Myanmar. The contents of planning items should be adjusted to the formulation of legal systems which will be set in the future.

7.1.2 Application of Urban Development Management in Pathein

Area Classifications

- To realize the spatial plan of Pathein for 2040, the development activities by private and public sectors should be guided and promoted properly. This shall also contribute to avoid uncontrollable urban sprawl that will make Pathein a compact city. In this context, Pathein City shall be classified into four areas. Further examination for formulation of the detailed plan is as follows:

    1) **Urbanized area** is the current built-up area (e.g., CBDs, residential, and industrial zones). Some areas shall be target of urban redevelopment.
    2) **Urbanization promotion area** is suitable for future urban development by 2040. The areas shall be reserved for development of new towns, CBDs, and industrial and logistics zones.
    3) **Urbanization control area** is where development activities shall be controlled properly but not prohibited. The areas shall be also utilized for urban parks, tourism, and/or green, and water belt.
    4) **Urbanization restricted area** is where development activities must be prohibited strictly. The areas shall be reserved for nature reservation and high valued agriculture development.



Source: JICA Study Team

Figure 7.1.1 Proposed Area Classification of Pathein

7.2 Capacity Development

- Officers have some concerns on the readiness of City Development Organization to implement all the planned development project during the study period. One officer expressed:

  "Pathein lacks the ability to manage urban planning and development projects, as Pathein does not have the city management structure similar with Yangon or Mandalay."

- However, considering the size of the city, it may be too early to conclude that Pathein has similar independent city management institution at this stage. Rather, the discussion about readiness or ability to manage many large-scale civil work and/or development project has something to do with communication among related governmental offices and lack of human resource on urban management. Taking into account the above argument, below are discussions on capacity development from institutional point and urban management point.

7.2.1 Capacity Development in Coordination Function of GAD

- As reported in prior studies conducted by UNDP and non-profit organizations (NPOs) on Myanmar's local governance structure, the horizontal coordination system within the local

governance structure is weak in Ayeyarwady Region. This point found remaining weakness in Pathein during the study, too. For high pitch development, multi-angled assessment would be required for Pathein to be a "clean modernized city" by 2040. It is necessary to strengthen the horizontal communication on urban planning and coordinating function in the key local governance structure such as GAD. GAD has key role in local development affairs, having seats in four key committees of the subnational government: Township Management Committee (TMC), Township Development Support Committee (TDSC), Township Development Affairs Committee (TDAC) (in some articles, this committee is translated as Township Municipal Committee (TMuC)), and Farmland Management Body (FMB). Capacity development in GAD as a key coordinator on information sharing, decision making process, and prioritizing fund allocation and development issues can be achieved by specialized program under the support of international organization or bilateral cooperation to strengthen systematic approach and process for such tasks of GAD.

7.2.2 Capacity Development in Urban Management

- Currently, Pathein urban development management by DAO or CTC is only focused on daily urban infrastructure management and maintenance, due to the lack of human resources and funds. For incoming large-scale urban development, TDO is likely not capable in providing necessary guidance and supervision to such projects. However, it is not only the case of Pathein DAO but also in many other cities. Even the private sector in Myanmar is facing the same problems, as they have not experienced this type of development in the past. To secure successful results of new development, it is only possible to accumulate experiences of such large-scale project year after year with local staff. To start with, it is recommendable to implement projects under the international cooperation by hiring globally experienced consultants to supervise projects, together with a training course for officers by consultants. For receiving international cooperation, Pathein City or Ayeyarwady Regional Government need to work together with the Union government to seek international support for its development.

7.3 Project Implementation

- In order to implement the development programs, which are described in Chapters 4, 5, and 6, and to realize balanced development as a whole, provision of support and intervention for the project and by public entities are necessary for their adequate implementation. For this purpose, the central government and local government are expected to take a role in the following implementation schemes:

7.3.1 Project Implementation by the Government

- Some projects should be implemented by the governments' initiative. Particularly, it is necessary to consider government's initiative for the implementation of unprofitable development project.

7.3.2 Subsidization for Implementation

- Subsidization is effective for promotion of small-scale urban development activities not conducted by large-scale investors.

7.3.3 Project Coordination by Government

- Generally, private investors are interested with large-scale development with profitable business program, and its development tends to progress individually without effective control. Governments' involvement in project coordination is expected for appropriate project realization and its management. It is necessary to coordinate individual development project under public entities by planning, licensing, and construction in order to secure its suitability as public orientated development.

APPENDIX: POSTER

Urban Development Plan for Mawlamyine 2040

< Summary >

Summary: Urban Development Plan for Mawlamyine 2040

1 Introduction and Planning Framework

1.1 Objectives of the Plan

- The primary objectives of the urban development plan of Mawlamyine 2040 are as follows:

  a) To present development visions and strategies with spatial and structure plan by 2040,
  b) To present urban and infrastructure development policies for the realization of the development visions, and
  c) To propose a roadmap of key projects.

1.2 Target Year

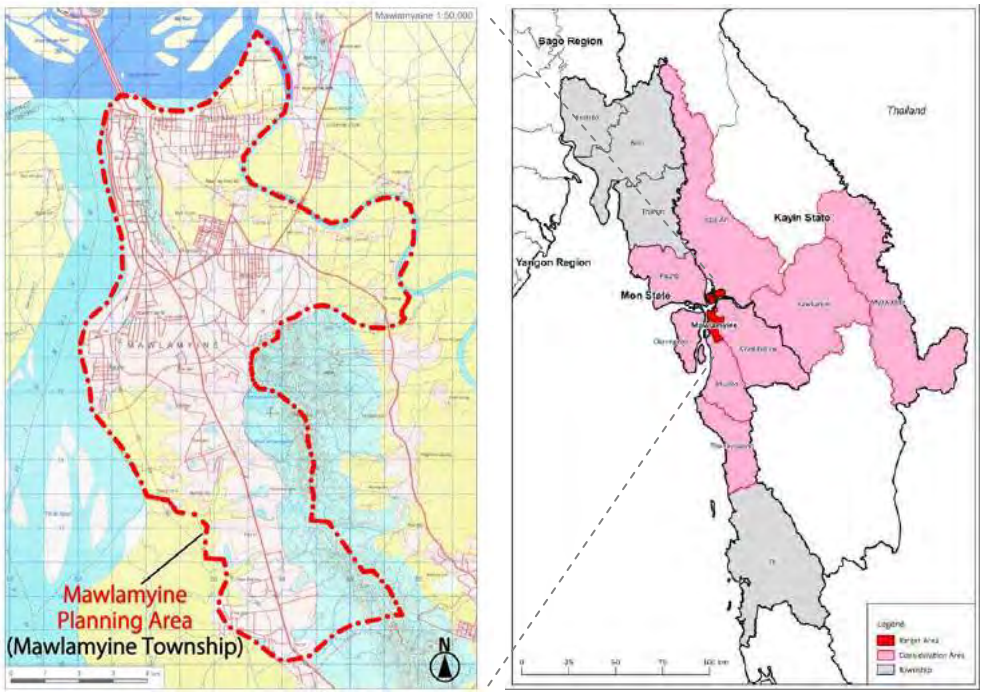
- The target year of the plan is set at 2040. Benchmarks are also set at 2030 as middle-term and at 2020 as short-term.

1.3 Target Area

- Mawlamyine is located in the south-east area of Myanmar, which is about 200 km south-east of Yangon. Mawlamyine Township is about 219 km^2, which stretches 11 km east and west and 18 km north and south.

- The planning area of Mawlamyine (hereafter referred as "Mawlamyine Planning Area") is the whole Mawlamyine Township area that belongs to Malwamyine District, Mon State. Figure 1.3.1 shows the boundary map of the target area.

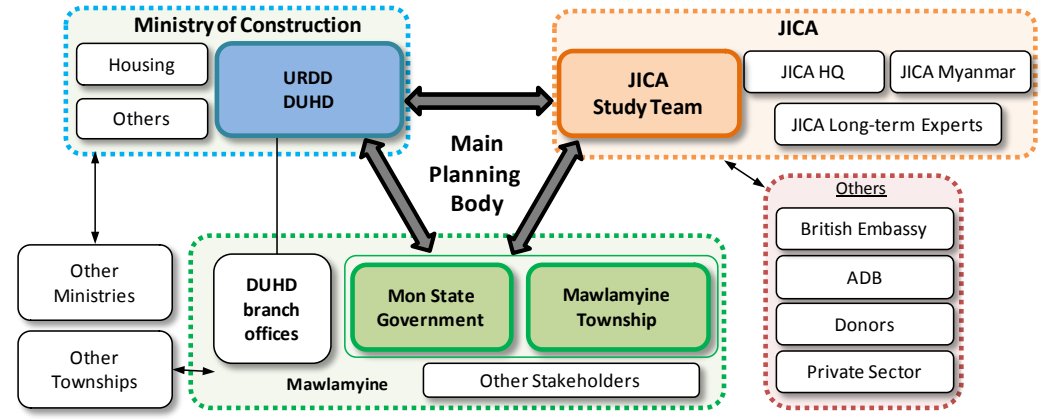
1.4 Planning Organizations and Process



Source: JICA Study Team

Figure 1.3.1 Planning Area of Mawlamyine

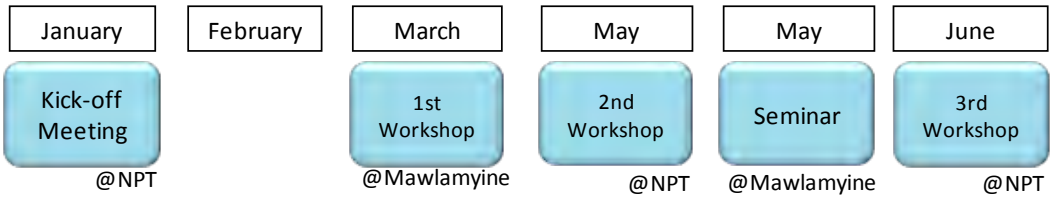
- The urban development plan of Mawlamyine was made possible by close cooperation of Mon State Government, Mawlamyine Township, Urban Regional Development Division (URDD) (Department of Urban and Housing Development: DUHD) of Ministry of Construction, and the Japan International Cooperation Agency (JICA) Study Team based on the existing conceptual plans.



Source: JICA Study Team

Figure 1.4.1 Planning Organizations

- The plan was formulated with public involvement in its planning process. There are two types of meetings as follows: The planning process is shown in Figure 1.4.2.
  - Workshop Meeting: to discuss with the counterpart (C/P) and related organizations; and
  - Seminar: to collect opinions of various stakeholders such as representatives of local communities.



