The Republic of the Union of Myanmar
Yangon Region Government (YRG)
Yangon City Development Committee (YCDC)

The Updated Strategic Urban Development Plan of the Greater Yangon

The Project for Updating the Strategic Urban Development Plan of the Greater Yangon

FINAL REPORT I

February 2018

Japan International Cooperation Agency (JICA)

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Data Collection Survey for the Project for Updating the Strategic Urban Development Plan of the Greater Yangon Final Report I

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LIST OF ABBREVIATIONS

Abbreviation	Words
ADB	Asia Development Bank
ASEAN	Association of Southeast Asian Nations
BLT	Build-Lease-Transfer
BOOT	Build-Own-Operate-Transfer
BOT	Build-Operate-Transfer
CBD	Central Business District
CP	Counter Part
DBFO	Design -Build- Finance-Operate
DCMF	Design-Construct-Manage-Finance
DDA	Department of Development Affairs
DHSHD	Department of Human Settlement and Housing Development
DMH	Department of Meteorology and Hydrology
DPMC	Disaster Preparedness Management Committee
DRB	Department of Roads and Bridges
FY	Fiscal Year
GAD	General Administration Department
GMS	Greater Mekong Sub-region
HIS	Household Interview Survey
HHWL	Highest High Water Level
ICHARM	International Centre for Water Hazard and Risk Management
ID	Irrigation Department
IWT	Inland Water Transport
JICA	Japan International Cooperation Agency
KOICA	Korea International Cooperation Agency
MES	Myanmar Engineering Society
MMK	Myanmar Kyat
MOAI	Ministry of Agriculture and Irrigation
MOC	Ministry of Construction
MODA	Ministry of Development Affair
MOPF	Ministry of Planning and Finance
MOSWRR	Ministry of Social, Welfare, Relief and Resettlement
MOT	Ministry of Transport
MOTC	Ministry of Transport and Communications
MPA	Myanmar Port Authority
MR	Myanmar Railways
MRV	Monitoring, Reporting and Verification
NNDMC	National Natural Disaster Management Committee
NNDML	National Natural Disaster Management Law
NNDPCC	National Natural Disaster Preparedness Central Committee
O&M	Operation and Maintenance
ODA	Official Development Assistance
PCCD	Pollution Control and Cleaning Department
PPP	Public Private Partnership
PWRI	Public Works Research Institute
RRD	Relief and Resettlement Department
RRI	Rainfall-Runoff-Inundation
SDZ	Special Disaster Zone
SEZ	Special Economic Zone
SUDP	Strategic Urban Development Plan of the Greater Yangon
TA	Technical Assistance
TOD	Transit Oriented Development
TS	Township
TSG	Township Group
UPD	Urban Planning Department
USD	US Dollar
WtE	Waste to Energy

WWTP	Waste Water Treatment Plant
YCDC	Yangon City Development Committee
YRG	Yangon Region Government
YRTA	Yangon Region Transport Authority
YTU	Yangon Technological University
YUTRA	Project for Comprehensive Urban Transport Plan of the Greater Yangon

CONVERSION RATE (AT FEBRUARY 2017)

1 MMK	= 0.08576 JPY,	1 JPY	= 11.66 MMK
1 USD	= 115.1 JPY,	1 JPY	= 0.008685 USD
1 USD	= 1342 MMK,	1 MMK	= 0.0007451

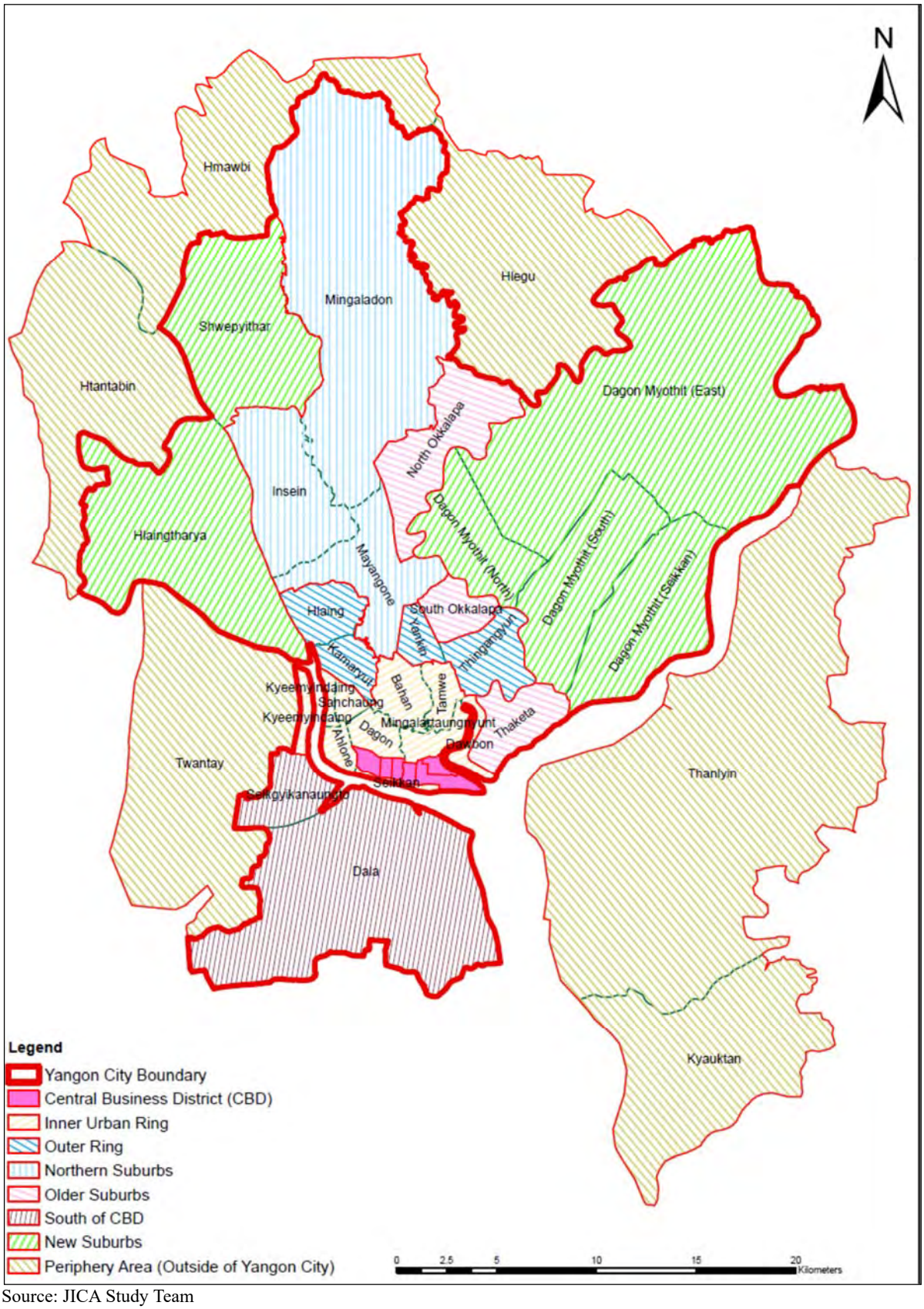
Source: JICA HP

DIFINITION OF THE STUDY AREA AND YANGON REGION

Administrative Boundary		Township Group	Township Name	Definition	
Yangon Region	Yangon City	CBD	Latha	**Whole area of those townships belongs to the target area**	**The Greater Yangon (Target Area) Total 1,535 km^2**
			Lanmadaw		
			Pabedan		
			Kyauktada		
			Botahtaung		
			Pazundaung		
		Inner Urban Ring	Ahlone		
			Kyee Myin Daing		
			Sanchaung		
			Dagon		
			Bahan		
			Tarmwe		
			Mingalar Taung Nyunt		
			Seikkan		
			Dawbon		
		Outer Ring	Kamaryut		
			Hlaing		
			Yankin		
			Thingangyun		
		Northern Suburbs	Mayangone		
			Insein		
			Mingalardon		
		Older Suburbs	North Okkalapa		
			South Okkalapa		
			Thaketa		
		South of CBD	Dala		
			Seikgyikhanaungto		
		New Suburbs	Shwe Pyi Thar		
			Hlaing Tharyar		
			Dagon Myothit (North)		
			Dagon Myothit (South)		
			Dagon Myothit (East)		
			Dagon Myothit (Seikkan)		
	Periphery Area (Outside of Yangon City)		Kyauktan	**Partial areas of each township belong to the target area**	
			Thanlyin		
			Hlegu		
			Hmawbi		
			Htantabin		
			Twantay		
			Taikkyi	*(Outside of the Target Area)*	
			Kawhmu		
			Kungyangon		
			Kayan		
			Thongwa		

Source: JICA Study Team

DIFINITION OF THE STUDY AREA AND YANGON REGION



Source: JICA Study Team

Part I

Survey & Planning Work

Chapter 1: Introduction

1.1 Background

Yangon Region, the largest economic center of Myanmar, has a population of approximately 7.36 million in 2014 (National Census). However, infrastructure has become decrepit due to limited investment and technical support caused by long economic sanction, and it becomes a bottleneck for sound urbanization while the current rapid urbanization and increasing population are putting more pressure on the existing old infrastructure.

Under such circumstances, The Project for the Strategic Urban Development Plan of the Greater Yangon (hereinafter referred to as "SUDP") was carried out with Yangon City Development Committee (hereinafter referred to as "YCDC") as its counterpart in order to proceed with efficient urban development for the Greater Yangon. Yangon Region Government (hereinafter referred to as "YRG") adopted proceeding with urban development in Yangon under the direction of SUDP at a Cabinet meeting. Later, however, economic growth and rapid and massive changes in urban development happened in Yangon, and large-scale development like at Dala and Kyee Myin Daing was proposed. Simultaneously, private companies have been planning high-rise or large-scale urban and building development.

The new administration of Myanmar, established in April 2016, strongly recognize that revised urban structure planning and enforced urban development management are necessary. Accordingly, it is required to collect data, find issues and then update SUDP to consider future action plans with the consideration of these situations including the changes in Yangon and the new administration's policy.

1.2 Objective

The objective of this study (hereinafter referred to as "the Study") is to revise SUDP and to support its implementation capacity under the new administration through conducting the following works:

a) Review of current conditions and issues, especially after the SUDP 2013,

b) Proposal of updated SUDP,

- To present a comprehensive development vision in long term, targeting the year 2040,
- To present an urban structure for the realization of the development vision,
- To present development policies of urban function and infrastructure development,
- To identify necessary priority projects in short-term, targeting the year 2020, and
- To present strategies of urban development management for promoting implementation.

c) Proposal of urban development management, and

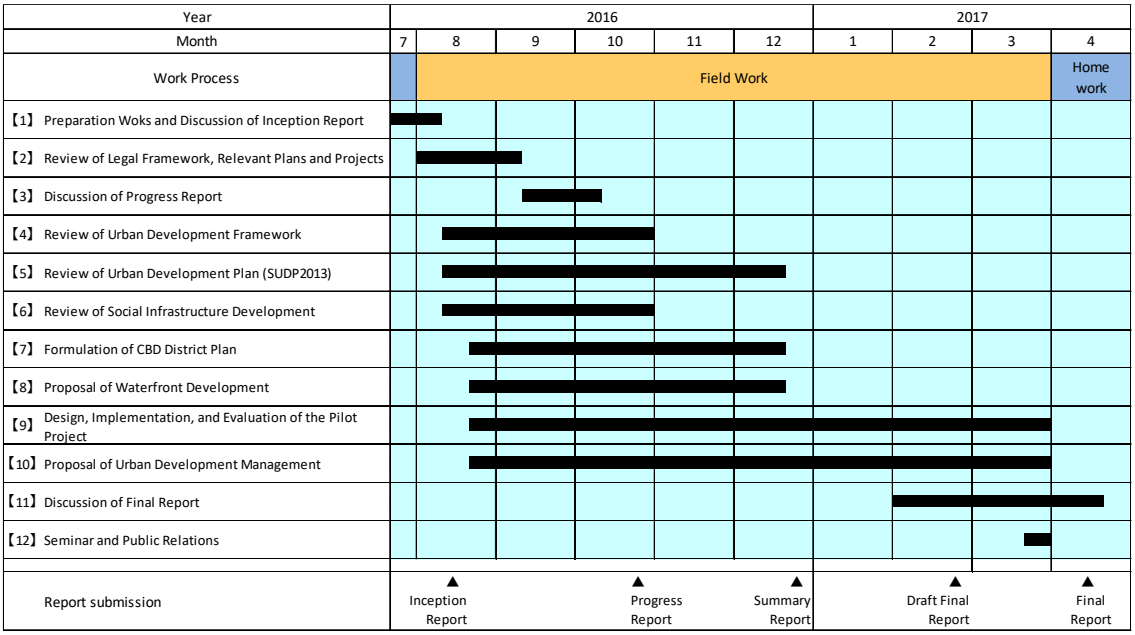
d) Support of implementation capacity improvement thorough conducting a pilot project.

1.3 Target Area

The main target area of the plan consists of Yangon City (829 km^2) and parts of the six neighboring townships of Kyauktan, Thanlyin, Hlegu, Hmawbi, Htantabin, and Twantay (hereinafter referred to as "the Greater Yangon"), which has a total area of approximately 1,500 km^2 as shown in the location map (see beginning page). But, the entire Yangon Region is basically considered in the planning work.

1.4 Target Year

The Study takes eight months started from August 2016 and was completed by April 2017 with submission of the Final Report

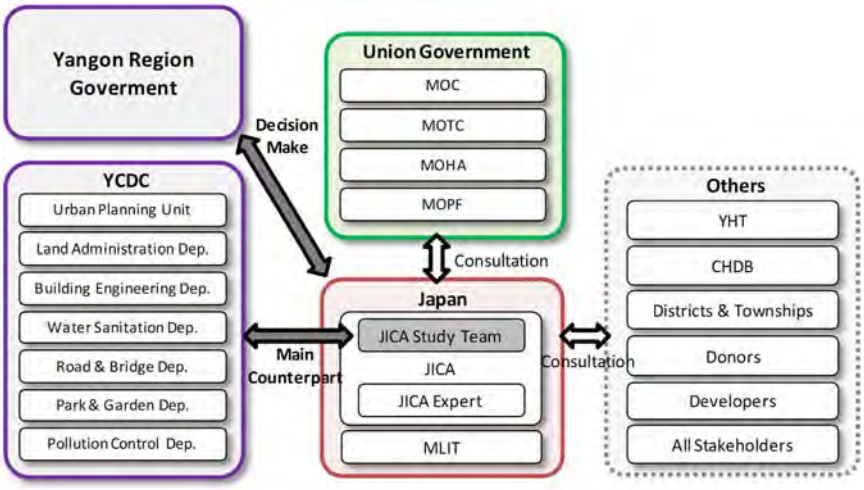


Source: JICA Study Team

Figure 1.4.1: Study Schedule

1.5 Planning Organizations

The plan was made under the direction of YRG in close works with YCDC as a counterpart. Consultation with other relevant organizations, such as union ministries, Yangon Heritage Trust (hereinafter referred to as "YHT"), and donors was considerably conducted.



Source: JICA Study Team

Figure 1.5.1: Study Implementation Organizations

1.6 Key Process of Planning and Study

1.6.1 Kick-off Meeting of YRG

Kick-off Meeting was held on 2nd August 2016 (Tue) in YRG, chaired by Chief Minister of YRG. The summarized result is shown in the following table.

Table 1.6.1: Summary Result of Kick-off Meeting

Title of the Meeting	Kick-off Meeting
Date and Time	2nd August 2016 (Tue) 13:00-14:15
Venue	YRG (Yangon)
Chairperson	Chief Minister of YRG
Total Number of Participants	39 participants
Agenda	1. Opening Remarks (Chairperson) 2. Explanation of the Study Outline (JICA Study Team) 3. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.2 1st Steering Committee

1st Steering Committee was held on 2nd August 2016 (Tue) as same day of the Kick-off meeting above in YCDC, chaired by Mayor of YCDC. The summarized result is shown in the following table.

Table 1.6.2: Summary Result of 1st Steering Committee

Title of the Meeting	1st Steering Committee
Date and Time	2nd August 2016 (Tue) 16:15-18:30
Venue	YCDC (Yangon)
Chairperson	Mayor of YCDC
Total Number of Participants	44 participants
Agenda	1. Opening Remarks (Chairperson) 2. Explanation of the Study Outline (JICA Study Team) 3. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.3 1st MOTC Meeting (4th Aug)

1st Ministry of Transport and Communication (hereinafter referred to as "MOTC") Meeting was held on 4th August 2016 (Thu), chaired by Union Minister of MOTC. The summarized result is shown in the following table.

Table 1.6.3: Summary Result of 1st MOTC Meeting

Title of the Meeting	1st MOTC Meeting
Date and Time	4th August 2016 (Thu) 9:00-11:00
Venue	MOTC (NPT)
Chairperson	Union Minister of MOTC
Total Number of Participants	(no data)
Agenda	1. Opening Remarks (Chairperson) 2. Explanation of the Study Outline (JICA Study Team) 3. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.4 1st MOC Meeting (4th Aug)

1st Ministry of Construction (hereinafter referred to as "MOC") Meeting was held on 4th August 2016 (Thu), chaired by Permanent Secretary of MOC. The summarized result is shown in the following table.

Table 1.6.4: Summary Result of 1st MOC Meeting

Title of the Meeting	1st MOC Meeting
Date and Time	4th August 2016 (Thu) 11:50-13:15
Venue	MOC (NPT)
Chairperson	Permanent Secretary of MOC
Total Number of Participants	(no data)
Agenda	1. Opening Remarks (Chairperson) 2. Explanation of the Study Outline (JICA Study Team) 3. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.5 1st Periodical Meeting of YRG (16th Aug)

1st periodical meeting of YRG was held on 16th August 2016 (Tue), chaired by Chief Minister of YRG. The summarized result is shown in the following table.

Table 1.6.5: Summary Result of 1st Periodical Meeting of YRG

Title of the Meeting	1st Periodical Meeting of YRG
Date and Time	16th August 2016 (Tue) 10:00-11:00
Venue	YRG (Yangon)
Chairperson	Chief Minister of YRG
Total Number of Participants	(no data)
Agenda	1. Explanation of the Study Progress (SUDP) 2. Explanation of the Study Progress (YUTRA) 3. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.6 2nd Periodical Meeting of YRG (7th Sep)

2nd periodical meeting of YRG was held on 7th September 2016 (Wed), chaired by Chief Minister of YRG. The summarized result is shown in the following table.

Table 1.6.6: Summary Result of 2nd Periodical Meeting of YRG

Title of the Meeting	2nd Periodical Meeting of YRG
Date and Time	7th September 2016 (Wed) 9:00-11:00
Venue	JICA (Tokyo)
Chairperson	Chief Minister of YRG
Total Number of Participants	(no data)
Agenda	1. Explanation of the Study Progress (SUDP) 2. Explanation of the Study Progress (YUTRA) 3. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.7 3rd Periodical Meeting of YRG (30th Sep)

3rd periodical meeting of YRG was held on 30th September 2016 (Fri), chaired by Chief Minister of YRG. The summarized result is shown in the following table.

Table 1.6.7: Summary Result of 3rd Periodical Meeting of YRG

Title of the Meeting	3rd Periodical Meeting of YRG
Date and Time	30th September 2016 (Wed) 14:30-17:00
Venue	YRG (Yangon)
Chairperson	Chief Minister of YRG
Total Number of Participants	47 participants
Participated Organizations	MOC, MOTC, Department of Urban Housing Development, General Administration Department, YCDC, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the progress of the study (JICA Study Team) 3. Discussion and comments from the Chief Minister
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.8 Interim Report Meeting of YRG (10th Oct)

Interim report meeting of YRG was held on 10th October 2016 (Mon), chaired by Chief Minister of YRG. The summarized result is shown in the following table.

Table 1.6.8: Summary Result of Interim Report Meeting of YRG

Title of the Meeting	Interim Report Meeting of YRG
Date and Time	10th October 2016 (Mon) 11:00-16:00
Venue	YRG (Yangon)
Chairperson	Chief Minister of YRG
Total Number of Participants	73 participants
Participated Organizations	Yangon Regional Government, Ministry of Rail Transportation, MOC, YCDC, Yangon Police, Yangon Region Transport Authority, MLIT, NPA, Embassy of Japan, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the progress of the study (JICA Study Team) & MLIT 3. Discussion and comments from the Chief Minister and from other Government Departments
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.9 2nd MOC Meeting (11th Oct)

2nd MOC meeting was held on 11th October 2016 (Tue), chaired by Minister of MOC. The summarized result is shown in the following table.

Table 1.6.9: Summary Result of 2nd MOC Meeting

Title of the Meeting	2nd MOC Meeting
Date and Time	11th October 2016 (Tue) 9:15-11:15
Venue	MOC (Nay Pyi Taw)
Chairperson	Minister of MOC
Total Number of Participants	29 participants
Participated Organizations	MOC, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the progress of the study (JICA Study Team) 3. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.10 2nd MOTC Meeting (12th Oct)

2nd MOTC meeting was held on 12th October 2016 (Wed), chaired by Minister of MOTC. The summarized result is shown in the following table.

Table 1.6.10: Summary Result of 2nd MOTC Meeting

Title of the Meeting	2nd MOTC Meeting
Date and Time	12th October 2016 (Wed) 9:10-11:30
Venue	MOTC (Nay Pyi Taw)
Chairperson	Minister of MOTC
Total Number of Participants	30 participants
Participated Organizations	MOTC, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the progress of the study (JICA Study Team) 3. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.11 4th Periodical Meeting of YRG (9th Nov)

4th periodical meeting was held on 9th November 2016 (Wed), chaired by Chief Minister of YRG. The summarized result is shown in the following table.

Table 1.6.11: Summary Result of 4th Periodical Meeting of YRG

Title of the Meeting	4th Periodical Meeting of YRG
Date and Time	9th November 2016 (Wed) 9:10-11:30
Venue	YRG (Yangon)
Chairperson	Chief Minister of YRG
Total Number of Participants	25 participants
Participated Organizations	Yangon Regional Government, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the progress of the study (JICA Study Team) 3. Discussion and comments from YRG
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.12 Stakeholder Meeting for a Trial Event (5th Dec)

Stakeholder Meeting for Trial Event was held on 5th December 2016 (Mon), chaired by Secretary of YCDC. The summarized result is shown in the following table.

Table 1.6.12: Summary Result of Stakeholder Meeting for a Trial Event

Title of the Meeting	Stakeholder Meeting for Trial Event
Date and Time	5th December 2016 (Mon) 13:15-15:45
Venue	YCDC (Yangon)
Chairperson	Secretary of YCDC
Total Number of Participants	54 participants
Participated Organizations	All Departments from YCDC, Ministry of Hotel & Tourism, National University of Arts and Culture, YHT, Various Press, Residence from the Trial Event Site, Western Yangon Technological University, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the outline of SUDP (JICA Study Team) 3. Presentation of the objective of the Trial Event (YCDC) 4. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.13 5th Periodical Meeting of YRG (7th Dec)

5th periodical meeting of YRG was held on 7th December 2016 (Wed), chaired by Chief Minister of YRG. The summarized result is shown in the following table.

Table 1.6.13: Summary Result of 5th Periodical Meeting of YRG

Title of the Meeting	5th Periodical Meeting of YRG
Date and Time	7th December 2016 (Wed) 14:20-15:20
Venue	YRG (Yangon)
Chairperson	Chief Minister of YRG
Total Number of Participants	26 participants
Participated Organizations	Yangon Regional Government, Embassy of Japan, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the progress of the study (JICA Study Team) 3. Discussion and comments from the Chief Minister
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.14 3rd MOC Meeting in Yangon (9th Dec)

3rd MOC meeting was held on 9th December 2016 (Fri), chaired by Deputy Director of DUHD, Housing Division. The summarized result is shown in the following table.

Table 1.6.14: Summary Result of 3rd MOC Meeting in Yangon

Title of the Meeting	3rd MOC Meeting
Date and Time	9th December 2016 (Fri) 10:00-13:00
Venue	MOC (Yangon)
Chairperson	Deputy Director of DUHD, Housing Division
Total Number of Participants	20 participants
Participated Organizations	MOC, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation on the explanation of the outline of the revised SUDP, Housing Development and Urban Development (SUDP, JICA Study Team) 3. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.15 6th Periodical Meeting of YRG (12th Dec)

6th periodical meeting of YRG was held on 12th December 2016 (Mon), chaired by Chief Minister of YRG. The summarized result is shown in the following table.

Table 1.6.15: Summary Result of 6th Periodical Meeting of YRG

Title of the Meeting	6th Periodical Meeting of YRG
Date and Time	12th December 2016 (Mon) 13:30-17:30
Venue	YRG (Yangon)
Chairperson	Chief Minister of YRG
Total Number of Participants	30 participants
Participated Organizations	Yangon Regional Government, MLIT, NPA, Embassy of Japan, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the progress of the study (JICA Study Team) and MLIT 3. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.16 4th MOC Meeting (19th Dec)

4th MOC meeting was held on 19th December 2016 (Mon), chaired by Minister of MOC. The summarized result is shown in the following table.

Table 1.6.16: Summary Result of 4th MOC Meeting

Title of the Meeting	4th MOC Meeting
Date and Time	19th December 2016 (Mon) 12:00-13:20
Venue	MOC (Nay Pyi Taw)
Chairperson	Minister of MOC
Total Number of Participants	24 participants
Participated Organizations	MOC, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the progress of the study (JICA Study Team) 3. Discussion on comments and suggestion from MOC
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.17 3rd MOTC Meeting (19th Dec)

3rd MOTC meeting was held on 19th December 2016 (Mon), chaired by Minister of MOTC. The summarized result is shown in the following table.

Table 1.6.17: Summary Result of 3rd MOTC Meeting

Title of the Meeting	2nd MOTC Meeting
Date and Time	12th October 2016 (Wed) 9:30-11:30
Venue	MOTC (Nay Pyi Taw)
Chairperson	Minister of MOTC
Total Number of Participants	31 participants
Participated Organizations	MOTC, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the progress of the study (JICA Study Team) 3. Discussion on comments and suggestion from MOTC
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.18 Consultative Workshop (23rd Dec)

Consultative workshop was held on 23rd December 2016 (Fri), chaired by Secretary of YCDC. The summarized result is shown in the following table.

Table 1.6.18: Summary Result of Consultative Workshop

Title of the Meeting	Consultative Workshop
Date and Time	23rd December 2016 (Fri) 9:00-12:00
Venue	YCDC (Yangon)
Chairperson	Secretary of YCDC
Total Number of Participants	73 participants
Participated Organizations	YCDC, Fire Service Department, Budget Department, Yangon Region Social Welfare and Services, MOC, National Planning Department, YHT, DWIR, Yangon University, MPT, YRDC, AMA, General Administration Department, JICA and Various Media
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the explanation of the study (JICA Study Team) and MLIT 3. Discussion and suggestions from the participants
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.19 Handing Over of Summary Report (24th Dec)

Handing over of Summary Report was held on 24th December 2016 (Sat), chaired by Chief Minister of YRG. The summarized result is shown in the following table.

Table 1.6.19: Summary Result of Handing Over of Summary Report

Title of the Meeting	Handing over of Summary Report
Date and Time	24th December 2016 (Sat) 15:00-16:00
Venue	YRG (Yangon)
Chairperson	Chief Minister of YRG
Total Number of Participants	27 participants
Participated Organizations	Yangon Regional Government, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Remarks by JICA 3. Handing over of the Summary Report and follow up by photo section
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.20 JCCM Meeting (20th Jan)

JCCM meeting was held on 20th January 2017 (Fri), chaired by the Minister of Embassy of Japan and the chief representative of JICA Yangon office in order to share the summary report among Japanese companies. The summarized result is shown in the following table.

Table 1.6.20: Summary Result of JCCM Meeting

Title of the Meeting	JCCM Meeting
Date and Time	20th January 2017 (Feb) 14:00-15:30
Venue	JETRO Myanmar Office
Chairperson	Minister of Embassy of Japan, chief representative of JICA Myanmar Offce
Total Number of Participants	About 25 participants
Participated Organizations	JCCM Members, Embassy of Japan, JICA, JICA Study Team (SUDP and YUTRA)
Agenda	1. Opening remarks (chairperson) 2. Presentation of the summary report (JICA Study Team) 3. Discussions

Source: JICA Study Team

1.6.21 7th Periodical Meeting of YRG (23rd Jan)

7th periodical meeting of YRG was held on 23rd January 2017 (Mon), chaired by Chief Minister of YRG. The summarized result is shown in the following table.

Table 1.6.21: Summary Result of 7th Periodical Meeting of YRG

Title of the Meeting	7th Periodical Meeting of YRG
Date and Time	23rd January 2017 (Mon) 13:30-14:30
Venue	YRG (Yangon)
Chairperson	Chief Minister of YRG
Total Number of Participants	17 participants
Participated Organizations	Yangon Regional Government, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the progress of the study (JICA Study Team) and MLIT 3. Discussion
Minutes and Participants	(See attached file)

Source: JICA Study Team

1.6.22 Development Partners' Meeting of YRG (20th Feb)

Development Partners' meeting of YRG was held on 20th February 2017 (Mon), chaired by Mayor of YCDC. The summarized result is shown in the following table.

Table 1.6.22: Summary Result of Development Partners' Meeting of YRG

Title of the Meeting	Development Partners' Meeting of YRG
Date and Time	20th February 2017 (Mon) 14:00-16:00
Venue	YRG (Yangon)
Chairperson	Mayor of YCDC
Total Number of Participants	(no data)
Participated Organizations	Yangon Regional Government, Corporation Partners Group, JICA
Agenda	1. Opening Remarks (Chairperson) 2. Presentation of the explanation of the study (JICA Study Team) 3. Discussion and explanation for the questions from CPG
Minutes and Participants	(See attached file)

Source: JICA Study Team

Chapter 2: Fact Findings, Planning Process, and Updated Points

2.1 Development Visions

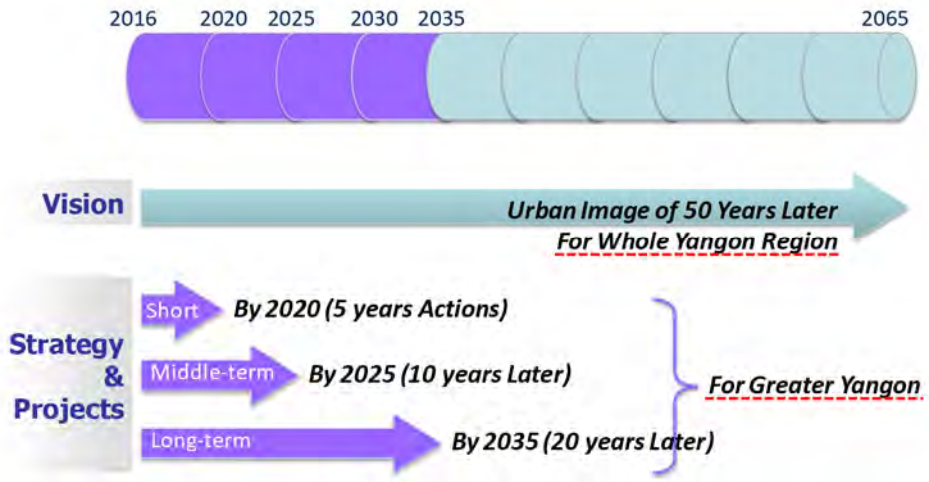
2.1.1 Framework and Planning Process

(1) Planning Framework (Target Year)

The target year of the plan is the year 2040 when the development visions of the Greater Yangon are set. To achieve set development visions step by step, benchmarks of the plan are set as follows;

- Short-term: the year 2020
- Middle-term: the year 2030
- Long-term: the year 2040

As mentioned above, the development vision is basically targeting year 2040, about quarter of century later. Since promotion and control of urban where a lot of people, buildings and infrastructure accumulate takes much time to be an ideal image, the vision is required to foresee longer period. In line with such idea, the development vision can be said to target from 2040 to 2065, about half of century later as shown in Figure 2.1.1.



Source: JICA Study Team

Figure 2.1.1: Target Year of the Plan

(2) Necessity and Formulating Process of Vision

A development vision is an ideal future image of a city which can be attained through addressing problems and issues, catering to the citizens' needs, and integrating foresight of the stakeholders, and

other disciplines. Without setting clear development vision, it would be difficult to implement an integrated urban development plan efficiently. Consequently, the administration would come to a deadlock, as there are a number of concerned sectors playing important roles in developing, improving, and managing a large city.

In this context, it must be noted that the development vision under the new administration commenced from April 2016 has been discussed and modified in the subsequent steps to reach the ultimate visions commonly based on the vision set in the previous SUDP. The formulating process of the development vision is shown in Figure 2.1.2

Source: JICA Study Team

Figure 2.1.2: Formulating Process of the Development Visions

2.1.2 Making of a Schematic Structure

A schematic structure of the whole Yangon Region with its surrounding area shall be discussed in long-term span in order to draw the big picture of the future urban image of Yangon. Drawing and sharing different kinds of viewpoints and approaches are being considered and determining which directions and areas are to be developed as urban areas in the future. Generally, creating and upgrading a city, especially such a large city like Yangon, takes much time in making it an ideal image.

(1) Review of Relevant Plans

Prior to make a schematic structure covering whole Yangon Region, some plans provided by other donors or developers were reviewed and reflected in the structure to be proposed in this plan. Other plans tend to focus more on south of Yangon stretching to the mouth of the Yangon River, namely Elephant points.

1) A Proposal introduced by YRG

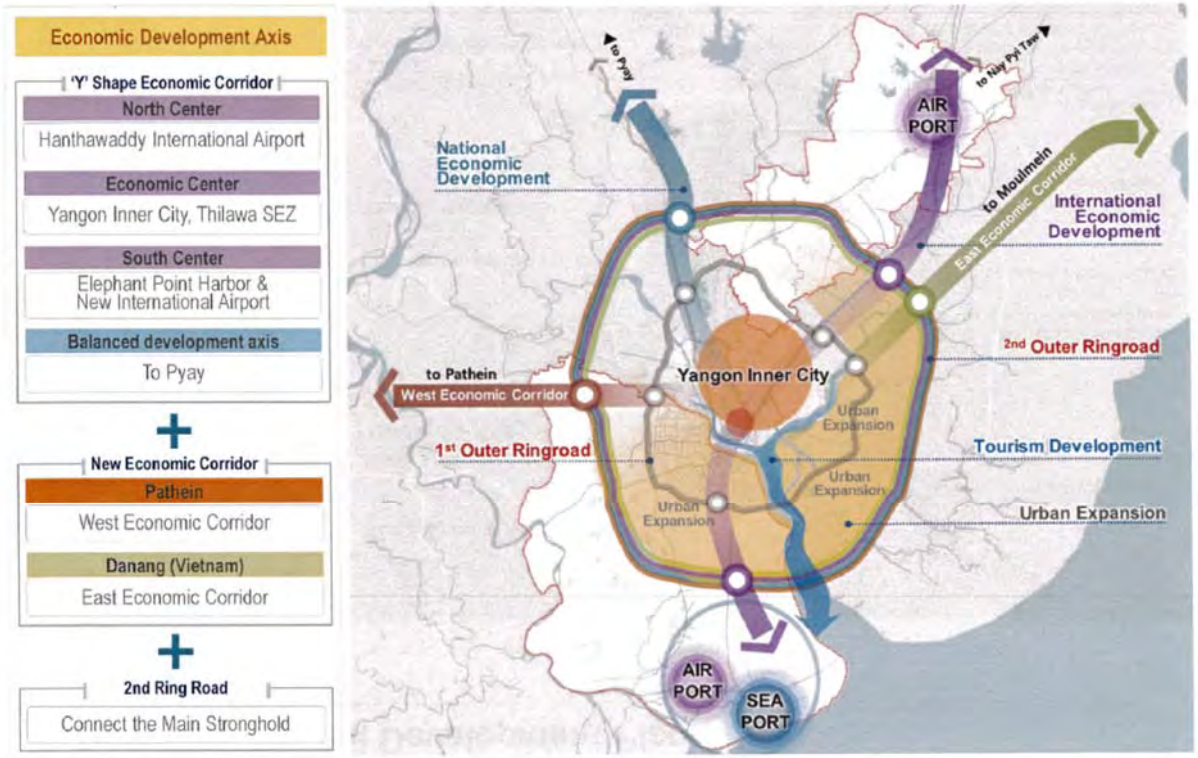
A proposal which consists of new city development concept of mixed use urban development, international airport and & SEZ and Port, was introduced to JICA Study Team by YRG in October 2016. The main target area is Kyee Mying Daing west side of Yangon River, Dala and southward of Yangon as shown in Figure 2.1.3 below. Since it is obvious that YRG's intention is development of west and south parts of Yangon according to this plan, the proposal was reflected in the plan of SUDP as step-wise development. This proposed 9 types of land use which are (1) SEZ (industrial and port), (2) Green and open area, (3) International airport, (4) Commercial, (5) Local port and commercial, (6) Mixed use zone, (7) Commercial and leisure, (8) Lake, and (9) Industrial zone with huge development areas.

Source: A Proposal introduced by YRG

Figure 2.1.3: New City Development Concept

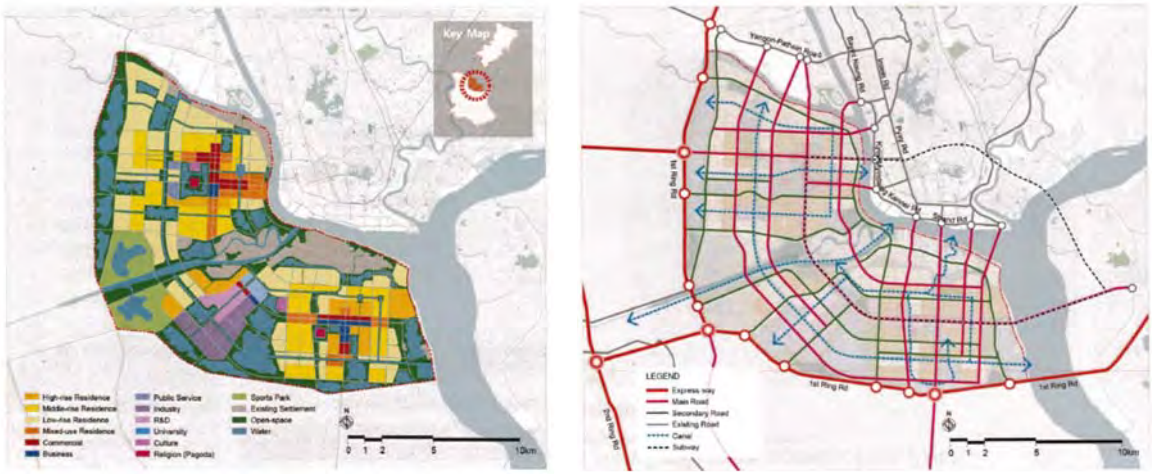
2) Master Planning Works prepared by KOICA

KOICA has been conducting A Project Consulting Service, namely Master Plans for Yangon-Hanthawaddy-Bago Corridor and Yangon South Western Region Development, which started from January 2016 and to be completed by the end of 2017. The service includes legal system establishment, regional development strategy master plan, and pilot project master plan. As its title mentioned, the plan covers not only Yangon but also Bago and south western part of Yangon.



Source: KOICA Project Consulting Service

Figure 2.1.4: Proposed Urban Growth Axis

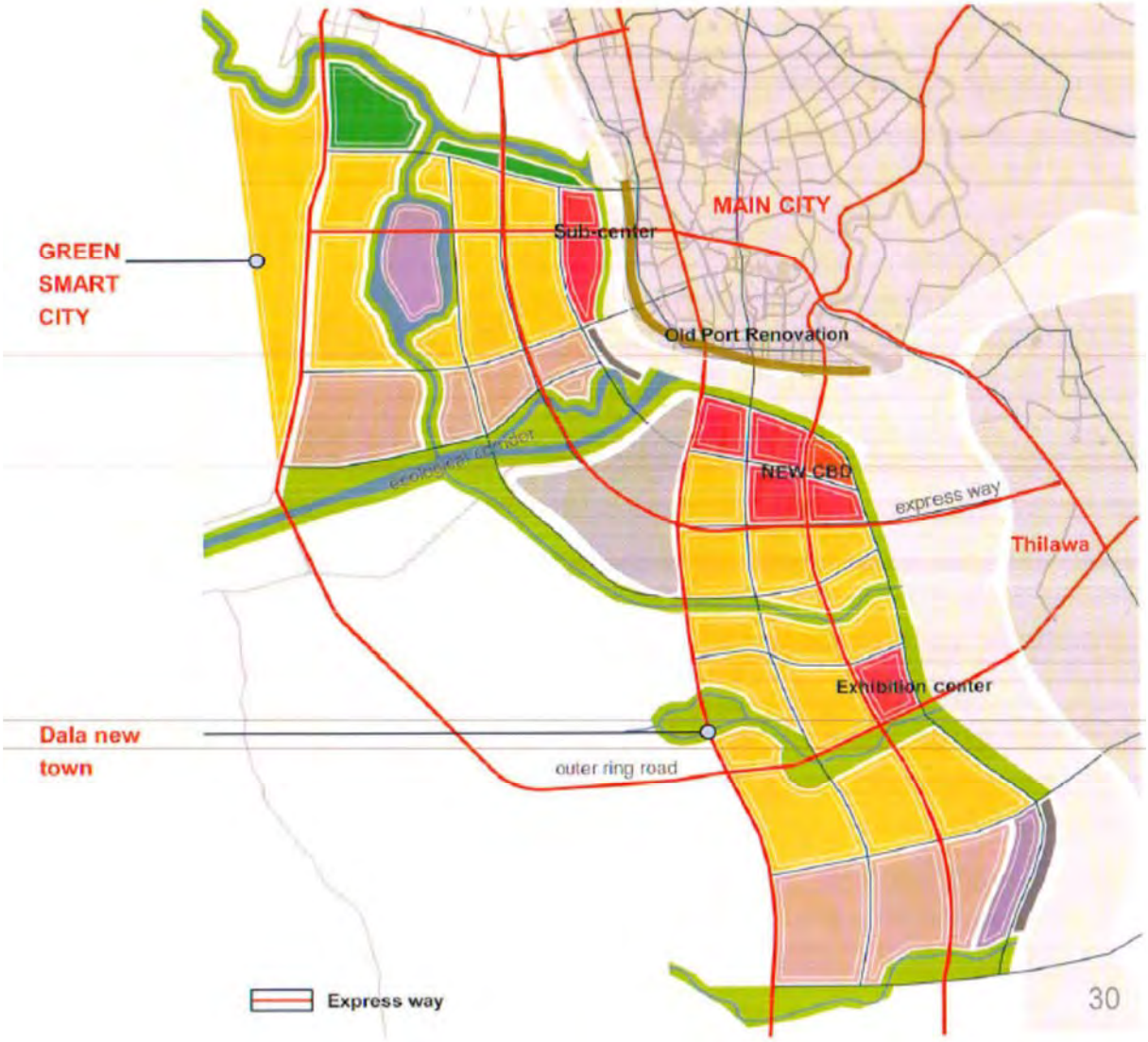


Source: KOICA Project Consulting Service

Figure 2.1.5: New City Development Plan

3) A Proposal prepared by a Chinese Company

A Chinese company, China Communications Construction, proposed a plan of south western part of Yangon, namely "Promoting Infrastructure Construction to Upgrade City - Creating a New Framework for Yangon Regeneration". This proposal includes key projects as short-term actions, which are new cities developments.



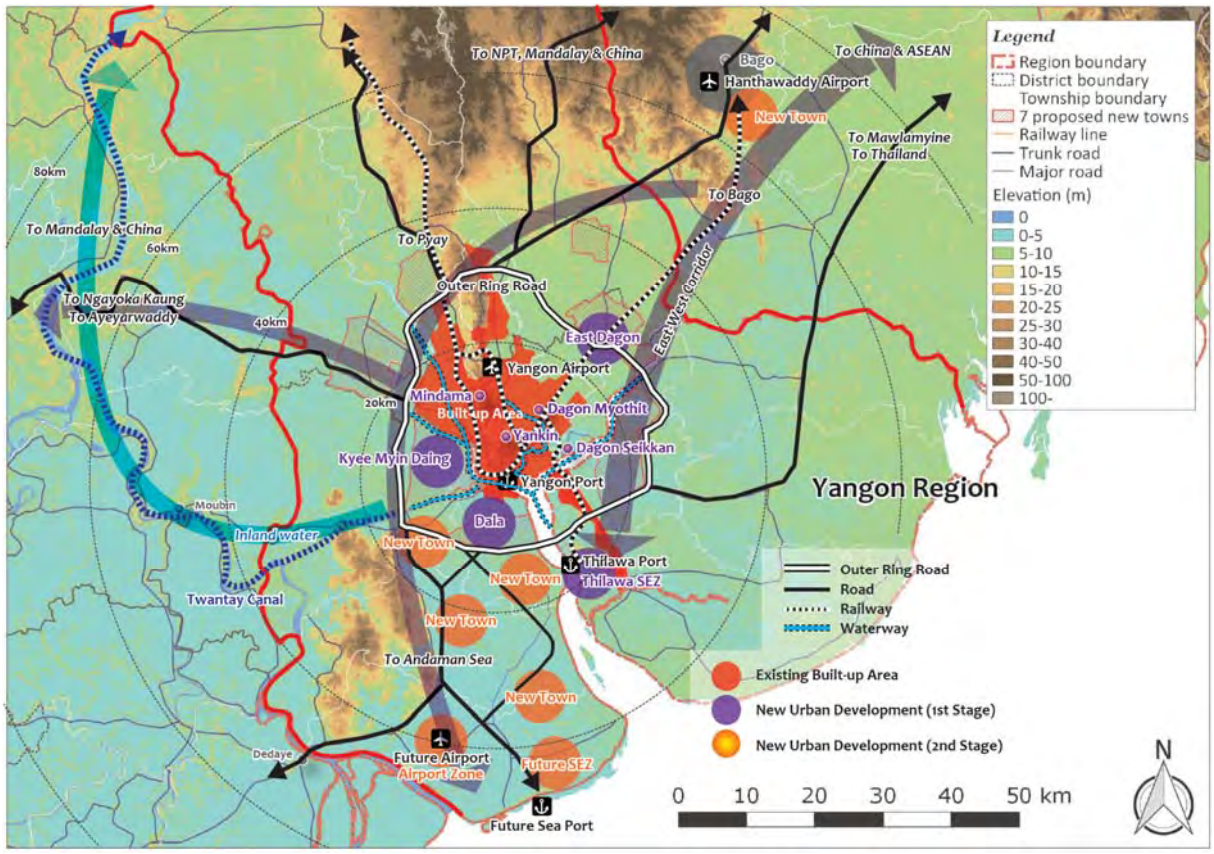
Source: China Communications Construction

Figure 2.1.6: Spatial Structure of New cities

(2) Yangon's Schematic Structure

To achieve the future urban image requires a long period. In this context, the schematic structure has the image of the year 2065, half a century later, as shown in Figure 2.1.7. Currently, Yangon Region consists of a total of 44 townships, where, 33 townships are covered by YCDC service area, which is Yangon City. Yangon Region has a population of approximately 7.4 million with its area of 10,170 km2, and YCDC service area has a population of approximately 5.2 million with its area of 895 km2. Applying an annual growth rate of 2.6%, the future population half a century later (year 2065) will be 27.2 million in the Yangon Region. Meaning, there will be an increase of 20 million in the population.

To manage such large city and to accommodate such large number of population properly and actively, step-wise urban development with appropriate infrastructure provision must be conducted together with governmental initiative in good relation with positive private activities and citizen's understanding and cooperation.



Source: JICA Study Team

Figure 2.1.7: Draft of Schematic Structure

(3) Logistics Function

Yangon is surely expected to enhance the function of its international logistics hub by having good linkages of land, sea, air, and water. Key functions must be developed to realize the schematic structure of the following:

Outer Ring Road should be functioned in connection with economic corridors
Source: JICA Study Team and DCA

Development of Hanthawaddy International Airport is negotiated

Function of Thilawa Area Port is necessary in short and middle term

Figure 2.1.8: Images of Necessary Logistics Functions

1) Economic Corridors and Outer Ring Road

To be more economically active, strengthening economic corridors by having strong connection with neighboring countries (e.g., China, Thailand, India) is essential in terms of logistics and industry by land-based, air-based, and water-based linkages. Yangon is currently expected to be a focal west gateway of the Greater Mekong Sub-region (hereinafter referred to as "GMS"). Additionally, a new emerging economic corridor connecting GMS east-west corridor and Yangon, and then stretching to the west to Ngayoke Kaung SEZ facing the Bay of Bengal, is considered recently. To establish an efficient logistics through the economic corridors and to avoid heavy traffic in existing built-up area of Yangon, an outer ring road should be developed well.

2) Airports

The existing Yangon (Mingaladon) International Airport reached a total of 4.9 million passengers in 2015. Considering the past trend of 18% annual growth, air traffic demand is forecasted to reach 42 million passengers in 2040 and 72 million passengers in 2050 respectively by the Myanmar Government. In line with this forecast, the current airport capacity will be inadequate and new international airports are necessary in the near future. Currently, the Hanthawaddy International Airport, located at about 65 km from of Yangon, is expected to start its operation around the year 2022, while the existing airport is processing to expand its capacity having 6 million passengers. Furthermore, development of a new international airport may be also considered in Kungyangon, south of Yangon, according to air traffic demands in a longer term, targeting half a century later.

3) Ports

The existing Yangon Port, a river port in the Yangon River, is composed of two port areas, namely: Yangon Main Port and Thilawa Area Port. The Thilawa Area Port has some definite advantages for its entrance because it takes 12 hours to enter Thilawa Area Port from Elephant Point, while it takes 24 hours to reach Yangon Main Port due to the additional time spent while waiting for the tidal cycle. The total container throughput forecast is estimated to be more than 4 million 20 foot equivalent units (hereinafter referred to as "TEUs") annually in 2030. As the capacity of Yangon Main Port is limited up to less than 1 million TEUs, the main logistics function must shift to Thilawa Area Port gradually. To encourage Yangon to be the logistics node through economic corridors, Thilawa Area Port should be developed and functioned well in short and middle term, and development of a deep sea port at the south of Yangon may be considered in longer term. (* a comparison study for the future sea port was done and discussed as referring to the end of this report).

4) Canal and Waterway

Twantay Canal, which was developed since the old time, should play an important role to connect with China through Mandalay in terms of logistics. It is also necessary to make good use of riverways such as the Yangon River, the Bago River, and the Pazundaung Creek for public transportation inside Yangon.

5) Railway

The current number of railway lines, which consist of eight lines with three main lines and five branch lines, is insufficient judging from the present population of Yangon. Not only modernization of existing three main lines but also construction of two new mass rapid transit (hereinafter referred to as "MRT") lines shall be required in the future.

(4) Urban Function

Yangon's urbanized areas shall be surely expanded more in the future. New built-up areas shall be developed to accommodate the increasing population of around 20 million in half a century later.

Riverside space of CBD should be recovered for the citizens.

Thilawa SEZ and new cities have been developed.

IZs (e.g., Hlaing Tharyar) should be improved more.

Source: JICA Study Team

Figure 2.1.9: Images of Necessary Urban Functions

1) Existing Built-up Area

Generally, urban areas are strongly recommended to be as compact as possible, basically inside of the outer ring road, for efficient traffic and infrastructure development and operation. In this context, existing built-up areas, which have basic infrastructure and social services should be utilized and rehabilitated in the future to have a more comfortable and attractive environment. To avoid further congestion of the current Central Business District (hereinafter referred to as "CBD"), decentralization of urban function should be promoted by creating new sub-centers. CBD has planning disciplines with grid pattern road network and plenty of greenery. In light that logistics function will shift to Thilawa Area Port, open spaces along the Yangon River has to be recovered for the citizens.

2) New Cities

To accommodate a large number of population in the future, development of some new cities is necessary in four main places, namely: Thilawa, Southwest New City (west side of Kyee Myin Daing), Dagon Myothit (East) New City, and Dala New City. Considering new cities, there are some necessary points to be considered thoroughly especially flooding risk at low-lying areas. In the long term, urban development in the south of Yangon is also considered with the proposed deep sea port and new airport.

More detailed planning on 3 suburb new cities should be conducted. The points of consideration are shown as below:

1. Linkage to public transportation (e.g. MRT, BRT)
2. Consideration of Land Suitability

There are some necessary points to be considered thoroughly especially flooding risk at low-lying areas.

Table 2.1.1: Points to be considered for New Urban Development

Items	Points
1. Population	A developing area should correspond to population forecast (increase population) no to be over-scale development.
2. Accessibility	A developing area should have strong linkage of public transportation connecting with built-up area of Yangon.
3. Infrastructure	A developing area should develop infrastructures and social services, especially how water and power are supplied.
4. Flood Resistant	Costly embankment and drainage system are necessary for a low-lying area to minimize flooding risk
5. Earthquake Resistant	Buildings in a developing area, especially low-lying, should consider deep-piling works, which takes much more cost
6. Development Cost Financing	Estimated cost becomes more expensive when the development area is selected in low-lying. Financing should be considered.

Source: JICA Study Team

3) Industrial Zones

Thilawa SEZ, as well as IZ such as Hlaing Tharyar and Shwe Pyi Thar, should be developed to promote more manufacturing and industrial activities. As the industry activates more in long term, development of more SEZs or IZs should be considered outside of Yangon.

2.1.3 Development Vision

(1) Development Vision

A development vision is an ideal future image of a city, which can be attained through addressing problems and issues, catering to the citizens' needs, and integrating foresight of the stakeholders, and other disciplines. Without setting clear development vision, it would be difficult to implement an integrated urban development plan efficiently. Consequently, the administration would come to a deadlock, as there are a number of concerned sectors playing important roles in developing, improving, and managing a large city.

(2) Definition of Vision

The development vision shall consist of "Statement of Vision", "Key Drivers of the Vision", and "Development Strategies". The definitions of the development vision in the plan are described as shown in the following table.

Table 2.1.2: Definition of Vision

Items	Definition
Statement	The statement of the vision expresses the image of the future Yangon. It summarizes related key drivers and strategies.
Key Drivers	Statement of the vision consists of several related key drivers. These key drivers correspond to major sector development field of the city and they are expected to become strengths and opportunities which lead to the realization of the vision.
Development Strategies	Strategies are development measures to be taken for the realization of the vision. These consist of measures such as: - Enhancement of current strength of the city and added value to current urban resources; and - Improvement of weakness of the city, which hinders progress of urban development and its favorable environment.

Source: JICA Study Team

(3) Set of Yangon's Development Vision

In this context, it must be noted that the development vision under the new administration commenced from April 2016 has been discussed to reach the ultimate visions. Consequently, the development visions of Yangon, which consists of one statement and four key drivers, was crafted as shown in Figure 2.1.10 in consideration of discussions mainly among YRG and YCDC.

Source: JICA Study Team

Figure 2.1.10: Development Visions of Yangon

1) Statement

Attractive International Port and Logistics HUB
-A City of Blue, Green, and Gold-

The statement above expresses Yangon's future goal of urban images, which has strong competitiveness in terms of port and logistics hub against neighboring countries in the world.

Yangon is rich in beautiful lakes, rivers, canals, green natural environment and lighting gold of Shwe Dagon Pagoda. Yangon will enhance its charms and characteristics not only to be stronger but also more attractive with its history, culture, environment, and people.

2) Key Drivers

Under the statement, key drivers of development visions are summarized into four main points, namely: 1) International Logistics HUB City; 2) Knowledge and Comfortable City; 3) Well-managed Infrastructure City; and 4) Good Governance City. These key drivers correspond to major sector development field of the city and they are expected to become strengths and opportunities which will lead to the realization of the development vision.

a) **International Logistics HUB City**
Yangon is expected to be an "International Logistics Hub City" with attractive and competitive urban and logistics functions where more people and companies (businesses) gather from surrounding area since Yangon is the city with the largest economy and with an international gateway to Myanmar.

b) **Knowledge and Comfortable City**
Yangon is expected to be a "Knowledge and Comfortable City", where everyone who lives and works in Yangon should be able to enjoy a more comfortable living in consideration of environmental and social aspects.

c) **Well-managed Infrastructure City**
To achieve an international logistics HUB city, urban infrastructure development must be the focal factor. To provide a safer, more reliable and convenient urban life, and to realize economic development and industrialization, the vision of becoming a "Well-managed Infrastructure City" must be realized in the future.

d) **Good-Governance City**
To establish a good city both for living and business, to be a "Good Governance City" is an indispensable key factor.

2.1.4 Development Strategy

(1) International Logistic HUB City

Yangon is expected to be an "International Logistics Hub City" with attractive and competitive urban and logistics functions where more people and companies (businesses) gather from surrounding areas. Moreover, Yangon is also expected to be an international business city with integration of Information Technology (hereinafter referred to as "IT"), manufacturing, and service industries at SEZ and new cities.

Yangon is a city with the largest economy and with an international gateway to Myanmar, which is

currently a country with increasing attractiveness and growing world attention. Additionally, Yangon is the focal node city of economic corridors of GMS, which are East-West Economic Corridor, Western Economic Corridor, Southern Economic Corridor, and New Emerging Corridor and Asian highways in strong linkage with China, Thailand, India, and other countries not only by land but also by sea, river way, and air. When goods and people movement becomes freer, particularly in the Association of Southeast Asian (hereinafter referred to as "ASEAN") region, the international logistics hub and gateway functions for exports/imports and exchange of knowledge shall be improved, thereby leading to accelerated and sustainable economic development.

Yangon has been and will be expected to enhance the central functions of service, trade, and distribution. This means that Yangon will further accommodate the increasing population and employment as the city with the largest economy in Myanmar. Developing the logistics, industrial, and commercial sectors would need a labor force either by in-migration from other areas or a shift from the agricultural sector to the manufacturing and services sectors in the future.

Yangon and Mandalay, which are the main cities of the country in the Two-Polar Development Strategy, will share their respective roles in the future in terms of economics, politics, and culture. These main cities will be connected with railway (Yangon-Mandalay railway) and highway networks and form the main frame of the nation passing Nay Pyi Taw, the capital city. In order to create well-balanced development in the whole country, it is very important to develop road network with broader trunk roads and accesses to logistics nodes all over the country, especially enhancing the function of economic corridors. An outer ring road and elevated inner ring road of Yangon should be constructed in connection with such national road network to mitigate traffic burden by cargo transport passing through the city. Twantay Canal also has a large potential to empower connection with China and Mandalay, in terms of inland water logistics.

Development of SEZ and an international port shall play an important role as an industrial and logistic core area to accelerate economic growth and industrial promotion for Yangon and Myanmar. To accelerate it in the short and middle term, development of Thilawa SEZ and port is necessary and significant. Other IZs should be also upgraded with safely and advanced technology. This shall contribute to, not only new job creation but also, economic development by means of attracting advanced manufacturing factories such as motor, electronic, and electrical assembly.

Yangon (Thilawa port and south deep sea port) and Ngayoka Kaung (SEZ and port in Ayeyarwady) shall be strongly connected with economic corridors by functioned key ports and IZs at the Bay of Andaman and Bengal. Additionally, since international airports shall push economic and logistics activities up efficiently, airports shall be constructed step by step according to demand forecast.

Source: JICA Study Team

Figure 2.1.11: Proposed Key Actions for International Logistics HUB City

(2) Knowledge and Comfortable City

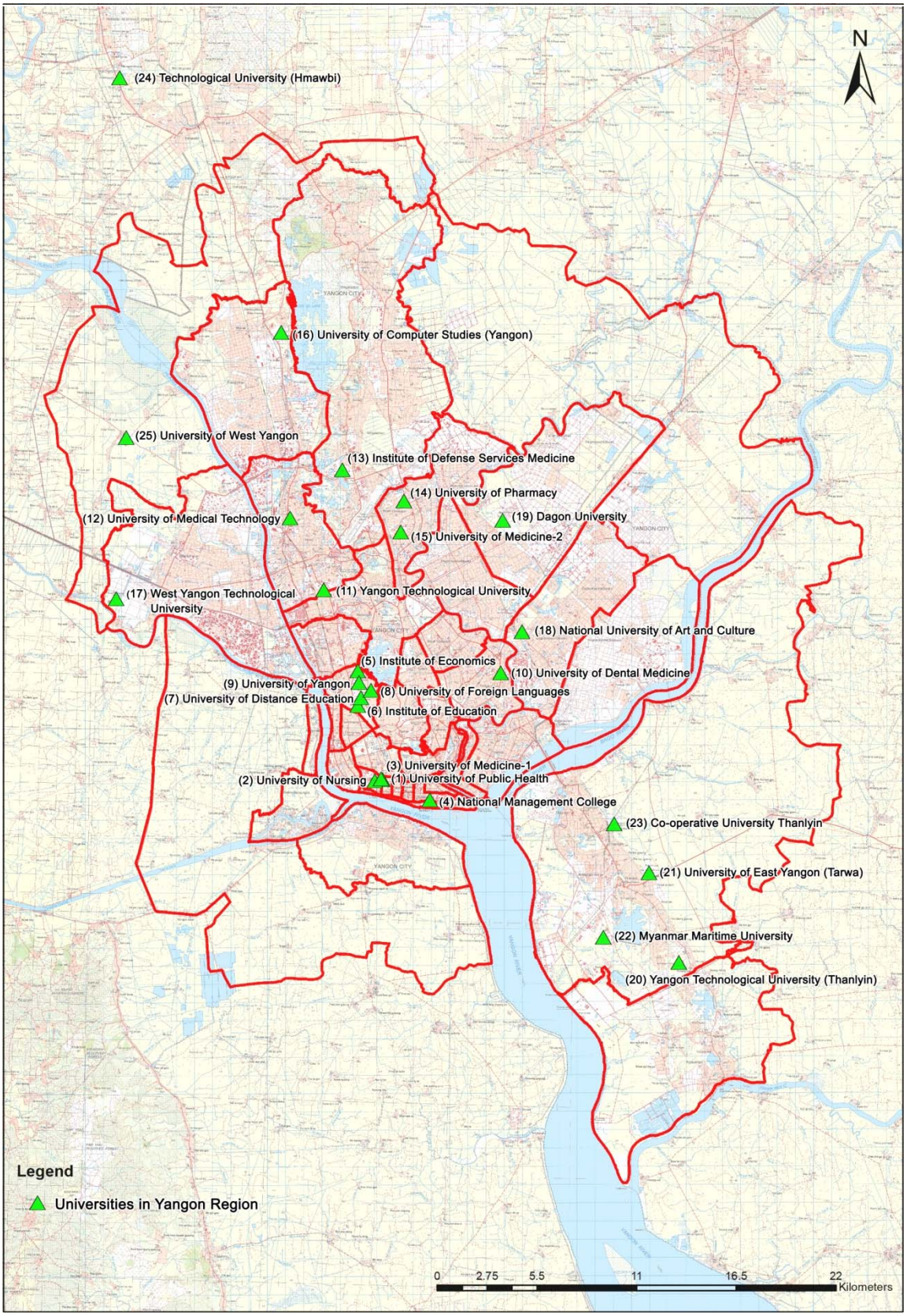
Yangon is expected to be a "Knowledge and Comfortable City", where everyone who lives and works in Yangon should be able to demonstrate their potentials and abilities and to enjoy a more comfortable living in consideration of environmental and social aspects.

Strengthening knowledge and educational function for improving human resources by research and development (hereinafter referred to as "R&D") facilities, educational organization, and related facilities shall be necessary. Human resources will be a key factor for foreign and domestic investors in making sound investment decisions to put their businesses in Yangon for international competitiveness.

Table 2.1.3: List of Universities

No	University	Township	Affiliation	Number of Students	Number of Teachers
1	University of Public Health	Latha	Ministry of Health	91	16
2	University of Nursing	Lanmadaw	Ministry of Health	748	150
3	University of Medicine (1)		Ministry of Health	4,312	417
4	National Management College	Botahtaung	Ministry of Education	689	16
5	Institute of Economics	Kamaryut	Ministry of Education	10,196	189
6	Institute of Education		Ministry of Education	5,076	134
7	University of Distance Education		Ministry of Education	150,681	151
8	University of Foreign Languages		Ministry of Education	2,046	168
9	University of Yangon		Ministry of Education	2,409	693
10	University of Dental Medicine	Thingangyun	Ministry of Health	831	141
11	Yangon Technological University	Insein	Ministry of Education	637	121
12	University of Medical Technology		Ministry of Health	607	68
13	Institute of Defense Services Medicine	Mingalardon	Ministry of Defense	-	-
14	University of Pharmacy	North Okkalapa	Ministry of Health	622	62
15	University of Medicine (2)		Ministry of Health	3,600	386
16	University of Computer Studies (Yangon)	Shwe Pyi Thar	Ministry of Education	630	149
17	West Yangon Technological University	Hlaing Thayar	Ministry of Education	-	-
18	National University of Art and Culture	South Dagon	Ministry of Culture	-	-
19	Dagon University	East Dagon	Ministry of Education	17,618	1,019
20	Technological University (Thanlyin)	Thanlyin	Ministry of Education	10,219	202
21	University of East Yangon (Tarwa)		Ministry of Education	8,677	460
22	Myanmar Maritime University		Ministry of Transport	2,244	132
23	Co-operative University Thanlyin		Ministry of Education	-	-
24	Technological University (Hmawbi)	Hmawbi	Ministry of Education	7,148	181
25	University of West Yangon	Htantabin	Ministry of Education	6,369	353
				235,450	5,208

Source: JICA Study Team



Source: JICA Study Team

Figure 2.1.12: Location of Universities

Yangon is expected to accelerate housing supply of more than one million units to accommodate the families in 2040 for various households. To achieve good living environment, housing supply will be one of the most important measures by means of creating new cities in the suburb area of Yangon including a mass low cost and affordable housings. Creation of sustainable sub-centers and station front urban area with appropriate size should also be considered in order to contribute for Yangon to be efficient and compact city with a concept of decentralization of urban function from CBD. In contrast, high-valued agriculture and related industries in the suburbs should also be enhanced in good balance.

To encourage well-balanced urban development with integrated business and residential areas and with traditional and natural environment with respect to Yangon's landscape and heritage is also important. Although Yangon has 189 registered historical heritage buildings, some of these heritage buildings are in decrepit condition without much care and utilization. The characteristics of these historical heritages should be maintained and enhanced further. Yangon would play the role of an international gateway for visitors to popular domestic tourism destinations. Succession of such historical heritages and creation of attractive river-front area should be carried forward to the future. Establishment of sustainable low carbon society is also a necessary approach to be achieved.

Source: JICA Study Team

Figure 2.1.13: Proposed Key Actions for Knowledge and Comfortable City

(3) Well-Managed Infrastructure City

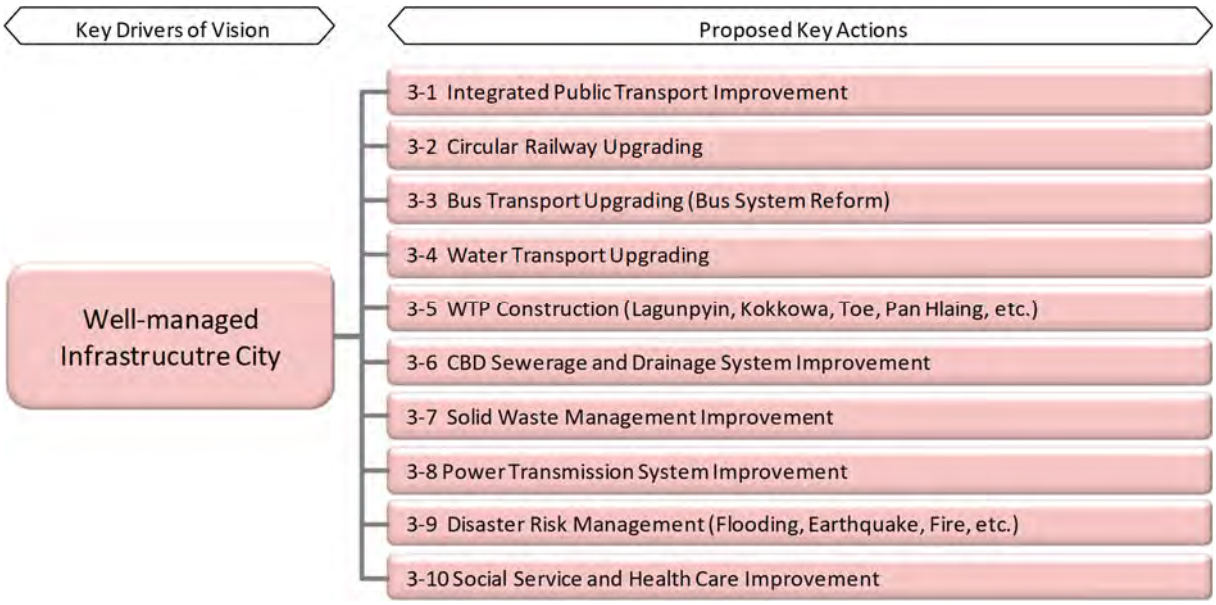
To achieve an international logistics HUB city, urban infrastructure development must be the focal factors. To provide a safer, more reliable and convenient urban life and to realize economic development and industrialization, the vision of becoming a "Well-managed Infrastructure City" must be realized for the future, especially in transportation and road, electricity, and water supply. A concept of "public safety" should be thoroughly considered by securing safer sanitation.

For the future of Yangon, the existing transportation system and facilities are inadequate as compared with what they should be. Consequently, it may be necessary to examine how to encourage more commuters to use the existing circular and intercity railway and/or whether to introduce the urban MRT. Integrated public transportation must be considered having suitable roles in good balance with automobiles. To reorganize bus routes with convenience, to upgrade railway network with punctuality, convenience, and comfort, and to utilize water transport as public transport and tourism are expected to enhance more.

Regarding electricity, improvement of power supply is one of the urgent needs. In Yangon, which has a share of almost half of the domestic power demand, it is important to draw the appropriate strategies of power supply and transmission in the future.

Additionally, urban infrastructure (water supply, sewerage, drainage, solid waste, telecommunication) and social services (education, medical, public facility, and tourism) are in relatively lower level than neighboring countries. Sustainable and reliable infrastructure shall be developed with consideration on effective operation and maintenance (hereinafter referred to as "O&M").

To be resilient against disaster risk of earthquake and flooding is also important and cope up with step by step to secure public safety.



Source: JICA Study Team

Figure 2.1.14: Proposed Key Actions for Well-Managed Infrastructure City

(4) Good-Governance City

To establish a good city both for living and business, to be a "Good Governance City" is an indispensable key factor. To realize this urban development plan, it is necessary to establish a system which controls and promotes urban development activities and building constructions based on land use plan and implements infrastructure development and social service projects based on the development strategies and action plans. A concept of "Social Benefit" should be thoroughly considered.

Since preparation and enactment of new laws take time, the tentatively enacted by-laws of Yangon shall be examined for rules and laws enforcement. To implement necessary development projects through transparent legal system under the rule of law is deeply expected, especially a system with regard to zoning regulation and development permission which restrict people's property rights.

Given the very fast pace of expanding economic activities in the Greater Yangon, needs for urban infrastructure development that needs massive financing sources because the existing financial sources alone are not able to close the financing gaps. To establish urban development financing mechanism in order to fill such gap in urban development by taxation and project financing are necessary in the implementation phase. In the mid to long term, it can be enabled and empowered to explore its untapped potential in order to increase and diversify "own-source revenues".

Recently, capacity development has been growingly recognized as one of the most essential factors for urban development in particular. Capacity development is defined as the process whereby people, organizations, and society as a whole unleash, strengthen, create, adapt, and maintain capacity over time. Continuous capacity development shall be necessary.

Source: JICA Study Team

Figure 2.1.15: Proposed Key Actions for Good Governance City

2.2 Urban Framework and Structure

2.2.1 Economic and Financial Status

(1) Export and Import

Major export commodities in 2014 were “Miscellaneous manufactured articles” (42% of total export) followed by “Mineral products” (mostly natural gas, 31%), “Vegetable products” (10%), and “Textiles and textile articles” (8%). The most notable changes in export are the facts that a share of “mineral products” fell by 7 points from its share of 38% in 2011, while a share of “Miscellaneous manufactured articles” jumped up by 20 points from its share of 22% in 2011. These changes reflect the fact that the economy of Myanmar is becoming more diverse in recent years. Major import commodities in 2014 were “Mineral products” (mostly refined mineral oil, 17% of total import), followed by “Machinery and mechanical appliances; electrical equipment” (16%), “Miscellaneous manufactured articles.” (16%), “Vehicles, aircraft, vessels and associated transport equipment” (12%) and “Base metals and products” (10%). Yangon is a center of export and import of the country, because of the presence of Yangon Port.

(2) Foreign Investment

Inflows of FDIs dramatically increased after 2009. Total amount of FDIs in the period of 2010-2014 was 38.2 billion USD, 4.3 times as much as the total in 2000-2009. By sector, the resource sectors composed of the oil and gas, power and mining sectors had been dominant until 2011 that made up a vast majority, 93% of a total permitted investment amounts by the existing enterprises in 2011. Starting from 2012, FDIs started to flow into more diverse sectors other than resource sectors. In total of 2012-2014, share of FDIs to “Manufacturing” sector jumped up to 27% from barely visible 0.8% in total of the previous period of 2000-2011, while the resources sector’s share became 29% in 2012-2014, still very large but not as prominent as it was.

It should be noted that foreign investment in the non-resource sectors would provide large benefits to Myanmar’s economy through creating employment opportunities, transferring the industrial technologies, enhancing the convenience of the nation, obtaining foreign currency and so forth. Therefore, it is crucial to encourage expansion of foreign investment in the non-resource sectors.

In Greater Yangon, growth in foreign investment is expected to the thermal power station, manufacturing, construction, transport, telecommunications, hotel, tourism, real estate and industrial park. It is expected that the new SEZ law, (January 2014), amendments of Investment Law (December 2015), and implementation of Thilawa SEZ development project farther encourage inflows and diversification of FDIs to Myanmar.

Table 2.2.1: Total USD Investment of Permitted Enterprises by Sector, Under the Foreign Investment Law

(Million USD)

Classification	2000-2009 total	2010	2011	2012	2013	2014	2010-2014 Total	2000-2011 Total %	2012-2014 Total %
Agriculture	20	139	-	10	20	40	208	0.5%	0.5%
Livestock & Fishery	41	-	-	6	96	27	128	0.1%	0.9%
Mining	876	1,396	20	15	33	6	1,470	6.8%	0.4%
Oil and Gas	1,328	10,179	248	309	-	3,220	13,957	35.1%	26.1%
Manufacturing	164	66	32	401	1,827	1,502	3,829	0.8%	27.6%
Power	6,311	8,219	4,344	364	47	40	13,013	56.3%	3.3%
Transport & Communication	38	-	1	-	1,190	1,679	2,870	0.1%	21.2%
Hotel & Tourism	39	-	-	300	435	358	1,093	0.1%	8.1%
Real Estate Development	31	-	-	-	441	781	1,221	0.1%	9.0%
Industrial Estate	0	-	-	-	-	-	0	0.0%	0.0%
Construction	21	-	-	-	-	-	0	0.1%	0.0%
Others	10	-	-	15	18	357	390	0.0%	2.9%
Total	8,879	19,999	4,644	1,419	4,107	8,011	38,180	100.0%	100.0%

Source: MNPED, Directorate of Investment and Company Administration (DICA) data.

(3) Financial Base of YCDC

YCDC is considered as an independent body raising its own revenues through collecting fees, taxes, issuing licenses, and etc.

As sources of funds, YCDC has a number of income generating enterprises including banking services, hotels, markets, condominiums, golf courses, property development and manufacturing of construction material such as bricks and cement. Total income of YCDC has dramatically increased by 480% from 58 billion MMK in 2011/12 to 279 billion MMK in 2015/16. The most increased source is "Capital Income" that has come to be 122 billion MMK (44% of total income) in 2015/16 that is 20 times as large as the one back in 2011/12.

The total income raised is, however, not always sufficient to cover the whole expenditure of YCDC. When a budget deficit occurs, money from a special fund may be used as it happened in 2011/2012. YCDC also receives financial assistants from international donors that are allocated to specific projects, and cannot be used to cover activity outside of the project scope. These are separately counted as "Income/expenditure from foreign aid" and have increased from 0.63 billion MMK in 2013/14 to 15 billion MMK in 2015/16.

A budget deficit, once it was as large as -23.4% as percentage to the total expenditure in 2011/12, has been controlled to be smaller at the level of -1.9% in 2015/16. Given huge needs for investments in urban renewal and development, however, it is indispensable to further diversify sources of income and enhance a sustainable financial base for urban management.

Table 2.2.2: Income and Expenditure Account from 2011-2012 to 2015-2016

(Million MMK)

Account Title	2011-2012 Actual	2012-2013 Actual	2013-2014 Actual	2014-2015 Actual	2015-2016 Actual
Total Income	**58,152**	**103,167**	**145,768**	**252,179**	**279,359**
Sub-total (Normal+Capital)	58,152	103,167	145,133	249,794	264,004
Normal Income	51,886	95,311	92,180	134,232	141,795
Capital Income	6,266	7,856	52,953	115,562	122,210
Sub-total (Other Sources)	0	0	634	2,385	15,354
Income from foreign aid			634	2,385	12,539
Income from debt					2,815
Total Expenditure	**75,949**	**100,198**	**145,727**	**252,141**	**284,826**
Sub-total (Normal+Capital)	52,214	100,198	145,093	249,756	269,472
Normal Expenditure	36,008	48,273	50,410	67,693	79,779
Capital Expenditure	16,206	51,926	94,682	182,062	189,693
Sub-total (from other sources)	23,735	0	634	2,385	15,354
Expenditure from Special Fund	23,735				
Expenditure from foreign aid income			634	2,385	12,539
Expenditure from debt income					2,815
Fiscal Balance (Income-Expenditure)	**-17,797**	**2,969**	**41**	**38**	**-5,467**
Fiscal Balance (as % of expenditure)	**-23.4%**	**3.0%**	**0.0%**	**0.0%**	**-1.9%**

Source: YCDC data.

(4) Housing in Yangon - Shortage of Low-cost and Affordable Housing

1) Huge Shortage in low-cost and Affordable Housing

Yangon, home to more than 5 million people, is also the economic center for much of the country's industry and services, and generates about 20 percent of Myanmar's GDP. Given the fact that the huge influx of population to the city is expected to continue, Yangon faces a housing shortage. While authorities have commissioned several affordable housing projects and MOC is planning to sell more than 1000 low-cost apartments in Yangon and to build and sell 8000 apartments over the next two years, it is far behind the demand for housing for average people.

According to research by the Department of Urban and Housing Development under MOC, while 65% of Yangon's population own their houses, more than 1.8 million or 35% of the population are in need of low-cost housing. It is also estimated that 25% of total population's dwellings are temporary huts and shanties that mainly house the rapidly increasing influx of population attracted by factory work in the city's industrial zones where FDIs are concentrated.

2) Supply-side of Housing-need Investment for "K10 Million Apartments"

The main challenge of low-cost housing is the need for sufficient investment to be able to sell apartments for under K10 million per unit. This is the price range where majority, as much as 60% of Yangon residents according to DUHD's estimates in 2015, who earn K300,000 a month (USD244) or less can afford. At the moment, however, there are no plans to build "K10 million apartments" under current market conditions. Most of the booming construction for housing over the past few years has been at the higher segments of the market.

U Myint Naing, DUHD's assistant director told the news media: "It could be possible to build low-cost homes on state-owned land, with the government providing water and other infrastructure, for less than K10 million per apartment. But given the limitations of the government budget, it would be very difficult to provide enough of them."[1] The government, "supply side" of low-cost housing is in short of budget for investment.

There is another option to increase supply of housing; to develop the rental sector. This "rental" option could be seen as provision of affordable and decent housing for the middle income population while they need some time to save enough money to pay for the first installment (usually 30% of total value) to buy their houses (often apartments).

3) Demand-side of Housing-need Better Housing Loans

For financing the demand side of housing, the Construction and Housing Development Bank (CHDB)[2] is the only development bank that can provide mortgage-type of loans to people to buy houses with the loan period longer than one year and up to 8 years at an interest rate of 12% per year. CHDB also provides finance for the developers of low-cost and affordable housing.

CHDB has recently announced that it will release new policies for selling low-cost apartments to depositors of the bank who can pay 30 per cent of the total value in an initial instalment. The managing director of the CHDB told the news media: "People can save their money at the CHDB. They will have a chance to buy apartments through a lucky draw program when they can pay the first instalment. It will take them a long time to save Ks 3 million if they save Ks 10,000 per month. It would take 30 months if they save Ks 100,000 per month. The main point is they will have to save enough money to pay the first instalment."[3] It is estimated by CHDB that monthly saving or repayment amount at 30% of monthly incomes is the viable range for average people.

Given the huge demand for low-cost and affordable housing, however, a scale of provision of loans by CHDB is not large enough, not long enough (8-years repayment is too short), and not affordable enough (interest rate of 12% is too high). These shortcomings are reflections of characteristics of the current sources of funds; short-term and high interest rates. In order for CHDB to provide forms of loans better fit to the needs, it is indispensable for them to have sources of funds with "long-term", "low-interest rate", and "large-scale" in their natures.

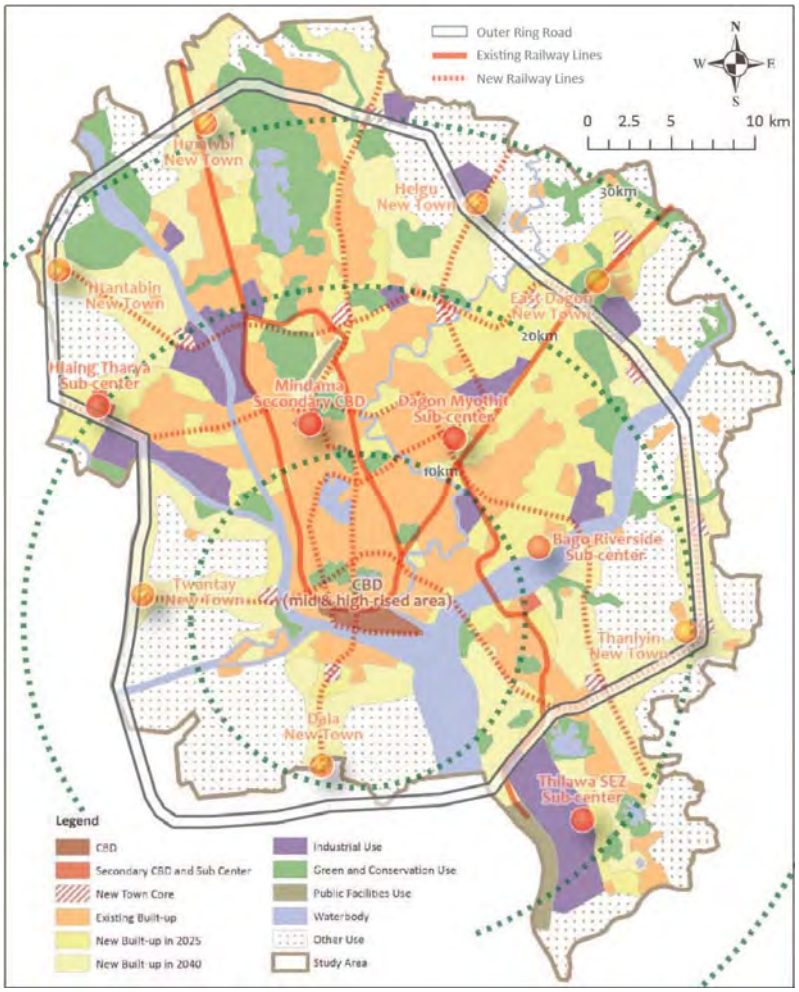
There is also a glitch in a legal framework that pauses CHDB a difficulty. Currently, there is no legal framework for "collective ownership" that enables the buyers to register their bought

[1] The Myanmar Times, Friday, 23 September 2016.
[2] The Construction and Housing Development Bank was set up in 2013 under the Ministry of Construction's supervision to providing the loans that could allow more people to afford homes, but so far its success has been limited. The CHDB has opened seven branches in Yangon, Nay Pyi Taw, Mawlamyine and Pathein. Plans are under way to open additional branches in places where the low-cost housing projects are implemented.
[3] Eleven Myanmar, Tuesday, 19 July 2016.

apartments as collaterals for their housing loans. Likewise, CHDB cannot provide real "mortgage" loans to those who buy apartments, which more likely the cases for urban areas.

2.2.2 The Previous Plan

In the previous SUDP study, "Sub-center with Green Isle System" was proposed and formulated through discussion in steering committees, stakeholder meeting and other opportunities, and interview survey whose targets are the chief of the townships to carry forward to formulate urban structure of future's Greater Yangon. In the structure plan, Thilawa SEZ development with 163,000 residential population and 204,000 labor population were already integrated.



Source: JICA Study Team

Figure 2.2.1: Previous Urban Structure Plan of Greater Yangon planned in 2013

However, after the previous SUDP was published in 2013, some urban development related plans such as YUTRA (Comprehensive Urban Transport Plan of the Greater Yangon), new city development plans and so on were planned, integration of the plans is required. In addition to this, since economic activities were drastically accelerated in Yangon, large-scale urban development projects are moving or planning. For the reason, reflection of these projects is also needed.