Source: JICA Study Team

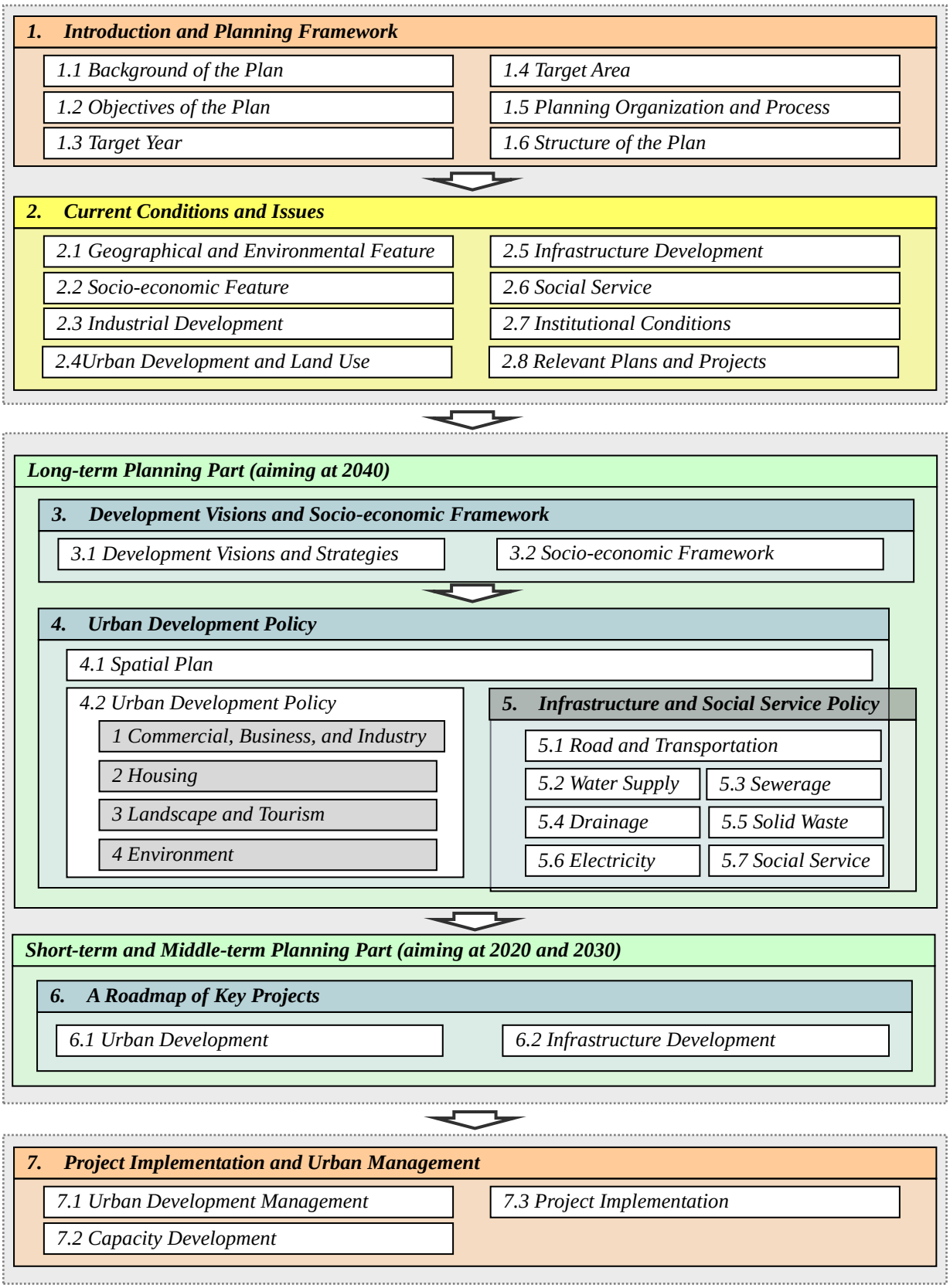
Figure 1.4.2 Public Involvement in the Planning Process

1.5 Approval of the Plan

- According to the drafted "Urban and Regional Development Planning Law" examined by MOC, the city conceptual plan is defined to be formulated by MOC (union ministry) and submitted to the national urban and housing development central committee. In line with this regulation, this plan shall be approved at the national level with consensus of the regional government.

1.6 Structure of the Plan

- Referring to the existing conceptual plans and considering general requirement of an urban development plan, the structure and basic contents of the plan are framed as shown in Figure 1.6.1. The plan shall have seven chapters. The main body of the plan shall consist mainly of two parts (long-term and short/middle-term) in order to satisfy the requirements for both of sharing future image and encouraging actions.



Source: JICA Study Team

Figure 1.6.1 Structure of the Urban Development Plan

2 Current Conditions and Issues

2.1 Geographical and Environmental Feature

2.1.1 Geography

- Mawlamyine is located in the southeast area of Myanmar, which is about 200 km southeast of Yangon, with its geographic coordinates at 16°29'N, 97°37'E. This regional capital city of Mon State sits on the Thanlwin delta and flanked by low hills between eastern side and western side. The Ataran River is in the east; and the Thanlwin River, the Gulf of Mottama, and the Andaman Sea in the west.

2.1.2 Natural Disaster

- The 2013 Global Climate Risk Index identified Myanmar as one of the countries which is most affected by severe weather disasters from 1992 to 2011 due to Myanmar's location, topography, climate, and geology. The major natural disasters in Myanmar are forest fire, landslides, earthquake, floods, drought, cyclones, and storm surges. Among all more than 70% of the disasters was accounted for man-made forest fire, then flooding ranking second with 11%.

- Tough Mawlamyine sits on the mouth of the Thanlwin River, Mawlamyine has natural protection from tsunami or high rise of seawater triggered by tropical cyclones, being sheltered by Bilugyun (Blue) Island from outer ocean. Thus, Mawlamyine is less prone to cyclones or storm surges.

- There are no active faults nor tectonic lineaments running across Mawlamyine, thus this city with cultural heritages is historically free from earthquake risks.

- However, Mawlamyine is susceptible to flooding. Especially, its low land in the northeast of the city annually suffers from flood damages after intensive rainfalls every once or twice a year during the monsoon season. This is caused by the combination of topographic and drainage system problems.

2.2 Socioeconomic Feature

- Mawlamyine City is the urban area of Mawlamyine Township, which is one of the six townships in Mawlamyine District. There are only two districts in Mon State and Mawlamyine District has the larger population. Among the population of 289,000 in Mawlamyine Township, 254,000 people are urban dwellers, which shows a quite high rate of urban population. This plan targets the whole area of Mawlamyine Township including both urban and rural populations. Table 2.2.1 shows the population of Mawlamyine District by township in 2014.

Table 2.2.1 Population of Mawlamyine District by Township in 2014

State/ District/Township	Population (in thousands)			Urban Population
	Total	Urban	Rural	
Mon State	2,054	572	1,482	27.8%
Mawlamyine District	1,232	434	798	35.2%
Mawlamyine	289	254	36	87.9%
Kyaikemaraw	196	11	185	5.6%
Chaungzon	122	8	114	6.6%
Thanbyuzayat	171	57	113	33.3%
Mudon	191	53	138	27.7%
Ye	152	34	118	22.4%
Lamine (ST)	88	14	75	15.9%
Khawzar (ST)	23	4	19	17.4%

Note: ST = Sub Township
Source: The 2014 Myanmar Population and Housing Census

2.3 Industrial Development

2.3.1 Industrial Activities

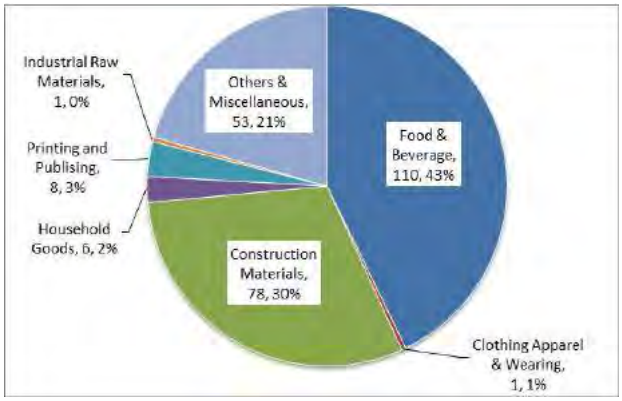
- The city of Mawlamyine is the capital of Mon State. It is the gateway to Southeast Myanmar, and also connected to Myawaddy, the eastern border with Thailand, by GMS East-West Economic Corridor (EWEC). Agricultural sector is the main source of economic activities of the state such as rice, oil palm, fruits and vegetables, and rubber. Some fruits grown in Maylamyine such as pomelo are known as the best in the country. Fishery products are also major components of the economy.

- According to "Myanmar Industry Directory 2015-16", there were a total of 2,155 registered industries in Mon State, corresponding to 5.0% of the total number in Myanmar. More than 80% of them were small industries. Table 2.3.1 and Figure 2.3.1 show the number of industries in Mawlamyine Township by size and by sub-sector in 2015-16, respectively. Major types of industries are "food and beverage" (43% of the total number of industries), "construction materials" (30%), and "others and miscellaneous" (21%), in descending order.

Table 2.3.1 Number of Industries by Size in Mawlamyine Township in 2015-16

Size of Industries	Number of Industries	Number of Employees
Large	43	483
Medium	32	228
Small	182	654
Total	257	1,365

Source: Ministry of Industry, Directorate of Industrial Supervision and Inspection, Mon State Office



Source: Ministry of Industry, Directorate of Industrial Supervision and Inspection, Mon State Office

Figure 2.3.1 Number of Industries by Sub-sector in Mawlamyine Township in 2015-16

- In Mon State, there is one industrial zone established under the supervision of the Mon State government in the mid-1990s as seen in Table 2.3.2, namely Maylamyine Industrial Zone. According to a study conducted by JETRO Yangon, a total of 86 factories were in the zone in 2013 for businesses such as food and beverages, mineral and petroleum products, and daily commodities. The industrial zone is located in Kyaik Mayaw Township, just outside of the northeast part of Mawlamyine City, along Zartha Pyin Road linking further to Hpa-An, Kayine State, after crossing a narrow suspension bridge over the Ataran River from the city center. The location causes a huge accessibility problem since the bridge makes large vehicles such as container trucks impossible to pass; and also since it is for small scale industries in the industrial zone, they have to pay tolls every time they cross the bridge to reach the city even for their small business. Underdevelopment of infrastructure such as electricity and water is also reported.

Table 2.3.2 Industrial Zones in Mon State

Industrial Zone	Location	Year of Establishment	Area (acre)	No. of factories*
Mawlamyine Industrial Zone	Kyaikemayaw Township, Mawlamyine District	1995	171.04	86

Note: * as of February 2013
Source: Myanmar Industry Directory 2015-16; JETRO (Yangon), 2013

- In response to this situation, development of a new industrial zone, Kyauktan Industrial Zone is currently promoted by private funds under a directive of the Mon State government. The area covering 254 acres is located in the southwest of the city of Mawlamyine. Construction of the new zone started in 2014 and the official opening ceremony took place in March 2016 with ten businesses having started their operations. The industrial zone is expected to contain a variety of businesses such as zinc, ready-mix cement, food and beverages, textiles, gold purification, ice factories, and shoe production.

2.3.2 Foreign Investment

- For comparison purposes, Table 2.3.3 shows the total investment amounts of permitted enterprises under the Foreign Investment Law in Mon State as well as the Union in total. In 2014-2015, six enterprises were permitted in Mon State with the investment of USD 326 million, out of the total of 211 enterprises with USD 8.011 billion permitted in Myanmar.