2.2.3 Planning Process

To draft the future vision and the structure plan for the Greater Yangon, internal discussions between JICA Study Team and YCDC were conducted constantly. After creation of the draft plan, official

meetings with nodal agencies such as YCDC, YRG, MOTC, MOC and other related organizations were held to form the plan or collect comments on it. The official meetings which were held to concrete urban framework and the structure are shown as below;

Table 2.2.3: Record of Meetings

Date	Title	Venue	Agenda
4th Aug 2016 (Thu)	Kick-off meeting with MOTC and MOC	MOTC and MOC office	• Explanation of the project overview from JICA and JST • Opinion exchange on the project implementation
5th Aug 2016 (Fri)	Meeting with MES	MES office	• Explanation of the project overview from JST • Opinion exchange on the project implementation
24th Aug 2016 (Wed)	Meeting with YCDC	YCDC office	• Discussion on the future vision and the schematic plan
7th Sep 2016 (Tue)	Meeting with YRG	YRG office	• Proposal of structure plan form JST
30th Sep 2016 (Fri)	Meeting with YCDC	YCDC office	• Explanation of the updated future vision and the structure plan
30th Sep 2016 (Fri)	Meeting with YRG	YRG office	• Explanation of the updated future vision and the structure plan
10th – 12th Oct 2016	Progress report meetings to YRG, MOTC and MOC	YRG, MOTC and MOC offices	• Progress report for the considerations on the suture vision and the structure plan
9th Nov 2016 (Wed)	Meeting with YRG	YRG office	• Explanation of population projection according to the updated structure plan

2.2.4 Updated Points from 2013 to 2016

(1) Urban Structure Plan Updating Principles

Urban structure plan of the Greater Yangon is updated according principles as follows;

1) 5.2 million population increase is accommodated by urbanized area in 2040

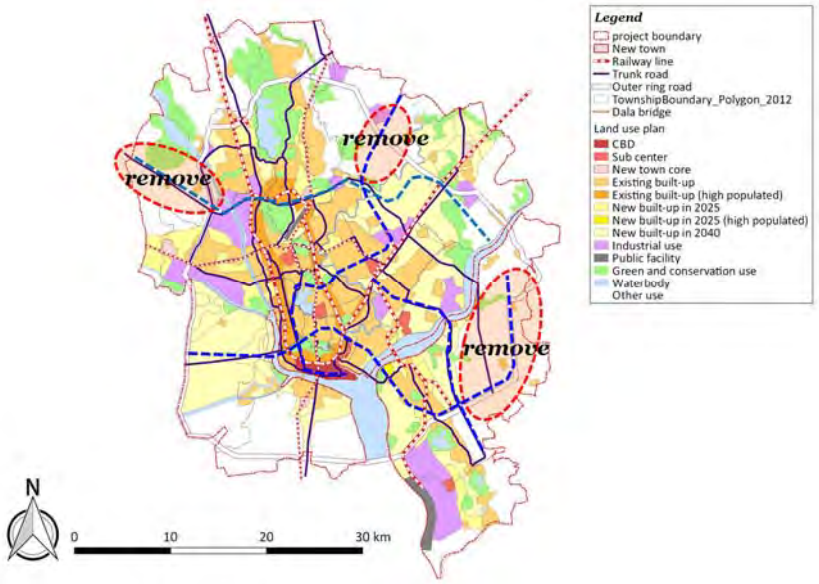
Since the latest census was published in 2014, base year of population estimation is updated from 2011 to 2014. Although population increase ratio “2.6 %” is same as the ratio used in previous SUDP, due to gap of the base year population, updated population is estimated as 10.8 million (10,794,920). As the result, population increase from 2014 (0 year) to 2040 (targeted year) was 5.2 million (5,256,473). New built-up area by 2040 and additional developments in existing built-up area shall be allocated to accommodate this amount.

2) Compact urbanized area

Although population density of new built-up area was equally set as 120 people/ha in previous SUDP, it should be partially higher in areas such as sub center or areas along railway like TOD (Transit Oriented Development) area. According to this principle, several range of population densities are to make urbanized area more compact.

3) Reflection of revision of railway development plan

Although 6 new railway lines were proposed in previous SUDP, 4 of 6 were removed through consideration of YUTRA. In line with this modification, suburb area without proposed railway lines is removed from new built-up area.

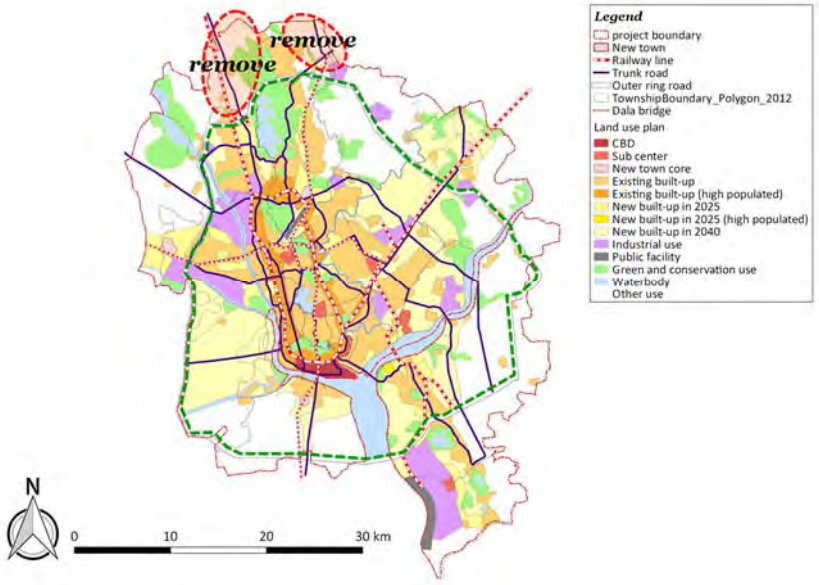


Source: JICA Study Team

Figure 2.2.2: Removed Proposed Railway Line after previous SUDP

4) Reflection of revision of outer ring road alignment

Through discussion with YCDC and MOC, alignment of outer ring road was revised.

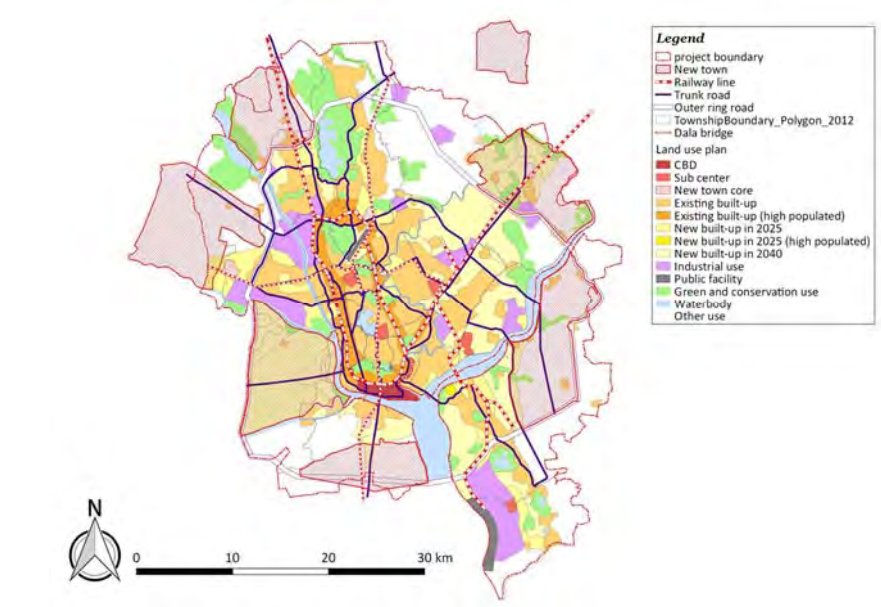


Source: JICA Study Team

Figure 2.2.3: Alignment of Revised Outer Ring Road

5) Inclusion of an idea of new city development planned by YCDC

Red hatched areas in Figure 2.2.4 below show seven new cities planned by YCDC. Since housing developments are important projects for the Greater Yangon, prioritized areas (not whole of new cities) are selected through discussion with YCDC and included as urbanized areas.



Source: JICA Study Team

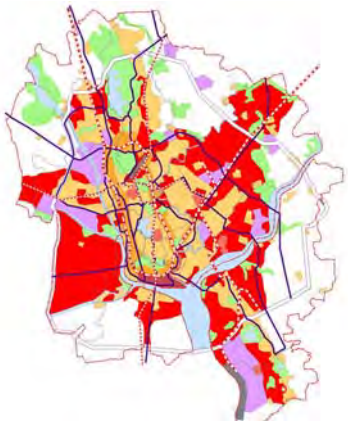
Figure 2.2.4: Seven New cities planned by YCDC

2.2.5 Updated Strategy of Urban Structure Plan

In line with updating principles above, 4 categories on urbanized area defined. The details are shown in the Table 2.2.4.

Table 2.2.4: Category of Urbanized Area

Category	Location	Description
Sub-center		● Planned population density: 200 people/ha ● Estimated population: +120 thousands ● Land use: public, commercial, office, residential ● Development image:  **Updating from previous Master Plan;** 1) Yankin was selected as a sub-center in stead of Hlaing Thaya, because Yankin area is more economically attractive and not only residential but also commercial developments are planned. 2) Dagon Seikkan was selected as a sub-center in stead of Bago Riverside, because wider area development(90 ha) funded by UN-Habitat is ongoing at the site.

Category	Location	Description
Urban area along circular railway line		● Planned population density: 200 people/ha ● Estimated population: +370 thousands ● Land use: commercial, residential ● Development image:  **Updating from previous Master Plan;** This land use is newly added to consider transport oriented development in the Greater Yangon.
Ongoing large-scale residential developments		● Planned population density: 200 people/ha ● Estimated population: +110 thousands ● Land use: mainly residential ● Development image:  **Updating from previous Master Plan;** Situation, especially about population, of large-scale residential developments such as Star City (Thanlyn) and Dagon Seikkan (Dagon Seikkan) were updated.
Newly urban area		● Planned population density: 120-150 people/ha ● Estimated population: +4,780 thousands ● Land use: mainly residential ● Development image:  **Updating from previous Master Plan;** In the new urban structure plan, 1) to North-east, and 2) to South-west are adopted as directions of urban expansion. Accordingly the urban area of the directions are widened, areas of the other directions are shrunk.

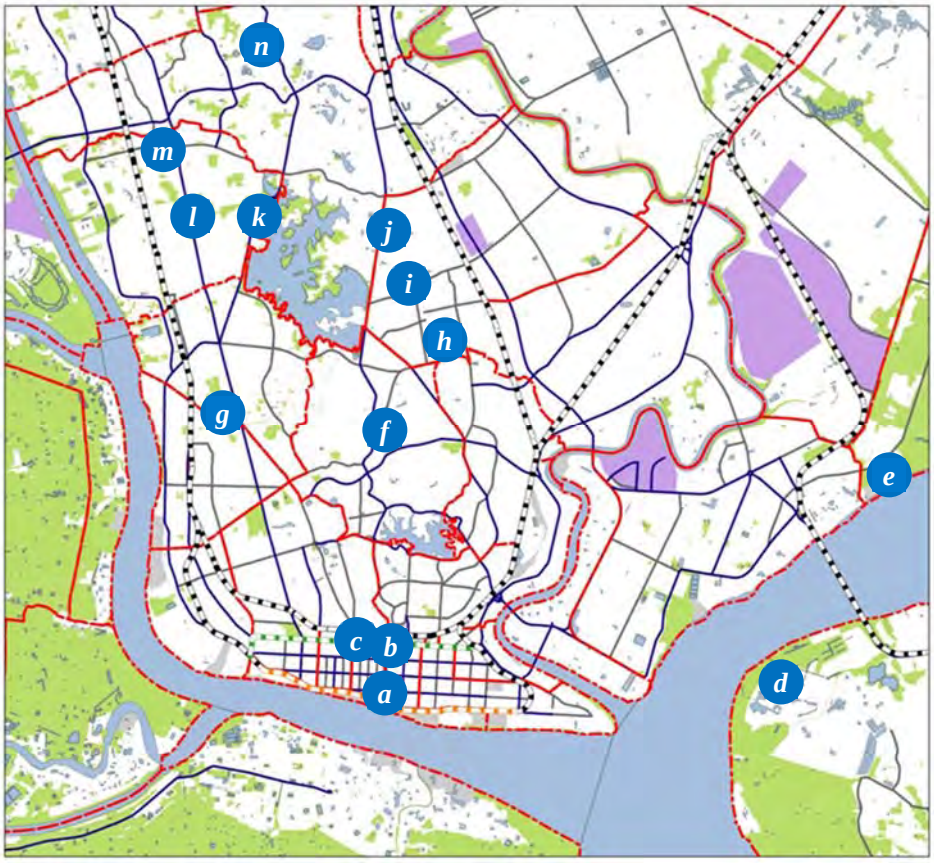
Source: JICA Study Team and Star City web site

2.3 Urban Function Development

2.3.1 Current Status

In recent years, not only public sector, but also private sectors have conducted many urban development projects with rapid urbanization in Yangon. In this clause, overview of major urban development projects by private sectors is summarized.

Figure 2.3.1 and Table 2.3.1 show location and list of large urban development projects in Yangon. Those high-rise buildings with commercial, business and residential use will occupy about 205 ha of land. Those will provide about 25,000 housing units of residence by 2020, which will accommodate about 100,000 populations.



Source: JICA Study Team

Figure 2.3.1: Location of Relevant Urban Development Projects

Table 2.3.1: List of Relevant Urban Development Projects

No.	Project Name	Status	Project Period	Area (ha)	Num. of Units
a)	Sule Square	Construction Period	2014-2016	n/a	n/a
b)	Landmark	Planned	2016-2020	4.00	n/a
c)	Junction City	Construction Period	2013-2019	2.60	n/a
d)	Star City	Construction Period	2013-2017	54.60	1,154
e)	Dagon Myothit (Seikkan)	Construction Period	n/a	89.00	19,600
f)	68 Residences	Construction Period	2014-2017	0.35	369
g)	Times City	Construction Period	2012-2017	4.05	260
h)	Golden City	Construction Period	2014-2018	33.50	935
i)	Skysuites Condominium	Construction Period	2014- n/a	0.33	108
j)	HAGL	Construction Period	2013-2018	8.00	937
k)	Lottee Hotel	Construction Period	2014-2017	6.00	315
l)	The Leaf Residence	Construction Period	2015-2019	1.09	321
m)	Pyae Sone Chan Thar Condo;	Construction Period	2014-2016	0.35	143
n)	Min Residences	Construction Period	2016-2019	1.30	614
Total				205	24,756

Source: JICA Study Team

a) Sule Square

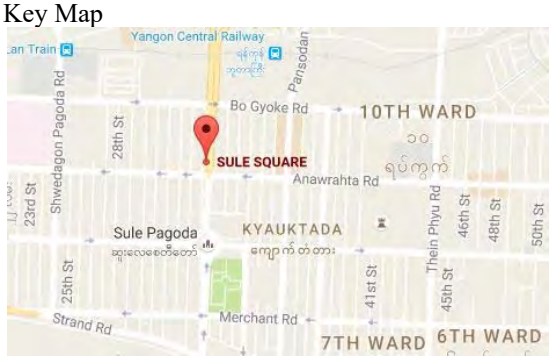
Developer: n/a

Contractor: CNQC construction and others

Source: www.buildersguide.com

Figure 2.3.2: Completion Image (LEFT), Typical Residential Floor Plan(RIGHT)

Key Map



Address: Sule pagoda road & Ahnawrahta road, Kyauktada Township.

Status: Under construction (2014-2016 Dec)

Project Area: n/a

Total Floor Area: 58,000 sqm

Num. of floor: 23 FL

Used FAR: n/a

Building use:
Restaurants, ballrooms and other facilities

Floor area for office place:
20,00 sqm (lettable floor area)

Rental price: 80-85 USD/sqm (office)

Num. of housing units: n/a

b) Landmark Project

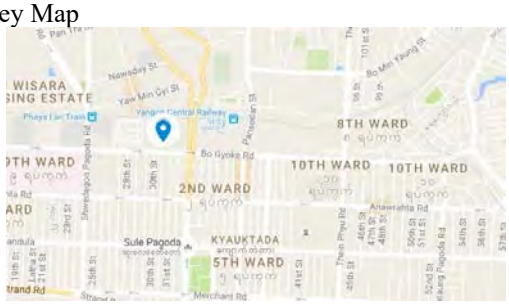
Developer: Yoma Strategic Holding (Local Main Developer) (proposed)

Contractor: Not known yet

Source: Mitsubishi Corporation

Figure 2.3.3: Completion Image

Key Map



Address: Corner of Sule pagoda road & Bogyoke road, Pabedan Township

Status: Suspended (before the end of FY 2016-before the end of FY 2020)

Project Area: 4 ha (including part of the site of a separate project)

Total Floor Area: no detail design is issued

Num. of floor: 21-25 FL

Used FAR: n/a

Building use: mix use

Floor area for office place: n/a

Rental price: n/a

Num. of housing units: n/a

c) Junction City

Developer: Shwe Taung Junction City (Main) & Keppel Land (Singaporere)

Contractor: Shwe Taung Construction (Main) & Green River Construction and Engineering

Source: Junction City Website

Figure 2.3.4: Completion Image (LEFT), Typical Residential Floor Plan(RIGHT)

Key Map

Status: Under construction, Developed in 2013 (will finish in 2019)

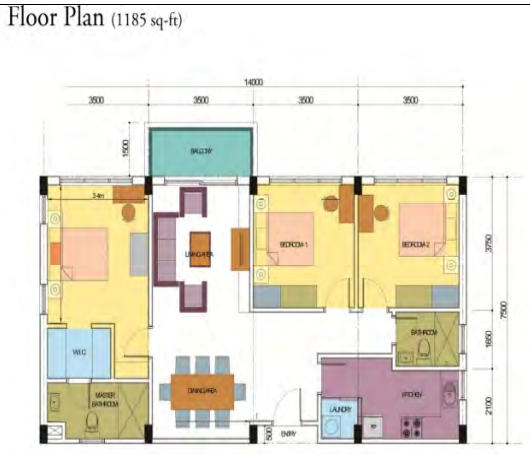
Project Area: 2.6 ha

Total Floor Area: 33400 sq.m (only office tower)

 Address: Corner of Shwedagon Pagoda Road and Bogyoke Road, Pabedan Township	Num. of floor: 23-28 FL Used FAR: n/a Building use: Hotel, office tower, Service Apartment tower, (mix-use) Floor area for 1 housing unit: 1700-2000 sq.m (for office tower) Selling/ rental price: 900 USD/sq.m Num. of housing units: hotel and office towers only (no residential unit)

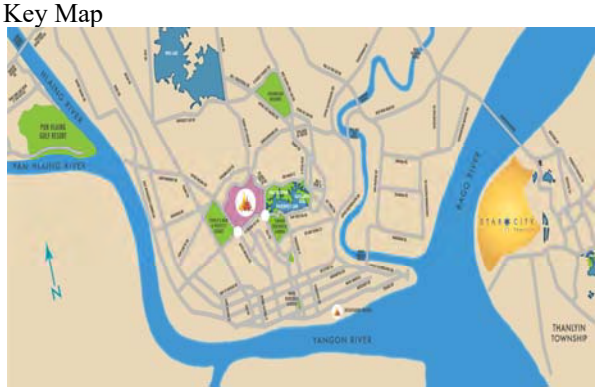
d) Star City

Developer: Thanlyin Estate Development (Myanmar)
Contractor: Dragages Singapore Pte Ltd. (Singapore)



Source: Brochure of Star City Project

Figure 2.3.5: Completion Image (LEFT), Typical Residential Floor Plan(RIGHT)

Key Map  Address: Kyaik Khauk Pagoda Road, Thanlyin ownship, Yangon, Myanmar.	Status: Under construction (2013-2017) Project Area: ~54.6 ha Total Floor Area: ~250000 sq.m Num. of floor: 28 FL Used FAR: n/a Building use: Residential, commercial, office, hotel, school, college and shopping mall. Floor area for 1 housing unit: 60-314 sq.m Selling price: ~ 2150 USD/sq.m Num. of housing units: 1154 units

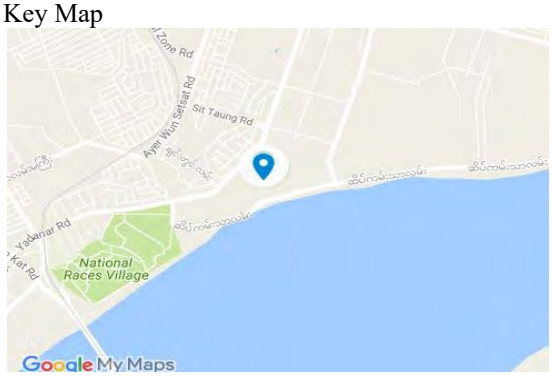
e) Ayeyarwun and Yadanar Housing (Dagon Myothit (Seikkan) Township)

Developer: Hteik Sin Co.,Ltd & Myanmar Saytana Co.,Ltd
Contractor: Crown Advanced Construction & Hteik Sin Construction Co.,Ltd.

Source: Brouchre of Dagon Myothit (Seikkan) Housing

Figure 2.3.6: Completion Image (LEFT), Typical Residential Floor Plan(RIGHT)

Key Map



Address: Dagon Myothit (Seikkan) Township, Yangon, Myanmar.

Status: Under construction
Project Area: 89 ha
Total Floor Area: 245,260 sq.m (for 11 buildings)
Num. of floor: 18 FL
Used FAR: n/a
Building use: Shopping centers, banks, business centers, clinics, playground, swimming pools, and schools, etc.,
Floor area for 1 housing unit: 55.7- 111.4 sq.m
Selling price: 893.08 USD/sq.m
Num. of housing units: 19,600 units

f) 68 Residence

Developer: United GP Development
Contractor: n/a (suppose that United GP is contractor)

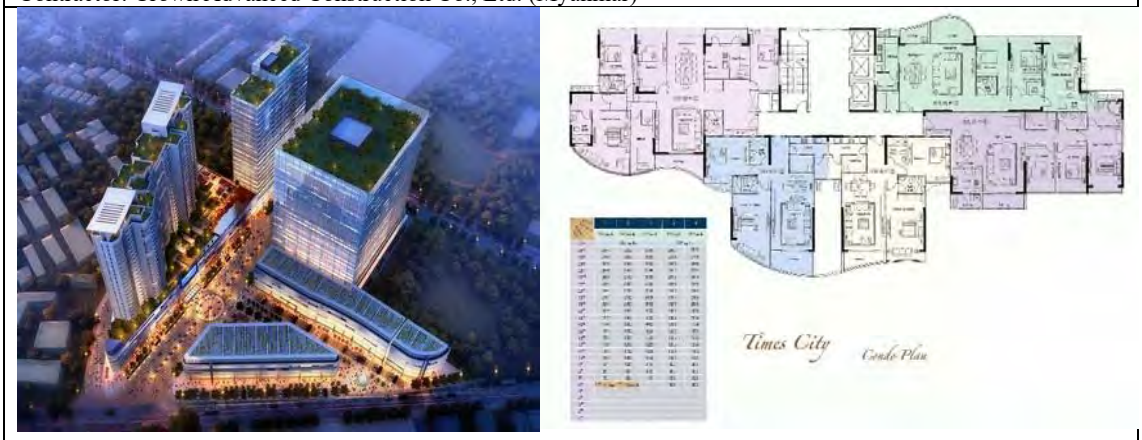
Source: Brochure of 68 Residence Project

Figure 2.3.7: Completion Image (LEFT), Typical Residential Floor Plan(RIGHT)

Key Map	Status: Under construction (2014-2017)
	Project Area: ~ 0.35 ha
	Total Floor Area: n/a
	Num. of floor: 27 FL
	Used FAR: n/a
	Building use: Residential, shopping mall.
	Floor area for 1 housing unit: 100-193 sq.m
	Selling price: 3300-4800 USD/sq.m
	Num. of housing units: 369 units
Address: At the corner of KabaAye Pagoda Road and Saya San Road, Bahan TS, Yangon, Myanmar.	

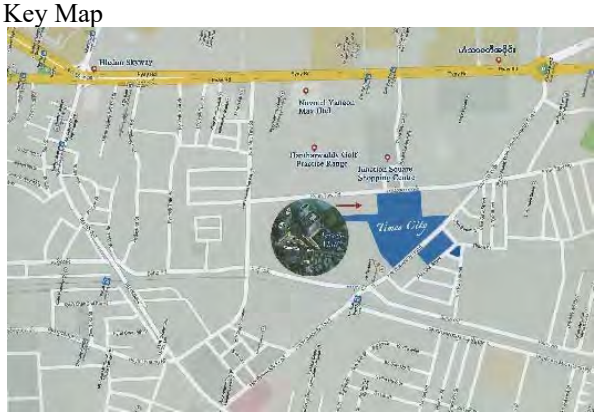
g) Times City

Developer: Local and Foreign Developers (divided by sectors)
Contractor: Crown Advanced Construction Co., Ltd. (Myanmar)



Source: Brochure of Crown Advanced Construction Co., Ltd.

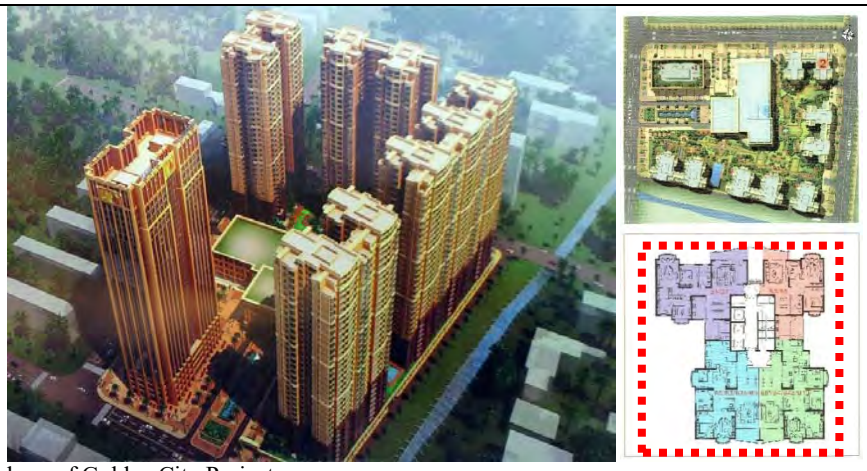
Figure 2.3.8: Completion Image (LEFT), Typical Residential Floor Plan(RIGHT)

Key Map	Status: Under construction
	Project Area: 4.05 ha
	Total Floor Area: n/a
	Num. of floor: 23-27 FL (including basements)
	Used FAR: n/a
	Building use: Residential, commercial, office, shopping mall & hotel
	Floor area for 1 housing unit: 115-213 sq.m
	Selling price: 2,350 USD/sq.m
	Num. of housing units: 1260 units
Address: Hanthawaddy Road, No (8) Ward, Kamayut/ Sanchaung TS	

h) Golden City

Developer: Golden Land Real Estate Development Co., Ltd. (Singapore)

Contractor: n/a



Source: Brochure of Golden City Project

Figure 2.3.9: Completion Image (LEFT), Typical Residential Floor Plan(RIGHT)

Key Map

Address: Yankin Road, CMA Old Building, Yankin Township, Yangon, Myanmar.

Status: Under construction (2014-2018)

Project Area: 33.5 ha

Total Floor Area: ~350000 sqm (gross)

Num. of floor: 33 FL

Used FAR: n/a

Building use: Residential, hotel, shopping mall and office tower.

Floor area for 1 housing unit: 45-400 sq.m

Selling price: 3000-3500 USD/sq.m

Num. of housing units: 935 units

Remarks: Run as joint venture between Uni Global Power Group (Singapore) and local conglomerate Jewelry Luck Group. Land ownership is by Ministry of Defense.

i) Skysuites Condominium

Developer: SCW Development
Contractor: Q Home (local company)

Source: Brochure of Skysuites Condominium

Figure 2.3.10: Completion Image (LEFT), Typical Residential Floor Plan(RIGHT)

Key Map

Address: No.23, Yanshin Road, Yankin Township, Yangon, Myanmar.

Status: Under construction
Project Area: 0.33 ha
Total Floor Area: n/a
Num. of floor: 23 FL
Used FAR: n/a
Building use: Residential
Floor area for 1 housing unit: 83-255 sq.m
Selling price: 2700-3700 USD/sq.m
Num. of housing units: 108 units

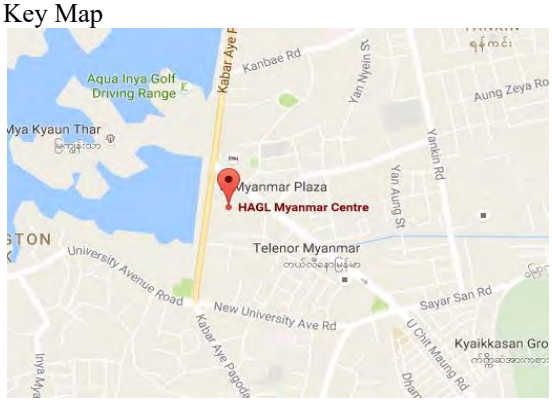
Remarks: Comcon Group Thailand made the project management

j) HAGL Project (Myanmar Plaza)

Developer: Vietnamese Developers
Contractor: n/a

Source: www.buildersguide.com

Figure 2.3.11: Completion Image

Key Map  Address: No (1) Industrial Road, Yankin	Status: Under construction (2013-2018) Project Area: Total Floor Area: 640,000 sq.m Num. of floor: 24 FL + Basements Used FAR: n/a Building use: Hotel, office towers, shopping area, residential Floor area for 1 housing unit: n/a Rental Price: 45-85 USD/ sqm (shops) : 50-65 USD/sqm (office) Num. of housing units: 937 (residential)

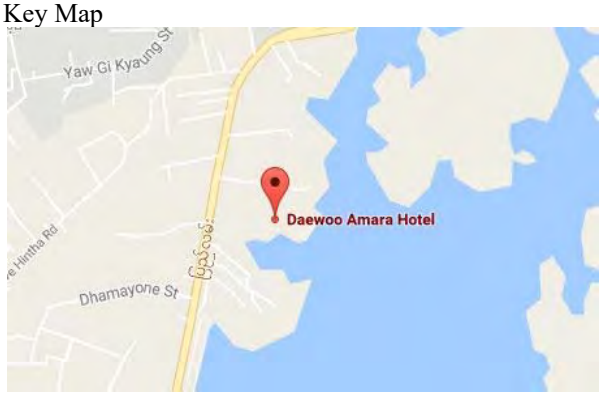
k) Lottee Hotel (Daewoo Amara)

Developer: Daewoo (Main Korea Developers) & Local Developers

Contractor: POSCO Engineering and Construction

Source: www.buildersguide.com

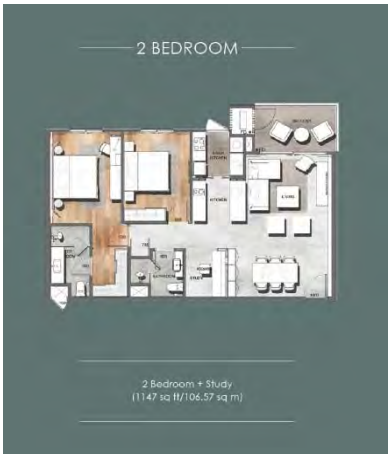
Figure 2.3.12: Completion Image (LEFT), Typical Residential Floor Plan(RIGHT)

Key Map  Address: Pyay Road, Hlaing Township	Status: Under construction Project Area: 6 ha Total Floor Area: 102,000 sq.m (for 11 buildings) Num. of floor: 15 – 29 FL Used FAR: n/a Building use: Restaurants, ballrooms and other facilities Floor area for hotel ball rooms: 1987 sqm Selling price: n/a Num. of housing units: 315 (residential) 343 (hotel rooms)
Remarks: Lottee Korea took part in Hotel Management. BOT system with MIC (Ministry of Commerce)	

l) The Leaf Residence

Developer: Global Green Development Group

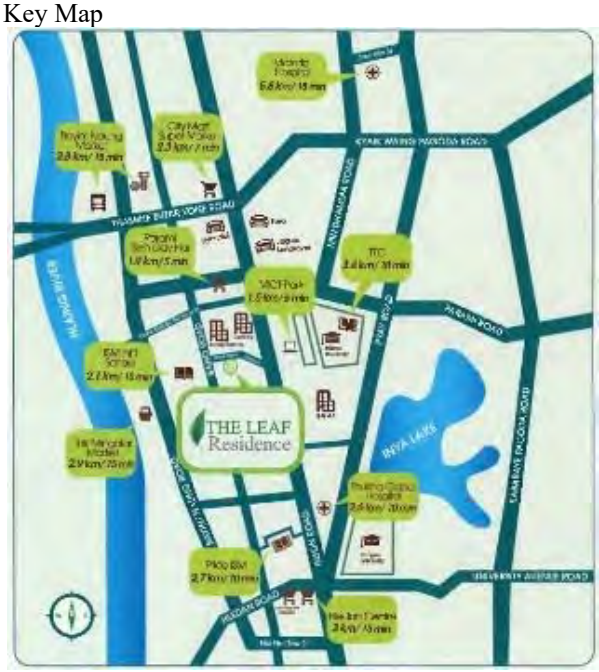
Contractor: IME Construction Co., Ltd.



Source: Brochure of The Leaf Residence and web page of The Leaf

Figure 2.3.13: Completion Image (LEFT), Typical Residential Floor Plan(RIGHT)

Key Map



Address: No. 204, Dhama Thukha Kyaung Street, Hlaing TS, Yangon.

Status: Under construction (March 2019)
Project Area: 1.093 ha
Total Floor Area: 74000 sq.m
Num. of floor: 12.5 FL
Used FAR: 677 %
Building use: Residential
Floor area for 1 housing unit: 50-300 sq.m
Selling price: 125-140 USD/sq.m
Num. of housing units: 321 units

Remarks: Surbana Jurong involved in Project Management.

m) Pyae Sone Chan Thar Condominium

Developer: Golden Gate International Development Co., Ltd

Contractor: Golden Gate Engineering

Source: Brochure of Pyae Sone Chan Thar Condominium.

Figure 2.3.14: Completion Image (LEFT), Typical Residential Floor Plan(RIGHT)

Key Map

Address: No-32, Oak Kyin Butaryone St, Hlaing TS, Yangon, Myanmar.

Status: Under construction (Dec 2016)
Project Area: ~0.35 ha
Total Floor Area: ~ 25000 sq.m
Num. of floor: 13 FL (including 2 basements)
Used FAR: 714 %
Building use: Residential
Floor area for 1 housing unit: 90-280 sq.m
Selling price: 1100-1400 USD/sq.m
Num. of housing units: 143 units

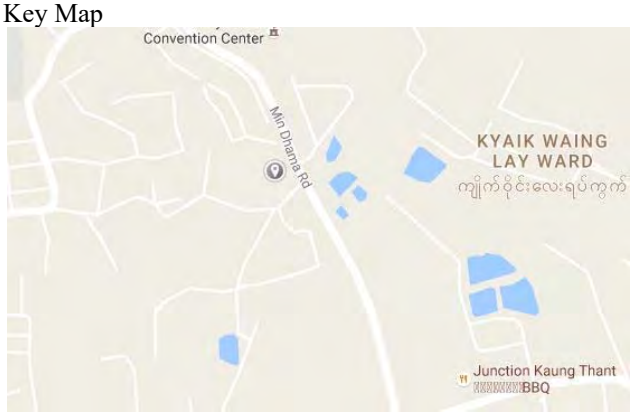
n) Min Residence

Developer: Oxley Myanmar (Singapore origin) & Mottama Holdings (Land Owner)
Contractor: Sino Great Wall (China)

Source: builders.com

Figure 2.3.15: Completion Image

Key Map



Address: Mindammha Road, Mayangone Township

Status: Under construction (2016-2019)
Project Area: 1.3 ha
Total Floor Area: 120000 sq.m
Num. of floor: 23 FL
Used FAR: n/a
Building use: Office space, shopping area and residential.
Floor area for 1 housing unit: 55.7-130 sq.m
Selling price: n.a
Num. of housing units: 614 units

2.3.2 Planning Process

Basically, consideration of the urban functions was conducted in parallel with the structure planning. For the reason, the planning process is almost same as the one for the structure planning. The official meetings which were held to concrete urban functions are shown as below;

Table 2.3.2: Record of Meetings

Date	Title	Venue	Agenda
4th Aug 2016 (Thu)	Kick-off meeting with MOTC and MOC	MOTC and MOC office	• Explanation of the project overview from JICA and JST • Opinion exchange on the project implementation
24th Aug 2016 (Wed)	Meeting with YCDC	YCDC office	• Discussion on the urban functions for the Greater Yangon
7th Sep 2016 (Tue)	Meeting with YRG	YRG office	• Proposal of the urban functions form JST
15th Sep 2016 (Thu)	Meeting with YCDC	YCDC office	• Discussion of cityscape planning and pedestrianization of the CBD
30th Sep 2016 (Fri)	Meeting with YCDC	YCDC office	• Explanation of the updated urban functions
30th Sep 2016 (Fri)	Meeting with YRG	YRG office	• Explanation of the updated urban

Date	Title	Venue	Agenda
			functions
10th – 12th Oct 2016	Progress report meetings to YRG, MOTC and MOC	YRG, MOTC and MOC offices	• Progress report for the considerations on the urban functions
9th Nov 2016 (Wed)	Meeting with YRG	YRG office	• Explanation of layout plan for the urban functions
9th Dec 2016 (Fri)	Meeting with DUHD, MOC	YRG office	• Opinion exchange on the housing development • Explanation of the key findings of urban redevelopment and land readjustment
19th Dec 2016 (Mon)	Meeting with MOTC and MOC	MOTC and MOC office	• Explanation of draft final report

2.3.3 Updated Points from 2013 to 2016

(1) Decentralization of the Urban Core

To decentralize the existing urban core in the CBD, development of secondary CBD and sub centers are proposed. The number of these new urban cores are same as the SUDP 2013, but layout is updated based on the latest development situation. Especially in Yankin area, a lot of private activities such as commercial complexes, hotels and residential buildings are accumulated after SUDP 2013 was formed. Because of it, the area is selected as a sub center.

(2) Layout of Three New city in Suburb Area

Through discussion with YCDC, suburb area development was focused in the three new cities development namely Southwest New City (west of Kyee Myin Daing and Twantay), Dala New City and Dagon Myothit (East) New City to make the future urbanized area more compact.

(3) Provision of Efficient and Effective Traffic Network

According to considerations above, trunk road network and public transportation network like railway lines are updated to provide smooth connectivity among those urban cores and new city cores.

(4) Categorized Housing Supply

Targets of housing project should be categorized by peoples' income for more practical distribution. And the number of housing provision in 2040 is updated along with new projection of population.

(5) Yangon Heritage Strategy

YHT provided the Yangon Heritage Strategy which proposes the 12 key principles for future vision, three-phased strategy, and 24 sections of action plan to combine conservation heritages and development for Yangon's livability in 2016. The cooperation of various professionals including YHT and human resource development for experts in various fields are required.

(6) Water-front Development

In water-front, there will be pressure for commercial development including living, workplace, and leisure development, for which the waterfront would provide an attractive environment.

(7) Goal of Area of New Public Park in New city

Area of public parks and other recreation spaces per capita should be kept as same as current. In new city areas, construction of new parks is needed to keep public services and urban environment.

2.3.4 Supplemental Explanations of the SUDP

(1) Establishment of Funds for Low-income People

For low-income people, it is problem that there are no funds to purchase houses. To distribute housing to low-income people, not only provision of affordable housing, but also establishment of a revolving fund for long-term housing loans are necessary.

2.4 Infrastructure Development

2.4.1 Water Supply

(1) Current Status

1) Progress and Achievement after SUDP

Current status of water supply projects mentioned in SUDP in 2013 is summarized in Table 2.4.1. Six projects in total were proposed and all projects have been completed or ongoing so far. Project No.1 and 2 have been executed by grant project and No.3 to 6 has been executed or will be executed by Japanese yen loan project except for the portion of construction of Lagunbyin WTP in No.3 which is being implemented by YCDC budget.

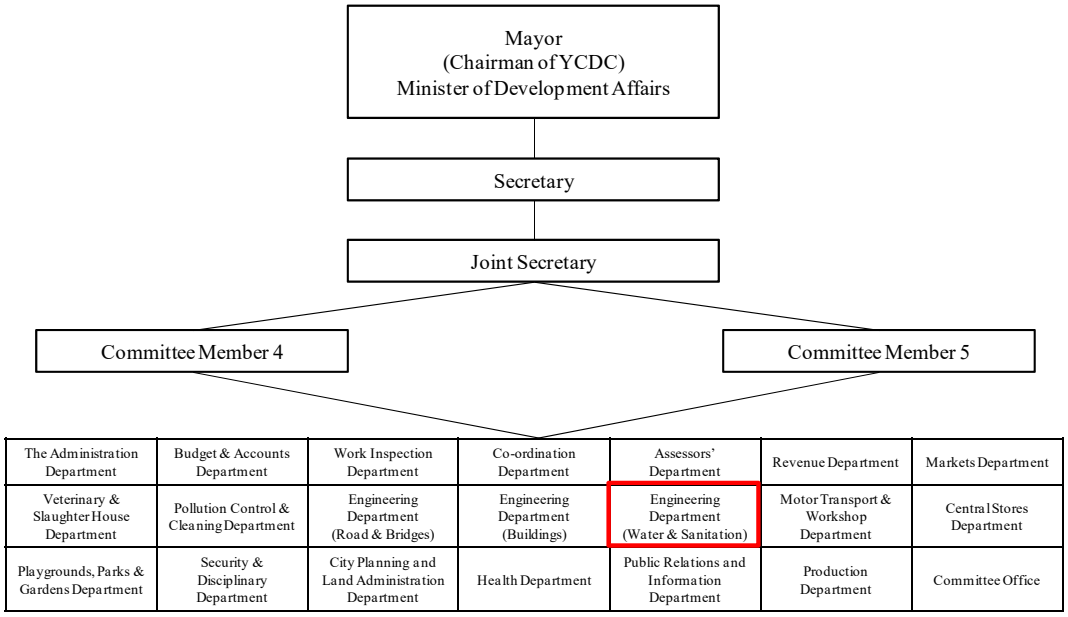
Table 2.4.1: Current Status of Water Supply Projects after development of SUDP in 2013

No.	Project Name	Outline	Current Status
1	Renewal of Pump Station of Nyaunghnapin WTP	- Replacement of all pump facilities, improvement of preventing water hammer, refurbishment of house and installation of monitoring equipment	Already completed in 2015
2	Renewal of Distribution Pipeline in Yankin Township	- Replacement of distribution pipeline between Kokkin Reservoir to Yegu Pumping Station - Establishment of DMA	Already completed in 2016
3	Construction of Kokkowa WTP and transfer/distribution pipeline	- Intake pump facilities from Kokkowa river and conduct pipeline - New WTP (75MGD) - Transfer/distribution pipeline	Already pledged in 2017
4	Construction of Lagunbyin WTP and transfer/distribution pipeline	- New WTP (40MGD) of which water resource is Lagunbyin reservoir - Transfer/distribution pipeline (19km)	Under construction and will be completed in 2021
5	Renewal of Distribution Pipe Network of Zone 1	- Renewal of distribution pipe network (556km) - Rehabilitation of existing reservoir - Installation of DMA - Installation of distribution pumps for higher area	Already pledged in 2017
6	Installation of Disinfection Facility	- Installation of disinfection facilities such as Gyobyu WTP, Nyauhnapin WTP and Hlawaga pumping station	Under construction and will be completed by 2021

Source: JICA Study Team

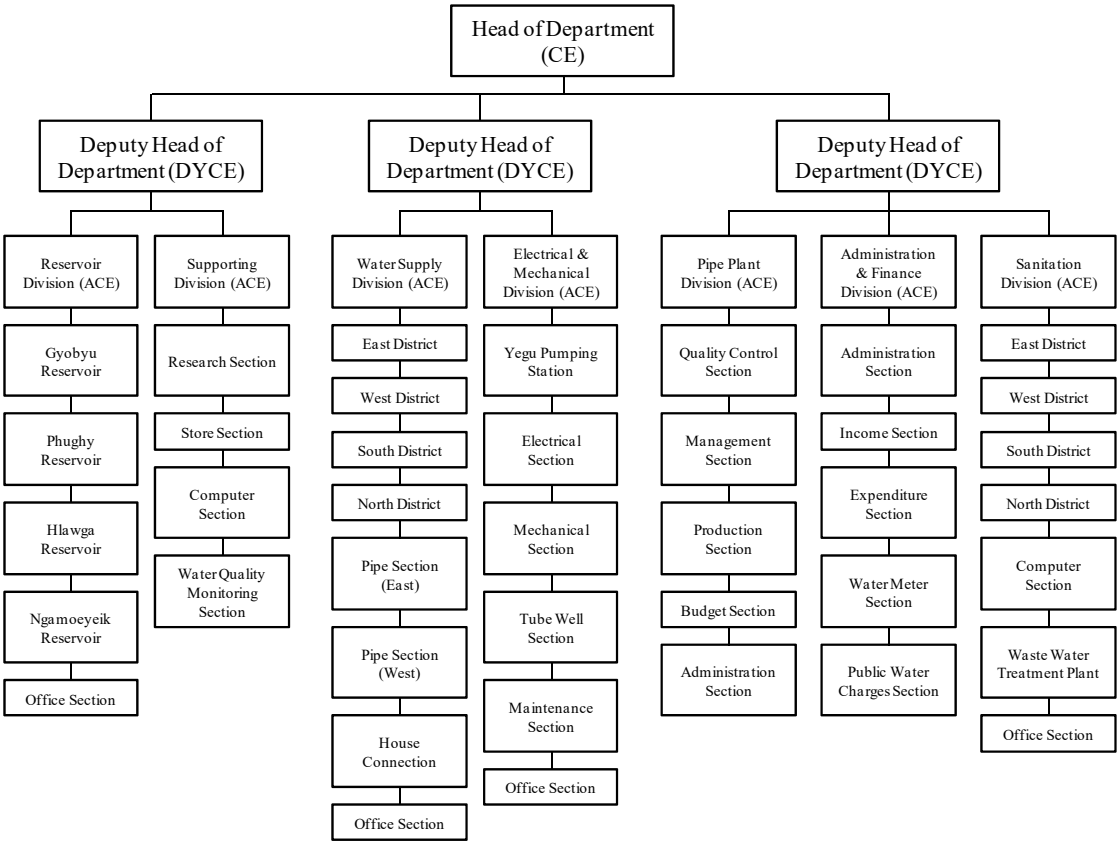
2) Institutional Setting

The water supply system for Yangon City is managed by the Engineering Department (Water and Sanitation) in YCDC with 2,185 staffs in total as of October 2016. Figure 2.4.1 shows organization chart of YCDC and Figure 2.4.2 shows organization chart of Engineering Department (Water and Sanitation).



Source: YCDC, Engineering Department (Water and Sanitation)

Figure 2.4.1: Organization Chart of YCDC



Source: YCDC, Engineering Department (Water and Sanitation)

Figure 2.4.2: Organization Chart of Engineering Department (Water and Sanitation)

Engineering Department (Water and Sanitation) consists of the following seven divisions.

a) Reservoir Division (439 staffs)

- O&M of three reservoirs (Gyobyu, Phugyi and Hlawga) and four pumping stations (hereinafter referred to as "P/S") (Gyobyu, Phugyi, Hlawga and Nyaughnapin Water Treatment Plant (hereinafter referred to as "WTP") P/S)

b) Supporting Division (50 staffs)
- Storing necessary instruments for auxiliary works
- Execution of water quality monitoring
- Preparation of documents such as drawings, etc.

c) Water Supply Division (1,201 staffs)
- Acceptance of new connections
- Repair of minor leakage
- Water distribution from tube wells

d) Electrical and Mechanical Division (160 staffs)
- O&M of booster P/S and Yegu P/S
- Maintenance and upgrade of existing machines and equipment

e) Pipe Plant Division (26 staffs)
- Production of pipes
- Maintenance of the transmission/distribution pipes

f) Administration and Finance Division (257 staffs)
- Execution of administrative works
- Formulation of short term and long-term plans
- Collection of water charge

g) Sanitation Division (152 staffs)
- O&M of sewerage system
- Desludging of septic tanks

It is considered that enhancement of management capacity of Engineering Department (Water and Sanitation) is necessary for providing reasonable water supply service to residents. Under the circumstances, JICA technical assistance project is being executed and will be completed in 2020. Main components for institutional improvement of this project are 1) establishment of the planning section, 2) development of the institutional management plan and 3) enhancement of human resources development.

3) Water Supply System

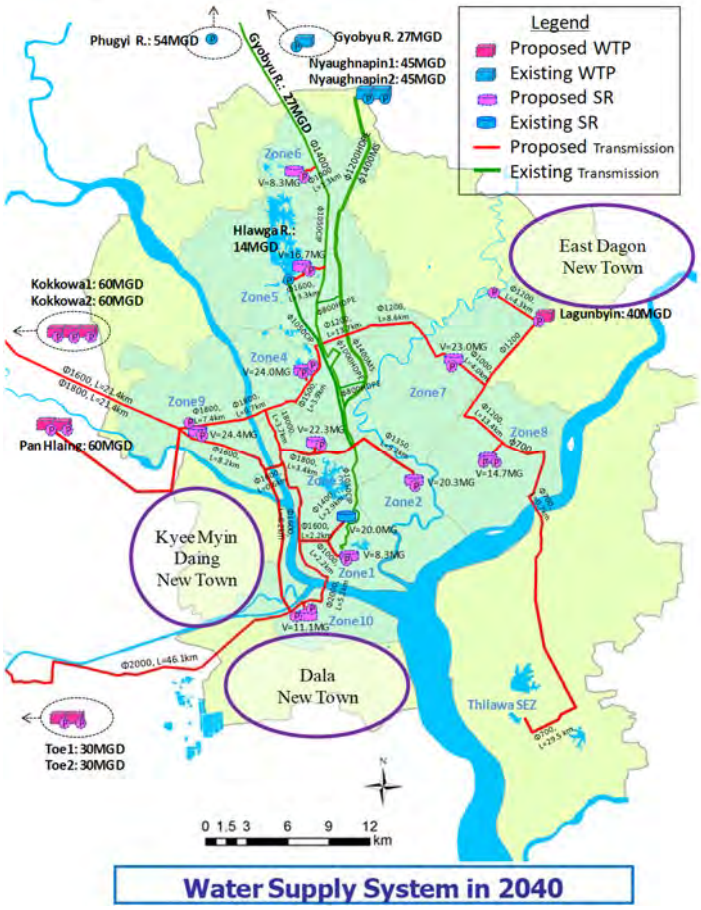
Main facilities of water supply system owned by YCDC are 1) reservoirs and tube wells as water resources, 2) WTPs, 3) pumping stations, 4) piping systems, etc.

There are three kinds of water resources, namely reservoir, river and tube well. Current and future water resources statuses are summarized in Table 2.4.2. Column of 2016 shows the current status, and that of 2040 is destination (refer to chapter 5.4.1 (3) 2)). The Engineering Department (Water and Sanitation) has five water resources, namely Gyobyu (27 million gallons per day (hereinafter referred to as "MGD")) Phugy (54 MGD), Hlawga (14 MGD), Ngamoeyeik (90MGD), and tube wells (8MGD) as of 2016. Additionally, Lagunbyin WTP (40 MGD) funded by YCDC is being developed (10 out of 40 MGD will be utilized for Thilawa SEZ). The feasibility study (hereinafter referred to as "F/S") for Kokkowa Phase 1 (60 MGD) has been completed, and it has already been pledged and will be commenced as ODA loan project. The location and capacity of each water resource is shown in Figure 2.4.3.

Table 2.4.2: Current and Future Water Resources (MGD)

Name	Water Resource	2016	2040	Remarks
Gyobyu	Reservoir	27	27	-
Phugy	Reservoir	54	54	-
Hlawga	Reservoir	14	14	-
Ngamoeyeik	Reservoir	90	90	-
Lagunbyin	Reservoir	-	30+(10)	10MGD for Thilawa will be available from 2019. Full capacity will be available after 2021.
Kokkowa	River	-	120	Phase 1 (60MGD) F/S has been completed
Toe	River	-	60	-
Pan Hlaing	River	-	60	-
Additional resource	River	-	155	Kokkowa, Toe or Pan Hlaing will be utilized
Tube well	Tube well	8	-	Not available after 2025
Total	-	193	610	-

Note: 1MGD=4,546m^3/day
Source: YCDC Engineering Department (Water and Sanitation), JICA Study Team



Source: Based on The Water Supply, Sewerage and Drainage MP (2014), JICA Study Team updates the development capacity

Figure 2.4.3: Location and Capacity of Each Water Resource

There are six WTPs, namely Gyobyu, Nyaunghnapin, Yangonpauk, Dagon Myothit (South) No1, Dagon Myothit (South) No.2 and Thaephyu. Currently, water from Hlawga and Phugyi reservoirs is distributed without treatment. However, such situation will be solved by installation of chlorination facilities under ongoing ODA loan project.

YCDC water supply service ratio is 33% of total population in Greater Yangon as of 2014. To expand the coverage area, transmission/distribution pipes related to Lagunbyin WTP is to be installed under ODA loan project. Installation of transmission pipes and

installation/rehabilitation of distribution pipes to distribute the water from Kokkowa Phase 1 WTP will be executed as ODA loan project and YCDC budget project.

Non-Revenue Water (hereinafter referred to as "NRW") of YCDC water supply system in 2013 is quite high, estimated at 66%. To solve this situation, an NRW reduction projects for Mayangone Township (by Tokyo Metropolitan Government, TSS and Toyo Engineering), Insein Township and South Okkalapa Township (by Mitsubishi Corporation and Manila Water) are ongoing, and for Tarmwe Township funded by Agence Française de Développement (hereinafter referred to as "AFD") is under the planning stage.

YCDC water supply system mentioned above only covers Yangon City at present. However, part of around six townships, namely Kyauktan, Thanlyin, Hlegu, Hmawbi, Htantabin and Twantay Townships, are to be incorporated into YCDC water supply service area after 2025 sequentially. Currently, residents in these townships basically take water from private tube well, pond, rainwater, etc. There are only public water supply systems in Kyauktan and Thanlyin Townships, which are not operated by YCDC as shown in Table 2.4.3.

Table 2.4.3: Water Supply System in Kyauktan and Thanlyin Townships

Township	Kyauktan	Thanlyin
Water Resource	Reservoir	Tube Well
No. of System	1	3
No. of Private Tube wells	350	9986
No. of service connection	1564	97(42+19+36)
Population in 2016	128,254	236,060
Service coverage	6 %	0.18 %
No. of Service tank	15 communal tank	3 elevated tank
Water Tariff	4000 MMK/month	1000 MMK/month

Source: Yangon Region Development Committee

4) Financial Aspect

Current water tariff system is summarized in Table 2.4.4. Currency applied for water tariff collection has been unified to MMK.

Table 2.4.4: Water Tariff System

No.	Category	Meter Rate (MMK/m^3)	Flat Rate (MMK/month)
1	Governmental Institution • Departmental, officers and staffs • Housing factories, workshops	 88 110	Variable, price upon the daily water usage is estimated by water rate.
2	Public • Household ✓ High rise building, individual house with compounds, residences ✓ Individual house and apartment • Commercial ✓ Construction Industry ✓ Commercial	 88 88 110 110	 3000 1800 - -
3	Hotels, motels, inns (investment in foreign currency)	880	-
4	Industries, workshops, markets and condominium	880	-
5	Rent of household (including individual house with compounds, residences, apartments, high rise buildings)	440	-

Source: YCDC, Engineering Department (Water and Sanitation)

The revenue and expenditure of Engineering Department (Water and Sanitation) is shown in Table 2.4.5. Recently, the expenditure from water supply service exceeds the revenue.

Table 2.4.5: Revenue and Expenditure of Engineering Department (Water and Sanitation) (Million MMK)

Account Title	FY2013-2014	FY2014-2015	FY2015-2016
Revenue			
Water Charges for Government	1,111	1,608	1,697
Water Charges for Private	5,973	6,906	8,497
Water Connection Fees	218	296	536
Sales of Water Meters	130	280	732
The Others	167	197	292
Total	**7,599**	**9,288**	**11,753**
Expenditure			
Operational Expenditure			
Salary and Allowance	1,512	1,729	2,233
Material Cost, Labour Charge and Service	5,631	9,552	11,474
Maintenance and Repair	2,234	2,343	2,789
Capital Expenditure			
Extension of Water Supply Pipes	190	2,243	5,146
Water Resources	32,153	38,860	56,055
Water Supplies	1,843	7,950	4,013
Sewage Disposal	167	241	208
Waste Water Treatment Plant	49	69	39
Machinery	955	4	2
Total	**44,734**	**62,990**	**81,959**
Balance	**-37,136**	**-53,702**	**-70,207**

Source: YCDC Engineering Department (Water and Sanitation)

It has already been pointed out that improvement of water tariff is desired as one of the solutions to improve current situations. However, it has not been achieved so far and it was considered that formulation of sustainable financial management system and proper organization system were necessary. Under the circumstances, JICA technical assistance project to tackle with improvement of management system is ongoing.

(2) Planning Process

Table 2.4.6: Record of Meetings and Surveys (Water Supply)

Date	Title	Venue	Agenda
12th Sep 2016 (Mon)	Meeting with JICA Myanmar Office staffs	JICA Office	• Current Status of Water Supply • Opinions from JICA
15th Sep 2016 (Thu)	Meeting with JICA expert (Water Supply Sector)	YCDC City Hall	• Current Status of Water Supply
23th Sep 2016 (Fri)	Meeting with YCDC Engineering Department (Water and Sanitation)	YCDC City Hall	• Current Status of Water Supply • Opinions from Engineering Department
26th Oct 2016 (Wed)	Meeting with JICA expert (Capacity Development)	YCDC City Hall	• Current Status of Water Supply
31th Oct 2016 (Mon)	Meeting with YCDC Engineering Department (Water and Sanitation)	YCDC City Hall	• Opinions from Engineering Department
01th Nov 2016 (Tue)	Field survey	Lagunbyin WTP Nyaughnapin WTP Hlawga reservoir	• Field Survey
03th Nov 2016 (Thu)	Meeting with YCDC Engineering Department (Water and Sanitation), JICA experts	YCDC City Hall	• Discussion about Development Plan

Source: JICA Study Team

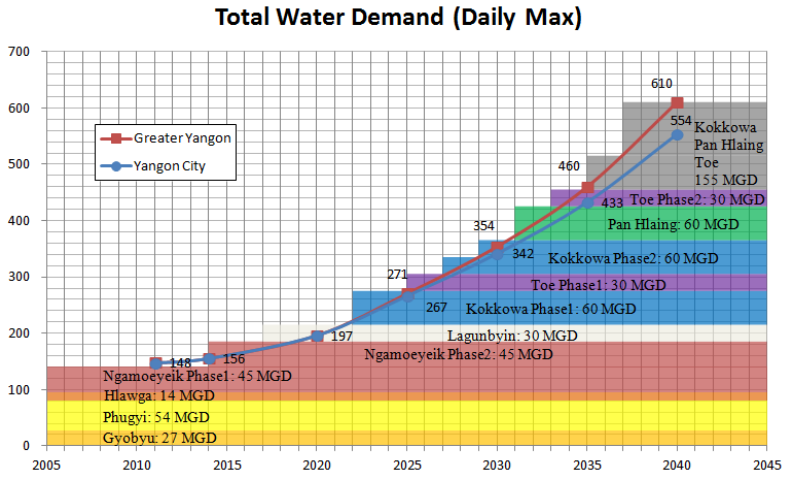
(3) Updated Points from 2013 to 2016

1) Water Demand

- Future population and Unit Water Consumption are updated in the Study.
- Water demand in 2040 for Greater Yangon is estimated at 610 MGD (634 MGD estimated in 2013).

2) Development Plan of Water Resources

- Total development capacity of water resources decrease from 635 MGD to 610 MGD due to reduction of estimated water demand as shown in Figure 2.4.4.
- Pan Hlaing River is added as available water resources with capacity of at least 60 MGD.
- After development of Toe River Phase 2, remaining water demand of 155 MGD will be covered by any of Kokkowa, Pan Hlaing and Toe River.



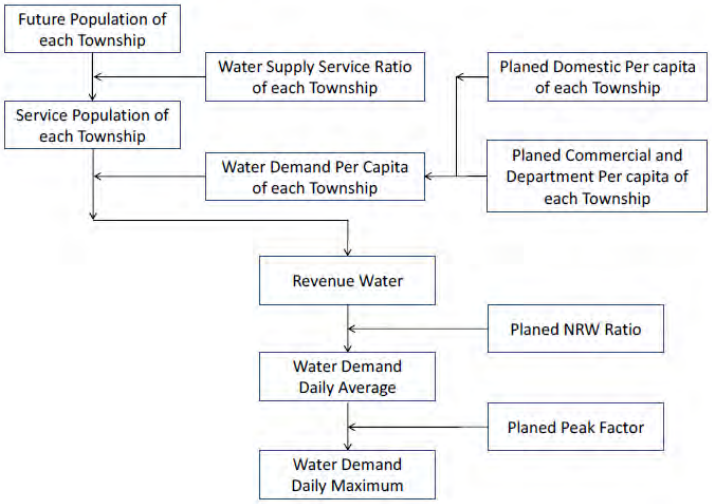
Source: JICA Study Team

Figure 2.4.4: Development Plan of Water Resources

(4) Supplemental Explanations of the SUDP

1) Demand Analysis

Water supply demand has been estimated in the Study. Flow of water demand forecast is shown in Figure 2.4.5.



Source: The Water Supply, Sewerage and Drainage MP (2014)

Figure 2.4.5: Flow of Water Demand Forecast

(I) Conditions applied for Water Demand Forecast

I) Future Population

Based on census 2014, future population for each township has been estimated in the Study and utilized for water demand forecast.

II) Water Supply Service Ratio

Basically, updated water supply service ratio estimated in Preparatory Survey for Greater Yangon Water Supply Improvement Project Phase II (2016) has been utilized because the estimated ratio reflects the result of census 2014. However, increasing ratio per year of Kyee Myin Daing Township is revised to 3% to reach almost same service ratio in 2040 as surrounding townships because Kyee Myin Daing Township is planned to be developed as New city Core. Additionally, increasing ratio per year for Twantay Township is also changed to 3% because Twantay Township also will be developed as new city core same as Kyee Myin Daing Township.

III) Water Demand per Capita, Planned NRW and Leakage Ratio and Planned Peak Factor

Same value shown in The Water Supply, Sewerage and Drainage MP (2014) is applied as shown in Table 2.4.7 and Table 2.4.8. 1.1 is applied as planned peak factor.

Table 2.4.7: Applied Water Demand per Capita

area	Water Demand per Capita (LPCD)					
	2014	2020	2025	2030	2035	2040
CBD, IUR, ORZ, NS,OS	185	220	250	278	305	333
SoCBD, NewS, PA	115	143	167	195	222	250

Source: The Water Supply, Sewerage and Drainage MP (2014)

Table 2.4.8: Applied NRW and Leakage Ratio

Year	2020	2025	2030	2035	2040
NRW (%)	46	35	26	20	15
Leakage (%)	33	25	18	13	10

Source: The Water Supply, Sewerage and Drainage MP (2014)

(II) Estimated Service Ratio and Served Population

Service ratio and served population are estimated based on the conditions above as shown in Table 2.4.9 and Table 2.4.10.

Table 2.4.9: Estimated Service Ratio

No.	Township Name	Township Group	2020	2025	2030	2035	2040
1	Latha	CBD	97%	100%	100%	100%	100%
2	Lanmadaw		82%	92%	100%	100%	100%
3	Pabedan		100%	100%	100%	100%	100%
4	Kyauktada		100%	100%	100%	100%	100%
5	Botahtaung		100%	100%	100%	100%	100%
6	Pazundaung		100%	100%	100%	100%	100%
7	Ahlone	Inner Urban Ring	32%	45%	55%	65%	75%
8	Kyee Myin Daing		16%	26%	41%	56%	71%
9	Sanchaung		26%	45%	55%	65%	75%
10	Dagon		59%	69%	79%	89%	99%
11	Bahan		98%	100%	100%	100%	100%
12	Tarmwe		99%	100%	100%	100%	100%
13	Mingalar Taung Nyunt		100%	100%	100%	100%	100%
14	Seikkan		78%	88%	98%	100%	100%
15	Dawbon		41%	51%	61%	71%	81%
16	Kamaryut	Outer Ring	20%	45%	55%	65%	75%
17	Hlaing		39%	49%	59%	69%	79%
18	Yankin		100%	100%	100%	100%	100%
19	Thingangyun		60%	70%	80%	90%	100%
20	Mayangone	Northern Suburbs	60%	70%	80%	90%	100%
21	Insein		38%	48%	58%	68%	78%
22	Mingalardon		42%	52%	62%	72%	82%
23	North Okkalapa	Older Suburbs	98%	100%	100%	100%	100%
24	South Okkalapa		80%	90%	100%	100%	100%
25	Thaketa		40%	50%	60%	70%	80%
26	Dala	South of CBD	22%	32%	42%	52%	62%
27	Seikgyikhanaungto		12%	22%	32%	42%	52%
28	Shwe Pyi Thar	New Suburbs	20%	30%	40%	50%	60%
29	Hlaing Tharyar		15%	45%	55%	65%	75%
30	Dagon Myothit (North)		46%	56%	66%	76%	86%
31	Dagon Myothit (South)		37%	47%	57%	67%	77%
32	Dagon Myothit (East)		28%	38%	48%	58%	68%
33	Dagon Myothit (Seikkan)		26%	36%	46%	56%	66%
34	Kyauktan	Periphery Area	0%	10%	20%	30%	40%
35	Thanlyin		0%	10%	20%	30%	40%
36	Hlegu		0%	10%	20%	30%	40%
37	Hmawbi		0%	10%	20%	30%	40%
38	Htantabin		0%	10%	20%	30%	40%
39	Twantay		0%	10%	25%	40%	55%

Source: JICA Study Team

Table 2.4.10: Estimated Served Population

No.	Township Name	Township Group	2020	2025	2030	2035	2040
1	Latha	CBD	24,305	25,057	25,057	25,057	25,057
2	Lanmadaw		38,671	43,387	47,160	47,160	47,160
3	Pabedan		33,336	33,336	33,336	33,336	33,336
4	Kyauktada		29,853	29,853	29,853	29,853	29,853
5	Botahtaung		40,995	40,995	40,995	40,995	40,995
6	Pazundaung		48,455	48,455	48,455	48,455	48,455
7	Ahlone	Inner Urban Ring	20,426	32,106	43,375	54,518	66,663
8	Kyee Myin Daing		18,933	32,363	53,550	75,433	98,543
9	Sanchaung		27,398	49,751	63,657	77,477	91,987
10	Dagon		18,290	25,064	32,904	40,229	48,264
11	Bahan		95,662	98,409	99,204	99,733	100,263
12	Tarmwe		168,436	174,480	178,823	181,718	184,613
13	Mingalar Taung Nyunt		142,679	151,845	161,011	167,122	173,233
14	Seikkan		2,204	2,487	2,769	2,826	2,826

15	Dawbon		31,813	40,613	49,821	58,954	68,359
16	Kamaryut	Outer Ring	18,444	44,599	58,298	71,883	86,385
17	Hlaing		68,585	93,030	120,275	147,099	175,790
18	Yankin		77,107	82,651	88,195	91,892	95,588
19	Thingangyun		131,410	159,315	188,936	217,699	247,606
20	Mayangone	Northern Suburbs	129,529	162,311	198,292	232,673	269,187
21	Insein		130,459	181,220	238,826	295,519	356,776
22	Mingalardon		171,450	248,132	338,608	426,325	523,238
23	North Okkalapa	Older Suburbs	361,371	400,653	432,561	453,832	475,104
24	South Okkalapa		132,310	152,300	173,057	175,614	178,171
25	Thaketa		91,525	118,121	146,203	174,038	202,863
26	Dala	South of CBD	27,161	42,012	63,525	95,402	143,446
27	Seikgyikhanaungto		4,468	8,830	13,774	18,892	24,398
28	Shwe Pyi Thar	New Suburbs	79,072	132,604	195,465	259,882	330,519
29	Hlaing Tharyar		116,177	383,621	511,758	638,596	775,832
30	Dagon Myothit (North)		106,568	143,708	185,837	226,635	270,761
31	Dagon Myothit (South)		155,250	217,491	288,363	358,228	433,847
32	Dagon Myothit (East)		101,573	225,245	394,915	667,751	1,006,298
33	Dagon Myothit (Seikkan)		58,728	105,855	166,615	257,367	367,596
34	Kyauktan	Periphery Area	0	6,624	18,003	38,518	74,181
35	Thanlyin		0	37,297	99,915	211,172	403,081
36	Hlegu		0	1,138	2,364	3,758	5,431
37	Hmawbi		0	3,243	6,487	9,730	12,974
38	Htantabin		0	4,729	15,167	36,574	76,167
39	Twantay		0	17,622	62,770	143,208	255,727
Township Total (Greater Yangon)			2,702,643	3,800,553	4,918,178	6,235,153	7,850,571

Source: JICA Study Team

(III) Result of Demand Analysis

Estimated water demand is shown in Table 2.4.11. Water demand is decreased from 634MGD, estimation in The Water Supply, Sewerage and Drainage MP (2014), to 610MGD because 1) total population decrease and 2) water supply service ratio for each township are changed by updating of population projection.

Table 2.4.11: Estimated Water Demand (MGD)

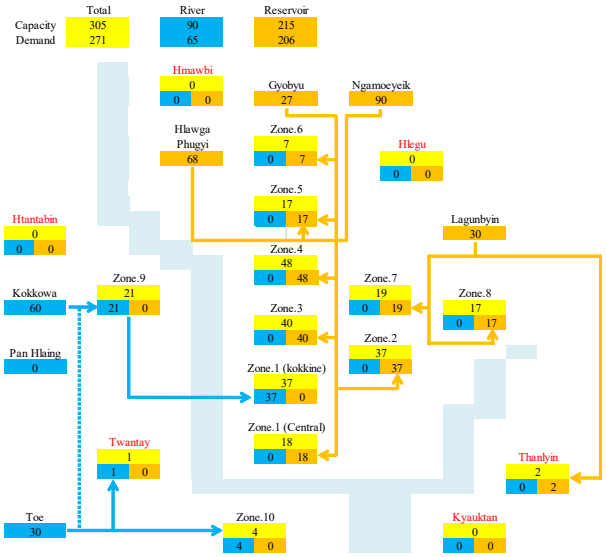
No.	Township Name	Township Group	2020	2025	2030	2035	2040
1	Latha	CBD	2	2	2	2	2
2	Lanmadaw		3	3	4	4	4
3	Pabedan		3	3	3	3	3
4	Kyauktada		2	2	2	3	3
5	Botahtaung		3	3	3	3	4
6	Pazundaung		4	4	4	4	4
7	Ahlone	Inner Urban Ring	2	3	4	5	6
8	Kyee Myin Daing		2	3	4	6	9
9	Sanchaung		2	4	5	7	8
10	Dagon		1	2	3	3	4
11	Bahan		8	8	8	8	9
12	Tarmwe		13	14	15	15	17
13	Mingalar Taung Nyunt		11	12	13	14	16
14	Seikkan		0	0	0	0	0
15	Dawbon		3	3	4	5	6
16	Kamaryut	Outer Ring	1	4	5	6	8
17	Hlaing		5	8	10	12	16
18	Yankin		6	7	7	8	9
19	Thingangyun		10	13	15	18	22
20	Mayangone	Northern Suburbs	10	13	16	20	24
21	Insein		10	15	20	25	32
22	Mingalardon		14	20	28	36	47
23	North Okkalapa	Older Suburbs	29	32	35	38	43
24	South Okkalapa		11	12	14	15	16
25	Thaketa		7	10	12	15	18
26	Dala	South of CBD	1	2	4	6	10
27	Seikgyikhanaungto		0	0	1	1	2
28	Shwe Pyi Thar	New Suburbs	4	7	11	16	22

29	Hlaing Tharyar		6	21	29	39	52
30	Dagon Myothit (North)		6	8	11	14	18
31	Dagon Myothit (South)		8	12	17	22	29
32	Dagon Myothit (East)		5	12	23	41	68
33	Dagon Myothit (Seikkan)		3	6	10	16	25
Township Total (Yangon City)			197	267	342	433	554
34	Kyauktan	Periphery Area	0	0	1	2	5
35	Thanlyin		0	2	6	13	27
36	Hlegu		0	0	0	0	0
37	Hmawbi		0	0	0	1	1
38	Htantabin		0	0	1	2	5
39	Twantay		0	1	4	9	17
Township Total (Greater Yangon)			197	271	354	460	610

Source: JICA Study Team

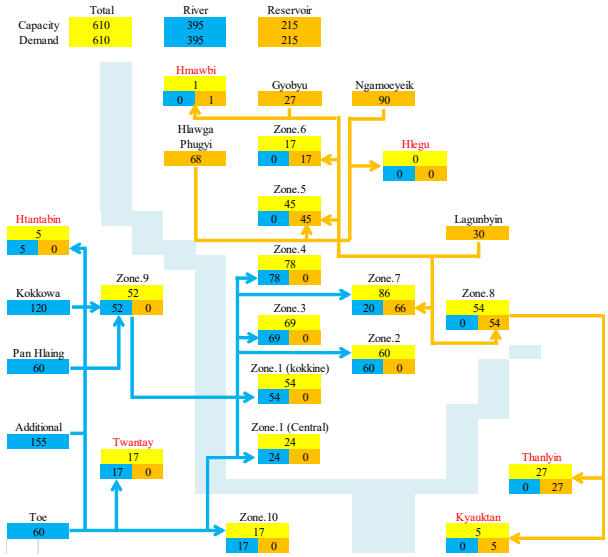
2) Water Allocation Plan

Water allocation plan in 2025 and 2040 are shown in Figure 2.4.6 and Figure 2.4.7.



Source: JICA Study Team

Figure 2.4.6: Water Allocation Plan in 2025



Source: JICA Study Team

Figure 2.4.7: Water Allocation Plan in 2040

2.4.2 Sewerage

(1) Current Status

1) Progress and Achievement after SUDP

Current status of sewerage projects mentioned in SUDP in 2013 is summarized in Table 2.4.12. Two projects in total were proposed. Installation of interceptor proposed in No.1 project has been executed by YCDC for improvement of water quality in Kan Dow Gyi Lake. However, the others works/project, dredging for the lake and introduction of sewerage system in CBD area, has not been commenced so far.

Table 2.4.12: Current Status of Water Supply Projects after Development of SUDP in 2013

No.	Project Name	Outline	Current Status
1	Improvement of water quality of Kan Dow Gyi Lake	- Interceptor and pumping station - Eliminating water bloom and dredging up sludge from bottom - Rain water discharge facilities	Partially executed by YCDC so far
2	Installation of Sewerage System	- Construction of sewerage system in CBD area	Not yet started

Source: JICA Study Team

2) Institutional Setting

The sewerage system is managed by the Sanitation Division with only 152 staffs in Engineering Department (Water and Sanitation) in YCDC as of October, 2016. Sanitation Division consists of seven sections as shown in Figure 2.4.2 and below;

a) East District Section
b) West District Section
c) South District Section
d) North District Section
e) Computer Section
f) Wastewater Treatment Plant Section
g) Office Section

3) Sewerage System

The sewerage collecting system was developed in 1890 during the British Colonial Period. It has been used for over 120 years with repairing and expansion and covers only CBD which accounts for about 4.1% of total population in Greater Yangon as of 2014. The existing wastewater treatment plant (hereinafter referred to as "WWTP") was built in 2005. The sewerage system consists of following components;

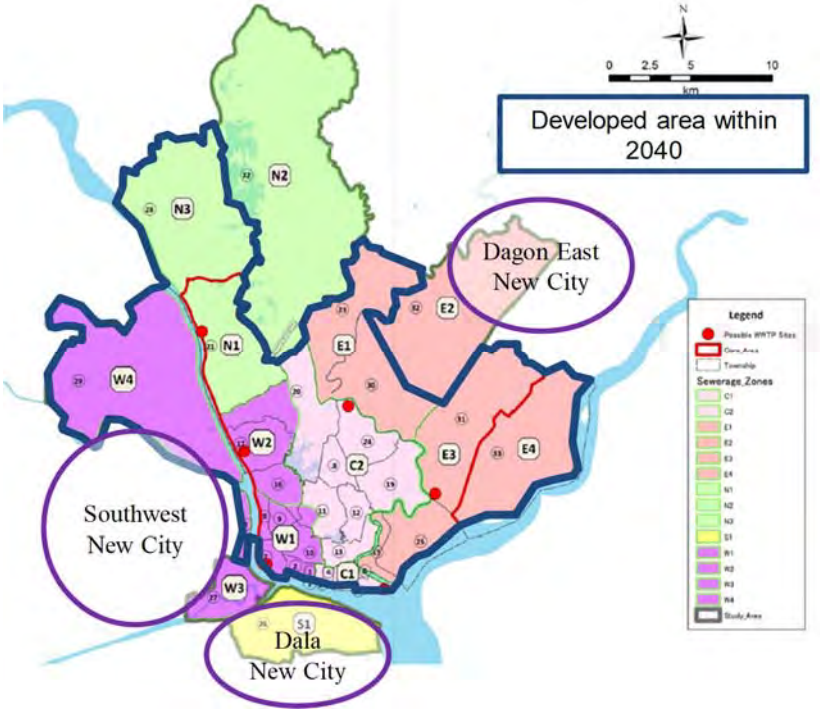
a) Sewer Main (L=10.8km, Diameter=300-900mm)
b) 40 ejector stations (5 out of 40 do not work)
c) Two air compressor stations
d) WWTP (Capacity=14,775m^3/day)

The sewerage system only collects black water and gray water is discharged without treatment, and the amount of sewage flowing into the WWTP is about one-tenth of the design capacity of the WWTP. Additionally, it is estimated that the capacity of 14,775 m^3/day is not enough in case the existing collecting system is improved and all sewage generated from the CBD flows into the WWTP. Therefore, improvement of the existing sewerage system was set as a priority

program in The Improvement of Water Supply, Sewerage and Drainage System in Yangon City (2014). However, no development works have been carried out so far.

Currently, two F/Ss funded by Japanese government whose target area are C1 and W1 are being executed and will be completed by the end of FY2016. Sewerage planning area is shown in Figure 2.4.8.

Outside of YCDC sewerage system service area, on-site disposal system, namely septic tank, pour flush, etc. are installed to treat wastewater.



Source: Based on The Water Supply, Sewerage and Drainage MP (2014), JICA Study Team updates the target area

Figure 2.4.8: Sewerage Planning Area

4) Financial Aspect

The account for sewerage is together with that of water supply. Currently, the sewerage service is provided to residents with no charge. Expenditure for sewerage is estimated at about MMK 502 million in 2016 as shown in Table 2.4.13, which accounts for about 0.6% of total expenditure of the Engineering Department (Water and Sanitation).

Table 2.4.13: Estimated Expenditure for Sewerage in 2016

Item		Quantity (Unit)	Cost (million MMK)
Manpower	Regular Staff	66 (Persons)	129
	Labor	79 (Persons)	102
Power		511 (MWh)	18
Maintenance		(per year)	242
Others		-	11
Total Estimated Sum		-	502

Source: YCDC Engineering Department (Water and Sanitation)

(2) Planning Process

Table 2.4.14: Record of Meetings and Surveys (Water Supply)

Date	Title	Venue	Agenda
12th Sep 2016 (Mon)	Meeting with JICA Myanmar Office staffs	JICA Office	• Current Status of Sewerage • Opinions from JICA
15th Sep 2016 (Thu)	Meeting with JICA expert (Water Supply Sector)	YCDC City Hall	• Current Status of Sewerage
23th Sep 2016 (Fri)	Meeting with YCDC Engineering Department (Water and Sanitation)	YCDC City Hall	• Current Status of Sewerage • Opinions from Engineering Department
27th Sep 2016 (Tue)	Meeting with METI study team	JICA Study Team Office	• Discussion about Sewerage System in CBD
26th Oct 2016 (Wed)	Meeting with JICA expert (Capacity Development)	YCDC City Hall	• Current Status of Sewerage
31th Oct 2016 (Mon)	Meeting with YCDC Engineering Department (Water and Sanitation)	YCDC City Hall	• Opinions from Engineering Department
02th Nov 2016 (Wed)	Field survey	WWTP in CBD	• Field Survey
03th Nov 2016 (Thu)	Meeting with YCDC Engineering Department (Water and Sanitation), JICA experts	YCDC City Hall	• Discussion about Development Plan

Source: JICA Study Team

(3) Updated Points from 2013 to 2016

1) Wastewater Generation

- Daily maximum wastewater generation in 2040 for Greater Yangon is estimated at 3,030,000m^3/day (3,138,000m^3/day estimated in 2013).
- The reason causing above change is that consumed water amount is different from that applied in 2013.

2) Development Plan in 2040

- Shwe Pyi Thar, Hlaing Tharyar and Dagon Myothit (Seikkan) Townships are newly selected as development area within 2040.
- Target wastewater generation to be treated and coverage ratio of total population in 2040 are 2,050,000m^3/day (1,529,000m^3/day estimated in 2013) and 60% (36% estimated in 2013) respectively.
- There is possibility that Latha and Lanmadaw Townships which belong to W1 area at present are incorporated into C1 area by the result of ongoing F/Ss by Japanese Government.

3) Improvement of Institution, Organization and Human Resources

- The project for improvement of legal system and capacity development for sustainable sewerage service is newly recommended as short-term projects.
- 1) improvement of legal system, 2) improvement of sewerage charging system and 3) capacity development for operation are main scope.

(4) Supplemental Explanations of the SUDP

1) Wastewater Generation Estimation

Based on the result of population projection executed in the Study, wastewater generation is estimated. Wastewater generation is calculated from water consumed by houses, public and commercial establishments plus infiltration. Consumed water equals to distributed water minus leakage. Infiltration is estimated by $10m^3$/ha/day adopted for Bangkok due to the similar characteristics of the both cities. It should be noted that maximum infiltration is assumed to be 30% of wastewater generation because infiltration at new development area which are to be developed in the future tends to be calculated excessively high. Estimated wastewater generation for each township is summarized in Table 2.4.15.

2) Selection of Target Townships

To select the target townships where centralized treatment system will be applied in 2040, the study of population density is implemented for evaluation of each township's urbanization in 2040. Townships whose population density will be over 100 person/ha in 2040 can be considered as urbanized townships where adoption of centralized treatment system is reasonable. There are 28 townships satisfying the conditions. As mentioned in previous chapter, Shwe Pyi Thar, Hlaing Tharyar and Dagon Myothit (Seikkan) Townships are newly selected as centralized treatment system area in 2040 as shown in Table 2.4.15.

Table 2.4.15: Estimated Wastewater Generation and Target Townships in 2040

No.	Township Name	Township Group	Estimated Wastewater Generation (m^3/day) (Daily Max)			Area (m^3)	Population Density (person/ha)	Urbanized in 2040
			Wastewater	Infiltration	Total			
1	Latha	CBD	9,188	600	9,788	604,770	414	X
2	Lanmadaw		17,292	1,310	18,602	1,310,572	360	X
3	Pabedan		12,223	610	12,833	618,984	539	X
4	Kyauktada		10,946	670	11,616	701,876	425	X
5	Botahtaung		15,032	2,580	17,612	2,601,921	158	X
6	Pazundaung		17,767	1,040	18,807	1,067,498	454	X
7	Ahlone	Inner Urban Ring	24,443	3,290	27,733	3,380,984	263	X
8	Kyee Myin Daing		28,499	4,520	33,019	4,570,110	304	X
9	Sanchaung		33,729	2,390	36,119	2,404,656	510	X
10	Dagon		17,697	4,640	22,337	4,894,633	100	X
11	Bahan		36,763	7,670	44,433	8,474,439	118	X
12	Tarmwe		67,691	4,990	72,681	4,985,869	370	X
13	Mingalar Taung Nyunt		63,519	4,780	68,299	4,943,032	350	X
14	Seikkan		1,036	224	1,260	1,174,225	24	-
15	Dawbon		25,065	2,950	28,015	3,111,295	271	X
16	Kamaryut	Outer Ring	31,675	6,380	38,055	6,472,493	178	X
17	Hlaing		64,456	9,250	73,706	9,820,283	227	X
18	Yankin		35,049	4,780	39,829	4,791,565	199	X
19	Thingangyun		90,789	12,090	102,879	13,120,302	189	X
20	Mayangone	Northern Suburbs	98,702	22,500	121,202	25,834,479	104	X
21	Insein		130,818	29,050	159,868	31,397,616	146	X
22	Mingalardon		190,684	68,006	258,690	127,943,855	50	-
23	North Okkalapa	Older Suburbs	174,205	26,460	200,665	27,755,247	171	X
24	South Okkalapa		65,329	7,960	73,289	8,217,705	217	X
25	Thaketa		74,383	12,600	86,983	13,448,713	189	X
26	Dala	South of CBD	39,448	29,402	68,850	98,400,859	24	-
27	Seikgyikhanaungto		6,709	3,349	10,058	12,101,872	39	-
28	Shwe Pyi Thar	New Suburbs	91,574	23,173	114,747	52,706,107	105	X

29	Hlaing Tharyar		213,354	44,264	257,618	77,614,147	133	X
30	Dagon Myothit (North)		74,546	15,077	89,623	24,177,408	130	X
31	Dagon Myothit (South)		119,463	30,959	150,422	37,506,127	150	X
32	Dagon Myothit (East)		274,901	62,125	337,026	170,871,278	87	-
33	Dagon Myothit (Seikkan)		101,089	17,960	119,049	42,035,707	132	X
34	Kyauktan	Periphery Area	20,400	4,604	25,004	76,120,987	24	-
35	Thanlyin		110,847	37,313	148,160	254,846,226	40	-
36	Hlegu		1,494	16,011	17,505	101,003,839	1	-
37	Hmawbi		3,568	16,549	20,117	84,228,570	4	-
38	Htantabin		20,946	11,915	32,861	81,770,250	23	-
39	Twantay		51,145	9,926	61,071	107,864,054	43	-

Source: JICA Study Team

3) Candidate Area of WWTP

WWTP should be constructed together with development of sewerage collecting system to treat collected wastewater. The candidate location for WWTP at each planning area was proposed in The Water Supply, Sewerage and Drainage MP (2014). However, necessary area for WWTP is changed in the Study due to update of population projection as shown in Table 2.4.16. According to the results below, necessary WWTP area at 7 out of 10 planning areas will increase. Therefore, it is necessary to consider the candidate location of WWTP at these planning areas accordingly. Additionally, the candidate location at W1 area has been used for port facilities. In the ongoing F/Ss by Japanese government, candidate location of WWTP at W1 will be studied as well.