Table 2.3.3 Total Investment of Permitted Enterprises under the Foreign Investment Law in Mon State

(USD in millions)

Region	2010-2011		2011-2012		2012-2013		2013-2014		2014-2015	
	No. of Enterprises	Foreign Investment	No. of Enterprises	Foreign Investment	No. of Enterprises	Foreign Investment	No. of Enterprises	Foreign Investment	No. of Enterprises	Foreign Investment
UNION TOTAL	**24**	**19,999 ***	**13**	**4,644 ***	**94**	**1,419 ***	**123**	**4,107 ***	**211**	**8,011 ***
Mon State	2	2,945	-	-	-	-	1	375	6	326

Note: * Increased in investment value.
Source: Ministry of National Planning and Economic Development (MNPED) Central Statistical Organization, "Myanmar Data CD-ROM 2015", February 2016. (Originally from Directorate of Investment and Company Administration)

2.4 Urban Development and Land Use

2.4.1 Urban and Housing

- The current urban area of Mawlamyine is composed of the following different characteristic zones. Their features and issues of urban space and buildings are described as follows:

Central Urban Area

- The central urban area of Mawlamyine is located between the east bank of the Thanlwin River and Yankin Hill. Many commercial buildings and trade buildings which have two to three storeys stand along the Strand Road and Lower Main Road and forms the central commercial area of the city. There are middle rise buildings with five to eight floors but they are exceptionally used such as hotel. The administrative buildings and public buildings stand along the Baho Street and Upper Main Road, which are located in the hinterland of the abovementioned commercial areas along the Thanlwin River. Flat and 2-3-storey detached housings are typical residential buildings in the area. In addition to that, middle rise apartment buildings with four to five storeys are observed in the area, but not many.

  The current environment of urban space is relatively good and its density of development are low, so specific problems in the area are not observed and remarkable.

Expansion Area towards East of the City

- In Kyeik Ma Nae area in the northeast of the city, there are expanded urban areas along the East-West arterial road towards the Ataran River and Kyeik Ma Yaw area beyond the river. This area is occupied with flat and 2-storey housings and commercial buildings for daily living goods and services. The area is formed with regular grid shape housing lots. Main streets in the area

are paved, but other small roads are not paved and drainage problem is observed. The living condition is not seriously bad.

Expansion towards Southeast between the New Railway Station and the Airport

There are planned residential areas in Zayar Myine area and Myine Than Yar area, which are located in the southeast of the city. Most of the buildings in these areas are detached one or two storeyed houses. Compared with the abovementioned housing areas in Kyeik Ma Nae, the housing lots in these areas are larger, their density is lower, and their urban environment is better. These areas are located in high ground and are not affected by inundation damage. There are few problems in their living condition.

South of Central City

- There are planned housing development areas in Thirimyine, Mupon, and Kyauktan areas, which are located in the south of the city.

East of the Ataran River

- There is a housing and industrial development area on the east bank of the Ataran River, in the Kyeik Ma Yaw area, along the inter city road to Hpa-A. The residential area is developed well with appropriate development density, wide road width, and enough open spaces. But difficulty on water supply obstructs the progress of development in the area.

2.4.2 Land Use and Regulations

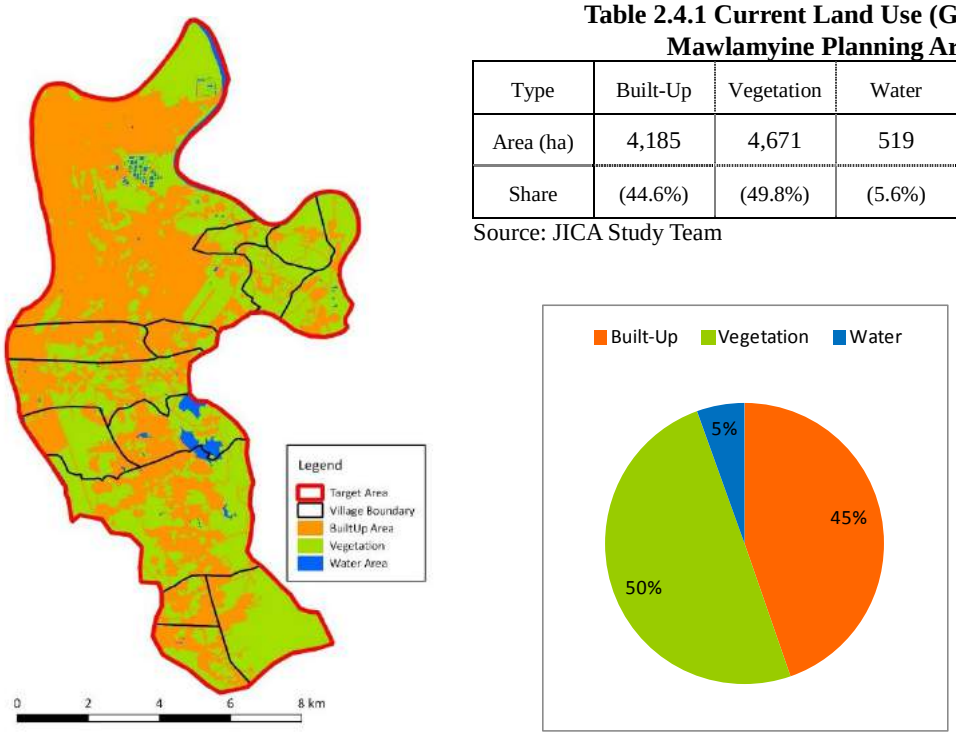
Land Use

- A land use pattern was developed based on the analysis of satellite imagery of 2015 covering only urban area, and using imagery of 2012 for other area. Looking at the land use, built-up shares 44.6% of Mawlamyine planning area (township area) as shown in Table 2.4.1 and Figure 2.4.1, especially in the urban area.

Table 2.4.1 Current Land Use (General) of Mawlamyine Planning Area

Type	Built-Up	Vegetation	Water	Total
Area (ha)	4,185	4,671	519	9,375
Share	(44.6%)	(49.8%)	(5.6%)	(100.0%)

Source: JICA Study Team



Source: JICA Study Team

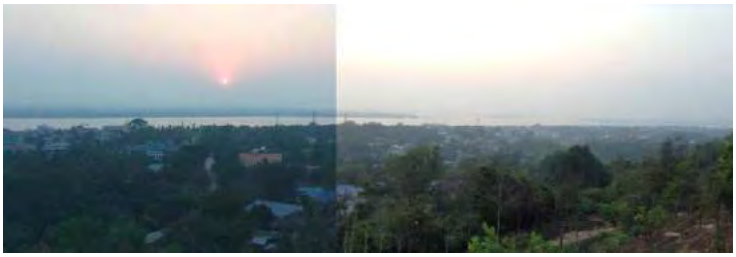
Figure 2.4.1 Current Land Use (General) of Mawlamyine Planning Area

Building Regulation

- According to the interview survey, Mawlamyine does not have any specific regulations related to building and land use.

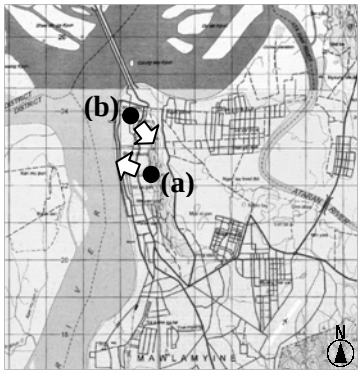
2.4.3 History, Landscape, and Tourism

- Mawlamyine was established in 1573. The Ataran River is in the east while Chaung Sone Town and the Thanlwin River are in the west of the city. Mawlamyine became a famous city because of the tourist attractions like the ancient pagodas and historical culture, Taung Wine Pagodas, ancient colony buildings, churches, the Thanlwin River, Gaung Say Kyun, and Bilu Kyun.
- Beautiful landscape surrounded by green towards the center of Mawlamyine where a lot of historical buildings are located can be overlooked from a viewpoint of Yankin Hill. It also provides a good view of the sunset with the Thanlwin River. There is no high-rise buildings that distort the view from the hill.
- The pagodas and monasteries on Yankin Hill can be seen from many points in the center of Mawlanyine. The perspective to pagodas and monasteries contains religious implications to people in Mawlamyine. Figure 2.4.2 shows the views from and towards the Yankin Hill.



(a) Panoramic View from Yankin Hill Towards West

(b) View Towards Yankin Hill



Point and Direction
of the Views (a) and (b)

Source: JICA Study Team (The pictures were taken in March 2016.)

Figure 2.4.2 View From and Towards Yankin Hill

2.5 Infrastructure

2.5.1 Transport and Road

- On-road Cargo Handling: Traffic congestion is observed during peak hours of cargo handling on Strand Road. Provision of cargo handling space could solve this issue.
- Public Transport: Generally, traffic congestion is not found in the city except on Strand Road mentioned above. Large-sized bus is not allowed to operate for short-trip traffic in the city. It is easy to catch small-sized taxi (motorbike or light truck type) everywhere in the city.
- Bus Terminal: Mawlamyine Bus Terminal will become saturated and the expansion is planned already.
- Truck Terminal: Zeigyo Truck Terminal is located in the built-up area and the relocation of the terminal might be considered. A possible candidate for the relocation might be the new industrial area in Kyauktan which is located further south from Zeigyo.
- New Bridge: The access road for Thanlwin (Chaung Sone) Bridge in Mawlamyine City is quite narrow.
- Abandoned Track: Since the completion of new railway track, the section towards the old station has not been used for passengers.
- International Freight: The international freight was not in service. It will be necessary to confirm the role of the airport and development priorities of the airport.
- Domestic Freight: The domestic freight is in service only once a week. It will be necessary to confirm the role of the airport and development priorities of the airport.

2.5.2 Water Supply

- Mawlamyine Township area is supplied piped water up to 22 out of 40 quarters from four intakes of water source. Currently, the water demand is nearly twice compared with the water supply volume.
- Many people need to rely on other water sources such as tube well, dug well, hand pump, and brick reservoir. The population connected to the Mawlamyine City Development Committee's water supply system remains as low as 18% of the total population and total number of taps is only 8,500. The promotion of tap water connected to the houses is urgently needed in Mawlamyine City
- Regarding the current situation on quality of raw water from the river system (Ataran-1 and Ataran-2), appropriate purification process and chlorination disinfection are not applied throughout the system. This indicates a risk to health, if the raw water contains coliform.
- According to Mawlanyine City Development Committee, 75% of the citizens purchase bottled water for drinking purpose but the remaining 25% are the poor citizens who cannot purchase bottled water and are drinking untreated or unsanitary water after boiling.
- Depending on the growth of demand, human resource capacity development is needed for operating water supply system and managing administration.

2.5.3 Sewerage

- There is no public waste water treatment plant (WWTP) to collect and treat domestic wastewater in Mawlamyine City. A domestic wastewater is discharged without appropriate treatment to street drainage, and finally flows into rivers and ponds. Also there are many households which cannot use toilet on clean sanitary conditions. These mainly cause water pollution.

- Although the water injection type toilet without a septic tank has become extensively popular, the toilet of this type should be changed with proper septic tank or connected to sewerage system. Furthermore, there are no modern night soil treatment plants in Mawlamyine City, and excreta or excess sludge removed from a pit toilet or a septic tank is thrown into the existing final dumping site without stabilization pond system.

- Project of sewerage system and sanitary night soil treatment plant are strongly required in Mawlamyine City. However, these projects require long time and large funds.

2.5.4 Drainage

- The capacity of the existing drainage and channel in Mawlamyine City is not enough against heavy rains. So, low-lying areas in the city are sometimes flooded every year. There are not enough gates, banks, and pumps which prevent flooding in the low-lying areas.

- Some hydrological surveys on existing drainage shall be required and a meteorological observation shall be collected for improvement of the drainage system.

- Soil sediments and garbage have accumulated on many drainage or canals. Some illegal buildings are on a canal. A small culvert at a road crossing is a bottleneck of the flow.

2.5.5 Solid Waste

- The final disposal sites are simple dumping sites without any pollution control facility (no landfill liner and no drainage of leachate). The issue of illegal industrial waste dumping and open burning of fields was long done there. As a result, the harmful acts caused pollution to the environment. The improper solid waste management will pose high risk on health and high impact on the environment.

- Collected solid waste is rapidly increasing in Mawlamyine City, then the capacity of the final disposal sites will be decreased. So, Mawlamyine City Development Committee shall start the 3R policy (recycle, reuse, and reduce) for environmental efforts.

2.5.6 Electricity

- In Mawlamyine, at the transmission level, the voltages are 230 kV and 66 kV. The input of the only primary substation in Mawlamyine (230/66/11 kV, 50 MVA x 2) comes from Thaton Power Substation with a 230 kV transmission line. The 230 kV main bus of the primary substation is also connected to the Mawlamyine combined cycle independent power producer (IPP). From the 66 kV main bus on the secondary side of the Mawlamyine primary substation, one feeder named Mawlamyine Feeder serves Mawlamyine Township by three 66 kV substations. According to the Ministry of Electric Power and Energy (MOEPE), these transformers are running on full load during peak season.

- There is one combined cycle IPP in Mawlamyine Township directly connected to the 230 kV primary substation. The existence of Myanma Oil and Gas Enterprise (MOGE) gas pipeline connected to Yadana-Zawdika Natural Gas Pipeline which goes through Mawlamyine, provides the potential to build another new power plant in the target area.

- Based on the latest available loading data and the MOEPE's load forecast, loading capacity of the power transformers has been assessed. According to the assessment, all the power transformers are already running on almost full load during peak hours and will be overloaded during peak season by the year 2017.

- According to MOEPE, current distribution loss in Mawlamyine is around 25% to 30%, which is a large value.

2.6 Social Service

2.6.1 Education

- The literacy rate in Mawlamyine Township is more than 95% and it is higher than its surrounding area and whole Myanmar, which indicates that basic education prevails more widely in the city.
- School attendance in Mawlamyine Township decreases gradually after the completion of the primary education cycle and the similar trend is shown for the whole Myanmar. Two of the main reasons of the gradual decrease of school attendance are economic difficulty of the household to send their children to school, where they cannot pay for the opportunity cost, and another is schools are located too far from home causing the children to commute.
- Preparation of facilities for primary and middle school education in Mawlamyine Township is at lower level than that of the whole Myanmar. In particular, the number of students per middle school in Mawlamyine Township is especially higher, which is beyond 1,100. And there is a tendency that the facilities will be insufficient in new urbanized areas with increasing number of housing and children.
- In terms of the population ratio whose highest level of education completed is under primary school in Mawlamyine Township is 22-25% lower than the surrounding areas and the whole Myanmar. However, the population ratio whose highest level of education completed is more than the university or college in Mawlamyine Township resulted higher values than the surrounding areas. It suggests that highly educated people are more concentrated in the city compared with the surrounding areas.

2.6.2 Health

- Basic health indicators of infant mortality rate, under-five mortality rate, and maternal mortality rate in Mawlamyine Township have improved in recent years. The health indicators are mostly same or better than the whole Myanmar.
- There are 10 hospitals, 139 clinics, 3 urban health centers, 2 sub-urban health centers, 3 rural health centers and 13 sub-rural health centers in Mawlamyine Township. In addition to Mawlamyine General Hospital, which is the state hospital of Mon State with 500 beds, there are big private hospitals like Yadanarmon Hospital and Zarni Bwar Hospital. Most of the hospitals are located in urban areas, while rural areas are mainly covered by small clinics and rural/sub-rural health centers.

2.6.3 Poverty

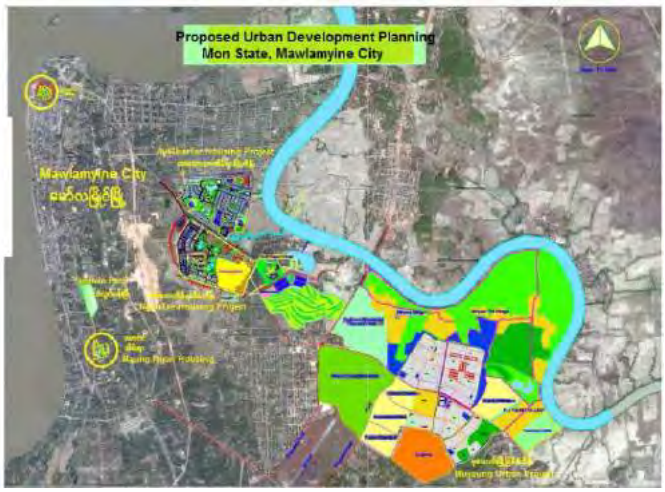
- The United Nations Development Programme (UNDP) implemented integrated household living conditions surveys in the whole Myanmar area in 2005 and 2010. Ratios of poor population in both urban and rural in Mon State area decreased from 2005 to 2010.

2.7 Relevant Plans and Projects

2.7.1 Existing and Past Plans

Conceptual Plan by MOC

- The Government of Myanmar laid down a policy on urban and regional development. It urged regional/state government to make long-term plans for urban development for their region, which is considered from comprehensive points including society, economy, environment, and infrastructures. To follow the policy, Mon State requested MOC to support the preparation of the plan. The MOC made urban development plans of Mawlamyine City in 2013, which consists of the current situation of the city including urban infrastructures and social status, and proposed urban development project including new urban area development and housing redevelopment project. Figure 2.7.1 shows the proposed project location for Mawlamyine in MOC plan. Although the plan includes some future development projects, it does not include future development vision, future structure plan, and land use plan.



Source: Mawlamyine Urban Development Conceptual Plan, MOC

Figure 2.7.1 Proposed Project Location for Mawlamyine in MOC Plan

Mawlamyine Town Plan by Mawlamyine Township Development Committee

- Mawlamyine town plan was made by Mawlamyine Township Development Committee in January 2016. The plan consists of current situation of the city including infrastructure and social status, and proposed development projects. Although the plan can be used to introduce current conditions of Mawlamyine, it is not used as future comprehensive development plan.

2.7.2 Ongoing and Planning Projects

- In Mawlamyine Planning Area, some housing supply projects are ongoing, being conducted by the public sector. In addition, “Kyauktan Industrial Zone” will be an important project to promote industrial and logistic function in Mawlamyine.

3 Development Visions and Socioeconomic Framework

3.1 Development Visions and Strategies

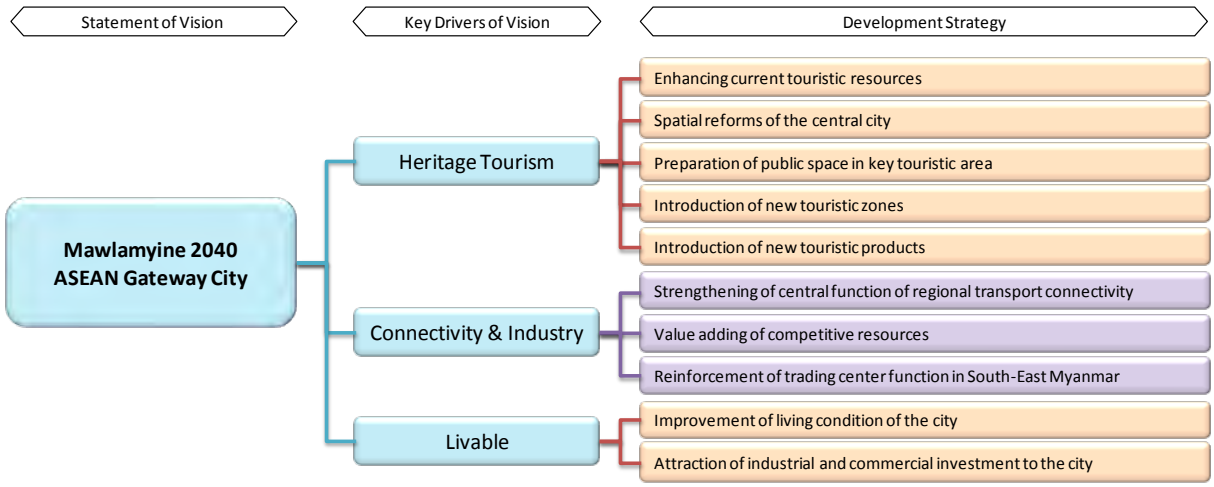
3.1.1 Development Visions

- Then the development vision of Mawlamyine was established as "ASEAN Gateway City". It intends that by 2040, Mawlamyine will be known as a world-class heritage tourism city with a spectacular waterfront and with a growing and advanced manufacturing zone focused on primary products like rubber in the south of the city. Figure 3.1.1 describes the development vision for Mawlamyine 2040.

Source: JICA Study Team

Figure 3.1.1 Development Vision for Mawlamyine 2040

3.1.2 Development Strategy



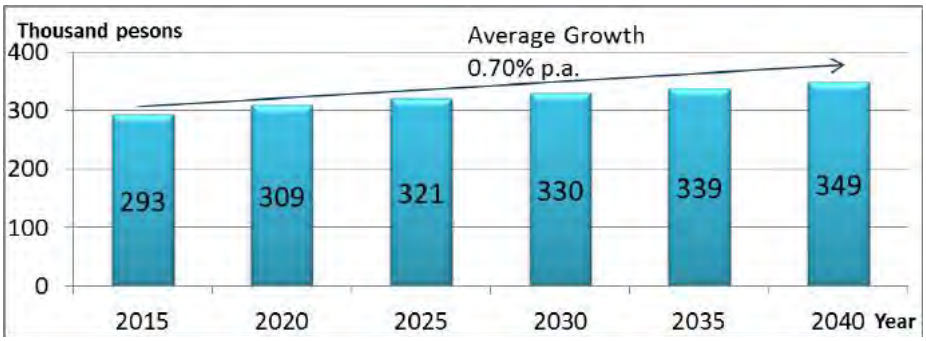
Source: JICA Study Team

Figure 3.1.2 Development Strategy in Linkage with Development Vision

3.2 Socioeconomic Framework

3.2.1 Demographic Framework

- Based on the assumptions, the population of Maylamyine Township is forecasted to reach **349,000 in 2040 from 293,000 in 2015, showing an increase of 56,000 persons.** This corresponds to an average annual growth rate of 0.70% during 2015-2040. Table 3.2.1 and Figure 3.2.1 show the forecasted population until 2040.