Table 2.4.16: Necessary Area for WWTP

	C1	C2	W1	W2	W4	E1	E3	E4	N1	N3
Daily Max (m^3/day)	60,868	471,453	160,058	150,459	257,618	290,288	265,420	119,049	159,868	114,747
WWTP Area (ha)	5.9	20.9	10.7	10.3	14.3	15.4	14.6	8.9	10.7	8.7
Deviation from previous MP (ha)	-0.5	-0.7	-1.0	+0.9	+1.8	+1.3	+0.1	+1.7	+0.9	+0.3

Source: JICA Study Team

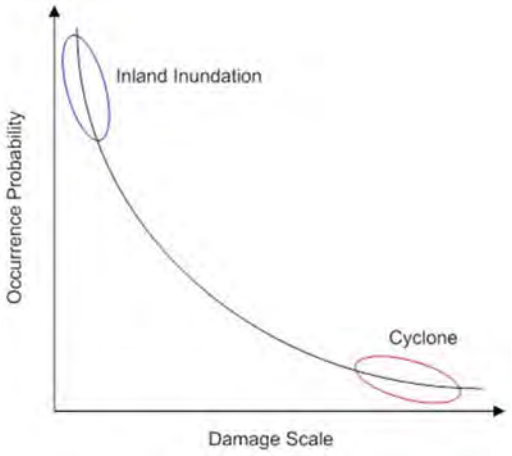
2.4.3 Drainage & Flood

(1) General

Generally, disaster risk can be indicated by the product of 1) damage scale and 2) occurrence probability, as shown below;

Disaster Risk = *Damage Scale* x *Occurrence Probability*

Normally, disasters that cause large damage tend to occur less frequently and disasters with small damage tend to occur more frequently. "infrequent disaster with large damage" and "frequent disaster with small damage" are distinctly treated in disaster management policy. In general, measures for "infrequent disaster with large damage" are considered to be more important than that for "frequent disaster with small damage" because of its impacts on human life and properties. For flooding in the Greater Yangon, the Cyclone can be categorized as "infrequent disaster with large damage" and inland inundation can be categorized as "frequent disaster with small damage" as shown in Figure 2.4.9. The Greater Yangon often have flood inundations almost every year which is due to 1) rainwater congestion in inland and 2) tidal water. Cyclones quite rarely come to the Greater Yangon. No citizen had experienced such disaster in and around the area before and after the Cyclone Nargis in May 2008. The cyclone caused severe damage in the Greater Yangon which may be the largest water related disaster in the area. Flood in 2015 also affected the Greater Yangon. [4]



Source: JICA Study Team

Figure 2.4.9: Theory of Disaster Risk

(2) Flood Conditions

1) Major Findings of Previous Study

(I) Flooding

Yangon downtown along with the Yangon River has little disaster risks against flooding although the district is suffering from drainage congestion during rainy season. Periphery areas of the Greater Yangon have flood disaster risks especially during high tide period because of their low ground elevation. The Household Interview Survey (HIS) carried out in SUDP also indicate frequent flood inundation in the Greater Yangon. 5,422 household in 10,045 household (53.8%) have never experienced flood inundation in own house area but 4,191 household (41.6%) have flood inundation every year in own house area. Most of the inundation depth at their areas are up to ankles or knees (91.8 %) and inundation duration ranges from less than half day to more than six days.

The Yangon River has large differences of water level between the low and high tides. The water levels of the Yangon River exceed El. 2.5 to 3.0 m during the high tide with full moon.

[4] Approximately 16,000 households were forced evacuation against the flood inundation as shown in Table 2.4.17.

There are several lowland areas below El. 3.0 m in the Greater Yangon where have rainwater drainage issue. The drainage congestion problem in the Greater Yangon is complicated; harsh natural conditions, rapid urbanization and poor capacity of drainage system, cause the problem.

Dala Township is located south part of the Greater Yangon across the Yangon River where has potential for development, but most of the area is lowland with El. 1.5 to 3.0 m utilized as paddy field. They experience inundation almost every high tide during the full moon time all around the year. Inundation that occur almost every month is relatively short and shallow: a half to one hour duration and 0.5 to 1.0 m inundation depth. Hence, rice crop can be grown and local people accept the periodical inundations.

Severe cyclones occur during the pre-monsoon season of April to May or post-monsoon season of October to November. Cyclones have three destructive force i.e. i) storm surge, ii) heavy rainfall and iii) strong wind. Cyclone Nargis hit the Greater Yangon in 2nd and 3rd May 2008 which largely inundated the area (e.g 83.37% of Dala TS) and blown off a lot of house roofs.

It was recommended that 1) implementation of detailed analysis and assessment of disaster risk, 2) legal and institutional improvements and 3) structural advices including i) compartmentalization of low-lying deltatic areas, ii) improvement of rainwater drainage system, iii) reduction of run-off water in urban area, iv) safety design of crest elevation of highway and railway and v) regulation of underground development.

Inland Inundation in Yangon City

Chronic flooding causes such as traffic congestion, has had an adverse effect on the socio-economic activities.

Dala TS, South Part of Greater Yangon

The area close to the downtown across the Yangon river has a development potential though it is frequently flooded.

Source: JICA Study Team

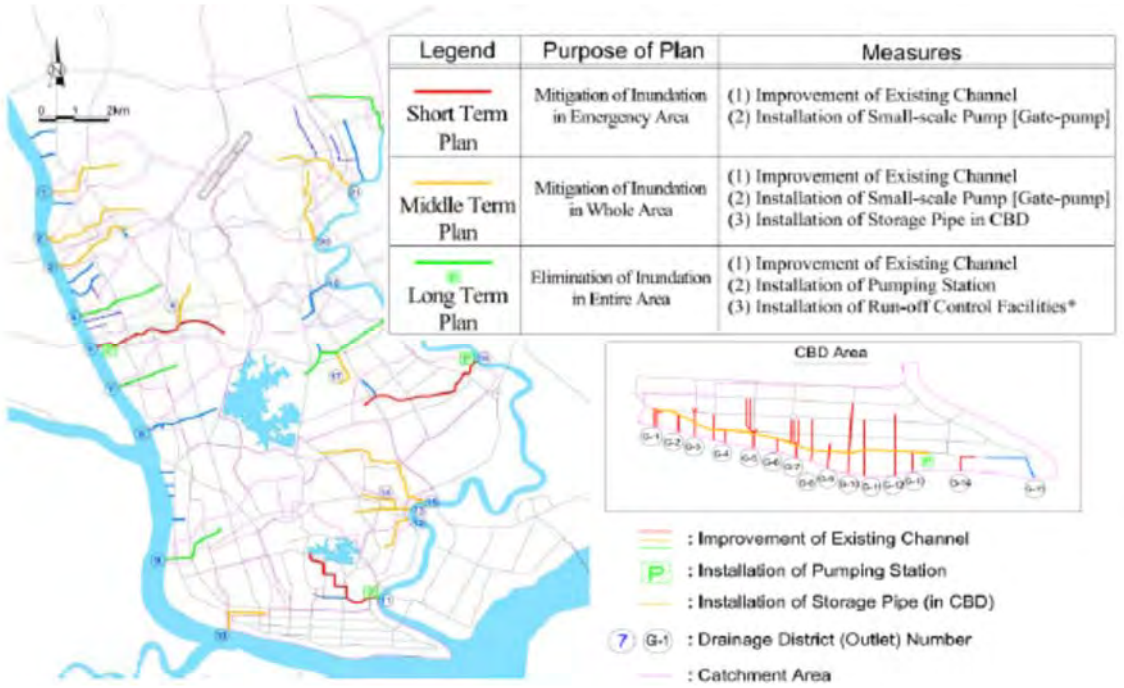
Figure 2.4.10: Present Flooding Conditions in Greater Yangon

(II) Rainwater Drainage

In SUDP, sewerage and rainwater drainage were categorized in one sector although both sector is managed by Department of Water and Sanitation and Department of Roads and Bridges, respectively. Rainwater drainages are normally arranged both side of major highways and urban roads. SUDP pointed out a section of drainage is indispensable to improve current rainwater congestion issue which section was absent in YCDC at that time.

SUDP proposed three term improvement plan of existing drainage system. As shown in a table in Figure 2.4.11, it was proposed that i) improvement of existing drainage channels in CBD and other three existing open channels in Yangon city as the short term plan, ii) installation of storage pipe (rainwater retarding pipe laid on underground) in CBD and improvement of other existing open channels in Yangon city as the middle term plan and iii) installation of pumping station (drainage pumping system) and other channels improvement as the long term plan.

However, the rainwater drainage improvement was not listed on the priority 77 sub-programs without any clear descriptions.



Source: SUDP and "The Project for the Improvement of Water Supply, Sewerage and Drainage System in Yangon City Vol V Sewerage and Drainage System Summary" (2014)

Figure 2.4.11: Master Plan of Rainwater Drainage Improvement

2) Update and Additional Information of Floods

(I) Flooding

I) Major Floods in Yangon Region

Statistical data of flood damages are available on state or region basis in Myanmar and those of township basis are not available according to responsible RRD staff.

Table 2.4.17 shows recent major flood damage in Yangon Region. Cyclone Nargis caused the most serious damage on the local people. The damaged area in the Yangon region was approximately 167 km^2. In addition, 7,379 cattle were killed and 530 padogas, 1,078 monasteries, 32 nunneries, 35 churches, 25 mosques, 17 Hindu shrines and 19 hospitals and 99 clinics and 832 primary schools, 69 junior high schools and 33 high schools were destroyed by the flood.

Table 2.4.17: Recent Major Flood Damage in Yangon Region

Event	Affected people	Mortality	Missing	Evacuated People	Damaged House
Cyclone Nargis (2008)	Approximately 4 million	1,640	8	?	371,373
2015 Flood	63,082	1	0	15,523	0

Source: JICA Study Team prepared based on information from RRD

II) Additional Survey on Flood Situations

The JICA study team received 6th draft version of the flood hazard map in Yangon city from the TA team (ADB flood hazard map hereinafter). There are some differences of flood inundation areas among flood inundation area maps [5]. We carried out quick interview survey on flood situations in some townships (TSs) with a YCDC CP to confirm the data accuracy. The survey areas are TSs of Shwe Pyi Thar, Mingalardon, Hlegu, Dagon Myothit (Seikkan), Dagon Myothit (South), Thaketa and North Okkalapa.

A house located in the southern part of Shwe Pyi Thar TS had flood inundation with 50 cm depth during Cyclone Nargis (Figure 2.4.12 (a)) which is not corresponding to flood inundation area by the Cyclone detected by UNOSAT shown in Figure 2.4.16 (a). A woman living in Mingalardon TS destroyed own house twice by the Cyclone and 2015 flood which corresponds the Figure 2.4.16 (a). Most of residences in Hlegu TS stilt up their house floors to avoid frequent flood inundations which implies frequent flood inundations around the area. A local community leader in Shwe Pyi Thar TS warned about approaching of Cyclone Nargis at five PM, 2nd May 2008: making a good enough time to evacuate people. Lots of houses were heavily damaged but nobody was injured because of evacuation to safer neighborhood house owned by a community leader. The community constructed foot passes with participate of community people: a construction worker per a household and donation based on each income scale. Highway in Hlegu TS has poor pavement conditions which makes difficulties of evacuation before disaster and transportation of daily goods during and after severe floods.

A developed area, Yuzana Garden City at Dagon Myothit (Seikkan) TS has less flood inundation which may correspond to the ADB flood hazard map. Cyclone Nargis also did not cause flood inundation although strong wind caused some damages. Apartment buildings areas newly developed at Dagon Myothit (South) TS are arranged rainwater drainage network (Figure 2.4.12 (b)). An inhabitant living 51 years at left bank side of Nga Moe Yeik Creek in Thaketa TS had flood inundations with depth of 50 cm and 15 cm on cyclone Nargis and 2015 flood, respectively. It is smaller depth than that of the ADB flood hazard map. Two inhabitants along Thu Dhamar road in North Okkalapa TS replied that they have no flood inundation after construction of a drainage along the road although they had previously. It indicates that the flood inundation situation have been changed with urban development. Periodical monitoring of flood inundation is required to understand flood risk in the study area.

III) Evacuation against Large Flood

The JICA Study Team visited and interviewed a monastery facility in Dala Township to collect information of evacuation activities of local people against large flood. Maha Thumanaryarma monastery located in Kamar Kathwe Ward, west part of Dala Township received approximately 700 to 800 evacuees immediately after Cyclone Nargis. They stayed the monastery around two to three months. Four buildings in the monastery area such as a dormitory of monk and a private school as shown in Figure 2.4.12 (c) and (d) were temporary used for evacuation place although the accommodation capacity of such buildings was only 200. The facility has no stock of daily necessities for the evacuees but the daily necessities were donated from other people.

[5] There are several flood hazard map for Yangon city as shown in Figure 2.4.16 and Figure 2.4.20 but there are some differences on flood inundation area and depth. Integration works are required to use the map.

(a) Quick Interview Survey on Flood Situations

(b) Apartment Buildings Area Newly Developed at Dagon Myothit (South) Township

(c) Dormitory of Monks

(d) Private School in Monetary Facility

Source: JICA Study Team

Figure 2.4.12: Present Flooding Conditions in Greater Yangon

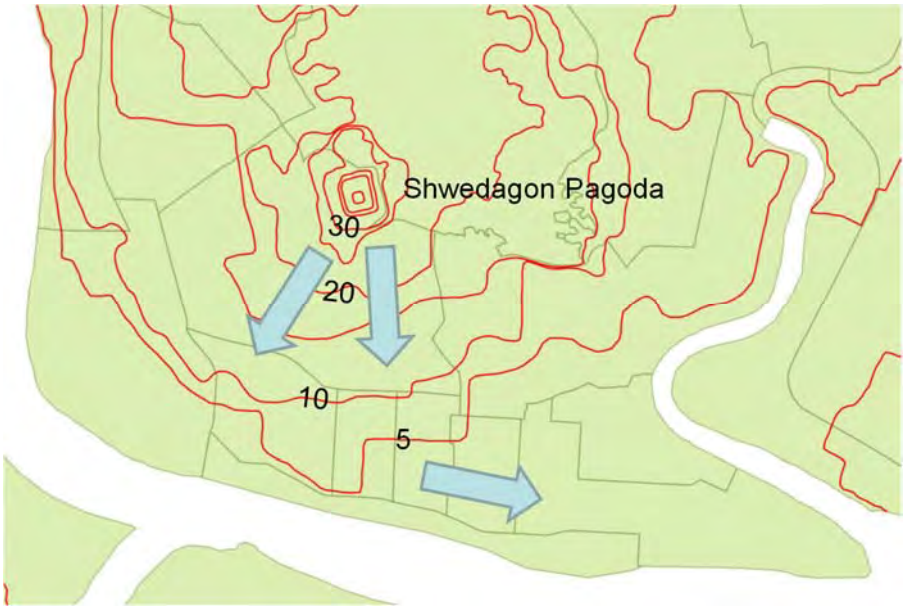
(II) Rainwater Drainage

Figure 2.4.13 shows drainage basin of CBD and arrows colored as light blue in the figure indicate possible rainwater direction based on topographical slope. Rainwater around the Shwedagon Pagoda may flow down to CBD even if circular railway divides the area on north and south parts on map. Rainwater in the west side of the Pagoda flow into the Kyon Gi canal in Lanmadow Township and then flow out to the Yangon River from drainage No.1: west boundary of Lanmadow Township shown in Figure 2.4.14.

Figure 2.4.14 shows conceivable flood inundation locations in CBD. Why "conceivable" is added on the tittle is 1) argument on some flood inundation locations are different among studies by several engineers and 2) the situation of flood inundations have been improved by responsible authorities: Engineering Department of Roads and Bridges (DRB) under YCDC. The most severe flood inundation occurs around traffic junction between Maha Bandula road and Thein Phyu Street in west portion of Botahtaung Township and secondly severe flood inundation is on between 19th and 22th streets along Kanner Road according to DRB staffs. Periodical monitoring of the situation and update of the flood inundation information including inundation depth is essential to study flood measure in CBD.

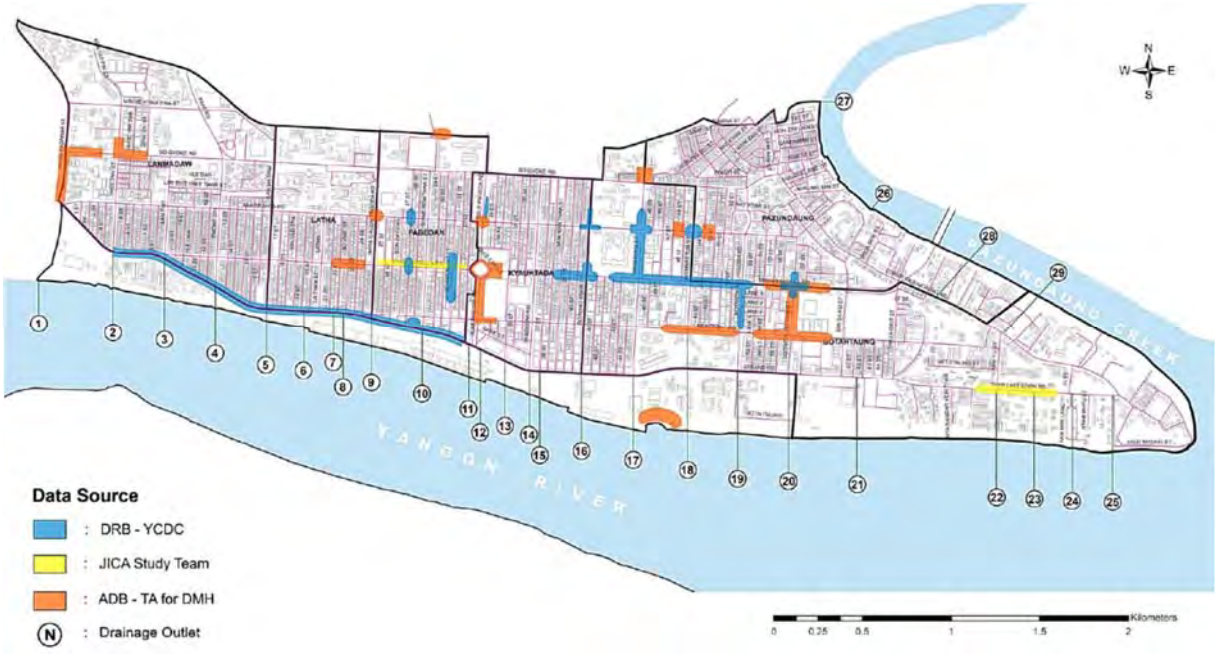
Figure 2.4.15 shows current maintenance works of drainage facilities by DRB, YCDC. The authority carries out removal of garbage in front of drainage outlet along Kanner Road twice a day on every day on outsourcing basis (Figure 2.4.15 (a)). However, maintenance of drainage flow capacity is quite difficult because of endless garbage dumping by people. There are 17

sluice gates in CBD which are operated (open and close of the gates) by employed daily workers. These gates are manually operated twice a day based on tidal water level to stop backwater from the Yangon River. A daily worker is assigned for a sluice gate with payment of 700 MMK/day.



Note: Arrows colored as light blue indicate possible rainwater flow directions based on topographical slope. Numbers shown in the map is elevation on each contour line.
Source: JICA Study Team prepared based on topographical survey result of SUDP and own survey results

Figure 2.4.13: Drainage Basin of CBD



Source: JICA Study Team prepared based on information from DRB-YCDC, ADB-TA for DMH and own survey results

Figure 2.4.14: Conceivable Flood Inundation Locations in CBD

(a) Removal of Garbage in front of Drainage Outlet

(b) Drainage Sluice Gate on Outlet at Yangon River (Strand Rd.)

Source: Role of YCDC on Disaster Management, YCDC

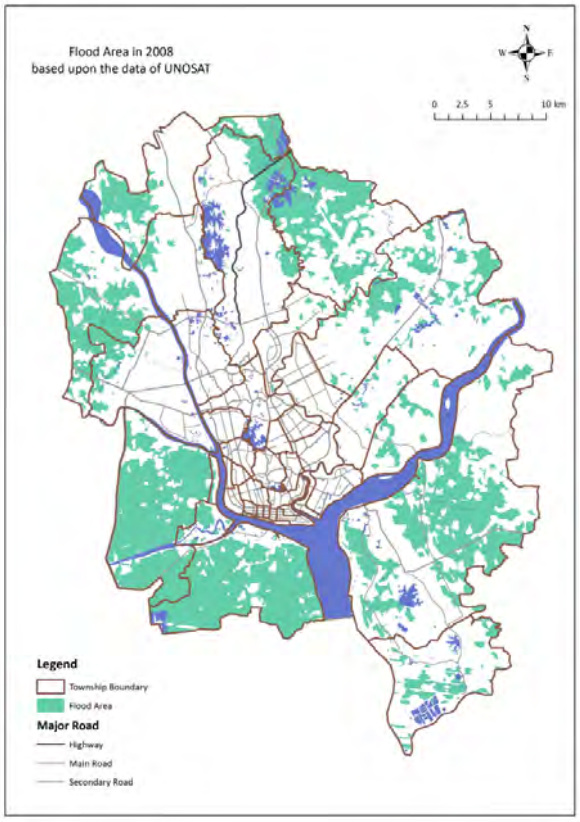
Figure 2.4.15: Operation and Maintenance of Drainage Facilities by DRB, YCDC

3) Flood Hazard Map

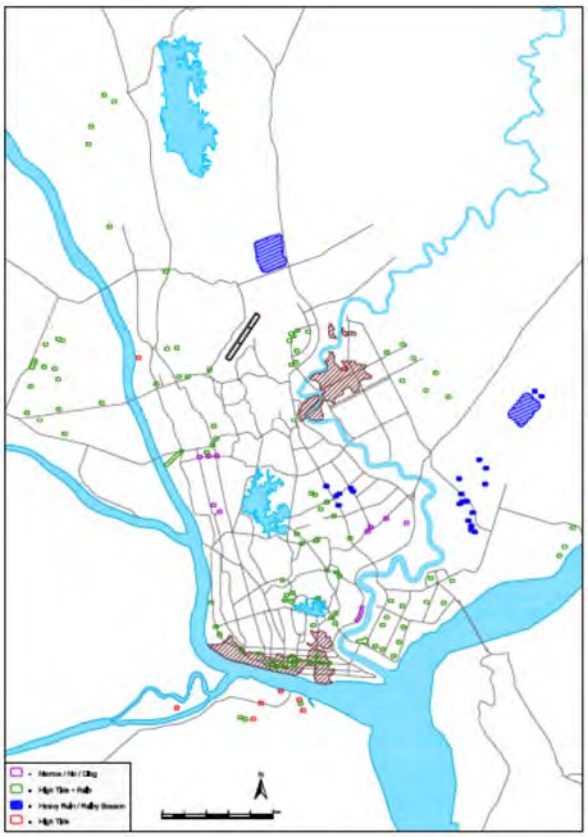
(I) Available Information on Flood Inundation

SUDP collected some information on flood inundation as shown in Figure 2.4.16. Figure 2.4.16 (a) is estimated flood inundated areas by cyclone Nargis based upon the satellite image. It indicates Township Group (TSG) of South of CBD and Periphery Area have flood inundation risk. Figure 2.4.16 (b) was prepared based on interviews on some township offices and local people. It indicates part of TSG Inner Urban Ring and CBD and along middle stretch of Nga Moe Yeik Creek in TSG New Suburbs are potential flood areas. In addition, it explains that high tide highly affects the flooding conditions in the study area. Figure 2.4.16 (c) was prepared for a railway project after SUDP based on the HIS result which indicate approximate flood inundation depth in house areas with exact locations.

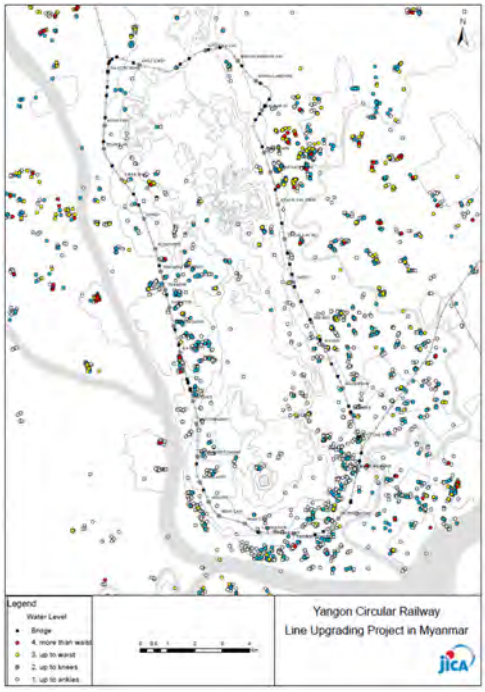
Recently, a technical assistance project namely, "TA-8456: Transformation of Urban Management – Part II, Flood Management" for Department of Meteorology and Hydrology (DMH), MOTC funded by ADB (ADB TA Project herein after). The project have prepared flood hazard maps of Yangon city using Rainfall-Runoff-Inundation (RRI) Model developed by a Japanese institute: International Centre for Water Hazard and Risk Management, National Research and Development Agency Public Works Research Institute (ICHARM, PWRI). A flood hazard map prepared by the project is shown in Figure 2.4.20.



(a) Flood Inundation Area in Greater Yangon by Cyclone Nargis, 2008 (SUDP based on UNOSAT)



(b) Flood Inundation Area in Yangon City (SUDP, 2013)



(c) Flood Inundation Depth in Yangon City (SUDP-HIS, 2013)

Source: JICA Study Team prepared based on SUDP outputs.

Figure 2.4.16: Several Information of Flood Inundation in Study Area

(II) Required Activities on Completion and Use of Flood Hazard Map

In this study, the flood inundation area in the Greater Yangon by Cyclone Nargis, 2008 (SUDP based on UNOSAT) is referred as potential flood inundation areas because it has affinity with ground elevation and interview survey results.

However, as the results of additional flood damage surveys, existing flood inundation map still requires some modifications. In addition, topographical conditions, land use and drainage conditions in the Greater Yangon are rapidly changed which impact on flood inundation conditions. The ADB TA Project also mentioned that preparation works of the flood hazard map in Yangon area have been carried out under lack of essential information and which left further modification works. Therefore, accumulation of fundamental data including flood damage conditions to prepare flood hazard map shall be carried out by responsible authorities which data shall be integrated in the central authorities such as DMH. The modified flood hazard map shall be shared by related authorities and local people in the Greater Yangon.

(3) Organizational Structure of Natural Disaster Management

1) Transition of Natural Disaster Response by Central Government

Table 2.4.18 summarizes natural disaster related history and transitions of disaster management laws and organizations in Myanmar. After the severe disaster Cyclone Nargis, national system for response on large scale natural disaster is gradually established with experiences of recent flood disasters.

Table 2.4.18: Transition of Natural Disaster Response by Central Government

Year	Action
1937	Establishment of Burma Meteorological Department (BMD): former Department of Meteorology and Hydrology (DMH)
1948	Establishment of former Relief and Resettlement Department (RRD)
1951	Establishment of RRD under Ministry of Social, Welfare, Relief and Resettlement (MOSWRR)
1972	Establishment of General Administration Department (GAD)
1974	Re-named DMH from BMD
2005	Adoption on Hyogo Framework for Action 2005 – 2015 Signature on ASEAN Agreement on Disaster Management and Emergency Response Establishment of National Natural Disaster Preparedness Central Committee (NDPCC)
2008	Cyclone Nargis on 2nd – 3rd May caused severe damages in Ayeyarwady Delta and southern Yangon Division
2009	Formulation of Myanmar Action Plan on Disaster Risk Reduction (MAPDRR) Draft of Standing Order on Natural Disaster Management in Myanmar
2011	Formulation of Standing Order on Natural Disaster Management in Myanmar
2013	Congress Approval of National Natural Disaster Management Law (NNDML) Emergency Call on NDPCC against a cyclone on May
2015	2015 Flood by floods and Cyclone Komen in August Flood disaster response by National Natural Disaster Management Committee (NNDMC)

Note: * The English notation called NDPCC was later revised to National Natural Disaster Management Committee (NNDMC) according to a research paper "Government disaster response and river infrastructure function in the 2015 Myanmar flood: An investigation in the Bago River Basin" (2016).
Source: JICA Study Team prepared based on several documents and web-site information.

2) Recent Organization for Natural Disaster Response

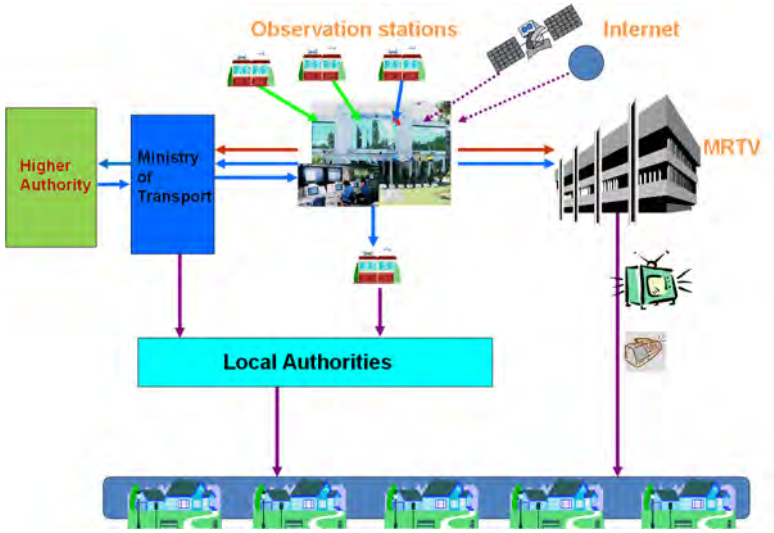
(I) NNDPCC / NNDMC

The National Natural Disaster Management Committee (NNDMC) of Myanmar equivalent to the Central Disaster Prevention Council in Japan was founded in 2005. It was called at a

nationwide disaster: the Cyclone Nargis on May 2008 by the chairman of committee i.e. the Prime Minister which is the first major activity of the committee. NNDMC is clearly determined in NNDML approved in the Congress in 2013 which is currently chaired by the second vice president.

(II) DMH

Department of Meteorology and Hydrology (DMH) carries out flood forecast and warning as precautionary measure against flood disaster. Figure 2.4.17 illustrates flood forecast and warning network of the country. Observations are normally reported from DMH branches such as Kaba Aye branch[6] in Yangon city to Multi-Hazard Early Warning Center of DMH. The center issues flood warning to local authorities such as Yangon Region, YCDC and mass media in case of emergency. In parallel, the urgent information including heavy rainfall information will be sent to related organizations including central offices of GAD and RRD. These central offices will inform the disaster to their township offices where have emergency disaster risk. Beside the Yangon Region office will also inform the urgent information to such township offices of GAD and RRD.



Source: Term used in Weather Forecasting, DMH

Figure 2.4.17: Flood Forecast and Warning Network from DMH Branch

[6] Japanese government donated the meteorological radar system on the Kaba Aye branch.

(III) GAD

General Administration Department (GAD) has responsible for instruction of evacuation, disaster preparedness activities through participate on DPMC (Disaster Preparedness Management Committee) in township level. The JICA Study Team interviewed a GAD township office although detailed situations and activities may differ in each GAD office of township.

The GAD township office has DPMC meeting every Friday morning. The major discussion topics are emergency and crime cases, awareness of flood disaster and existing drainage conditions. 50 monastery facilities such as pagoda are designated as evacuation place and 10 schools will be added as evacuation place in the township. Disaster information from DMH is provided through some SNS. The GAD office informs the disaster information from DMH to a FM radio studio. The executive officers in the GAD office moved to the office around 2014. They have no information about activities on the Cyclone Nargis case. GAD executive officers normally move working place every three years. They need inheritance of disaster information in townships when they move. No activities on the GAD office during 2015 flood because it was not so severe damage in the township.

(IV) RRD

Relief and Resettlement Department (RRD) was established under MOSWRR with the objectives to provide relief for victims of natural disasters to ease their sufferings and take precautionary steps as to minimize loss of lives and property of the victims of natural disasters.[7] RRD has initiative of disaster education activities e.g. Figure 2.4.18 (a) to (c). Six cyclone shelters are constructed in the Yangon Region (Figure 2.4.18 (d)).

Some INGOs from Japan carried out a disaster education event. SEEDS Asia[8] carried out evacuation drill against Cyclone for RRD Yangon Region through a grassroots grant aid of Japan."Iza! Kaeru Caravan!" was carried out in BEHS Lanmadow TS, Yangon city on 6th December 2013 which made effects on not only disaster management capacity of the citizens but related organizations for disaster management such as RRD. The events have been continued by RRD staffs in monetary facilities despite of its smaller scale.

(a) Disaster Management Training on Public Officers

(b) Public Awareness of Flood Disaster

[7] http://www.preventionweb.net/organizations/16762
[8] SEED Asia is a member of the working group for disaster management in the country. The working group carry out some activities on disaster management including preparation of awareness brochure on natural disasters.

(c) Evacuation Drill for Flood Disaster

(d) Cyclone Shelter in Kyaktan TS

Source: JICA Study Team prepared based on Disaster Management Presentation, RRD and own survey results.

Figure 2.4.18: Disaster Education Activities and Evacuation Facility Introduced by RRD

(V) YCDC

YCDC township offices contribute disaster responses such as preparation and maintenance of evacuation places. They collected information of flood inundation conditions including locations, inundation depths and inundation durations in 2012 and 2015 which is fundamental and useful data to modify flood hazard map, to study urban plan and to carry out public awareness of flood disaster.

3) Organizations for Flood Management of Inland Inundation

There are two organizations to manage flood protection structures in the study area: 1) DRB under YCDC, and 2) Irrigation Department (ID) under Ministry of Agriculture, Livestock and Irrigation (MOALI). Table 2.4.19 summarizes their responsibilities on flood protection structures.

Table 2.4.19: Responsibility on Management of Flood Protection Structures

Implementation Agency	Management Authority	Responsible Structures
DRB	YCDC	Drainage networks including open channels in Yangon city
ID	MOAI	River structures including river embankment, reservoir.

Source: JICA Study Team

(4) Recent and On-going Projects and Research for Flood Management

1) YCDC

(I) Rehabilitation of Existing Drainage Network (DRB, YCDC)

Currently, DRB have rehabilitated existing drainage networks in CBD (Figure 2.4.19) and have planned to rehabilitate other six townships i.e. TSs of Ahlone, Kyee Myin Daing, Sanchaung, Dagon, Bahan, Mingalar Taung Nyunt in TSG of Inner Urban Ring. DRB created a drainage section under the department and annual budget for drainage management was arranged approximately 14 billion MMK in fiscal year of 2015.

Under Construction of Drainage Culvert below Walkway

Completed Drainage Culvert below Walkway

Source: Role of YCDC on Disaster Management, YCDC

Figure 2.4.19: On-going Rehabilitation of Existing Drainage Network by DRB, YCDC

(II) Grassroots Technical Cooperation by Fukuoka City (DRB)

DRB have received a grassroots technical cooperation from Fukuoka City funded by JICA since March 2016. It objects capacity development of the department staffs to carry out plan, design, construction and operation and maintenance of effective road drainage systems. The grassroots technical cooperation will last to March 2019.

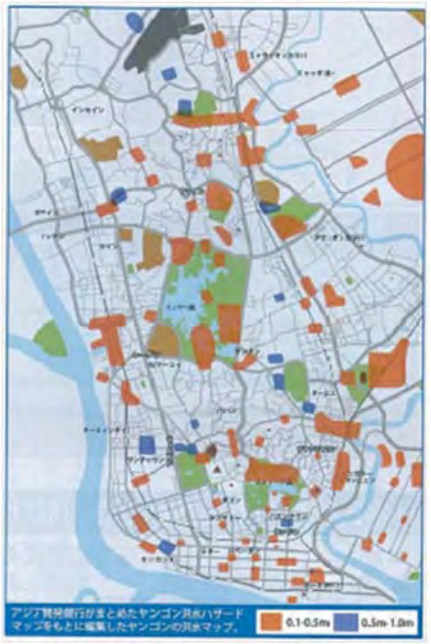
(III) METI Study (DWS)

Ministry of Economy, Trade and Industry (METI) of Japan started a study for improvement of sewerage and drainage system in Yangon city in this year. The main counterpart is Engineering Department of Water and Sanitation (DWS). The study is from late September 2016 to end of February 2017. Study area is CBD and west part of Inner Urban Ring. The study team of METI think that combined type sewerage and rainwater drainage is one affordable alternative from view point of economic efficiency.

2) Related Authorities

(I) Project for Establishment of Disastrous Weather Monitoring System and the ADB TA Project (DMH)

A Japan's grant aid project namely, the Project for Establishment of Disastrous Weather Monitoring System provided a meteorological radar system including data display and communication system and related software in DMH Yangon compound. It is expected that the equipment will improve flood forecast and warning capacity of DMH. Currently, observed rainfall are recorded daily basis. Short time rainfall data will be available after hand over of the meteorological radar system by the Japan's grant aid on coming October.



Source: Myanmar Japon, August 2016.

Figure 2.4.20: Example of Flood Hazard Map Produced by ADB TA Project

The ADB TA Project have been carried out for DMH which aims to promote sustainable urban development in Myanmar cities by building the

institutional capacity of local authorities, leading to the prioritized needs-based provision of essential infrastructure. The project is composed of two parts: Part I: Urban Management and Part II: Flood Management. The main objectives of the Part II are: 1) Hydro-meteorological analysis related to floods and storm surges; 2) Flood and storm surge risk assessment; 3) Capacity development of the DMH; and 4) Capacity development of organizations relevant to flood and storm surge risk assessment. One component of the Part II have prepared a flood hazard map of Yangon area using the RRI Model developed by ICHARM. Currently the flood hazard map is under finalization. The hydrological model and data was transferred to DMH staffs. Two permanent staffs in the central office of DMH are assigned for modeling works. Two staffs in DRB, YCDC also had a training of the modeling. Figure 2.4.20 shows flood hazard map of urban area in Yangon city which is published with a free paper magazine. The flood hazard map contributes that citizen in Yangon city aware danger locations of flood inundation.

(II) Construction of Cyclone Shelter (Yangon Region)

Recently, nine cyclone shelter were completed by the YRG on coastal area of the Region. No cyclone shelter is constructed in the Greater Yangon. The JICA Study Team visited a cyclone shelter in Kyauktan Township which was completed February 2016 (Figure 2.4.18 (d)). No use during normal time so the facility has no usage experience. The facility comprises capacity of 100 persons accommodation with solar panel system for lighting and rainwater collection system for toilet and septic tank for wastewater.

(III) SATREPS (YTU)

The Yangon Technological University (YTU) have received a project namely, Project for Development of a Comprehensive Disaster Resilience System and Collaboration Platform in Myanmar under Science and Technology Research Partnership for Sustainable Development (SATREPS) of Japan. The project aims capacity building of YTU on scenario analysis and disaster response systems to predict the disaster vulnerability in Myanmar. Japanese Universities including the University of Tokyo and Tohoku University participate the project. The project period is from May 2014 to April 2020. For water related disaster management, i) assessment of human health risk by inundated wastewater from drainage and ii) establishment of flood warning system on the Yangon and the Bago River basins and development of unified disaster response system is under implementation.

(5) Planning Process

Table 2.4.20: Record of Meetings and Surveys (Water Supply)

Date	Title	Venue	Agenda
30th Aug 2016 (Tue)	Field Survey	Shwe Pyi Thar, Mingalardon, Hlegu TSs	• w/ YCDC, Ms. Nyein Aye (Division Head)
31st Aug 2016 (Wed)	YCDC meeting	YCDC	• w/ YCDC-DRB, Mr. U Tin Maung Kyi, Chief Engineer (Head of Department)
31st Aug 2016 (Wed)	Information Collection	MES	• w/ Mr. U Aung Myint (President) and staffs
2nd Sep 2016 (Fri)	Information Collection	YTU	• w/ Ms. Daw San San Moe (Associate Professor)
3rd Sep 2016 (Sat)	Field Survey	Dagon Myothit (Seikkan), Dagon Myothit (South), Thaketa and North Okkalapa TSs	• w/ JST members
7th Sep 2016 (Wed)	Information Collection	DMH	• w/ Ms. Yee Yee Nyein, (Director, Lower Myanmar Branch)

8th Sep 2016 (Thu)	Information Collection	GAD,	• w/ Mr. U Aung Lwin (General Administrator of North Okkalapa TS)
9th Sep 2016 (Fri)	Information Sharing	JST Office	• w/ Mr. Takaaki Kato Associate Professor, The University of Tokyo, SATREPS team
12th Sep 2016 (Mon)	Meeting	JICA Yangon Office	• w/ Ms. Kiko and Ms. Sakurai
14th Sep 2016 (Wed)	Meeting	YCDC	• w/ YCDC-DRB, Mr. U Aye Ko (Deputy Chief Engineer)
15th Sep 2016 (Thu)	Meeting	YCDC	• w/ Vice Mayor
7th Oct 2016 (Fri)	Meeting	YCDC	• w/ YCDC-DRB, Mr. U Aye Ko (Deputy Chief Engineer)
11th Oct 2016 (Tue)	Field Survey	Kyauktan TS	• w/ YCDC, Ms. Nyein Aye (Division Head)
13th Oct 2016 (Thu)	Field Survey	CBD, Inner Urban Ring	• w/ YCDC-DRB, Mr. U Aye Ko (Deputy Chief Engineer) and staffs
17th Oct 2016 (Mon)	Field Survey	Dala TS	• w/ YCDC, Ms. Nyein Aye (Division Head)
20th Oct 2016 (Thu)	Information Collection	YCDC	• w/ YCDC-DRB, Mr. Kyaw Min Oo (Assistant Engineer)
20th Oct 2016 (Thu)	Information Sharing	JST Office	• w/ Mr. Sawano, ICHARM (Team Leader of ADB-TA for DMH)
21st Oct 2016 (Fri)	Information Sharing	JST Office	• w/ Mr. Komori Associate Professor, The University of Tokyo, SATREPS
24th Oct 2016 (Mon)	Meeting	YCDC	• w/ YCDC-DRB, Mr. U Aye Ko (Deputy Chief Engineer) and staffs
24th Oct 2016 (Mon)	Information Sharing	JST Office	• w/ Mr. Komori Associate Professor, The University of Tokyo, SATREPS
26th Oct 2016 (Wed)	Meeting	YCDC	• w/ YCDC-DRB, Mr. U Aye Ko (Deputy Chief Engineer) and staffs
26th Oct 2016 (Wed)	Meeting	YCDC	• w/ YCDC, Ms. Nyein Aye (Division Head)

(6) Updated Points from SUDP 2013 to 2016

a) Update and Additional information of floods in the study area is updated.
b) Current status of flood hazard maps in the study area is studied.
c) Organizational structures of natural disaster management including i) transition of natural disaster response by the central government, ii) recent organizations for natural disaster response, and iii) organizations for flood management of inland inundation is updated.
d) Recent and on-going projects and research for flood management by YCDC and related authorities are studied.
e) Current conditions and issues on flooding are reviewed.
f) The sector vision and the basic policy on rainwater drainage and large flood management are modified and newly prepared.
g) Preliminary development plan including i) strategies, ii) flood management in the whole area, iii) rainwater drainage improvement in CBD and iv) implementation schedule is prepared.

(7) Supplemental Explanations of the SUDP

1) Current Conditions of Flood Inundation

(I) Harsh Natural Conditions

Low Elevation in Deltatic Periphery Area: There are several lowland areas below El. 3.0 m in the Greater Yangon with rainwater drainage issue. Most of the lowlands are located in south part of the area including townships of Dala, Twantay, Kyauktan and Thanlyin (Figure 2.4.21 (a)).

Variable Topography: A part of urban area in Yangon city is located on elongated hill from south to north which topography is variable rather than flat. Rainwater goes to lower ground on concrete and asphalt surface which makes prolonging paddles because of less opportunity of infiltration.

Short & Intense Rainfall: Rainfall in the Greater Yangon is short in duration and intense. Remarkably, 50 year probable 60-minute rainfall intensity exceeds 100 mm/hour. Such a high intensity of rainfall is a major cause of inundation problems in downtown Yangon.

Backwater of Yangon River during High Tide and River Floods: The Yangon River has large water level differences between the low and high tides. Water levels of the Yangon River increase El. 2.5 to 3.0 m during the high tide with full moon. Dala township has periodical high tide on every high tide during full moon time all around the year although it is short duration: half to one hour. Rainwater cannot be drained out to the Yangon River from some drainages in the Greater Yangon.

(II) Rapid Urbanization

High Run-off Ratio Associated with Buildings and Pavements: Most of urban area is covered by concrete and asphalt except for Inya and Kan Daw Gyi Lakes, limited gardens, public parks. Rainwater does not infiltrate to ground and goes to lower land immediately.

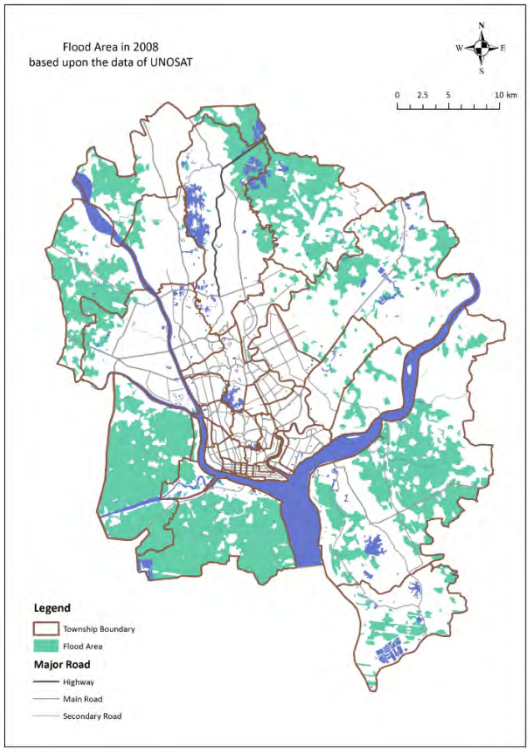
Development of Wetlands including Paddy Field and Pond to Construct Buildings: In the past, wetlands reserved rainwater coming from higher land and then infiltrate to ground or flow out to rivers little by little. Recently, a lot of wetlands developed as new urban areas or illegally settled resulted in reduction of rainwater retaining function in the urban areas.

Illegal Dumping of Garbage on Drainage Open Canal: Illegal dumping of garbage on drainage open canal reduces flow capacity of drainages. DRB-YCDC cleans up such garbage twice a day using outsources but the illegal dumping is non-stop habit.

Inadequate Infrastructure: Construction of drainage facilities cannot catch up rapid urbanization in the suburb area of the Yangon city which may be caused by difficulties of land acquisitions for new drainage facilities and shortage of budget allocation for the infrastructure construction (Figure 2.4.21 (b)).

(III) Poor Capacity of Drainage System

Structural Problems on Drainage System: Some drainage facilities do not contribute enough. Figure 2.4.21 (c) shows a large paddle next to an inlet of drainage. The water level of the paddle is higher than the inlet structure due to road settlement.



(a) Flood Inundation Area in Greater Yangon by Cyclone Nargis, 2008 (SUDP based on UNOSAT)

(b) Conceivable Flood Inundation Locations in CBD

(c) A Paddle Immediately in Front of Drainage Inlet Beside a Major Highway

Source: JICA Study Team

Figure 2.4.21: Flood Situations in Greater Yangon

2) Demand Analysis

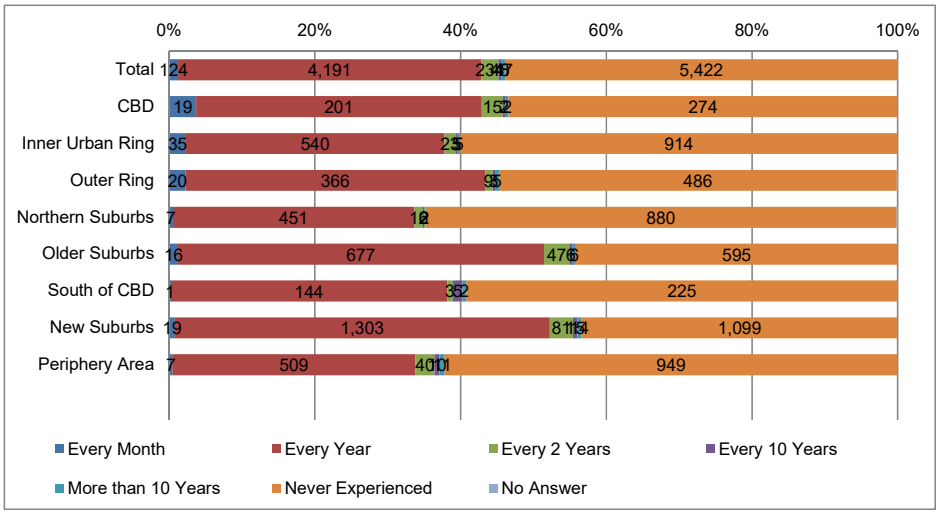
(I) Flood Damages

The Household Interview Survey (HIS) in SUDP carried out from September to November 2012 revealed flood situation in the Greater Yangon. Figure 2.4.22 shows frequency of flood inundation in house. 5,422 households (53.8% of 10,069 household surveyed) have no experiences of flood inundation in own house but 4,644 households (42.9%) have flood inundation every year or almost every month. Figure 2.4.23 shows flood inundation depth in house during the maximum flood. Within 4,644 households who have experienced flood inundation in own house, flood inundation depth up to knees is majority with accounting for 4,264 households (91.8%). The inundation depth up to waist and above waist is 280 households (6.2%) and 64 households (1.4%), respectively. South of CBD and Periphery Area have relatively deeper inundation depth.

As described in before[9], Cyclone Nargis in 2008 took away 1,640 people and 2015 Flood forced approximately 16,000 people to evacuate in the Yangon Region. Table 2.4.21 shows health effects i.e. physical damage of people in HIS household due to experienced floods. The number of mortality/dies by cyclone is much larger than that of normal floods. Periphery Area has 120 mortality by cyclone where is the most vulnerable area against flood disaster in the Greater Yangon.

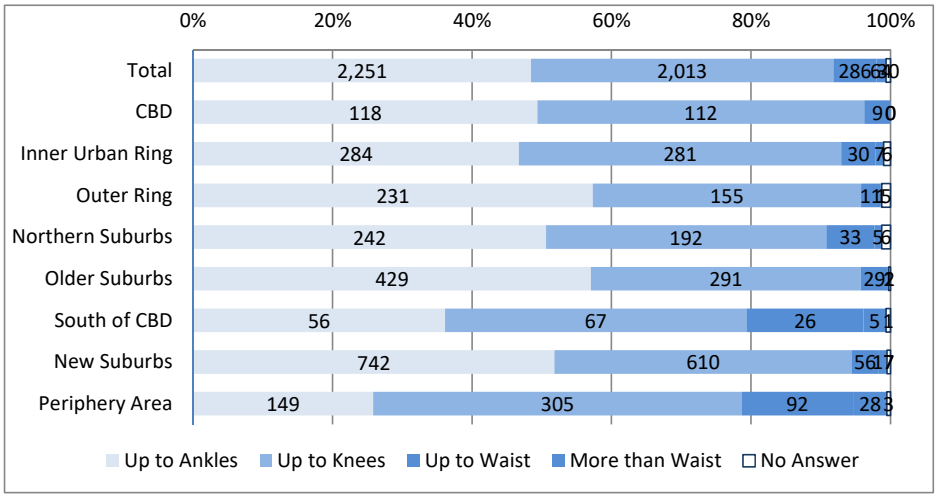
9 "1.2.9 Disaster (Flood & Drainage), (2) Flood Conditions, 2) Update and Additional Information of Floods, (I) Flooding, I) Major Floods in Yangon Region" in this report.

Therefore, urban fringe areas as Periphery Area and South of CBD highly need proper measures of flood management.



Source: JICA Study Team prepared based on SUDP-HIS results

Figure 2.4.22: Frequency of Flood Inundation in House



Source: JICA Study Team prepared based on SUDP-HIS results

Figure 2.4.23: Flood Inundation Depth in House during Maximum Flood

Table 2.4.21: Health Effects of HIS Households by Experienced Floods

Health Effect	Sickness		Injury		Mortality /dies	
Cause	Cyclone	Flood	Cyclone	Flood	Cyclone	Flood
Total	286	7	204	4	165	5
CBD	5	0	1	0	0	0
Inner Urban Ring	18	4	6	0	0	0
Outer Ring	9	0	7	0	4	0
Northern Suburbs	38	0	35	0	35	0
Older Suburbs	6	0	7	0	0	0
South of CBD	17	0	2	0	0	0
New Suburbs	52	2	21	0	6	0
Periphery Area	141	1	125	4	120	5

Source: JICA Study Team prepared based on SUDP-HIS results

(II) Potential Demand on Rainwater Drainage in Urban Area

Table 2.4.22 shows area, population and population density on township group basis. CBD has extremely highest population density in the Greater Yangon. Inner Urban Ring has secondly high population density in the study area. From the viewpoint of beneficiaries, priority areas of rainwater drainage infrastructures are on 1) CBD and 2) Inner Urban Ring.

Table 2.4.22: Area and Population in Township Groups

Township Group	Area (km^2)	Population (2011)	Population Density (Person/km^2)
CBD	6.91	252,391	**36,525**
Inner Urban Ring	37.94	778,156	**20,510**
Outer Ring	34.20	596,426	17,439
Northern Suburbs	185.18	219,512	1,185
Older Suburbs	49.42	848,153	17,162
South of CBD	110.50	805,461	7,289
New Suburbs	404.91	1,642,030	4,055
Periphery Area	705.83	430,114	609
Total	**1,534.89**	**5,572,242**	**3,630**

Source: SUDP

3) Development Goals and Target Effect Indicators

Table 2.4.23: Development Goals and Target Effect Indicators for Flood Management

Development Goal	Effect Indicators
a) Damages on people in the Greater Yangon by flood disaster is significantly mitigated	- No mortality by flood disaster - Mitigate flood damage including sickness, injury and house inundation
b) Construction and establishment of operation and maintenance system of rainwater drainage facilities in urban area of the Greater Yangon	- No flood inundation by five year probable flood in the Greater Yangon

Source: JICA Study Team

2.4.4 Solid Waste

(1) Current Status

1) Progress and Achievement after SUDP

Current status of solid waste management projects after development of SUDP in 2013 is summarized in Table 2.4.24. There are two key projects launched since 2013. One is a pilot scale waste to energy projects in Shwe Pyi Htar Township utilizing the Japanese Joint Crediting Mechanism, the other one is a private-based project for development of comprehensive waste management facility in Thilawa Special Economic Zone (SEZ). On the other hand, three projects, which are large-scaled waste to energy project, utilizing land fill gas and construction of a new sanitary landfill site and privatization of waste collection service utilizing Build Operation Transfer (BOT) and Public Private Partnership (PPP), are suspended or terminated. As for short term projects proposed in the SUDP, only some waste vehicle and equipment were procured by YCDC expense and the other all of the project have not been started yet.

Table 2.4.24: Current Status of Solid Waste Management Projects after development of SUDP in 2013

Category	Solid Waste Management Project/ Program	Outline	Current Status
Short Term Projects proposed in the SUDP	Project for Supply of Collection Equipment for Solid Waste Management (1)	- Procurement of waste vehicles and equipment. - Procurement of maintenance tools and equipment	Only some vehicle and equipment were procured by YCDC expenses
	Project for Capacity Development of SWM (1)	- Preparation of an action plan for short term development - Reviewing and updating and modify the waste collection system - Development of operation manual of hazardous waste management - Public enhancement program. - Coordination with the concerned stakeholders - Development and executive of a regular training program for SWM	Not yet started
	Project for Sanitary Landfill Development [Htein Bin, Kyi Su, Hlaing Tharyar, Thanlyin (1), and Dala (1)]	- Construction of a sanitary landfill - Procurement of necessary equipment and facility for landfill management such as weighing scale, heavy equipment, environmental monitoring equipment, etc.	Not yet started
	Project for Hazardous Waste Treatment Facility (Pilot scale) [Htawe Chaung]	- Construction of an incinerator for hazardous waste treatment as a pilot scale facility [treatment capacity: 100ton/day] - Procurement of necessary equipment and facility	Not yet started
Projects planned by YCDC-PCCD	Waste to Energy Project (Pilot Scale) in Shwe Pyi Thar Industrial Zone	- Construction of a pilot scale waste incineration power plant [60 tons/day x 1 unit with 0.7 MW] - Supported by the Japanese Joint Crediting Mechanism (Reducing CO_2 emissions by about 2,400 t-CO_2/year)	Under construction (To be completed in March 2017)
	Waste to Energy Project (BOT Project) in Htawae Chaung	- Construction of a waste incineration power plant [700 tons/day including 100 tons/ day for hazardous industrial waste]	Suspended (Effected until the first half of 2017)
	Landfill Gas Utilization and New Final Disposal	- Construction of gas collection system from landfill site and its utilization	Suspended (Effected until

Category	Solid Waste Management Project/ Program	Outline	Current Status
	Site Project (BOT Project) in Htein Bin	- Construction of final disposal site (extension)	the first half of 2017)
	Privatization of waste collection services in Yangon City (PPP Project)	- Outsourcing waste management for 33 townships in Yangon under public-private partnership	Terminated
Projects by private sector	Waste Management Facility including hazardous waste in Thilawa Special Economic Zone	- Construction and operation of waste management facilities [sorting and recycling, controlled final disposal site, Wastewater treatment] by a Japanese Private Company (DOWA Eco-system, Japan) - 40 ha located in Thilawa Special Economic Zone	Operated since November 2015

Source: JICA Study Team

2) Key International Cooperation and Bilateral Assistance Projects

Key international cooperation and bilateral assistance projects related to SWM in Yangon City after development of SUDP in 2013 is summarized in Table 2.4.25. There are two local level projects for YCDC funded by EU and JICA, and one national level project related to YCDC funded by Norway Government. In addition to the above three projects, there are various small sized projects on SWM in Myanmar such as Developing National/City Waste Management Strategies funded by UNEP and Capacity Development Program on Solid Waste Management funded by KOICA.

Table 2.4.25: Current Status of International Cooperation and Bilateral Assistance Projects related to Solid Waste Management

Project Name	Implementation Agency	Key Counterparts	Component of the Project	Period
Environmental protection and sustainable development: building local capacities on solid waste management in Myanmar	EU	YCDC	1. Reinforcement of institutional and technical capacities of Local Authorities of YC 2. Development of an information system for SWM to be managed by the YCDC-PCCD 3. Increase of community awareness on the importance of good practices	2013-2015
Grassroots Project on Improvement of Solid Waste Management in Yangon City (Phase 2)	JICA (Tokyo Metropolitan Government)	YCDC	1. Development of a manual to accomplish a planned and comprehended waste treatment system 2. Development of a public awareness tool to improve communication between residence and government	2015-2017
Norway-Myanmar Bilateral Environmental Program	Norwegian Government	MONREC-ECD YCDC MDCD	1. Conservation of biodiversity and improved management of protected areas in Myanmar, 2. Integrated water resources management - institutional building and training, and 3. Management of hazardous waste	2015-2018

Source: JICA Study Team

3) Key Achievements

(I) Waste to Energy Project (Pilot Scale) in Shwe Pyi Thar Township

According to the website of JEE Engineering Cooperation which is implementing construction of the waste incineration plant in Shwe Pyi Thar Township, JFE Engineering was entrusted from YCDC to implement the design and procurement and construction of the waste incineration power plant to be completed in March 2017. This plant will have a waste incineration treatment capacity of 60 tons/day, and will generate approximately 5,200 MWh/year (0.7 MW) of electric power. The plant used the bilateral Joint Crediting Mechanism (JCM) between Myanmar and Japan. JCM is a bilateral scheme which makes it possible to achieve Japan's emission reduction target through reductions of greenhouse gas (GHG) emissions in developing nations that are realized by dissemination of outstanding Japanese low-carbon technologies, products, and services to those nations

Source: JFE Engineering Cooperation (http://www.jfe-eng.co.jp/en/news/2015/20151112.html, accessed in October 2017)

Figure 2.4.24: Conceptual Drawing of Waste to Energy Project (Pilot Scale) in Shwe Pyi Thar Township

(II) Comprehensive Waste Management Facility in Thilawa SEZ

According to the website of DOWA Eco-System Co., Ltd., 100% subsidiary company of the DOWA Eco-System; Golden DOWA Eco-System Myanmar Ltd. constructed and started operates a comprehensive solid waste management facility since November 2015 to provide services including transportation, pre-treatment, recycling, and final disposal. The facility has 40 ha in total and can be received industrial and business-related waste including hazardous waste. The outline of main waste management facilities are as follows;

a) Sorting & Recycling
   Sorting and recycling process for waste will save resource and contribute to make zero-waste society.
b) Final disposal
   Landfill is designed refer to international standard of structure of hazardous waste (US EPA). It has high safety performance for prevention of accident.

c) Waste water treatment
Waste water treatment system has biological and coagulating sedimentation process for proper treatment of waste water.

Source: DOWA Eco-System Co., Ltd. (http://www.dowa-eco.co.jp/en/group/myanmar, accessed in October 2017)
Figure 2.4.25: Birds-eye Picture of Comprehensive Waste Management Facility in Thilawa Special Economic Zone

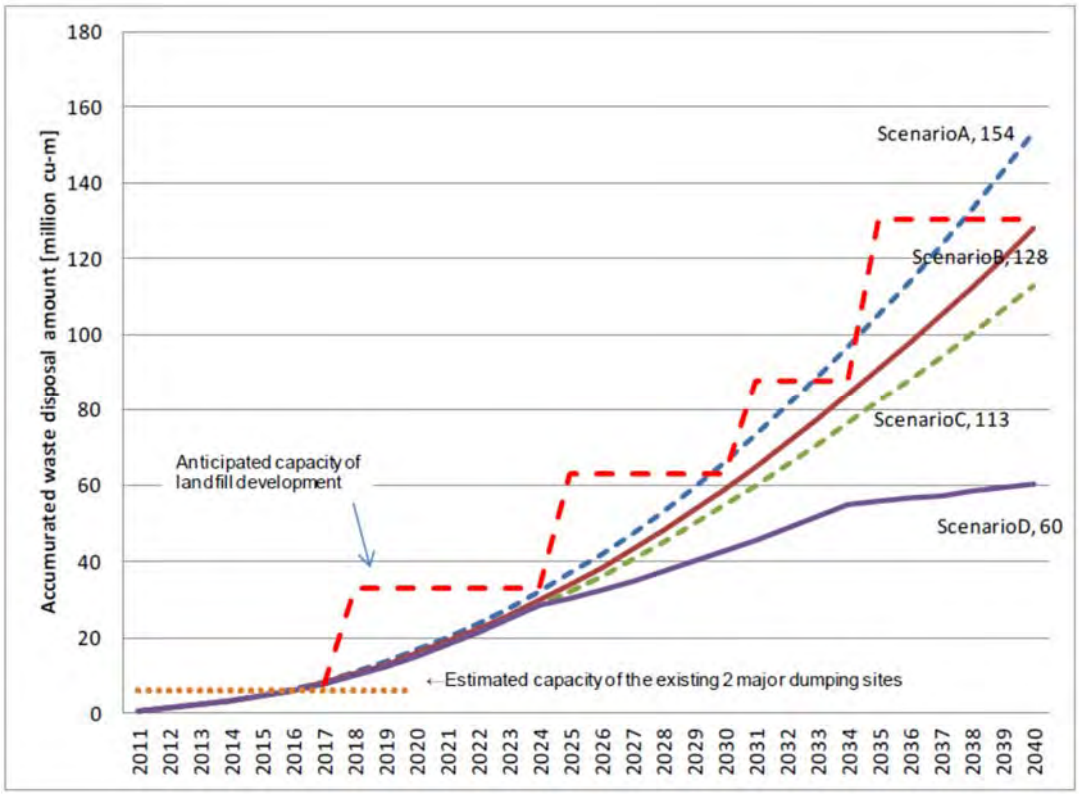
4) Present Approach of Short and Middle Terms SWM Planned by YCDC

According to Pollution Control and Cleansing Department (PCCD) of YCDC, PCCD pointed that three critical issues on solid waste management have been laying.

a) Issue on Securing Capacity of Final Disposal Site

There are two large scaled open dumping sites (Htain Bin in Hlaing Thar Ya Township and Htwei Chaung in Dagon Myothit (East) Township) managed by YCDC, which remaining number of years to receive solid waste are about ten years. However, land acquisition of new FDSs to be secured in case the existing dumping sites become full are nowhere in sight. The previous SUDP predicted that the amount of solid waste to go to FDS will be around four times from 2016 to 2025 due to population increase and economic growth as shown in Figure 2.4.26. Thus, securing lands for new FDSs and/or installation of municipal waste incinerators will be required to meet the demand of waste to be disposed.

Another important issue related to the existing FDSs is the possibility of environmental and health impacts to the surrounding areas and underground due to seeping leachate from the sites without any treatment and prevention system.



Source: The Project for the Strategic Urban Development Plan of the Greater Yangon, JICA

Figure 2.4.26: Capacity Demand of Final Disposal Site by Year 2040 with Waste Reduction (Municipal Waste)

b) Issue on Lack of Facility to Treat High Risk Hazardous Waste

YCDC has a simple hazardous waste disposal site to dispose expired medicines, paints, and; mercury and a crematory furnace to incinerate hospital waste. However, high risk hazardous waste such as liquid infectious waste, explosive waste, and corrosive waste shall be treated by a hazardous waste incinerator or detoxifying treatment such as solidification and chelation.

c) Issue on Pollution from Industrial Zones

According to PCCD of YCDC, illegal dumping sites are existing in and around industrial zones. In the industrial zones in Yangon City, labor-intensive industries, such as food processing and clothing, are dominant and organic waste may be generated from such sectors. Hazardous and chemical waste may be generated through manufacturing process in some factories such as battery, dyeing, and metal smelting. There is a possibility that these illegal dumping sites may cause health impacts to the surrounding residence due to seeping leachate from the sites including hazardous and chemical wastes.

In addition to critical issues pointed by PCCD, the following issues are also identified as the results of the survey to achieve vison and basic policy:

i) Lack of detailed plan for solid waste management (SWM),
ii) Weakness of legislation/unclear enforcement of hazardous/infectious waste management,
iii) Incomplete cost recovery from beneficiary,
iv) Inefficient waste collection system and old equipment, and

v) Securing lands for transfer stations in the city to respond to increased municipal solid waste for reducing cost and environment burden to be transferred to new dumping sites.

On the basses of the above situations, PCCD is planning three approaches to tackle with solid waste issues in short term and mid-term as follows.

a) Waste to Energy Projects

In order to extent remaining number of years to receive solid waste in the existing disposal sites before opening the new final disposal sites, YCDC has a plan to build four new incineration power plants (including in one pilot plant) in Yangon City. YCDC plans to install three medium scale (600-800 tons/day) plants in three zones; north-east, south, and west taking into consideration of optimization of collection and transportation, available land. The estimated total capacity of the plants is 2,000 tons/day which may be able to cover receiving municipal wastes in 2025.

b) Hazardous and Infections Waste Incinerator Project

In order to treat hazardous and infections waste from industries and hospitals in Yangon, a hazardous and infections waste incinerator plan to be installed in Hlaing Tharyar Township. According to PCCD, the installation cost (approximately 20 billion MMK) has been budgeted. This plant may be a first advanced hazardous and infections waste incinerator in Myanmar.

c) Recycling Center Projects in Industrial Zones

In order to reduce illegal dumping from industrial zones and to separate recyclable from non-recyclable waste, to and segregate non-hazardous waste from hazardous waste, YCDC plans to build recycling center in each industrial zone. If the recycling centers are established and segregated industrial waste in accordance with a category of hazardous waste to be set by Ministry of Natural Resources and Environmental Conservation (MONREC), a large portion of hazardous waste generated from industrial zone will be identified and treated by the hazardous waste facility of YCDC and the comprehensive waste management facility in Thilawa SEZ.

(2) Planning Process

In order to establish solid waste management as urban infrastructure development plan, the study team carried out meeting with PCCD and UPD in YCDC, and private companies which commences solid waste management services, and site visits as shown in Table 2.4.26.

Table 2.4.26: Record of Meetings and Surveys (Solid Waste Management)

Date	Title	Venue	Agenda
12th Sep 2016 (Mon)	Meeting with JICA Myanmar Office	JICA Myanmar Office	• Current status of solid waste management • Opinions from JICA
12th Sep 2016 (Mon)	Meeting with YCDC-UPD	YCDC-UPD	• Current status of solid management activities in urban planning process
15th Sep 2016 (Thu)	Meeting with Secretary of YCDC	YCDC	• Opinion exchanges about policy for solid waste management
22nd Sep 2016 (Thu)	Meeting with YCDC-PCCD	YCDC-PCCD	• Current status of solid management activities and on-going project by YCCD-PCCD
12th Oct 2016 (Wed)	Site Visiting	Pilot waste to energy plant in Shwe Pwi Thar	• Site visiting waste to energy plant • Opinion exchanges about waste to

Date	Title	Venue	Agenda
			energy projects
18th Nov 2016 (Fri)	Joining the task force to develop master plan for hazardous waste management under Norway	Hotel in Yangon	• Current progress of developing master plan for hazardous waste management
7th Dec 2016 (Wed)	Site Visiting	Comprehensive waste treatment facilities in Thilawa SEZ	• Site visiting comprehensive waste treatment facilities • Opinion exchanges about industrial and hazardous waste management
28th Feb 2017 (Tue)	Training on solid waste management for YCDC UPD & PCCD	YCDC-UPD	• Lectures & group discussion on solid waste management • Introduction of updated solid waste management plan
28th Feb 2017 (Tue)	Meeting with YCDC-PCCD	YCDC-PCCD	• Current status of solid management activities and on-going project by YCCD-PCCD

Source: JICA Study Team

(3) Updated Points from SUDP 2013 to 2016

As mentioned in Table 2.4.24, most of the proposed SWM projects in SUDP have not been started yet since 2013 but pilot waste to energy project in Shwe Pwi Htar township and comprehensive waste management facilities development project in Thilawa SEZ have already started. In response to this, SUDP is updated from 2013 to 2016. The main updated points in the short-term are summarized below;

a) Industrial and Hazardous Waste Management

A private project for development of a comprehensive waste management facility in Thilawa SEZ has been in operation since November 2015. In addition, MONREC is preparing a categorization and classification of hazardous waste in accordance with the requirement stipulated in the Environmental Conservation Rules. Furthermore, YCDC has plans to install recycle centers in each IZ and to install an incinerator for infectious waste. On the bases of the above actions, construction of hazardous waste landfill site is canceled and construction of recycling centers of each industrial zone and incinerator for infectious waste are proposed in the short-term.

b) Final Disposal

There are two critical issues on FDSs, namely: 1) securing new FDSs possible to receive enough volume of waste to be disposed even if large-scaled incinerators are installed and 2) improvement of existing open dumping without causing pollution. Thus, securing land in the short-term and stepwise construction of new FDSs are proposed taking into consideration the remaining number of years to receive solid waste by FDSs in the middle- and long-terms. As for improvement of existing dumping sites, a project for the improvement of existing dumping sites to sanitary landfill sites is propose in the short term because stopping environmental pollution is a primary issue on SWM, and improvement of waste collection and transportation and intermediate treatment without sanitary landfill sites is an ineffective one-sided solution.

c) Waste to Energy Project

Although two (2) waste to energy (hereinafter referred to as “WtE”) projects under BOT scheme have not started yet since 2013. Currently, YCDC keeps promoting of WtE projects (three3 projects to treat approx. 2,000 tons/day in total) to reduce waste to the final disposal sites and to contribute to electricity power supply. Thus promotion of WtE projects are listed in the priority projects in the short-term. However, it is necessary to assess the feasibility on the projects in terms of environment, society, economy, and technical aspects during the short-term because it

is difficult to get a feasible result on WtE projects in other ASEAN countries without consideration of tipping fee, power selling price, and financial support from the government.

(4) Supplemental Explanations of the SUDP

As a supplemental explanation of the SUDP, the most critical point to improve current solid waste management is to have a common understanding on further prioritizing projects listed in the short-term among important stakeholders such as YRG, policy decision maker of SWM (Mayor and Secretary of YCDC), and its enforcement organizations (YCCD-PCCD). Especially, it is essential to make comparative analysis between i) promotion of WtE and ii) securing additional final disposal site for selection of prioritization based on lessons and learnt on suspending current WtE projects, Table 2.4.27 summarizes IFC WtE strategy in the challenges of waste to emerging markets by International Finance Corporation (IFC). For promotion of WtE ptoject, YCDC also has to take into consideration the IFC WtE strategy.

Table 2.4.27: Summary of IFC WtE Strategy

Strategy	Items	Contents
Basic Strategy	When WtE makes sense	• Constrained land and transport infrastructure • Sufficient revenue streams
	Where WtE Makes Sense	• Rapidly growing large cities • Island nations
	WtE is a win-win	• Bring together electric utility or offtaker and local waste management authority in decision-making process.
Challenges of WTE in emerging markets	Structural	• Waste regulations and enforcement • PPP regulations • Waste supply capacity • Creditworthiness • Ability for long-term agreements / PPAs
	Technical	• Proven WtE technology & sponsor • Waste Quantity and Quality • Electricity grid access issues
Others	Considerations for development financing	• Transparent and competitive selection process • Community engagement and acceptance • Impact on informal sector • Air and effluent emissions standards • Environmentally sustainable ash disposal solutions • Integration into a broader SWM plan

Source: International Finance Corporation (http://iswa2015.org/assets/files/downloads/03_miller__stephanie.pdf)

2.4.5 Electricity

(1) Current Status

1) Progress and Achievement after SUDP

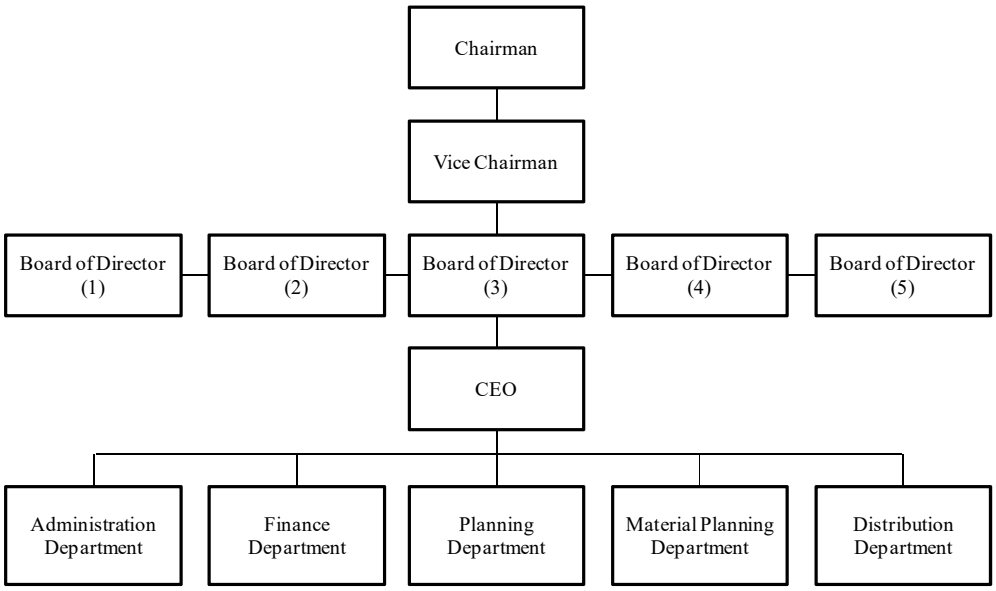
No short-term projects on electricity was proposed in SUDP in 2013.

2) Institutional Setting

The electricity system is managed by the Ministry of Electricity and Energy (hereinafter referred to as "MOEE"), and MOEE is consisted of 11 departments as below. Each department has responsibility, such as planning, power generation, transmission/distribution, etc.

1) Department of Electric Power Planning (DEPP)
2) Oil and Gas Planning Department (OGPD)
3) Department of Power Transmission and System Control (DPTSC)
4) Department of Hydro Power Implementation (DHPI)
5) Electric Power Generation Enterprise (EPGE)
6) Electricity Supply Enterprise (ESE)
7) Myanma Oil and Gas Enterprise (MOGE)
8) Myanma Petrochemical Enterprise (MPE)
9) Myanma Petro Product Enterprise (MPEE)
10) Yangon Electricity Supply Corporation (YESC)
11) Mandalay Electricity Supply Corporation (MESC)

One of the departments, Yangon Electricity Supply Corporation (hereinafter referred to as "YESC") is in charge of electricity distribution in Yangon area. Organization chart of YESC is shown in Figure 2.4.27. Townships of YESC electricity system service area is summarized in Table 2.4.28.



Source: YESC

Figure 2.4.27: Organization Chart of YESC

Table 2.4.28: Townships of YESC Service Area

District Office of YESC	East District	West District	South District	North District
Townships Covered by the District Office	Thingangyun	Kyauktada	Thanlyin	Insein
	Yankin	Pabedan	Kyauk Tan	Mingalardon
	South Okkalapa	Latha	Thon Gwa	Hmawbi
	North Okkalapa	Lanmadaw	Kha Yan	Hlegu
	Daw bon	Ahlone	Twantay	Taikkyi
	Thaketa	San Chaung	Kawhmu	Htantabin
	Tarmwe	Ka Mar Yut	Kungyangon	Shwe Pyi Thar
	Mingalar Taung Nyunt	Kyee Myin Daing	Dala	Hlaing Tharyar
	Pazundaung	Hlaing	Seikgyikhanaungto	Htaukkyant
	Bothahtaung	Ma Yan Gone	Cocokyun	Okekan
	Dagon Myothit (North)	Bahan	Lat Khote Kone	Dapain
	Dagon Myothit (South)	Dagon	Kyeik Htaw	Ahpyauk
	Dagon Myothit (East)	Seikkan	Tada (sub-township)	Phaunggyi
	Dagon Myothit (Seikkan)	Kyee Myin Daing (other side of river)		Myaungtaga
	Shwe Paukkan			Inndine
				Shwelinpan

Source: YESC

Currently, YESC has a five years' investment plan (FY 2016-FY 2020). On the other hand, there is no official Electricity M/P for whole Myanmar. Under the circumstances, JICA is executing the assistance project which will continue up until early 2019 for formulating Electricity M/P. MOEE is expected to familiarize itself with technical knowledge and skills required for the formulation/update of the M/P through this project.

3) Electricity System

Myanmar has four types of power station, namely hydropower (2,801 MW), gas turbine power (1,714 MW), combined cycle and thermal power (498 MW), and coal-fired power (120 MW). The total installed capacity reaches 5,133 MW as shown in Table 2.4.29 to Table 2.4.32. Additionally, incineration plant from waste has started operation in Shwe Pyi Thar Township with capacity of 700 kW as alternative energy source.

Table 2.4.29: Existing Hydropower Stations as of 2016

No	Name of Power Plant	Specification of generator		
		Installed Capicity (MW)	Generator Number	Total (MW)
	Total (Hydro)		**70**	**2801**
1	Paung Laung	70	4	280
2	Beluchaung (1)	14	2	28
3	Beluchaung (2)	28	6	168
4	Beluchaung (3)	26	2	52
5	Ye Ywa	197.5	4	790
6	Shweli (1)	100	4	400
7	Mone Chaung	25	3	75
8	Kintar	28	2	56
9	Tha Phan Seik	10	3	30
10	Kha Paung	15	2	30
11	Se Taw Gyi	12.5	2	25
12	Ye Nawe	12.5	2	25
13	Zaung Tu	10	2	20
14	Zawgyi (1)	6	3	18
15	Zawgyi (2)	6	2	12
16	Kyaing Taung	18	3	54
17	Shwe Kyin	18.75	4	75
18	Tapein (1)	60	1	60
19	Koon	20	3	60
20	Kyi Own Kyi Wa	37	2	74

21	Tout Yay Khat	40	3	120
22	Nan Cho	20	2	40
23	Chipwenge	33	3	99
24	Phyu Chaung	20	2	40
25	Upper Paung Laung	70	2	140
26	Myoe Gyi	15	2	30

Source: YESC

Table 2.4.30: Existing Gas Turbine Power Stations as of 2016

No	Name of Power Plant	Specification of Generator		
		Installed Capacity MW	Generator Number	Total MW
	Total (Gas Turbine)		**420**	**1714**
1	Kyun Chaung	18.1	3	54.3
2	Mann	18.5	2	37
3	Shwe Taung	18.5	3	55.5
4	Myan Aung	18.5	1	18.5
		16.3	1	16.3
5	Tha Htone	18.5	1	18.5
		16.3	2	32.6
6	Myin Chan (Aggreko)	1.1	92	101.2
	Myin Chan (V power)	1.6	96	153.6
7	Kyauk Se (GE)	1.5	75	112.5
8	Mawlamyine (ML)	21.5	1	21.5
		43.5	1	43.5
		43.5	2	87
9	Kyauk Phyu (V Powper 1)	1.6	32	51.2
	Kyauk Phyu (V Powper 2)	1.6	32	51.2
10	Hlaw Ga	33.3	3	99.9
	Hlaw Ga (MCP-1)	1	26	26
	Hlaw Ga (MCP-2)	9	3	27
11	Ywama (EGAT)	120	2	240
	Ywama	18.5	2	37
		24	1	24
	Ywama (UPP)	4	13	52
12	Ahlone	33.3	3	99.9
	Ahlone (Toyo Thai)	47	2	94
13	Thaketa	19	3	57
	Thaketa (MAX)	3.3	16	52.8
14	Thilawa	25	2	50

Source: YESC

Table 2.4.31: Existing Combined Cycle and Thermal Power Stations as of 2016

No	Name of Power Plant	Specification of Generator		
		Installed Capacity MW	Generator Number	Total MW
	Total (Gas Turbine)		**11**	**498.6**
1	Hlaw ga	54.3	1	54.3
2	Ywama	9.4	1	9.4
3	Ahlone	54.3	1	54.3
4	Ahlone (Toyo Thai)	27.6	1	27.6
5	Thaketa	35	1	35
6	Mawlamyine (ML)	33	1	33
		45	1	45

Source: YESC

Table 2.4.32: Existing Coal Fired Power Stations as of 2016

No	Name of Power Plant	Specification of Generator		
		Installed Capacity MW	Generator Number	Total MW
	Total (Coal)		**2**	**120**
1	Ti Kyit	60	2	120

Source: YESC

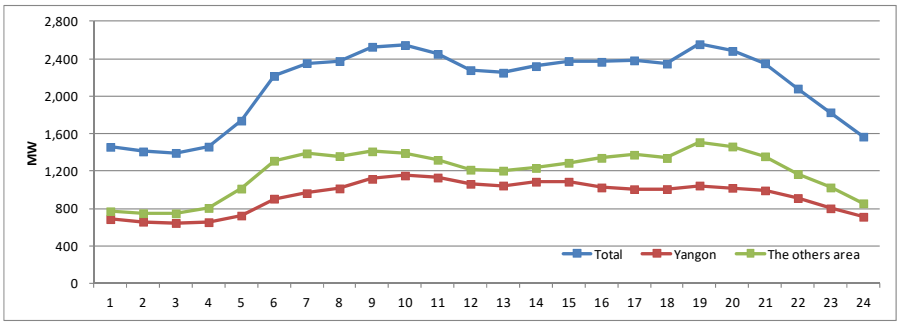
The electric power transmission system in Myanmar consists of 230 kV, and 66 kV; while distribution system consists of 33 kV, 11 kV, 6.6 kV, and 0.4 kV or less. Transmission/Distribution lines are controlled by different department depending on the area as shown in Table 2.4.33.