Source: JICA Study Team

Figure 3.2.1 Population Forecast of Mawlamyine Township

- MOC's Conceptual Plan for Mawlamyine City forecasts the population growth for a 10-year time from 2012 to 2022 at an average rate of 2.0% annually, although the conceptual plan shows at the same time that the annual growth rate for the preceding 15 years (1997 to 2012) was only 0.6% on average. UN HABITAT's Demographic Study of Mawlamyine (July 2015) have projected annual growth rates of population until 2040 in a close range to the above forecasted by the JICA Study Team (UN HABITAT: 0.68% for slow scenario and 0.71% for moderate scenario).

3.2.2 Economic Framework

- Reflecting on the proportion of calculated productivity index of the target area to that of Mon State, GRP of the target area was computed as shown in Table 3.2.1. **The GRP is forecasted to grow by 6.3 times and will reach MMK 3,100 billion in 2040** from MMK 490 billion in 2015 at constant prices. **The GRP per capita is forecasted to grow by 5.3 times arriving at over MMK 8.9 million in 2040** from MMK 1.7 million.

Table 3.2.1 GRP of Mawlamyine Township from 2015 to 2040

Item	2015	2020	2030	2040	Average Annual Growth Rate
Mon State	2,529	3,752	7,695	14,857	7.3%
Mawlamyine Township GRP (MMK in billions)	491	739	1,563	3,101	7.7%
Mawlamyine Township Population (in thousands)	293	309	330	349	0.7%
GRP per capita (MMK in millions)	1.67	2.39	4.73	8.88	6.9%
Mon State: GRP Index (A)	2,507	2,610	2,710	2,799	
Mawlamyine Township: GRP Index (B)	487	514	550	584	
(B)/(A)	19.4%	19.7%	20.3%	20.9%	

Note: GRP figures forecasted are based on 2010/11 prices.
Source: JICA Study Team

4 Urban Development Policy

4.1 Spatial Plan

- In light of the past trends and considerations of logistics function and some large-scale development projects, the urbanization of Mawlamyine is likely to extend outward, especially southwards and west and eastwards in connection with the ASEAN Highway direction of Hpa-An. By constructing a new bridge, connection with Chaungzon Township shall also accelerate urban development in the future trend.

- The central business district (CBD), which is the center of Mawlamyine including traditional market and jetty port, has limited potential for future expansion of its central business function due to lack of surplus land for new development and complicated land ownership. Preservation of the beautiful panoramic view from Yankin Hill to the Than Lwin River is also considered as a symbol and tourism attraction of the city. To be a national gateway city, development of new CBD and promotion of tourism destination are necessary to lead business and economic activities of Myanmar as well as Mawlamyine. Development of new CBD in the vicinity of the new railway station is recommended.

- Population of Mawlamyine by 2040 will increase to 56,000. Setting 100 persons/ha as appropriate population density of the new town and the required land for new town development mainly for residential function would be 5.6 km^2 (1,383 acre). The required lands have been allocated in the spatial plan.

Table 4.1.1: Required Land for Future Population Increase of Mawlamyine

Items	Population of 2015	Population of 2040	Population Increase	Density of New Town (person/ha)	Required Land (ha)	Required Land (km2)	Required Land (acre)
Mawlamyine	293,000	394,000	56,000	100	560	5.6	1,383

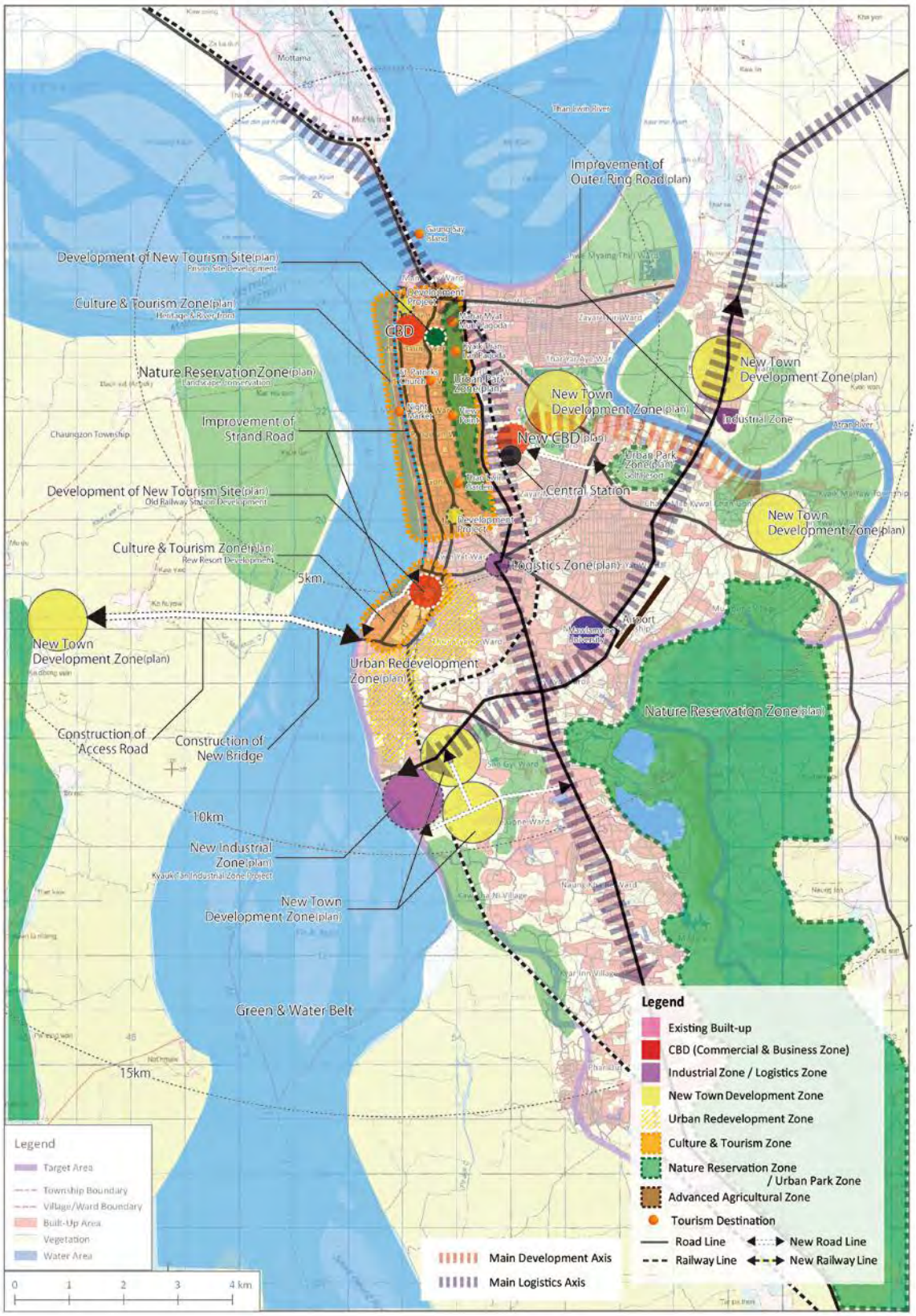
Source: JICA Study Team

Table 4.1.2: Proposed Zones and Contents in the Spatial Plan of Mawlamyine

Items / Zones	Characteristics of Zone	Proposals in the Spatial Plan
Existing Built-up (Residential and Mixed-use)	Current urbanized areas which are covered by buildings mainly for residential, commercial, and mixed-use.	All areas would be upgraded gradually in its environment, infrastructure, and social service. The south area of the city center is likely to be necessary for urban redevelopment.
CBD (Commercial and Business)	Current center of commercial and business area leads economic activities of Mawlamyine. It includes traditional market and jetty ports.	Although existing CBD function must be kept in the future, it is likely more for tourism attracting foreign tourists. Townscape and building height must be controlled.
Industrial Zone Logistics Zone	Industrial and logistic functions must be in good connection with other focal cities and countries by roads, railways, and water as the gateway city of the ASEAN.	Mawlamyine has less industrial function currently other than the industrial zone located at east side of the Atran River. Logistics function is necessary in the future in linkage with other gateway cities.
Urban Redevelopment Zone	In the existing built-up area, low-level residential areas (informal houses) seem to exist without access to proper infrastructure.	An area along the Than Lwin River in the south shall be improved with proper road system and infrastructure.
New CBD (Commercial and Business Zone)	To accelerate economic growth, development of highly functional commercial and business area is necessary.	New CBD is proposed at the central station area, east side of Yankin Hill. In this area, high-rise buildings shall be allowed for better function.

New Industrial Zone New Logistics Zone	To be a connectivity and industry city, expansion of industrial and logistic functions is important.	New industrial zone, Kyauk Tan Industrial Zone, is under construction located in the south of the city by local developer.
New Town Development Zone (Residential and Mixed-use)	New town includes function of not only residential but some commercial and business as mixed-use.	Development of new town with an area of 5.6 km^2 in total is necessary in the future. Several new towns are proposed at the vicinity of industrial zone and new CBD and suburbs such as Chaungzon Township.
Culture and Tourism Zone	To encourage tourism development, promoting culture and tourism zone is recommended to conserve and utilize historic resources and good panoramic view. Improvement of access is also necessary.	Main two culture and tourism zones were proposed, namely: heritage river-front zone and new resort development zone. Since Strand Road along the river has good atmosphere and connection of two proposed zones, improvement of the road as tourist place is recommended as Tourism Axis.
Urban Park Zone Green and Water Belt Zone	To upgrade urban environment, both urban parks inside the city and green and water belts surrounding the city are necessary.	Yankin Hill and panoramic view toward west side (sunset view) must be conserved and utilized as urban park for symbol and key tourism destination of the city. Then, the Lwin River and Atran River are functioned as appropriate green and water belts.
Nature Reservation Zone	In nature reservation zone, development activities are basically prohibited to avoid urban sprawl and to keep the city more compact and efficient.	Mountain in the southeast must be conserved as nature reservation zone of Mawlamyine for water reservation.

Source: JICA Study Team



Source: JICA Study Team

Figure 4.1.1: Proposed Spatial Plan of Mawlamyine Planning Area

4.2 Urban Development Policy

4.2.1 Commercial, Business and Industry

- The following table shows the development policy of commercial, business, and industry in Mawlamyine City, especially for achieving a future city to be connectivity and industry as ASEAN gateway city. In order to execute these policies, spatial control is collective and principal measures for the realization of urban development policies and projects have to be undertaken by the local and central government. These control measures are expected to be executed based on the law, by-laws, and other legal frameworks. Concrete measures are described in Chapter 7.1.2 of this report.