Table 2.4.33: Department for controlling Transmission/Distribution Line

Department	Controlling Transmission and Distribution line	Remark
DPTSC (Department of Power Transmission and System Control)	500kV (Future plan), 230 kV, 132 kV and 66 kV	Except for Yangon Region
YESC (Yangon Electricity Supply Corporation)	66 kV,33 kV (to be abolished in the future), 11 kV, 6.6 kV (to be abolished in the future) and (0.4-0.23 kV)	for Yangon Region
MESC (Mandalay Electricity Supply Corporation)	33 kV and less	for Mandalay Region
ESE (Electricity Supply Enterprise)	33 kV and less	Except for Yangon and Mandalay Region

Source: YESC

Actual maximum electricity supply in 25th August 2016 is only 2,554 MW as shown in Figure 2.4.28, though total installed capacity is 5,133 MW. One of the main reasons is that the losses on transmission/distribution lines, about 25% consisting of 7% from transmission and 18% from distribution. Additionally, the electricity demand in 2016 and 2030 is estimated at least 2,800 MW and 9,100 MW respectively according to the Data Collection Survey on Capacity Development of Power Sector Development Planning (2015). Currently, the generation does not meet the demand by about 300 MW and the shortage will increase year by year. Under the circumstances, additional power station's development and rehabilitation/upgrade of existing power stations are being executed and planned. Moreover, MOEE has procured 600 MW rental based power generation for next five years. Regarding the distribution losses, the improvement of distribution lines and substations are being executed and planning by YESC. However, development plan of ten substations in Dagon South and South Okkalapa is facing with the difficulties in terms of time and land acquisition.



Source: YESC

Figure 2.4.28: Actual Power Generation at 25th August 2016

4) Financial Aspect

The following electricity tariff shown in Table 2.4.34 has been applied since 1st April 2014.

Table 2.4.34: Electricity Tariff in Myanmar

Consumer Type	Unit (kWh)	Fixed Rate (MMK)
Domestic/Residential	1 to 100	35
	101 to 200	40
	201 and above	50
Industrial/Commercial	1 to 500	75
	501 to 10,000	100
	10,001 to 50,000	125
	50,001 to 200,000	150
	200,001 to 300,000	125
	300,001 and above	100

Source: YESC

(2) Planning Process

Table 2.4.35: Record of Meetings and Surveys (Electricity)

Date	Title	Venue	Agenda
14th Sep 2016 (Wed)	Meeting with Japanese electricity expert	Project office	• Current Status of Electricity in Yangon • Opinions from expert
26th Sep 2016 (Mon)	Meeting with YESC staffs	YESC office	• Current Status of Electricity in Yangon • Opinions from YESC
28th Oct 2016 (Fri)	Meeting with DEPP under MOEE staffs	MOEE office	• Current Status of Electricity in Myanmar • Opinions from MOEE

Source: JICA Study Team

(3) Updated Points from SUDP 2013 to 2016

1) Power Station Construction Plan

- Currently, the installed capacity of hydropower stations accounts for more than 50% of total capacity.
- It is said that the power stations should be developed not to rely on the kind of generation according to the Data Collection Survey (2015).
- MOEE is now considering option to import Liquefied Natural Gas (hereinafter referred to as “LNG”) as fuel for power generation. Therefore, gas fired power plants utilizing imported LNG is the key for power supply in the middle term.
- It should be noted that JICA is assisting for formulation of the Electricity M/P and will be completed within 2019. All of the development plans should follow the M/P after formulation.

2) Distribution Line and Substation Improvement in Yangon City

- Five year’s development plan was formulated by YESC, and it is mention that improvement of distribution line and substation are necessary.
- It is necessary to improve these facilities in accordance with development plan.

2.4.6 Information Telecommunications

(1) Current Status

1) Progress and Achievement after SUDP

Current status of telecommunication project mentioned in SUDP in 2013 is summarized in Table 2.4.36. One project was proposed and under construction by Japanese yen loan project currently.

Table 2.4.36: Current Status of Telecommunication Projects after development of SUDP in 2013

No.	Project Name	Outline	Current Status
1	Construction of Next Generation Network	- Installation of 4 NGN core facilities and construction of FTTX	Under construction and will be completed in 2019

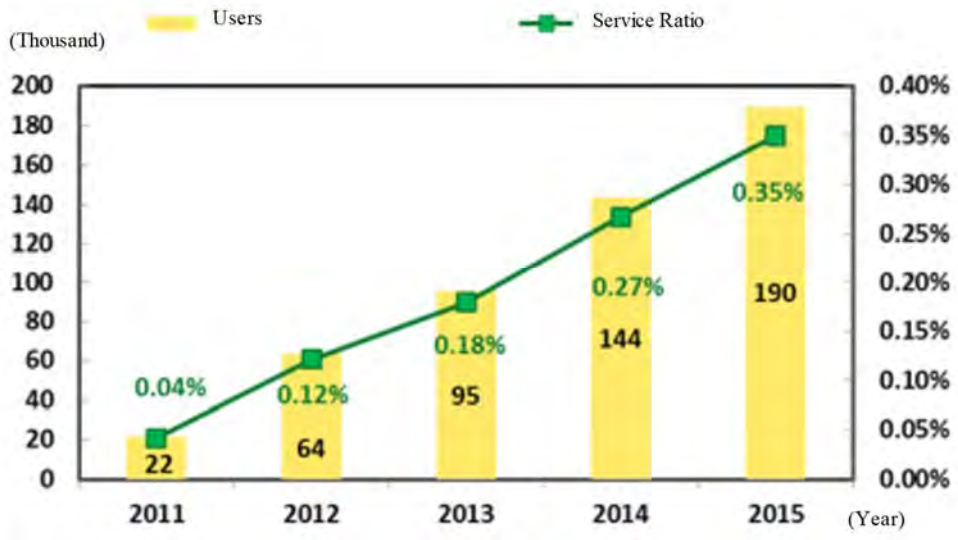
Source: JICA Study Team

2) Institutional Setting

The MOTC is in charge of telecommunication work. There are two organizations under MOTC related to telecommunication, namely Myanmar Posts and Telecommunications (hereinafter referred to as "MPT") and Posts and Telecommunication Department (hereinafter referred to as "PTD"). The MPT provides telephone, telegram, mobile phone and postal services; and PTD regulates telecommunications and broadcasting.

3) Telecommunication System

The number of service providers for internet service has become 27 including MPT, Yadanaporn Teleport, etc., as of August 2015, even though the number was only three in 2012. Satellite terminal, digital subscriber line (hereinafter referred to as "DSL"), and fiber to the x (hereinafter referred to as "FTTx") services are provided. Users of broadband gradually increase year by year as shown in Figure 2.4.29. However, it was still only 190,000 people accounting for 0.3% of the total population as of 2015 due to the delay of implementation of fixed telecom network.



Source: Based on ITU World Telecommunication/ ICT Indicators Database, 2016
(http://www.soumu.go.jp/g-ict/country/myanmar/detail.html#internet)

Figure 2.4.29: Broadband Users and Service Ratio (2011 to 2016)

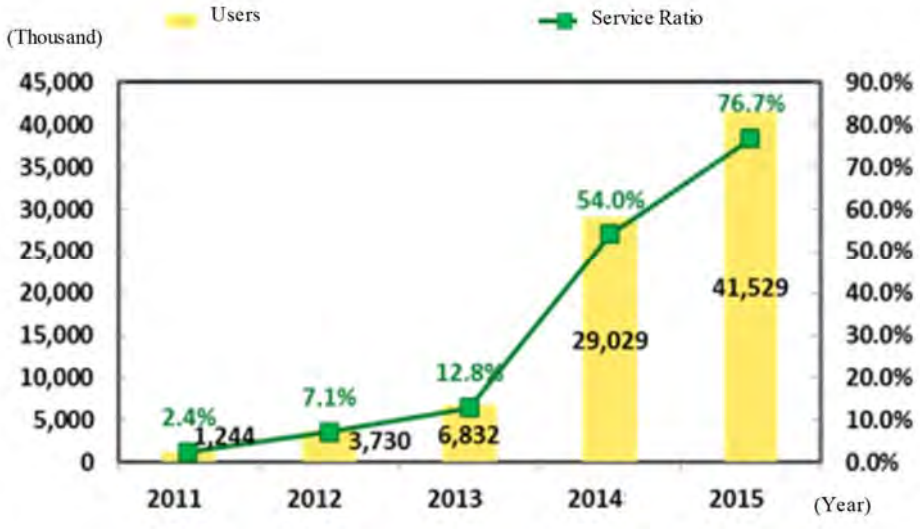
Telenor from Norway and Ooredoo from Qatar have entered the mobile phone business in Myanmar since September 2014. Additionally, Viettel from Vietnam has been selected as the fourth mobile phone business company in March 2016. There are four carriers including the MPT cooperating with KDDI and Sumitomo Corporation at present.

Telenor has started the GSM and W-CDMA service in Yangon, Naypyidaw and Mandalay from September 2014 and possessed more base station than Ooredoo had as of October 2015. They have launched 4G LTE service in Naypyidaw from July 2016.

Ooredoo also has started the W-CDMA type's 3G service in major cities including Yangon, Naypyidaw and Mandalay in 2014 and got loan from ADB and IFC to expand the service area of 3G. Additionally, they have introduced 4G LTE service in a part of Yangon, Naypyidaw and Mandalay from March 2016.

MPT has provided various types of mobile phone service, such as CDMA, GSM and W-CDMA, and lowered the price of SIM card to compete with other companies. From October 2016, they have also launched 4G LTE service in Yangon and Naypyidaw.

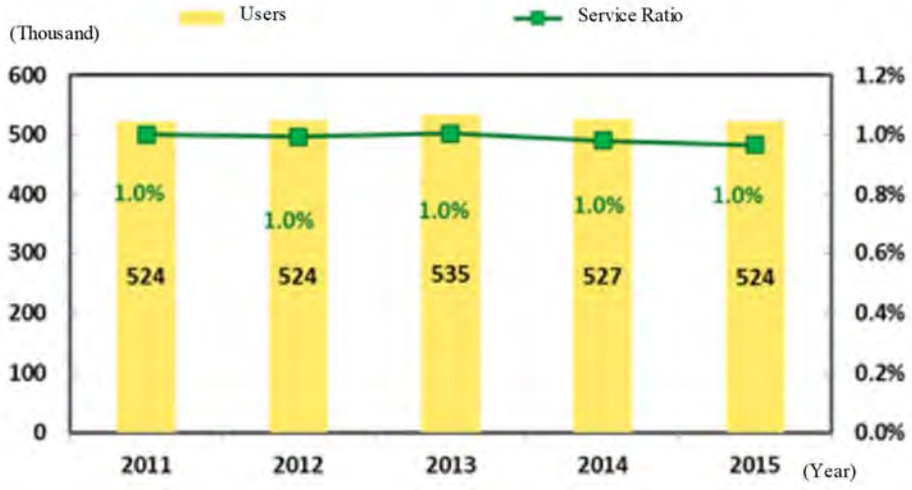
These situation has caused drastic increase of subscriber of mobile phones. Approximately 80% of the total population in Myanmar owns their mobile phones as of May 2016. The changes of mobile phone users and service ratio from 2011 to 2015 are shown in Figure 2.4.30.



Source: Based on ITU World Telecommunication/ ICT Indicators Database, 2016
(http://www.soumu.go.jp/g-ict/country/myanmar/detail.html#internet)

Figure 2.4.30: Mobile Phones Users and Service Ratio (20110 to 20154)

As for fixed telephone service, only MPT provide the service. Fixed network development is being executed by ODA loan project. The number of users is still low as shown in Figure 2.4.31 because of 1) increase of demand for mobile phones and 2) insufficient network for fixed telephone.



Source: Based on ITU World Telecommunication/ ICT Indicators Database, 2016
(http://www.soumu.go.jp/g-ict/country/myanmar/detail.html#internet)

Figure 2.4.31: Fixed Phones Users and Service Ratio (2011 to 2015)

(2) Planning Process

Table 2.4.37: Record of Meetings and Surveys (Telecommunication Supply)

Date	Title	Venue	Agenda
25th Oct 2016 (Tue)	Meeting with Japanese telecommunication experts	Project office	• Current Status of telecommunication • Opinions from experts

Source: JICA Study Team

(3) Updated Points from SUDP 2013 to 2016

1) Internet Infrastructure Development

- The development of internet infrastructure is being moved forward rapidly. Introduction of optical fiber cable (hereinafter referred to as "OFC") is under implementation between major cities and in each city.
- Enhancement of the national gateway in Yangon and Nay Pyi Taw is ongoing.

2) Telecommunication Network Development

- Wireless communication system, such as Long-Term Evolution (hereinafter referred to as "LTE"), is being developed by each carrier sequentially, and the users of mobile phone drastically have increased.
- Development of next generation network (hereinafter referred to as "NGN") is desirable for high speed and reliance network.

2.4.7 Disaster Risk Management (Earthquake)

(1) Current Status

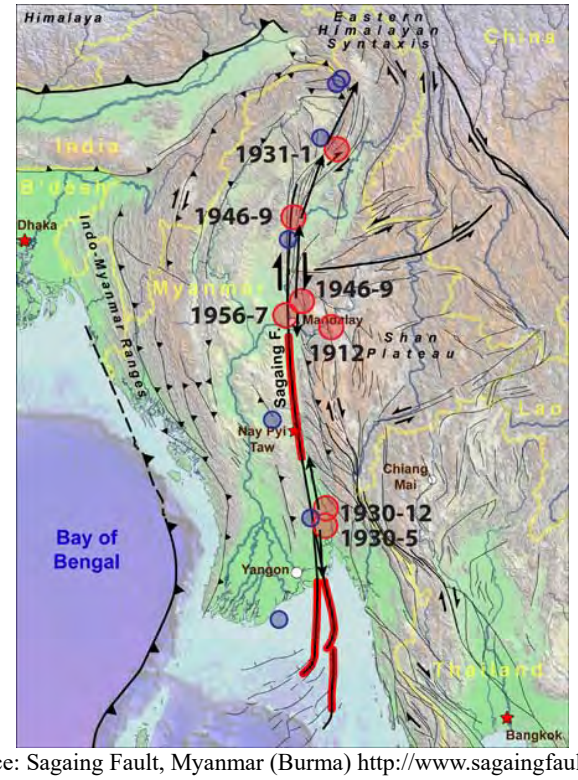
1) Major Destructive Earthquakes in Myanmar

The 1,200 km long Sagaing Fault is running from north to south in the central area of Myanmar. M7 class earthquakes have been recurring around this fault since 1900's. Major cities such as Yangon, Nay Pyi Taw and Mandalay are adjacent to Sagaing Fault. Table 2.4.38 lists up major destructive earthquakes with year of occurrence and magnitude, and Figure 2.4.32 shows the location of Sagaing Fault and distribution of epicenter of these major destructive earthquakes. Areas circled in red line in Figure 2.4.32 indicate high-probability areas that have potential risk of earthquake to happen in the future. Yangon has high seismic risk for this reason. Seismic property of city infrastructure and buildings need to be improved for Yangon to achieve sustainable development.

Table 2.4.38: Major destructive earthquakes

D/M/Y	Disaster area	Magnitude	Remarks
23/5/1912	Mayo, Mandalay Region	8.0	Severe disaster with deceased
5/5/1930	Kayan, Yangon Region	7.3	500 dead in Bago and 50 dead in Yangon
3/12/1930	Nyaunglebin, Bago Region	7.3	30 dead
27/1/1931	Myitkyina, Kachin State	7.6	Crack in the ground (Myitkyina earthquake)
12/9/1946	Tagaung, Mandalay Region	7.8	M7.5 aftershock occurred
16/7/1956	Sagaing Region	7.0	Pagodas collapsed, 40-5- dead

Source: 'Research Report on Infrastructure Development for Earthquake Disaster Prevention in Myanmar' August 2015, The Overseas Construction Association of Japan, Inc.



Source: Sagaing Fault, Myanmar (Burma) http://www.sagaingfault.info

Figure 2.4.32: Sagaing Fault and Distribution of Epicenter of Major Destructive Earthquakes

2) Earthquake-Resistant Design Standards of Myanmar

The following are issues regarding earthquake-resistant design that address potential seismic risk in Myanmar.

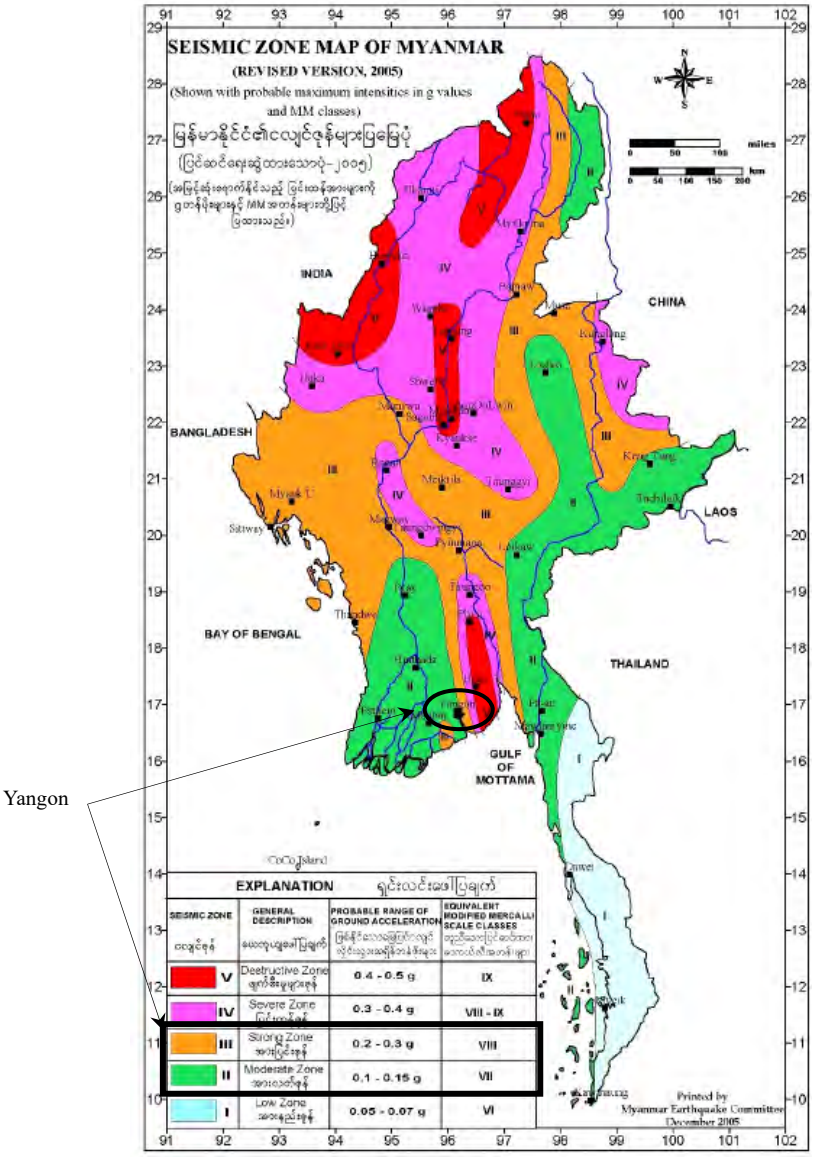
a) **Myanmar National Building Code:** Currently there is no building standards law in place. Myanmar National Building Code (hereinafter called 'MNBC') is still in process of creation. This is going to be enacted into law in the future.
b) **Committee for Quality High-rise Building Project:** Currently, YCDC is examining nine to twelve stories buildings in Yangon city with the instruction of the Committee for Quality High-rise Building Project (hereinafter referred to as "CQHP). This institution is not based on any laws either. Majority of the CQHP basically refers to Uniform Building Code 97 (hereinafter referred to as "UBC97"), and there is not much detailed description. However, some items such as fixing length of slab RC are specifically stated in Burmese language, while detailed seismic design method is not. Under the circumstances, it is assumed that seismic design standards are not widely recognized among local designers.
c) **Reference Code :** Both MNBC and CQHP are created by partially revising United States' design criteria. MNBC is based on the American Society of Civil Engineer 7 (hereinafter referred to as 'ASCE7') while CQHP is based on the UBC97. Difference in design methods adopted by ASCE7 and UBC97 may cause confusion when the MNBC is officially legislated.
d) **Problems of Application Procedures at YCDC:** The building lower than eight stories does not require seismic design.

Table 2.4.39 shows seismic zone at MNBC. Figure 2.4.33 shows design for shear coefficient map established by MNBC. This map indicates that the institute takes into account the seismic risk caused by the Sagaing Fault.

Table 2.4.39: Seismic Zone at MNBC

Seismic Zone		Seismic Acceleration	The Modified Mercalli Intensity Scale	
I	Low Zone	0.05 - 0.07g	VI	Strong: Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
II	Moderate Zone	0.1 - 0.15g	VII	Very Strong: Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
III	Strong Zone	0.2 - 0.3g	VIII	Severe: Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IV	Sever Zone	0.3 - 0.4g	VIII-IX	(VIII) Severe: Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. (IX)Violent: Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
V	Destructive Zone	0.4 - 0.5g	IX	Violent: Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

Source: USGS http://earthquake.usgs.gov/learn/topics/mercalli.php, Myanmar National Buildings Code 2016



Source: Myanmar National Building Code-2016

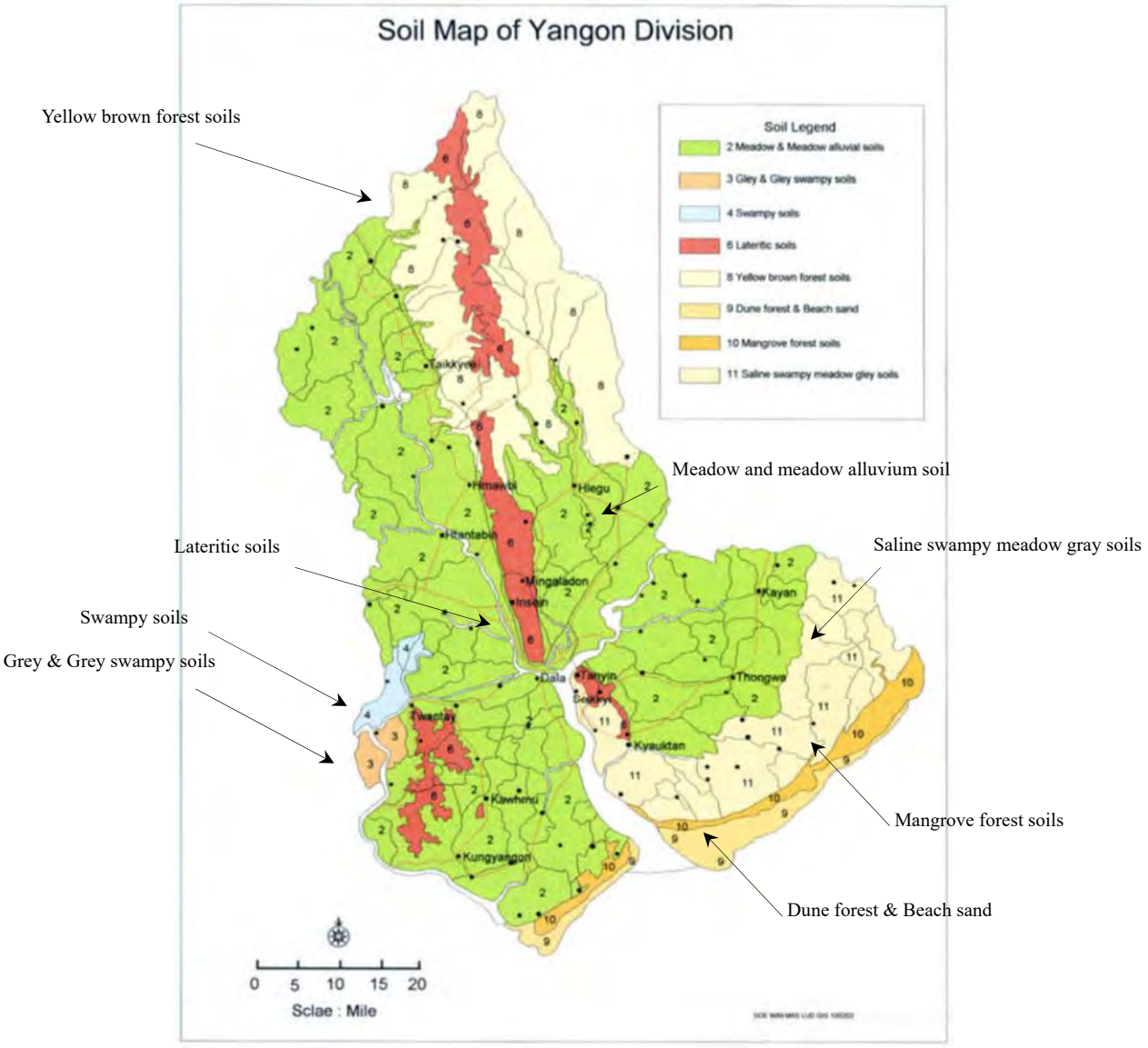
Figure 2.4.33: Design for shear coefficient distribution map (excerpt from MNBC-2016)

3) Issues concerning Building Seismic Property of Yangon

(I) Locational Characteristics and its Risks

Yangon is located adjacent to high-probability area (area that had seismic activity in the past but hasn't been the seismic center for a long period of time) of Sagaing Fault that has potential risk of earthquake in the future. Due to this reason, Yangon has quite high seismic risk.

In addition, majority of the Yangon urban area is located in the flood plain area formed by Ayeyarwaddy River etc. Figure 2.4.34 shows geological map of Yangon division. This indicates that Yangon has a vast layer of soft alluvium soil along rivers, and once earthquake occurs, this soft surface stratum can amplify the tremor and cause massive damage from the earthquake.



Source: Yangon River Geomorphology Identification and Its Environmental Impact Analysis by Optical and Radar Sensing Techniques, HP

Figure 2.4.34: Soil Map of Yangon Division

(II) Building Construction

Visit to the construction site and concrete factory revealed some issues and challenges as described below. The visit details are described in 3.3 Building Seismic Diagnosis.

a) Construction site: 4U5S (Hlaing Tharyar Township)
b) Concrete factory: HIGH TECH CONCRETE Co., LTD.

I) Construction Technologies

As for issues in the actual construction site, it is highly likely that construction site manager does not receive appropriate professional ethics education. In addition, due to absence of supervisor (engineer) on the construction site, construction workers are not educated about adequate construction method. Due to the following issues are coming up to the surface.

a) Construction is done based on a drawing different from the one submitted to YCDC.
b) Column rebar is decentered from the center of mold form and covering depth is different between left and right.
c) Spacer is used only in some areas, and even when it's used the concrete piece is not fixed (might move while casting). We observed such cases where insufficient construction accuracy is achieved for maintaining design strength.
d) Vibrator is inserted askew.
e) We observed honeycombed concrete in columns that came immediately out of mold form. This is assumed to be due to blending of concrete, grain size of coarse aggregate (quality of material used) and inappropriate use of vibrator.


Decentered column rebar


Unfixed spacer


Vibrator inserted askew


Honeycombed column

Source: JICA Study Team

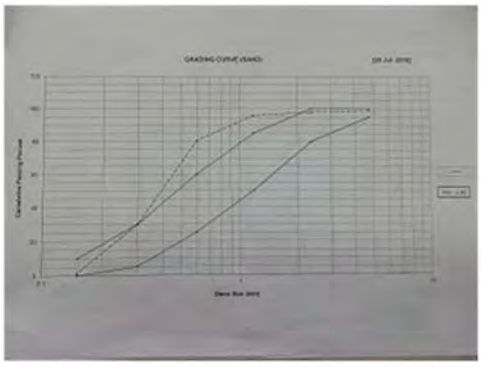
Figure 2.4.35: Photos from Construction Site

II) Material Used

(i) Concrete

a) Concrete factory is performing appropriate management of material and mixing of concrete, and the quality of concrete is stable.
b) However, due to the cost or shortage of supply, many of the construction sites are partially using side-mixed concrete. In case of 4U5S (Hlaing Tharyar Township), factory-made concrete is used for beam and slab, and side-mixed for column and foundation. Instead of using proper scale that can weigh accurately, they use a plastic case as a unit of measure for blending concrete material. (Refer to Figure 2.4.36)
c) River Single or Crushed Stone is used for aggregate.
   - Fine grain distribution of River Shingle does not meet ASTM (USA) standards
   - Fine grain distribution of Crushed Stone meets ASTM (USA) standards
d) However, many of the local contractors are using less expensive River Shingle. This is also the case for side-mixed concrete.

Side-mixing of concrete



Factory produced concrete
Fine grain test result for River Single

Source: JICA Study Team

Figure 2.4.36: Concrete Mixing Status

(ii) Rebar

a) Rebar is put on wood pieces so as not to touch the ground. (Rust was observed on the surface of rebar stocked outside exposed to rain.)
b) Rust in rebar is removed before using.
c) Bending work is done on site.
d) Rebar is produced abroad.

Source: JICA Study Team

Figure 2.4.37: Material storage status

As a result of visit to the construction site, inconsistencies between submitted drawing and construction drawing used on site, and issues concerning construction quality such as construction technologies and storage of construction material have been confirmed. Due to these findings, it is hard to expect that the buildings under construction possess sufficient building strength as outlined in the design document. Improvement of such construction quality is one of the challenges in current construction situations in Myanmar.
During concrete factory visit it was observed that management of material (cement and aggregate) and various tests are being performed properly, therefore we can assume that proper product quality is assured. However, material that does not meet ASTM standards is sometimes used for aggregate due to cost reasons. This needs to be improved.
In order to resolve above issues, countermeasures to improve construction quality are required via conducting unannounced construction site inspection by additional personnel in supervising organization (YCDC) or giving proper advice to the contractor

(III) Institutional Point of View

I) New Building (Legal system reform)

As previously mentioned, without building standards related law in place, the building lower than eight stories are not obliged to adopt earthquake-resistant design. In addition, since buildings don't need to go through inspection after construction, there are cases where buildings are constructed differently from the submitted drawing. Construction quality is also low. In order to improve such issues, following regulations should be established or improved.

a) Establish building standards related law (MNBC is underway)
The following items should be incorporated in the Building Code enforcement.
- Obligatory earthquake-resistant design
- Create standards documents in Burmese so that seismic design standards become widely established.
- Designating construction material to be used (designation of quality)
- Implementing mandatory inspection by third party during and after construction

b) Establish construction status monitoring system
One of the examples is execution of unannounced test against construction site by adding personnel in the supervising institution (YCDC). It is desirable to establish regulations that enforce post-construction inspection for all buildings.

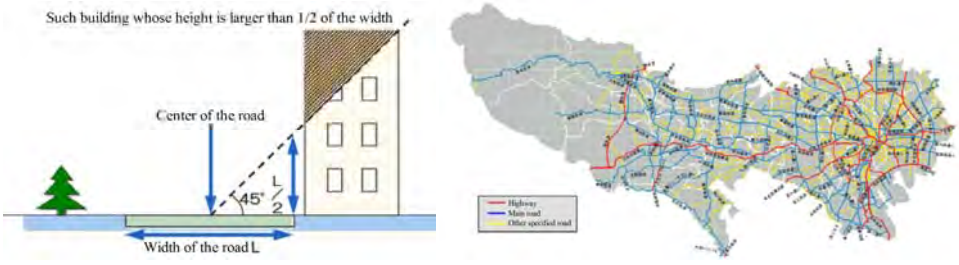
c) Establish the institution to improve construction quality
It is necessary to provide professional ethics education to construction supervisors and set up license system to be granted for construction supervising engineer. It is desirable to establish regulations mandating that personnel who obtained abovementioned license resides on-site and instructs construction workers.

II) Existing Building (Building quake-proof city)

Seismic diagnosis and seismic reinforcement are required for improving aseismic properties of existing buildings. We hereby propose following steps to ensure execution of improvement in a step-by-step and stable manner.

a) Define specific emergency transportation routes for transporting emergency goods in times of disaster.
b) Start with buildings along emergency routes for applying seismic reinforcement. Specifically, identify buildings along the emergency roads and mandate application of seismic reinforcement on such buildings whose maximum height is larger than 1/2 of the width.

Specific emergency transportation routes: Prevent roads from being obstructed by collapsed buildings in time of earthquake that mainly secures evacuation and transportation routes in a wide area. For example, over four-lane road that can facilitate truck transportation.



Setting up specific emergency transportation routes. Tokyo prefecture: Sample of specific emergency transportation routes
Source: Tokyo Metropolitan Government Earthquake-Resistant portal site (http://www.taishin.metro.tokyo.jp/)

Figure 2.4.38: Example of specific emergency transportation routes

(2) Planning Process

Table 2.4.40: Record of Meetings and Surveys (Earthquake)

Date	Title	Venue	Agenda
11th Aug 2016 (Thu)	4U5S on-site investigation	Hlaing Tharyar Township	• RC arrangement status investigation • Sample gathering
12th Aug 2016 (Fri)	Room layout investigation with YCDC	YCDC Engineering Department	• Hearing investigation about legal system and examination system
15th Aug 2016 (Mon)	4U5S on-site investigation	Hlaing Tharyar Township	• Hearing with on-site supervisors • Casting status investigation
17th Aug 2016 (Wed)	Concrete factory inspection	HTC	• Hearing about quality management • Material management status investigation
22th Aug 2016 (Mon)	4U5S on-site investigation	Hlaing Tharyar Township	• RC arrangement investigation • Casting status investigation
23th Aug 2016 (Tue)	Concrete factory inspection	CPAC	• Hearing about quality management • Material management status investigation
16th Oct 2016 (Sun)	Concrete quality check	MES	• Hearing about concrete quality
7th Dec 2016 (Wed)	Schmidt hammer test	Grand Mee Ya Htar Hotel	• Concrete quality investigation

Source: JICA Study Team

(3) Supplemental Explanations of the SUDP

1) Result of Seismic Diagnosis

Aiming at evaluating seismic properties of buildings currently under construction in Yangon, seismic diagnosis was conducted for following three building. None of the buildings adopt seismic design.

a) As a result of seismic diagnosis, all the three buildings have a risk of collapse in case of moderate-sized earthquake. It is preferable that the buildings are reinforced.
b) According to the calculation, it was confirmed that some beams in two buildings out of three are already yielded by stationary load. There is a risk that floor crumbles when heavy load is put on, some countermeasures need to be taken.
c) The buildings in Yangon (target buildings) have larger column cross-section compared to beam cross-section and are expected to result in beam collapse type. Since it is not appropriate to adopt the same simplified diagnosis practiced in Japan, we hereby proposed a seismic diagnosis tailored for Yangon that assumes beam collapse. This proposed seismic diagnosis (simplified diagnosis) for Yangon can offer accurate diagnosis result and easier calculation compared to incremental analysis (detailed diagnosis). Therefore, it is considered to be a simple and effective method for diagnosing seismic capacities of buildings in Yangon.

2.4.8 Disaster Risk Management (Fire)

(1) Current Status

1) Introduction

This section describes fire accidents in Yangon. It is investigated in five viewpoints and some suggestions for fire protection method are provided. Five viewpoints are as follows:

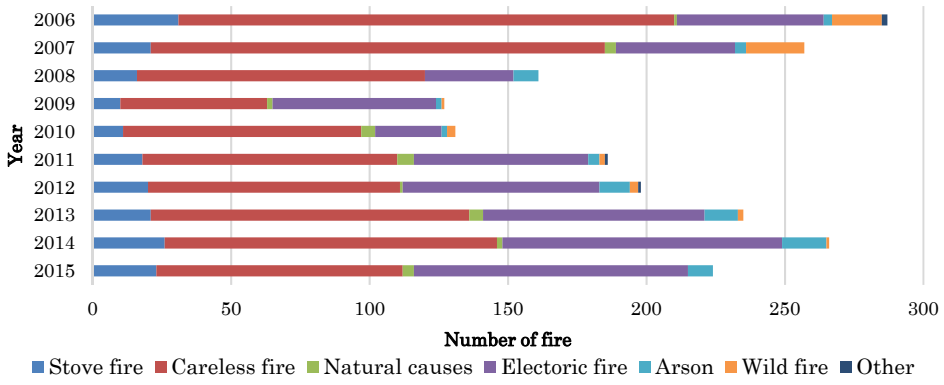
a) The actual condition of fire accidents
Some graphs are shown for understanding about actual condition of fire accidents.
b) Fire stations
As fire stations are important for urban fire protection, list of fire engines and water resources are presented.
c) Map of large road
Large roads can be applied as fire spread prevention belts. It is important for urban fire safety to separate by fire spread prevention belts.
d) Maintenance condition of fire standard
There is no fire standard at present.
e) Visual survey in town
Surveying of some crowded building areas was carried out.

2) The Actual Condition of Fire Accidents in Yangon

(I) The number of fire

Figure 2.4.39 shows the number of fire accidents per year in Yangon. And it shows the breakdown of causes. The graph was formed from data provided by Myanmar Fire Service Department.

a) The number of fire accidents was on the increase from 2010 to 2015. Especially, electric fire was on the increase. Electric fire can occur at any classification of building type.
b) The number of fire accidents decreased from 2006 to 2010. Careless fire decreased the most.
c) In 2015, Careless fire and Electric fire are recorded as the main causes of fire accidents.
d) The causes of electric fire are mainly of cable and faulty wiring.
e) About 200 fire accidents occurred every year.



Source: JICA Study Team based on the data of Fire Department

Figure 2.4.39: The number of fire accidents

(II) The amount of loss by fire accidents

Table 2.4.41 is the amount of loss by fire accidents per year in Yangon. The table was compiled from data provided by Myanmar Fire Service Department.

a) The amount of loss was not proportional to the number of fire accidents.
b) In 2009, 2010 and 2012, the amount of losses is regarded to be large amount. Reason of large amount in 2012 is that there was huge fire at Myanmar International Terminal Thilawa. The amount of loss was 4,000 million MMK. If excluding 4,000 million MMK, amount of loss in 2012 would be 346 million MMK which sums to similar amount of other years. Maybe 2009 and 2010 may have the same reasons.

Table 2.4.41: The Amount of Loss by Fire Accidents

Year	Fire accidents	Buildings or houses	Victims	Amount of loss (MMK)
2006	287	158	916	374,172,225.00
2007	257	133	735	330,125,496.00
2008	161	643	3751	282,880,000.00
2009	127	48	145	9,084,016,300.00
2010	131	1647	597	23,488,397,900.00
2011	186	204	1528	305,473,500.00
2012	198	1596	1908	4,345,850,791.00
2013	235	127	1238	377,399,200.00
2014	266	197	307	328,782,300.00
2015	224	316	1216	365,270,500.00

Source: JICA Study Team based on the data of Fire Department

(III) Huge Fire Accident

Table 2.4.42 describes big fire accidents with loss over 10 million MMK from 2011 to 2015 in Yangon. The table was made from data provided by Myanmar Fire Service Department.

Sometimes buildings or house rows are empty in this table, because this table was made for amount of loss.

a) Market fire is easy to become the inception of huge fire. Because market has small shops having a lot of items and lack of separation by wall. It is easy to spread to the adjacent shops.
b) There were 5 accidents that amount of loss were over 100 million MMK.
c) The highest amount of loss was at Myanmar International Terminal Thilawa, 26 March 2012. According to “Myanmar Times”, the huge fire destroyed teak and hardwood logs that were stored at the port for export. And it took about 16 hours to bring under control.
d) Huge fire explosion occurred in Mingalar Taung Nyunt, 2011. According to “The New Light of Myanmar”, an explosion occurred due to chemical reaction of the herbal materials. Fire started at the electronics warehouse and spread to the chemical material warehouse. Then the chemical material ware house was exploded. The explosion broke many houses.
e) The fire in market is easy to become a huge fire. Because there are many shops in markets. Each shop has many items like a warehouse. And the partitioning with neighbor shops is absent. In this condition, fire spreads at fast speed.
f) Markets and factories are burned down every year.

Table 2.4.42: Huge Fire Accidents with Loss over Ten Billion MMK.