Table 4.2.1: Development Policy of Commercial, Business, and Industry in Mawlamyine

Commercial, Business, and Industry Policy	1) Spatial Improvement of Current Central Area 2) Relocation and Functional Reform of Logistics Zone of the City 3) Redevelopment of Former Railway Station Site (Sub-center Development) 4) Promotion of Industrial Investment to Kyank Industrial Zone 5) Construction of New CBD Area

Source: JICA Study Team

4.2.2 Housing

- In accordance with population growth, increase of migrant workers based on the demands of industrial areas and change of living styles, corresponding housing units are expected to be supplied in conformity to the city plan. To be livable city, housing development should secure quality and quantity. Typical housing demands and issues for the realization of the development vision of Mawlamyine City are concluded as follows:

Table 4.2.2: Development Policy of Housing in Mawlamyine

Housing Policy	1) Improvement of Current Residential Areas with Reconstruction of Buildings 2) New Town Development around the Station (housing supply by new residential types, apartment building, modern-style building) 3) Housing Supply around Industrial Areas for Workers (introduction of affordable housing units and social housing, need to be supplied for new migrant workers in the industrial areas) 4) New Residential Development in Remote Areas

Source: JICA Study Team

4.2.3 Landscape and Tourism

- Mawlamyine attracts tourists due to its heritage sites such as pagodas on the hill, heritage buildings that remained as a historical town of the British colonial period, as well as its unique natural landscape including Yankin Hill and the Thanlwin River. Considering not only the tourist attraction in the area but also the location which is between Thailand and Yangon, Mawlamyine has a big potential in the tourism sector at the international level in the future. However, preservation and utilization of heritage and landscape are not well managed and there is a need for development of tourist zone also to become an international tourist destination. The following policies should be considered to establish an attractive tourism city, heritage tourism as the key driver, utilizing and enhancing the tourism function and landscape of Mawlamyine:

Table 4.2.3: Development Policy of Landscape and Tourism in Mawlamyine

Landscape and Tourism Policy	1) Enhancing Current Tourism Resources 2) Introduction of New Tourism Zones 3) Introduction of New Tourism Products

Source: JICA Study Team

4.2.4 Environment and Agriculture

- Since Mawlamyine will be developed as livable and heritage tourism city by 2040, there are environmental concerns that need to be addressed in its development policy. There are four main concerns to be taken into consideration: a) nature conservation, b) pollution control, c) living conditions, and d) natural hazard.

Table 4.2.4: Development Policy of Environment and Agriculture in Mawlamyine

Environment And Agriculture Policy	1) Creation of Nature Reservation Zone 2) Monitoring Air and Water Quality 3) Ensuring Less Impact on the Environment

Source: JICA Study Team

5 Infrastructure Development and Social Service Policy

5.1 Road and Transportation

- Traffic survey data is not available and the quantitative demand analysis could not be conducted. According to the visual observation, there is no congestion on the road network in Mawlamyine even during morning/evening peak hours. Cargo handling activities on the road, loading and unloading on the road, induce traffic blockade on Strand Road and streets around the market near Strand Road are common in the streets of Mawlamyine.

Table 5.1.1: Development Policy of Road and Transportation in Mawlamyine

Road and Transportation Policy	1) Provision of Urban Development Axis 2) Provision of Logistic/Industrial Development Axis 3) Provision of Public Transportation

Source: JICA Study Team

5.2 Water Supply

- Designed water supply population multiplied the future population by the water supply cover rate of the target year. Although water supply cover rate is dependent according to the status of use of wells, from the point-of-view of public health or environment, it should target the highest possible level. In this study, the water supply cover rate has set 90% by referring to the interview to Mawlamyine CDC. The forecast of designed water supply population for every target year is shown in Table 5.2.1.

Table 5.2.1: Served Population of Water Supply in Mawlamyine Township Up to 2040

Year	2015	2020	2025	2030	2035	2040
Urban Area Population (thousand)	258	273	284	294	303	313
Rural Population (thousand)	36	37	37	37	35	36
Total Population (thousand)	293	309	321	330	338	349
Service Coverage Rate (%)	55%	63%	71%	79%	85%	90%
Served Population (thousand)	161	195	228	261	287	314

Source: JICA Study Team

Table 5.2.2: Development Policy of Water Supply in Mawlamyine

Water Supply Policy	1) Upgrading of Shwe Nat Taung Dam Water Supply System 2) Upgrading of Kim Mon Chone Dam Water Supply System 3) Upgrading of Attran-1 and Attran-2 River Water Supply System 4) Extension of Water Supply System

Source: JICA Study Team

5.3 Sewerage

- The demand of sewerage in the urban area of Mawlamyine was forecasted to be about 40,000 m^3/day in 2040. For preserving the sanitary water environment in the urban area, the development of "efficiently and advanced sewage treatment system" is required according to the increasing amount of sewage discharge. The forecasted demand of sewerage for each target year in the urban area of Mawlamyine is shown in Table 5.3.1.

Table 5.3.1: Demand of Sewerage in Mawlamyine (Urban Area) Up to 2040

Year	2015	2020	2025	2030	2035	2040
Target Coverage Rate (%)	0%	15%	30%	45%	60%	72%
Covered Population (in thousands)	0	29	68	117	172	251
Domestic Sewage (lpcd)	93	100	110	120	130	130
Non-Domestic Sewage Rate (%)	10%	10%	10%	10%	10%	10%
Infiltration and Inflow Rate (%)	10%	10%	10%	10%	10%	10%
Daily Maximum Rate	1.1	1.1	1.1	1.1	1.1	1.1
Demand for Sewerage Daily Average (m^3/day)	0	3,539	9,104	17,054	27,087	39,514
Demand for Sewerage Daily Maximum (m^3/day)	0	3,893	10,014	18,759	29,796	43,465

Source: JICA Study Team

Table 5.3.2: Development Policy of Sewerage in Mawlamyine

Sewerage Policy	1) Improve the Water Environment in Public Water Areas 2) Improve the Sanitary Living Environment 3) Use the Flushing-clean Toilet 4) Develop the Beautiful City with Wealthy Water and Green

Source: JICA Study Team

5.4 Drainage

- Stormwater in Mawlamyine Township flows into the Thanlwin River or the Attran River. The area in the east side and near the Attran River have low and flat topography. Hence, these areas basically have drainage problems. Although habitual flood occurs in some areas, people do not seem to consider this as a big problem because flood usually disappears a few hours later. Also, flood depth is normally less than knee high. The issue points of the drainage are shown below.

a) Some drainage canals have accumulated soil sediments, which inhibit the flow .
b) There are not enough gates, banks, and pumps which prevent flooding in the low-lying areas.
c) The increase of rain water runoff rate following urban development is a concern due to expansion of flooding.

Table 5.4.1: Development Policy of Drainage in Mawlamyine

Drainage Policy	1) To Reduce the Frequency of Flooding in Urban Area 2) Existing Drainage Should be Used as much as Possible but shall be Upgraded and Extended

Source: JICA Study Team

5.5 Solid Waste

- Considering the present collected garbage, the demand of solid waste management is roughly calculated by unit volume (0.56 t/thousand-p/d) of the other project. As a result, the demand of solid waste management in the urban area of Mawlamyine was forecasted to be about 64,000 tons/year in 2040. The 3Rs policy (Reduce, Reuse, and Recycle) is required for reducing solid waste which continues to increase. Therefore, the scenarios of the 3Rs are assumed below. The forecasted demand of solid waste for each target year based on the scenario of the 3Rs policy in the urban area of Mawlamyine is shown in Table 5.5.1.

a) Scenario-A: reduce 10% by reuse of available material from waste
Reuse (10% by 2040)
b) Scenario-B: in addition, reduce 10% by recycle of organic material
Reuse (10%) + Recycle (10% by 2040)
c) Scenario-C: moreover, reduce 15% by incineration of waste
Reuse (10%) + Recycle (10%) + Reduce (15% by 2040)

Table 5.5.1: Demand of Solid Waste Management in Mawlamyine (Urban Area) Up to 2040

Year		2015	2020	2025	2030	2035	2040
Urban Population (in thousands)		258	273	284	294	303	313
Unit Volume (t/thousand-p/day)		0.56	0.56	0.56	0.56	0.56	0.56
Demand of Solid Waste Management (t/day)		144	153	159	165	170	175
Yearly Total Demand (t/year)		52,560	55,845	58,035	60,225	62,050	63,875
Scenario-A of 3Rs:	Reuse Rate (%)	0%	2%	4%	6%	8%	10%
	Reuse (t/year)	52,560	54,728	55,714	56,612	57,086	57,488
Scenario-B of 3Rs:	Recycle Rate (%)	0%	2%	4%	6%	8%	10%
	Recycle (t/year)	52,560	53,634	53,485	53,215	52,519	51,739
Scenario-C of 3Rs:	Reduce Rate (%)	0%	3%	6%	9%	12%	15%
	Reduce (t/year)	52,560	51,992	50,142	48,120	45,669	43,116

Source: JICA Study Team

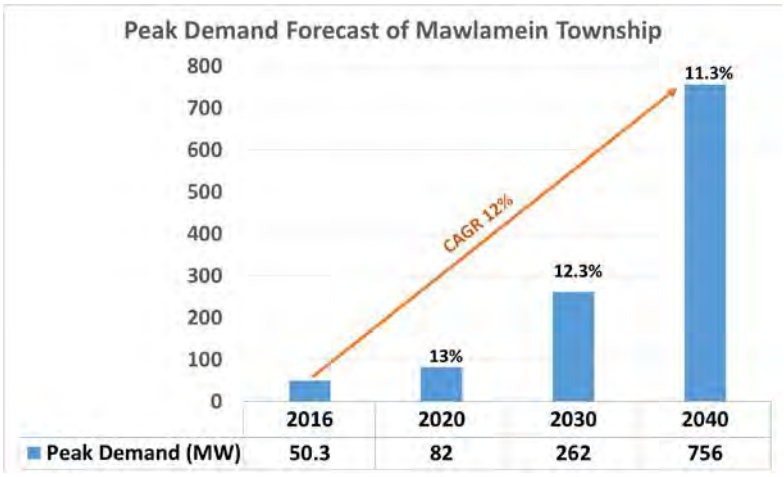
Table 5.5.2: Development Policy of Solid Waste in Mawlamyine

Solid Waste Policy	1) Renewal of Solid Waste Management with Safety 2) Promote 3Rs (Reduce, Reuse, and Recycle) 3) Buildup of Sound Material Cycle Society 4) Reduce Environmental Impact by Disposal of Hazardous Wastes Properly

Source: JICA Study Team

5.6 Electricity

- By comparing the GRP growth trend in constant price and the peak demand growth trend, a rough estimation of elasticity value equal to 1.74 has been predicted for the Mawlamyine Township. Since both the GRP growth trends and peak power demand trends are based on limited time period of history and various conditions on data, the elasticity value may have a certain degree of deviation. But for the moment, this is assumed to be the best value of elasticity. The forecasted growth rate of peak power demand is assumed to be equal to 'elasticity value' times of forecasted 'GRP per capita growth rate'. By considering the abovementioned data, the peak demand growth forecast for public load till 2040 is made and is shown in Figure 5.6.1. The CAGR of this forecast is 12%.



Source: JICA Study Team

Figure 5.6.1: Peak Demand Forecast of Mawlamyine Township

Table 5.6.1: Development Policy of Electricity in Mawlamyine Township

Electricity Policy	1) Distribution Loss Reduction 2) Developing Digital Database 3) Comprehensive Urban Energy and Electric Power System Development Plan 4) Upgrading and Strengthening of Primary Substations Network 5) Involvement of the Ministry of Electrical Power and Energy (MOEPE) in Urban Planning

Source: JICA Study Team

5.7 Social Service

- Benefits from the achievements of the master plan of Mawlamyine Planning Area including economic growth and improvement of environmental condition should be shared with all the people in the community. This means not only increasing the incomes of the poor, but also addressing the needs of the disadvantaged and excluded groups. In addition, the development should allow them to fully participate and contribute in the process of growth. To achieve inclusive development, it is key to provide equal opportunity and accessibility to social services for all the people which include all classification in any income groups. To secure the provision of social service, the following development policy should be aimed for:

Table 5.7.1: Development Policy of Social Service in Mawlamyine

Social Service Policy	1) Provision of Equal Opportunity of Education and Employment for All People 2) Provision of Healthy and Secure Living Environment for All People 3) Provision of Social Safety Net for All People

Source: JICA Study Team

6 A Roadmap of Key Project

6.1 Key Projects

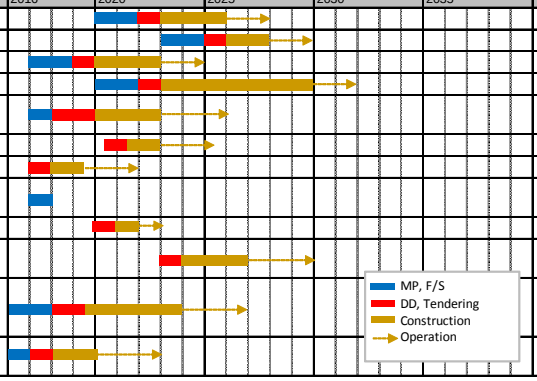
Table 6.1.1:List of Key Projects

Sector	Project Name	Vision (Key Drivers)		
		Heritage Tourism	Connectivity & Industry	Livable
Urban Development	1. New CBD Development Project		++	+
	2. New Tourism Site Development Project	++		
	3. Strand Road Improvement Project	++		+
	4. Heritage Redevelopment Project	++		+
Infrastructure Development	5. Road Network Restructuring and Truck/Bus Terminals Relocation Project		++	
	6. Public Transportation Introduction Project		++	+
	7. Port Facilities Improvement Project		++	
	8. New Port Development Project (Feasibility Study)		++	
	9. Mawlamyine Airport Improvement Project		++	
	10. Access-controlled Highway Project (Study)		++	
	11. Third Greater Mekong Subregion Corridor Towns Development Project (Water Supply and Solid Waste Management)	+	+	++
	12. Power Supply Capacity Improvement Project	+	+	++

Note: ++ Strong Relation, + Relation
Source: JICA Study Team

Table 6.1.2: Implementation Schedule and Rough Cost Estimation of Key Projects

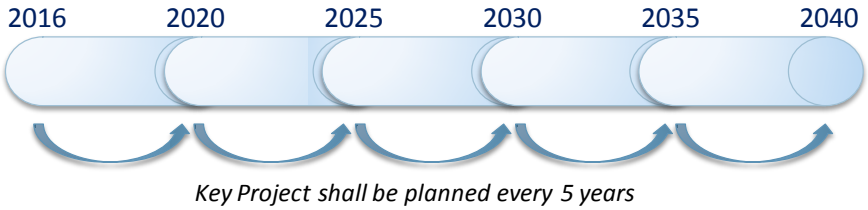
No.	Project Name	Implementation Schedule	Rough Cost Estimation (million USD)	Status*	Implemented by
		2016 2020 2025 2030 2035			
1	New CBD Development Project		77	-	-
2	New Tourism Site Development Project		45	-	-
3	Strand Road Improvement Project		10	-	-
4	Heritage Redevelopment Project		14	-	-
5	Road Network Restructuring and Truck/Bus Terminals Relocation Project		15	-	-
6	Public Transportation Introduction Project		15	-	-
7	Port Facilities Improvement Project		10	-	-
8	New Port Development Project (Feasibility Study)		1	-	-
9	Mawlamyine Airport Improvement Project		10	-	-
10	Access-controlled Highway Project (Study)		1	-	-
11	Third Greater Mekong Subregion Corridor Towns Development Project (water supply and solid waste management)		105	Ongoing (F/S started)	City Development Committee supported by ADB
12	Power Supply Capacity Improvement Project		3	-	-



Note: * " - " in the status column means the project is in proposal stage and its implementation body is not yet determined.
Source JICA Study Team

- It is recommendable that the key projects are planned every five years through the monitoring regard on progress of conducting projects and change of circumstances. According to drafted "Urban and Regional Development Plan", a master plan shall be formulated every 5 – 10 years

under the conceptual plan. In this context, re-planning of key projects shall be one of the works in master planning.



Source: JICA Study Team

Figure 6.1.1: Image of Planning Cycle for Key Projects

Table 6.1.3: New CBD Development Project

Current Status and Issues	Vacant land is currently available in the vicinity of the existing railway station. This land can be used to create a new modern CBD for the city. The new CBD would be completely walkable and pedestrian friendly. The buildings in key locations would be iconic hotel blocks and office towers.
Purpose	Creation of a new CBD with offices, hotels, workplaces, and malls to boost the economic activity of the city.
Main Scope	a) Creating business places, offices, and malls. b) Creating hotels and tourist infrastructure. c) Creating cultural and leisure activities for citizens.

Source: JICA Study Team

Source: JICA Study Team

Figure 6.1.2: Image of New CBD Development Project

Table 6.1.4: New Tourism Site Development Project

Current Status and Issues	The old railway station area is unused and has a potential to be developed as a commercial and tourist area owing to its prime location and connectivity. The project can be developed in two phases: Phase 1 would be the development of the station core area. Phase 2 can be the extension of the CBD in the surrounding area. The redevelopment would comprise mostly of commercial usage with some hotels, restaurants, and cafes. A small railway museum can also be proposed to conserve the historic engines and the railway track.
Purpose	Redevelopment of the old railway station site to a new sub-centre.
Main Scope	a) Commercial development. b) Tourist facilities. c) Strengthening of connectivity to Strand Road.

Source: JICA Study Team

Table 6.1.5: Strand Road Improvement Project

Current Status and Issues	Strand Road has immense potential to be developed as a major tourist zone. Currently, there are not enough tourist facilities in the area and a lot of buildings on the Strand Road are in a dilapidated condition. Some of the interventions required are: to provide additional tourist facilities, development of the public realm, adding open street cafes, adequate lighting and landscaping, provision of jogging tracks, and commercial development to activate the area.
Purpose	Tourist and cultural development of the Strand Road.
Main Scope	a) Development of hotels. b) Development of open cafes and restaurants. c) Development of waterfront promenade and greens. d) Development of the public realm.

Source: JICA Study Team

Source: JICA Study Team

Figure 6.1.3: Images of Strand Road Improvement Project

Table 6.1.6: Heritage Redevelopment Project

Current Status and Issues	Many buildings in Mawlamyine are over 100-150 years old. These buildings are currently being used for administrative uses and their heritage value is underutilized. There are no identified tourist circuits. There is a scope to develop the area around such buildings in order to facilitate heritage conservation and boost tourism. Some of the interventions required are removal of overhead electric lines, adding tourist information boards, adding informal tourist activities, increase accessibility, redevelopment of pavements, and conservation and restoration of the buildings.
Purpose	Conservation of heritage buildings and exploiting the tourist potential of Mawlamyine.
Main Scope	a) Heritage redevelopment of buildings. b) Development of heritage trails that connects various buildings of heritage value. c) Development of tourist facilities around such buildings. d) Signage and infrastructure development. e) Creating awareness and linkages to such buildings.

Source: JICA Study Team

Table 6.1.7: Road Network Restructuring and Truck/Bus Terminals Relocation Project

Current Status and Issue	- Narrow arterial roads (mainly two-lanes) in the city - Abandoned railway track - Truck terminal in built-up areas - Bus terminals are not connected with the railway station
Purpose	Restructuring of the road network and relocation of truck/bus terminals to suit with the proposed urban special plan.
Main Scope	a) Improvement of road network by outer skirts roads. b) Construction of new road on the abandoned railway track and improve accessibility to the new bridge. c) Integration of two bus terminals and the central railway station. d) Relocation of the Zeigyo Truck Terminal.

Source: JICA Study Team

Table 6.1.8: Public Transportation Introduction Project

Current Status and Issue	- Lack of public transportation system - Expanding of the urban area toward south - Less pedestrian sidewalk
Purpose	Modal shift to public transportation and reduce future traffic congestion Upgrading of non-motorized transport (NMT) facility for citizens and tourists
Main Scope	a) Bus service facilities between CBD and the residential area along NH-8 b) Minimum widening of the existing roads for introduction of public transportation (space for bus stop, etc.) c) Construction of sidewalk at least more than 1.5 m in width

Source: JICA Study Team

Table 6.1.9: Port Facilities Improvement Project

Current Status and Issue	Old port infrastructure is still being used in jetties. No parking space is provided for loading/unloading around jetties and traffic congestion is induced by cargo handling works on Strand Road.
Purpose	Ease traffic congestion on Strand Road.
Main Scope	Construction of parking space for cargo handling activity.

Source: JICA Study Team

Table 6.1.10: New Port Development Project

Current Status and Issue	- Shallow depth of the Thanlwin River (approximately 4.5 m) - Necessity of hub port in the region to support national and regional development - New road to Thailand (Thanpyuzayat–Payathonesu) under construction
Purpose	Confirmation of feasibility of the new port
Main Scope	a) Construction of a new port in the region with 12 m depth (Kyaikkami will be a candidate location in the region.) b) Construction of the access road to the proposed new port

Source: JICA Study Team

Table 6.1.11: Mawlamyine Airport Improvement Project

Current Status and Issue	- Cancelation of international pre-flight service in 2015 - Budget constraint and damaged airport infrastructure
Purpose	Proper maintenance and repair of airport infrastructure
Main Scope	a) Overlaying of the runway b) Replacement/improvement of damaged/old facilities

Source: JICA Study Team

Table 6.1.12: Access-controlled Highway Project (Study)

Current Status and Issue	Existing highway, NH-8, serves as a “community road” and also a “logistic road” and might induce safety risk to vulnerable villagers along the road. There are several road construction projects between Myanmar and Thailand and the logistic axis to Yangon shall be upgraded.
Purpose	Improvement of traffic safety on the existing two-lane road between Mawlamyine and Yangon. Provision of high-standard logistic axis road to accelerate regional and national development.
Main Scope	Feasibility study for the access-controlled highway between Mawlamyine and Yangon.

Source: JICA Study Team

Table 6.1.13: Third Greater Mekong Subregion Corridor Towns Development Project (Water Supply and Solid Waste Management)

Current Status and Issues	**1. Water Supply** Need to extend/improve all networks, increase amounts/qualities of water produced and to reduce levels of NRW. In concert with these, operational and financial management needs to be improved, whether this is within government or the private sector. For Mawlamyine there is a real risk to current systems from expected future climate change. In addition, proposals for dams on existing supply rivers provide a high level of uncertainty as to the location of any new surface water intakes. But an area of the country which receives an average of 5 meters of rain per annum should not really have a problem in developing an appropriate and safe supply of potable water. **2. Solid Waste Management** The Mawlamyine (MTDC) provides solid waste collection services to 23 of the

	28 wards (covering about 90% of the total population). It has only 7 waste vehicles for and manages to collect waste twice a week. The town produces about 142 ton/day and about 50% of waste is collected and dumped at the designated dump site. Hazardous waste is not separately collected but mixed with household waste. There is a clear risk of contamination of these water resources by leachate from the dump site. The illegal burning of waste takes place at the dump site to reduce waste volumes.
Purpose	**1. Capacity Building Program (included Water Supply)** The Mon State Capacity Building Program (MS-CBP) should be composed of training sessions, on-the-job training, workshops and also specific studies and small pilot projects. **2. Solid Waste Management** The 3Rs of "Reduce, Reuse and Recycling" formulate the most preferred options, because the main goal of solid waste management is reducing and eliminating adverse impacts of waste materials on human health and environment.
Main Scope	**1. Capacity Building Program (included Water Supply)** ・ Capacity Strengthening for Project Implementation ・ Technical Strengthening in house technical knowledge and practice ・ Strengthening O&M of urban services by involving the private sector ・ Strengthening Urban (and Spatial) Planning **2. Solid Waste Management** ・ Collection Improvement ・ Recycling + Hospital Waste Incinerator ・ New Controlled Landfill (Cell No.1: 3.0ha) ・ Compost Plant

Source: Preparing Third GMS Corridor Towns Development "MON STATE REPORT (Dec 2015)" by ADB

Table 6.1.14: Power Supply Capacity Improvement Project

Current Status and Issues	Currently, the overall capacity of primary substations are almost full during peak demand and existing primary transformers will be overloaded during the peak season by the year of 2017.
Purpose	Ensuring the supply reliability of electric power.
Main Scope	a) Installation and rehabilitation of 66 kV substations and/or b) Upgrading 66 kV substations to 132 kV substations with higher loading capacity c) Enable well-planned cascade connections to ensure N-1 contingency condition

Source: JICA Study Team

6.2 Future Image of Mawlamyine 2040

- A bird's-eye view of future urban image of Mawlamyine was drawn in clan-based graph drawing. The view from west is the river-front area, Yankin Hill at the middle, and new the CBD behind.

Source: JICA Study Team

Figure 6.2.1: Bird's-eye View of Future Urban Image of Mawlamyine

7 Project Implementation and Urban Management

7.1 Urban Development Management

7.1.1 General View of Urban Development Management by Official

- The spatial control is common and principal measures should be taken by the local and central government for the realization of urban development policies and projects. These control measures are expected to be executed based on the law, by-laws, and other legal frameworks.

- The following shows spatial control zones which are expected to be introduced for the realization of planning items:

  a) Boundary of urbanization area: Determines the areas which can be used and developed for future development. The area is composed of urbanization area, urbanization control area, and development restricted area.
  b) Zoning of land use: The land use determines permitted activities of land and buildings. The planning index, such as the floor area ratio (FAR), building coverage ratio (BCR), open space ratio, and maximum height of building, are prescribed in relation with land use zoning in many cases. It also relates development capacity of each area.
  c) Boundary of specific urban development project: In order to secure the land for future infrastructure facilities and urban development for public purpose, areas are designated in advance, and construction activities in these areas will be restricted.

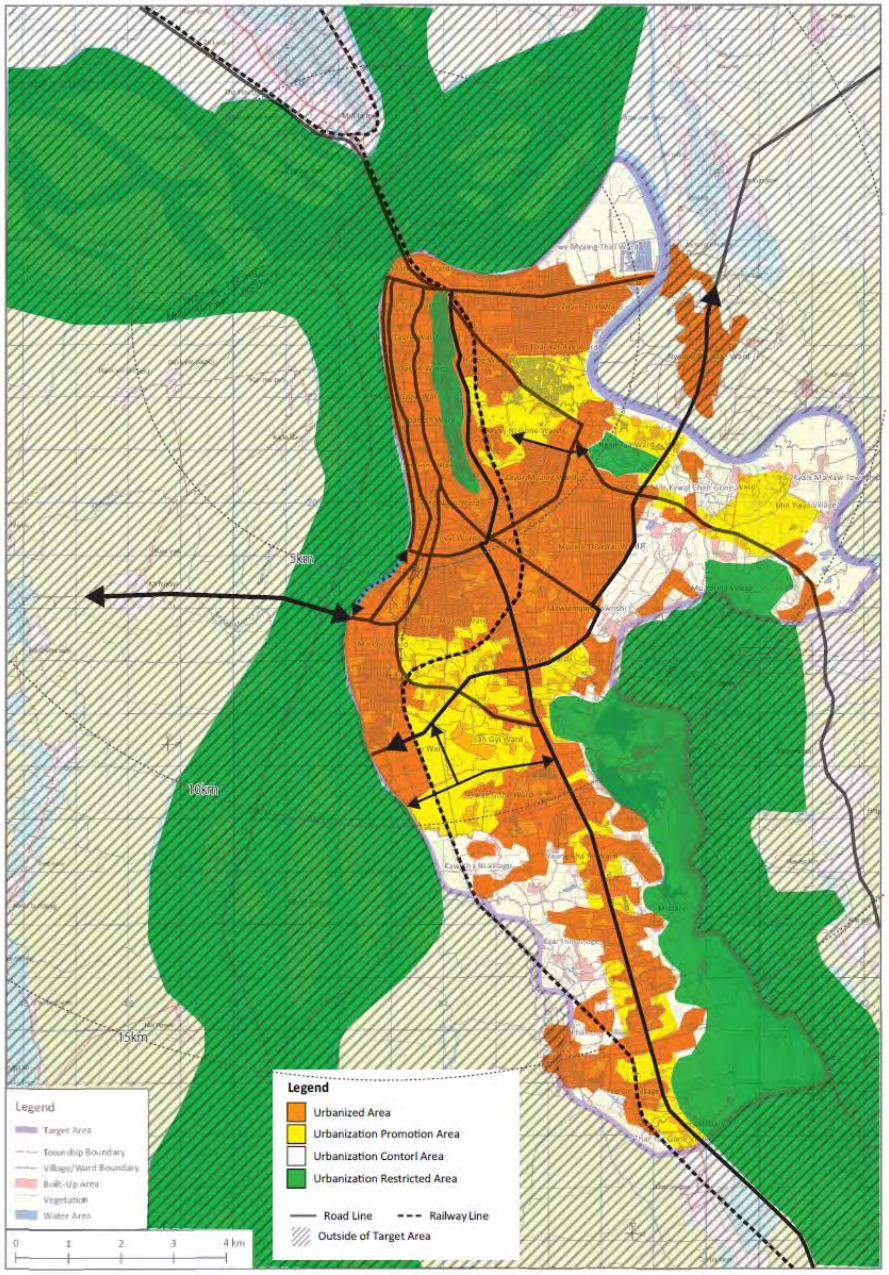
- For the enforcement of the abovementioned control measures, detailed contents of planning items should be examined in the following detailed plan study. Currently, the legal spatial control measures have not been formulated and under preparation in Myanmar. The contents of planning items should be adjusted to the formulation of legal systems, which will be set in the future.

7.1.2 Application of Urban Development Management in Mawlamyine

Area Classifications

- To realize the spatial plan of Mawlamyine for 2040, the development activities by private and public entities should be guided and promoted properly. This shall also contribute to avoid uncontrollable urban sprawl in Mawlamyine which can be a compact city. In this context, Mawlamyine Township shall be classified into four areas in further examination for the formulation of detailed plan as follows:

  1) **Urbanized Area**: which is currently a built-up area (e.g., CBDs, residents, and industrial zones). Some areas shall be targets of urban redevelopment.
  2) **Urbanization Promotion Area:** which is suitable for future urban development by 2040. The areas shall be reserved for development of new towns, CBDs, industrial, and logistics zones.
  3) **Urbanization Control Area**: in which development activities shall be controlled properly but not prohibited. The areas shall be also utilized for urban parks, tourism, and/or green and water belt.
  4) **Urbanization Restricted Area:** in which development activities must be prohibited strictly. The areas shall be reserved for nature conservation and high-valued agriculture development.



Source: JICA Study Team

Figure 7.1.1: Proposal of Area Classification of Mawlamyine

7.2 Capacity Development

- Mawlamyine has experienced receiving groups of specialists and academe for economic, social, and environmental studies of the city and of the region. There are many ongoing regional economic development researches and feasibility studies by non-governmental organizations (NGOs) such as the Asian Development Bank, as Mawlamyine is a strategic city for international trade between Myanmar and Thailand. Due to this geographic position of the city, it is expected that Mawlamyine will continue receiving international specialists for regional development and for its economic projects and urban development projects in the future as well. Thus, one of the areas where capacity development is urgently required for Mawlamyine is the area which requires deeper interaction with the people by international specialists, while the other area is urban management service for densely populated and for expansion of the city.

7.2.1 Capacity Development in Urban Management

- As mentioned, Mawlamyine receives many international visitors and feasibility studies in diverse social concerns and many subjects of studies are related to or influential on its urban development. Thus, it is crucial for Mawlamyine City, as well as the Department of Development Affairs of Mon State government, to be involved in communications and study processes. Although being a part of the discussion process or results of the study may not be strong enough to strengthen the capacity within the Mons State government nor Mawlamyine City Development Organization to become independent to draw and plan a comprehensive development plan for the city, having direct communication enriches the experience and amount of information from such interaction with international experts in urban management and economic development among local officers. Through such experience, it is expected to have increased quality in municipal governance as well as urban management as an eventual result.

7.2.2 Capacity Development in Project Implementation

- Mawlamyine is expected to expand towards the east and to the south of the city as the city grows for the next two decades. This is an inevitable direction as the current urban area is already dense and further densification would cause negative impact on the people's living standard. Mawlamyine will experience higher density urban management and expansion of urban service area at the same time. The Mawlamyine City Development Organization needs to prepare to meet this future demand of city service and urban management at the same time. For this purpose, it is necessary to set up a systematic and well considered urban planning within the City Development Organization in advance, and this is the recommended area of capacity development. Such training program may be conducted locally under the support of international NGOs as well as bilateral support from other countries such as Japan.

7.3 Project Implementation

- In order to implement the development programs, which are described in Chapters 4, 5, and 6, and to realize balanced development as a whole, provision of support and intervention for the project and by public entities are necessary for their adequate implementation. For this purpose, the central government and local government are expected to take a role in the following implementation schemes:

7.3.1 Project Implementation by Government

- Some projects should be implemented by the governments' initiative. Particularly, it is necessary to consider government's initiative for the implementation of unprofitable development project.

7.3.2 Subsidization for Implementation

- Subsidization is effective for promotion of small-scale urban development activities, which is not conducted by large-scale investors.

7.3.3 Project Coordination by the Government

- Generally, large-scale development with profitable business program catches the interest of private investors and its development tends to be individually progressed without effective control. Government involvement in project coordination is expected for appropriate project realization and its management. It is necessary to coordinate individual development project under public entities by planning, licensing, and construction in order to secure its suitability as public-orientated development.

APPENDIX: POSTER