Year	Date	Time	Township	Ward/Village	Cause of Fire	Building or House	Amount of loss (MMK in million)	Remark
2011	17.04	14:20	Thardukan	Car manufacturing factory	Over-heated less fuel KVA machine		20.00	
	26.04	1:35	Shwe Pyi Thar	VeVe Juice factory	Over-heated switch		30.50	Factory
	28.12	16:10	Mayangone	Baho Road leather factory	Child playing gas lighter	1	13.00	
	29.12	10:45	Mingalar Taung Nyunt	Myittar Mon traditional medicine shop	Exploded fire	94	113 60	
	30.12	17:30	Kamayut	Seint Augustin School	Charging battery		41.50	
2012	06.02	12:15	Hlaing Tharyar	Ah Lae village	Remaining fire	339	10.08	
	26.03	14:20	Kyauktan	Thilawa MITT	Cigarette disposal		4000.00	
	10.04	1:20	South Okkalapa	Haymawun market	Apply mosquito-coil in the evening	893	61.30	Market chamber
	12.04	14:50	Hlaing Tharyar	Shwe Lin Ban Industrial Zone	Heated punching of polystyrene foam box	1	95.00	
	18.05	1:05	San Chaung	Gwa market	Wire shock	233	349.50	Market chamber
	11.06		Hlaing Tharyar	Shwe Lin Ban Industrial Zone	Gas Pipe line		30.26	
	15.07	18:05	Kyauktada	India Embassy	Over-heated inverter		13.19	
2013	12.03	12:00	Hlaing Tharyar	Ppcl petroleum oil	Diesel filling accident	2	29.00	
	07.04	11:45	Mingalardong	Pearl(1) Ward	Workshop welding		20.03	
	18.04	18:50	Dagon	Corner of Zizawa Road & Samon Road	Wet Cable shock		27.52	
	18.9	11:30	Mingalardong	A1 Garment factory	Over-heated wire		12.70	
	06.11	6:30	Dagon(ya)	Industrial Zone(113)Ward (Pwint Oo furniture store)	Over-heated complex wire		100.00	store(1)
2014	21.01	18:05	Mingalardong	Mingalar market Ward(Military security troop(air force) oil storage warehouse	Fall of oil tank from truck		28.20	store(1)
	28.01	23:45	Kyee Myin Daing	Thida Ward(Old Thirimingalar market/Sinma Furniture factory)	Jam of saw dust and others in exhaust-fan		12.10	
	05.04	19:23	Hlaing Tharyar	(7) Ward	Wire shock spark transit to water-proof sheet	8	18.10	
	13.11	15:45	Hlaing Tharyar	Industrial Zone(2),Opal-1 Garment factory	Over-heated glue purification machine of FUSSING on first		80.00	Factory(1)

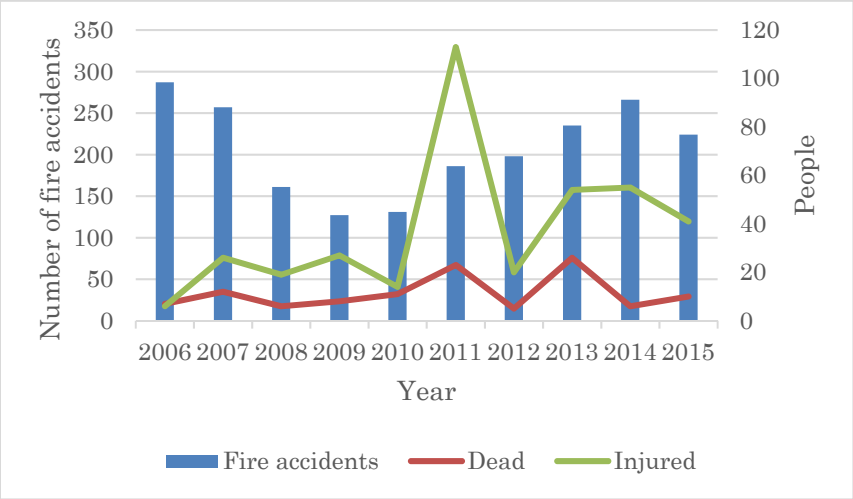
Year	Date	Time	Township	Ward/Village	Cause of Fire	Building or House	Amount of loss (MMK in million)	Remark
					floor			
	04.12	24:00	Hlaing Tharyar	Industrial Zone(2),(Myanmar Sandy Shoes factory) raw material store	Labors' reckless cigarette disposal		40.00	store(1)
2015	31.07	3:15	Hlaing Tharyar	Hlaing Tharyar Industrial Zone(3), MrSon paper box factory for 'Yes' cartoon	Over-heated wire in CCTV control room		23.00	
	24.09	6:30	Mingalardong	Zaygabar garden+Yangon Industrial Zone R-7 Road, raw material store for Coca Cola bottle of Shwe Than Kyaw Company	Apply mosquito-coil		112.50	Store(1)
	19.11	4:00	Hlaing Tharyar	Industrial Zone(2),Makaya Prince Road,'Shwe' peanut oil factory	Over-heated main power-line switch and spark on oil-screening sheet		15.00	Factory(1)

Source: JICA Study Team based on the data of Fire Department

(IV) The dead and injured people by fire accidents

Figure 2.4.40 was made from data provided by Myanmar Fire Service Department. It was the data of Yangon.

a) About 20 people die every year.
b) Dead and injured people were not decreased. Recently, the number of high rise buildings and big shopping center is under increase in Yangon. Those are popular as gathering spaces. Then there are some possibilities of increasing dead and injured people.



Source: Myanmar Fire Service Department

Figure 2.4.40: The Dead and Injured People by Fire Accidents

3) Fire Station

(I) Fire Station

There are three types of fire station.

a) Township Fire Station – 36 stations
b) Zonal Fire Station – 14 stations
c) Volunteer Fire Station – 5 stations

Township fire stations are main fire station. Zonal fire stations are at compliment position for Township fire stations. Volunteer fire stations are sub fire station.

In average, callings from fire accidents received in Yangon are at two to three times per day during dry season and one to two times during rainy season per day.

Source: JICA Study Team

Figure 2.4.41: Kyauktada Fire Station (Township Fire Station)

(II) The Number of Fire Engine

The features of fire engines in Yangon City are as followings;

- Pump vehicle is main fire engine. It has pump and small water tank. Pump vehicle takes upon roles that pumping up from water resource and discharge of water to fire.
- Tank vehicle has big size water tank.
- Engine vehicle has tank and portable fire pump.
- Support vehicle is special support for firefighting. For example Ladder vehicle.
- Mobile pump is light weight pump.
- Trailer is attached to vehicle.
- Command vehicle is for commander.

There are 55 fire stations and 109 fire engines. Compared to fire stations, the number of fire engines appears to be a small amount. The Fire Service Department does not have the right-of-way.

Table 2.4.43: The Number of Fire Engine

District	Township Fire Station	Zonal Fire Station	Volunteer Fire Station	Pump vehicle	Tank vehicle	Fire Vehicle	Support vehicle	Mobile pump	Trailer	Command vehicle
Head quarter	–	–	–	–	–	1	1	2	–	5
East	12	6	–	34	14	1	8	67	–	2
West	6	2	1	19	8	–	6	45	2	–
South	10	2	1	25	11	5	1	46	7	3
North	8	5	3	31	12	9	3	56	2	–
Total	36	14	5	109	45	15	18	214	11	5

Source: JICA Study Team based on the data of Fire Department

Pump Vehicle

Tank Vehicle

Mobile Pump

Control Vehicle

Source: JICA Study Team

Figure 2.4.42: Fire Engines

(III) The Number of Water Resources for Fire-fighting (Outdoor Standpipe)

Water resources are important for fire-fighting. It is accessed from outdoor standpipes (Figure 2.4.43). Table 2.4.44 shows the number of outdoor standpipes in each township.

Source: JICA Study Team

Figure 2.4.43: Photo of Outdoor Standpipe

Table 2.4.44: The Number of Outdoor Standpipe by Township

District	Township	Outdoor Standpipe
East	South Okkalapa	30
	North Okkalapa	25
	Thingangyun	27
	Dagon Myothit (South)	14
	Dagon Myothit (North)	17
	Dagon Myothit (East)	2
	Shwe Pauk Kan	10
	Seikkan	4
	Total	129
West	Kyee Myin Daing	7
	Kyauktada	8
	San Chaung	12

District	Township	Outdoor Standpipe
	Dagon	10
	Pabedan	15
	Bahan	18
	Latha	7
	Lanmadaw	9
	Ahlone	6
	Total	92
South	Thaketa	15
	Dawbon	3
	Tarmwe	36
	Yankin	16
	Mingalar Taung Nyunt	35
	Pazundaung	6
	Botahtaung	11
	Dala	8
	Total	130
North	Kamaryut	11
	Hlaing	19
	Mayangone	20
	Insein	53
	Mingalardon	20
	Shwe Pyi Thar	98
	Hlaing Tharyar	1
	Hlaing Thar Yar Industrial Zone	10
	Aung Mingalar Highway Bus Terminal	12
	Dagon Ayar Highway Bus Terminal	8
	Total	252

Source: JICA Study Team based on the data of Fire Department

4) Map of Large Road

Figure 2.4.44 shows width of roads. The features of Yangon City are as followings;

a) 4-6 lanes road can be fire spread prevention belt.
b) CBD has many fire spread prevention belts.
c) New city area has a few fire spread prevention belts.

Fire spread prevention belt means that road prevents spreading fire over urban area. Urban area should be separated by fire spread prevention belt. Because spread of fire leads to a huge fire.

The spread fires prevention method of buildings are fireproofing of buildings and separatedby fire spread prevention belts.

Most of the buildings in Yangon are made of concrete and block. It is already fireproofing for buildings.

In Great Hanshin-Awaji Earthquake in Japan 1995, over 12m width road prevented fire spread. Then over 12m

Source: JICA Study Team

Figure 2.4.44: The Number of Road Lanes

width road can be fire spread prevention belt. Since road width per lane is about 3m and road width of four lanes is about 12m, over four lanes road can be fire spread prevention belt.

The CBD, as a main urban area, is separated by many wide roads. Although all areas almost outside of the CBD area are separated by some fire spread prevention belts, the north-east area is not separated by fire spread prevention belts. Therefore, the risk of fire spread would increase with the increase of buildings

5) Maintenance Condition of Fire Safety Code

Buildings in Yangon have few fire prevention measures because there is no Fire Safety Code in place.

6) Visual Survey in Yangon

Visual features in Yangon City from a view point of fire prevention are as followings.

Table 2.4.45: Features of Yangon City from a View Point of Fire Prevention

 **CBD (1)** Separated by wide road.	 **CBD (2)** Inside of market. There are many shops with a lot of goods.	 **CBD (3)** Narrow road between old buildings. Buildings were made of concrete.
 **CBD (4)** Trash-strewn alley.	 **CBD (5)** Roadside car parking in narrow road.	 **CBD (6)** Electric wires outstretched above narrow road.
 **Tarmwe (1)** Separated by wide road	 **Tarmwe (2)** A lot of electric wires which are not arranged properly	 **Tarmwe (3)** Many old residence buildings don't have space between each building

 **Dagon Myothit (North) (1)** Separated by large road	 **Dagon Myothit (North) (2)** New residence buildings	 **Bahan** It is near Shwedagon Pagoda. There are 5-8 stories buildings. These are crowded.

Source: JICA Study Team

(2) Planning Process

Table 2.4.46: Record of Meetings and Surveys (Fire)

Date	Title	Venue	Agenda
23th Aug 2016 (Tue)	Field Survey	CBD, Bahan	• Field Survey of Town
24th Aug 2016 (Wed)	Collecting Information	Kyauk Tadar fire station	• Collecting Information of Fire Accident data
	Field Survey	Dagon Myothit (North), Tarmwe	• Field Survey of Town
25th Aug 2016 (Thu)	Collecting Information	YCDC (Building Department)	• Collecting Information of Fire Safety Code
31th Aug 2016 (Thu)	Collecting Information	MES	• Collecting Information of Fire Safety Code
1st Sep 2016 (Thu)	Field Survey	Factory in Mingalar Taung Nyunt, Haymawun Market, Gwa Market	• Field Survey of Fire Site
24th Oct 2016 (Mon)	Field Survey	CBD	• Field Survey of Town
25th Oct 2016 (Tue)	Field Survey	CBD	• Field Survey of Town
26th Oct 2016 (Wed)	Meeting with YCDC	YCDC (Head of Division)	• Plan of Field Survey • Agenda of meeting with Fire Force
27th Oct 2016 (Thu)	Meeting with Myanmar Fire Force	Myanmar Fire Force	• System of Fire Department
28th Oct 2016 (Fri)	Meeting with YCDC	YCDC (Building Department)	• Collecting Information of Fire Safety Code
	Field Survey	FMI building	• Field Survey of Buildings
1st Nov 2016 (Tue)	Field Survey	Sakura Tower, Market Place	• Field Survey of Buildings
9th Nov 2016 (Wed)	Meeting with Myanmar Fire Force	Myanmar Fire Force	• Development plan of fire
	Field Survey	National Theater	• Field Survey of Buildings
10th Nov 2016 (Thu)	Meeting with YCDC	YCDC (Roads and Bridges Department)	• Development plan of fire
10th Nov 2016 (Thu)	Meeting with YCDC	YCDC (Head of Division)	• Development plan of fire

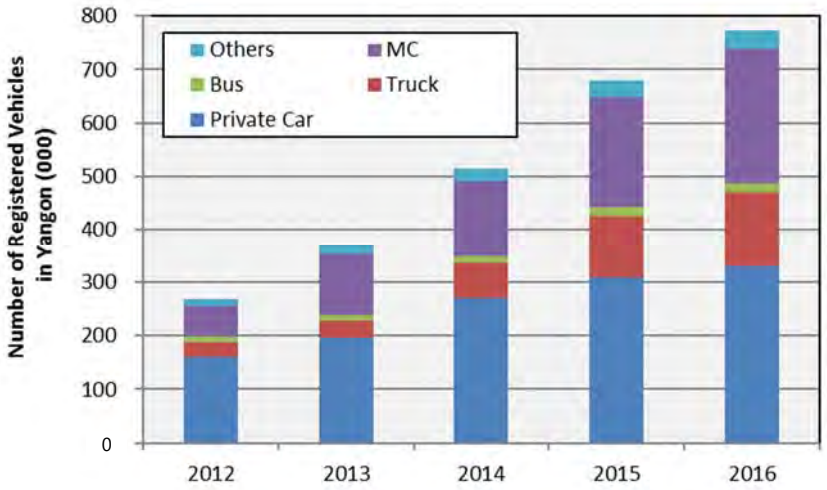
2.4.9 Urban Transport Management

This Study, SUDP, has been conducting in parallel with the other study, namely YUTRA, which focuses on urban transportation. Basic direction and contents of this part, urban transport and logistics, basically follow YUTRA Study.

(1) Current Status

(I) Overall Traffic Conditions

Number of registered private car is currently approximately 0.33 million (as of June 2016) in Yangon region, which is more than doubled comparing to the number in 2012 (about 0.16 million) as shown in Figure 2.4.45. Number of registered trucks has also been rapidly increasing, approximately 27,000 in 2012 to 141,000 in 2016, which is more than 5 times comparing to the number in 2012.



Source: Myanmar Statistical Yearbook 2015 (2012-2015), Road Transportation Administration Department (2016)

Figure 2.4.45: Number of Registered Vehicle in Yangon Region

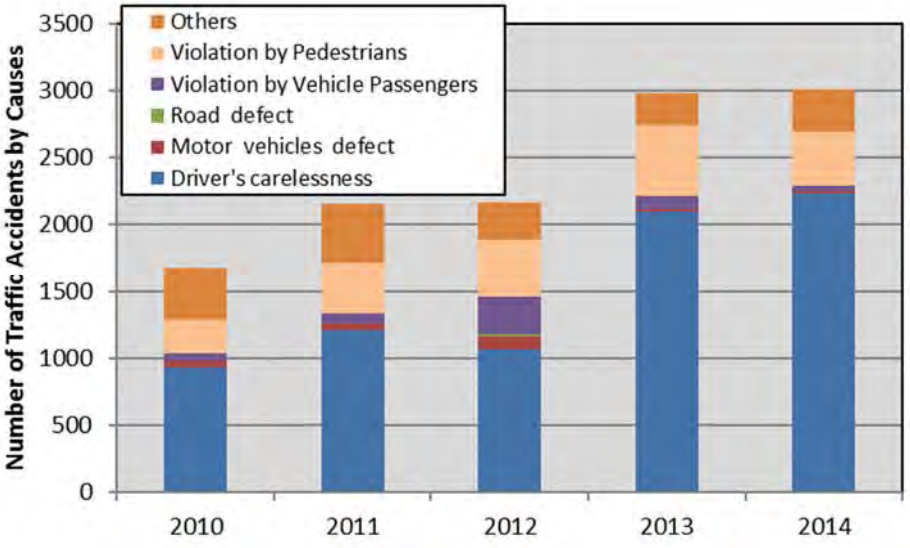
While bus plays a significant role as a major public transportation as shown in Table 2.4.47, bus operation system has not been improved and deteriorated traffic congestion, management and safety. 358 public bus lines used to be operated in Yangon City and multiple operators are competing in the same major routes along the arterial roads that became a major issue causing traffic congestion. Since the bus drivers are paid based on the number of trips and customers, such competitive situation makes the driver's manner more aggressive and risks traffic safety. In order to improve such conditions, bus lines were consolidated into about 70 routes in January 2017.

Table 2.4.47: Urban Transport Demand and Modal Share in the Greater Yangon (2013)

Mode	Type	No. of Trips (000/day)	Share (%)	
			Including Walking	Excluding Walking
Walking		4,778	42.2	-
Road	Bicycle	1,472	13.0	22.5
	Motorcycle	471	4.2	7.2
	Car/van	530	4.7	8.1
	Taxi	502	4.4	7.7
	Bus	2,838	25.1	43.4
	Truck bus	391	3.5	6.0
	Truck	101	0.9	1.5
	Subtotal	**6,305**	**55.7**	**96.5**
Railway		71	0.6	1.1
Waterway		160	1.4	2.4
Total (Excluding Walking)		**6,536**	**57.8**	**100**
Total		**11,313**	**100**	**-**

Source: YUTRA

Due to the rapid increase of the number of vehicles and weak management of public transportation, number of traffic accidents has almost doubled in 2014 (3,008 in total) comparing to the number in 2010 (1,678 in total) as shown in Figure 2.4.46. The major reasons of the accidents, which are the careless of drivers and violation of traffic rules by pedestrians, imply the significant importance of enforcement on awareness rising for the traffic safety and securement of safe and convenient pedestrian access.



Source: Myanmar Statistical Yearbook 2015

Figure 2.4.46: Traffic Accidents by Causes in Yangon Region

While uncontrolled on-street parking also causes traffic congestion, major improvements have not been implemented since the completion of the previous YUTRA Study (Project for Comprehensive Urban Transport Plan of the Greater Yangon) in 2014. According to the traffic simulation by previous YUTRA Study, average travel speed will be increased by approximately 6 to 7 km/hr. in CBD area under enforcement of on-street parking. Additionally insufficient numbers of traffic signals is in the Greater Yangon (147 as of April 2013) and its old operation system deteriorates the traffic congestion. Therefore, currently traffic signal improvement project is under implementation including the installation of 154 signals with an area traffic control center in Yangon region by Myanmar Shwe Yin Company and China Railway

Construction Corporation Limited. While the control center was completed in late 2016, it has not started its operation as of January 2017.

(II) Organizational Structure

YUTRA proposed the establishment of responsible agency to implement urban transport plans in a holistic manner and Yangon Region Transport Authority (hereinafter referred to as "YRTA") started to be organized in July 2016. Steering Committee of YRTA consists of the members from YRG, YCDC, MOTC, Public Transport Company, Myanmar Engineering Society, and Yangon Technological Institute.

2) Road Network

(I) Bottleneck Locations

In addition to the issues on traffic management previously described, physical issues on road network also cause traffic congestion. Since study area is divided by Yangon River, Bago River, Pun Hlaing River, Pazundaung Creek, and Twante Canal, bridges crossing these waterways become bottleneck that causes traffic congestion. Flyover also can cause a bottleneck if the number of lanes are insufficient at the junction point. While five flyovers have been completed since 2014 as shown in Figure 2.4.47, two more flyovers planned to be constructed at the intersection of Kabar Aye Pagoda Road and Parami Road as well as at North Okkalapa Roundabout have been canceled due to the risk to deteriorate the traffic conditions in the adjacent areas.

Traffic Congestion at Myaynigone Flyover **Tarmwe Flyover under Construction**

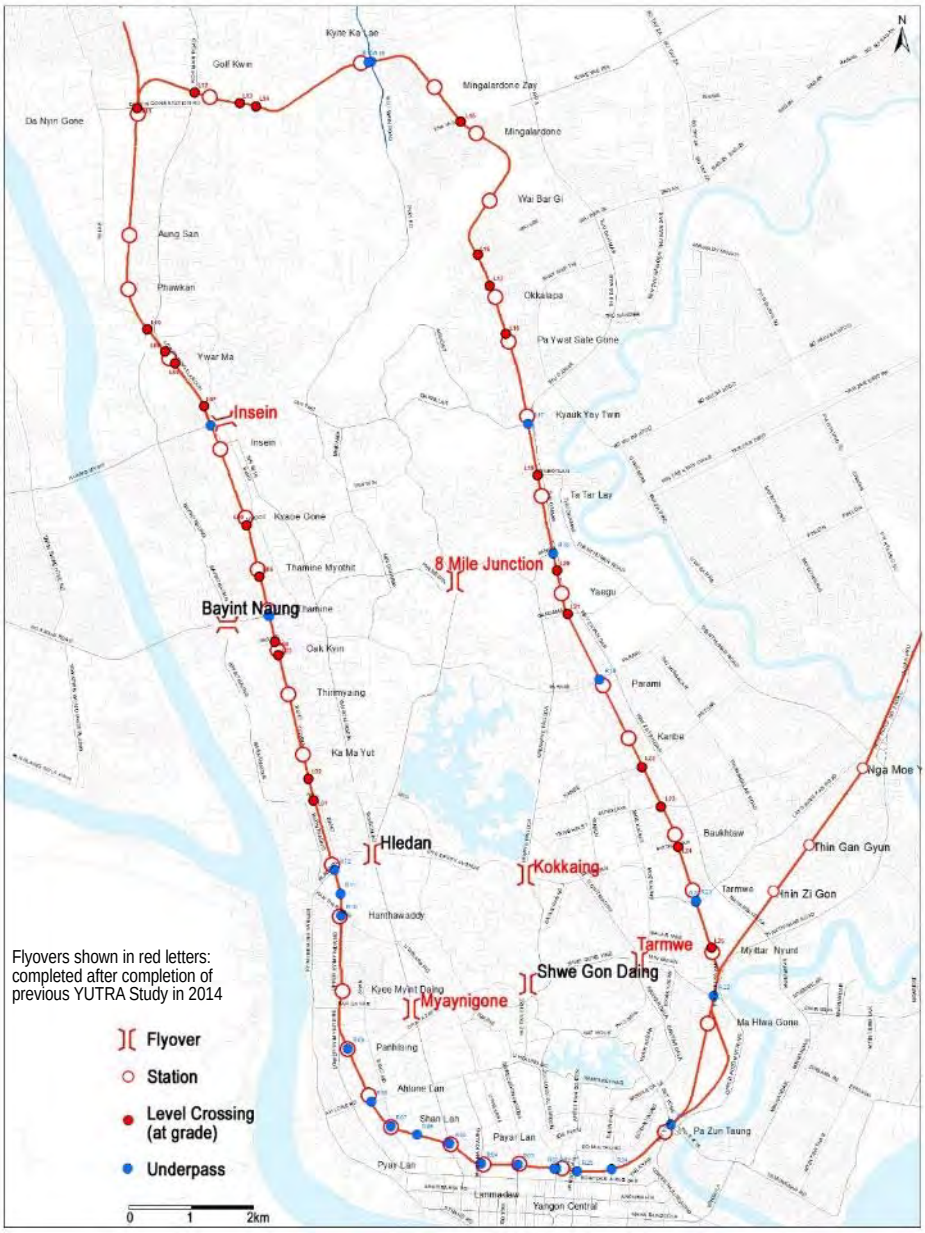
Note: The pictures were taken in March 2016
Source: Preparatory Survey on Urban Transport Development in the Greater Yangon, JICA

Figure 2.4.47: Flyovers in Yangon City

Railway crossing also become a bottleneck especially the level crossing at grade. As shown in Figure 2.4.48, total of 25 level crossings are located along circular railway except for the south section close to CBD area where underpasses are adopted.

Many roundabouts in the study area also exceed their traffic capacity and cause traffic congestion especially during peak hours.

In order to eliminate the bottlenecks, holistic approach should be adopted such as continuous grade separation rather than a spot solution.



Source: Preparatory Survey on Urban Transport Development in the Greater Yangon, JICA

Figure 2.4.48: Locations of Flyovers, Level Crossings and Underpass for Circular Railway

(II) Completed and On-going Projects

Bayint Naung Bridge was completed in 2014 and new Thaketa Bridge is currently under construction by JICA Grant Aid. The project for construction of Bago River Bridge is also currently underway by JICA.

Other donors are also involved in road and bridge projects in the Greater Yangon. Master plan for Yangon-Hanthawaddy-Bago Corridor and Yangon south western regional development is currently preparation by Korea International Cooperation Agency (KOICA) and construction of Dala Bridge has been pledged by ODA loan by Korean government associated with the master plan.

Since the private sector also has proposed some infrastructure development projects such as several bridge construction projects associated with the large scale residential development plan

in Twantay, public sector should review these proposed plans in a careful manner to confirm the consistency with its master plan as well as to secure necessary social benefits by the project.

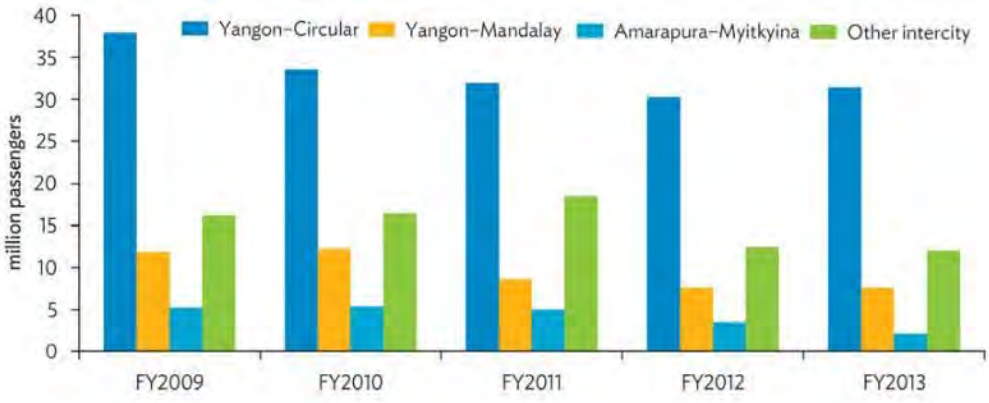
3) Railway

(I) Implementation System

Total number of 20,479 staffs are belonged to Myanmar Railways (MR) as of March, 2015. The implementation system at MR is divided into 11 divisions that are further grouped namely Lower Division (Division 5, 6, 7, 8, and 9) and Upper Division (Division 1, 2, 3, 4, 10 and 11). Study area is under Division 7 in Lower Division.

Although Circular Railway has the largest passenger (31 million in FY 2013) among the routes operated by MR, total number of passengers have been decreasing mainly due to the decrease of intercity railway passengers as shown in Figure 2.4.49.

In terms of legal framework for implementation, The Railway Act originally formulated in 1890 was amended and approved by the parliament in January 2016. One of the major highlights of the amendment is the introduction of various Public Private Partnership (PPP) strategies such as BOT (Build-Operate-Transfer), BOOT (Build-Own-Operate-Transfer), BLT (Build-Lease-Transfer), DBFO (Design -Build- Finance-Operate), and DCMF (Design-Construct-Manage-Finance) to improve convenience of public transport and economic efficiency.

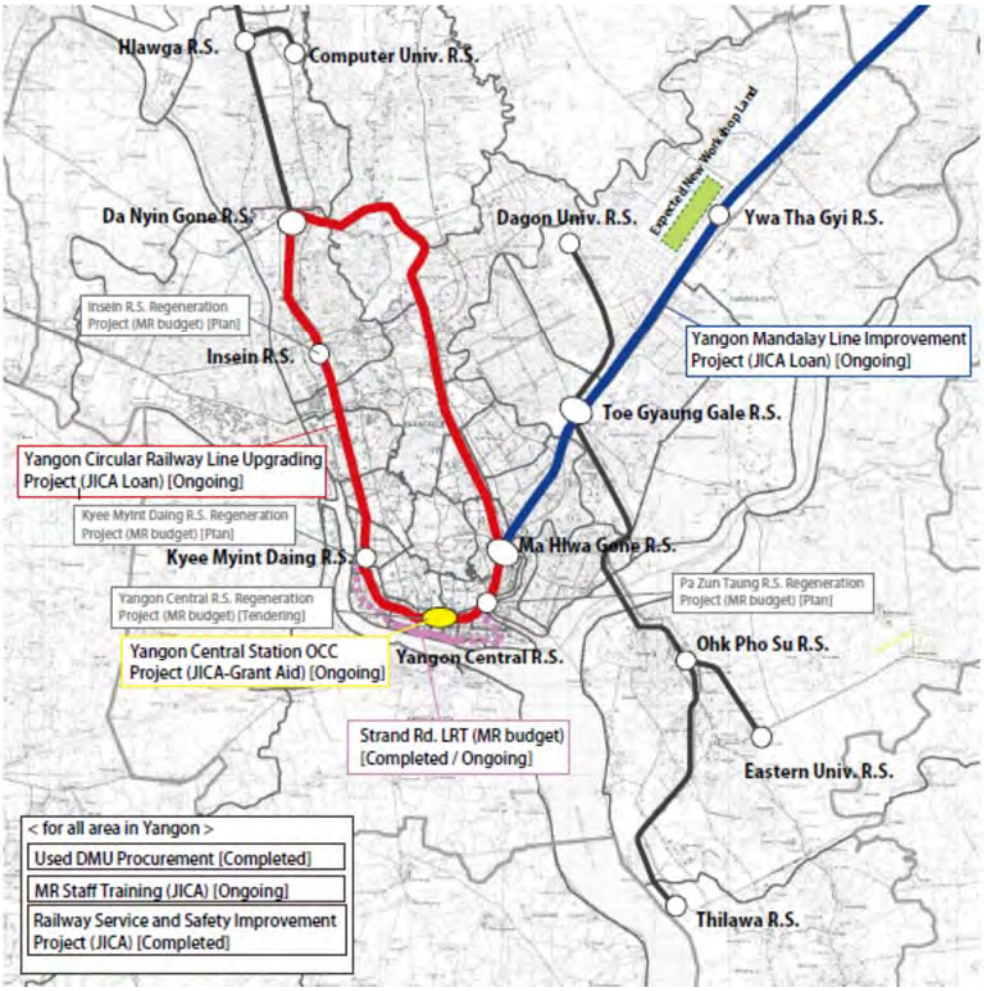


Source: MR, ADB Myanmar Transport Sectoral Policy Note-Transport (2016)

Figure 2.4.49: Number of Passengers by Train Service

(II) Completed and On-going Projects

Several railway projects have been completed and under implementation during the last couple of years including Basic Design Study on the Yangon Circular Railway Line Upgrading Project by JICA as shown in Figure 2.4.50.

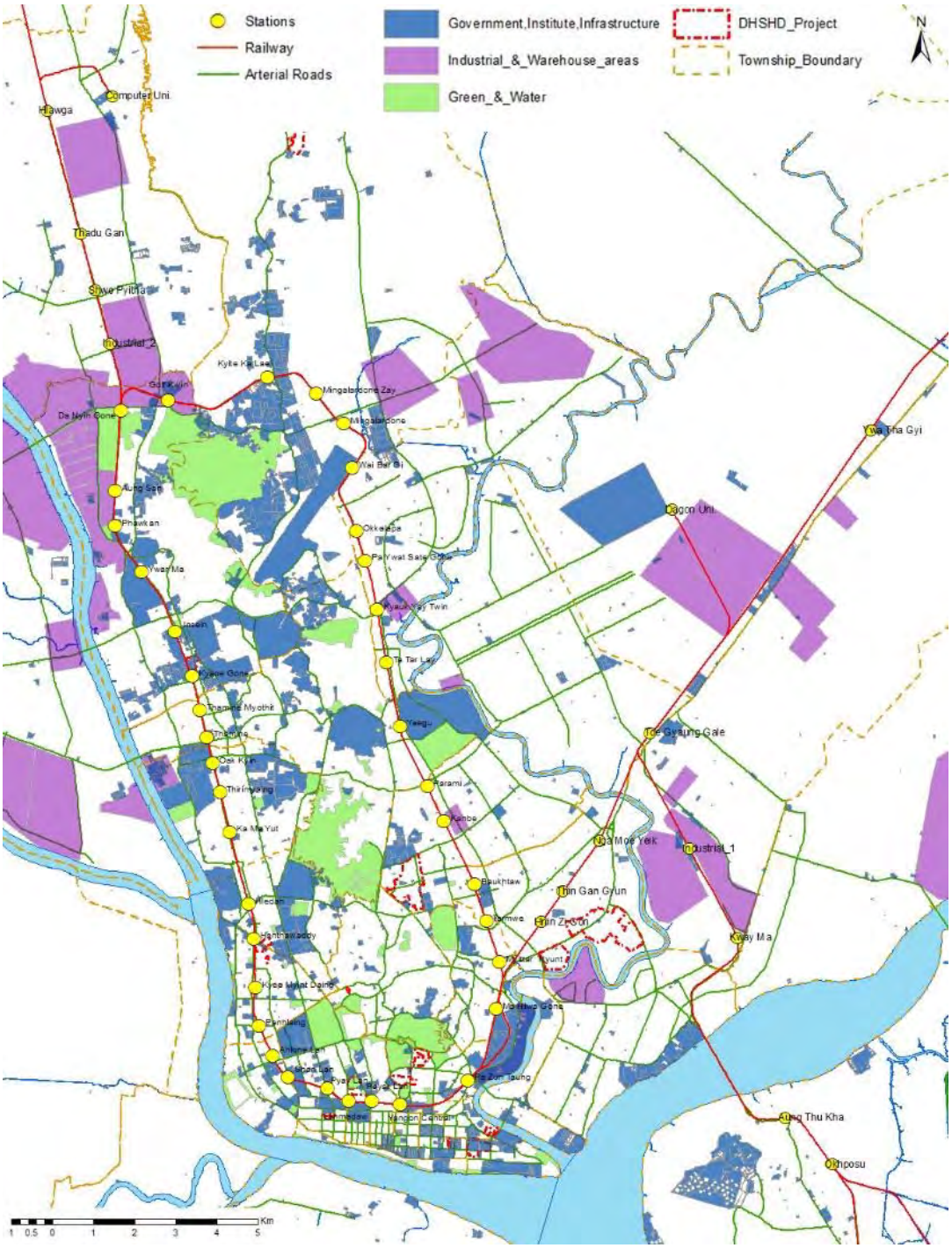


Source: Preparatory Survey on Urban Transport Development in the Greater Yangon, JICA

Figure 2.4.50: Completed and On-going Railway Projects in the Greater Yangon

(III) Opportunities and Issues on Integrated Development

Although potential governmental lands for integrated development with railway projects surely exist peripheries of railway lines as shown in Figure 2.4.51, consensus needs to be made among the relevant agencies. While areas registered as industrial use are mostly underutilized with ample room for intensification of land use through mixed use development, such improvements also require the coordination with landowners. Also, agricultural lands and green areas along north portion of Circular Railway includes some potential for the integrated development with on-going Circular Railway line upgrading project.



Source: YCDC, SUDP, and YUTRA

Figure 2.4.51: Potential Sites for Integrated Development with Railway Projects

Integrated development includes social infrastructure and housing projects in addition to commercial and mixed use development since enhancement on accessibility/mobility as well as development of residential /commercial /business areas are essential to secure sufficient ridership for sustainable railway operation and management. Since majority of the existing railway stations lack sufficient feeder transport services and pedestrian access, roadway improvement projects as well as local public transport service project need to be implemented as a part of integrated development.

Once owners of these governmental lands are able to coordinate to consolidate the land for the integrated development, land value will be more increased and captured by the public sector in a timely manner to implement relevant social infrastructure and housing projects.

While TOD (Transit Oriented Development) tends to be focused in site scale for limited station area development such as commercial and mixed use development, it also needs to be considered in city scale by a holistic manner through the integration with urban development in terms social, economic and environmental aspects.

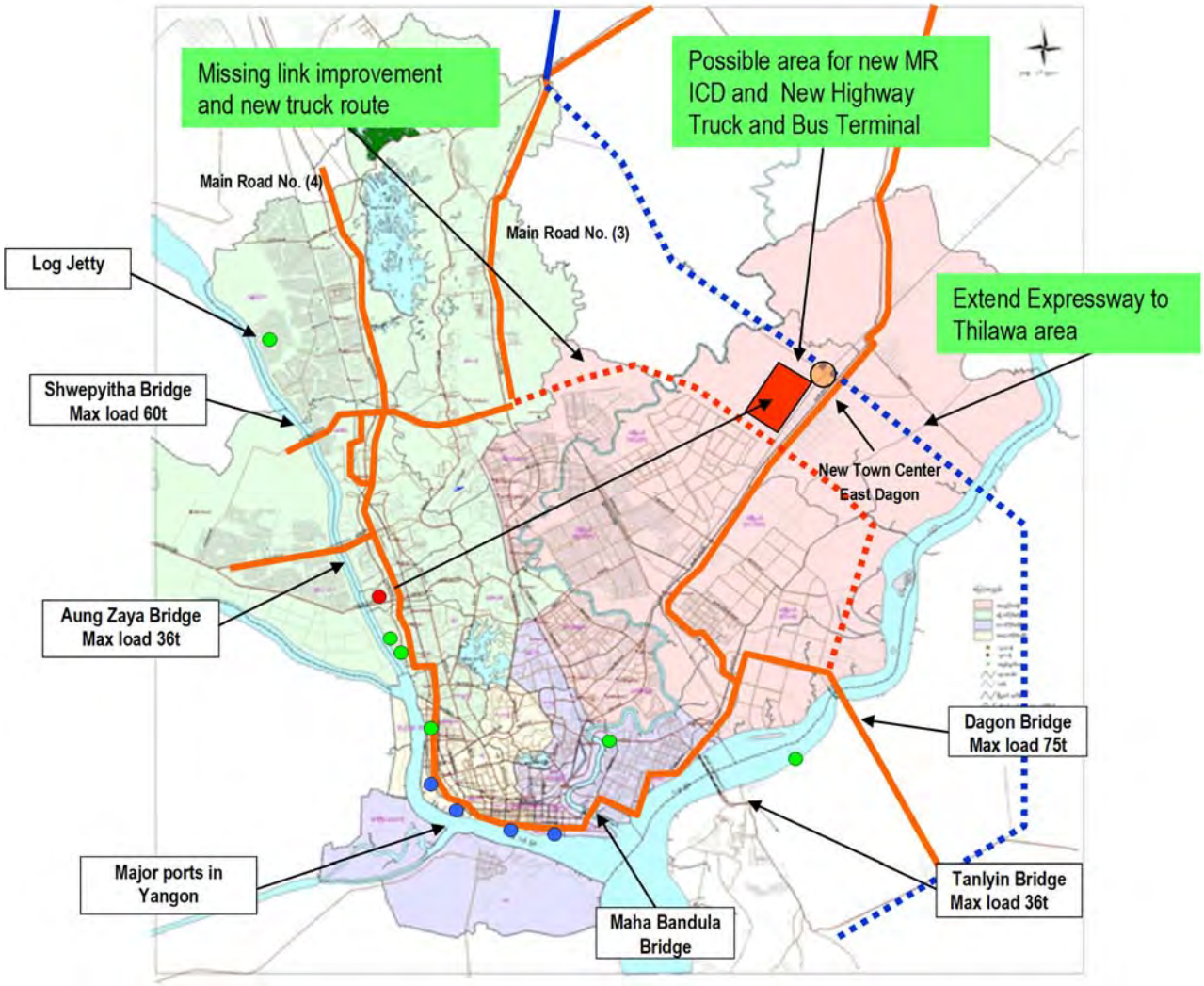
4) Port and Logistics

(I) Freight Transport

Container handling throughput at Yangon Inner Harbor has been significantly increasing due to its rapid expansion of container area and became more than double amount in 2014 comparing to the number in 2011 as shown in Figure 2.4.52. It follows that number of container trucks has also been increasing and deteriorating traffic congestion in CBD area as well as the adjacent areas of major truck routes shown in Figure 2.4.53. Although YUTRA proposed to relocate the existing truck terminal to segregate the freight transport from inner city transport as shown in Figure 2.4.53, relocation has not been implemented as of January 2017.

Source: Myanmar Port Authority

Figure 2.4.52: Container Handling Throughput in Yangon Inner Harbor and Thilawa Area

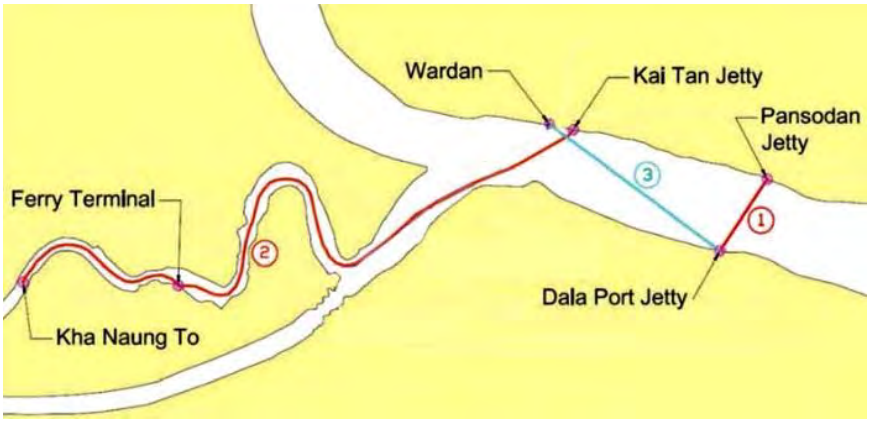


Source: YUTRA

Figure 2.4.53: Improvements on Freight Truck Routes

(II) Passenger Transport

Since the Greater Yangon is divided by rivers and creeks, ferry service plays an important role to connect CBD and surrounding areas. Currently IWT (Inland Water Transport) operates three routes shown in Figure 2.4.54. Yangon-Dala route provides the most frequent services (46 round trip a day from 5:00 to 21:30) that carry 27,200 people a day on average according to the latest data (from April 2015 to March 2016).



Source: YUTRA, IWT

Figure 2.4.54: Ferry Route across Yangon River

Table 2.4.48: Profiles of Ferry Routes across Yangon River

No.	Route	Passenger Fare (MMK)	No. of Round-trips/day	Ave. No. of Daily Passengers*
1	Pansodan Jetty ⇔ Dala Port	100	46	27,200
2	Kai Tan Jetty ⇔ Kha Naung To	200	8	2,174
3	Wadan ⇔ Dala Port Jetty (Car Ferry)	100	10	284

* Average passengers from April 2015 to March 2016
Source: IWT

(2) Planning Process

Table 2.4.49: Record of Meetings and Surveys (Urban Transport & Logistics)

Date	Title	Venue	Agenda
26th Aug 2016 (Fri)	Meeting with City Planning & Land Administration Department (Urban Planning)	Office of Deputy Head of Department	• Current status of urban development projects relevant to urban transport
31st Aug 2016 (Wed)	Meeting with City Planning & Land Administration Department (Urban Planning)	City Planning & Land Administration Department	• Current status of compilation of road and land use data including availability of GIS data
1st Sep 2016 (Thu)	Meeting with Engineering Department (Building) of YCDC	Engineering Department	• Building regulation relevant to urban transport • Recent trend of construction permission
3rd Sep 2016 (Sat)	Field Survey	Project Area	• Field survey of public housing development projects and their impact on transport
22nd, 23rd Nov (Tue, Wed)	Field Survey	Station Areas of Yangon Circular Railway	• Field survey of existing conditions at major stations along Yangon Circular Railway

Source: JICA Study Team

(3) Updated Points from SUDP 2013 to 2016

1) Urban Transport Management

As previously described, YRTA was started to be organized in 2016 to manage urban transport in a holistic manner. Base law to stipulate YRTA was also approved in 2016 and according to the law, YRTA was officially established in January 2017. While new traffic signals and new

traffic control center were constructed in 2016, the center has not started its operation yet as of January 2017.

2) Road Network

In addition to the completion of Bayint Naung Bridge, construction of Thaketa Bridge, planning of Dala Bridge and Bago River Bridge as previously mentioned, improvements on several arterial roads and bridges have been implemented. Main road No.3 was widened to 4 lane road and upgrade of Main Road No.4 is currently under planning. Road widening for Thilawa SEZ Access road (from 2 to 4 lanes) is currently under bidding.

3) Railway

Japanese ODA Loan agreement was signed in October 2015 for upgrading Yangon Circular Railway and relevant JICA studies are currently underway aiming for the completion of upgrading by 2020. Phase 1 section (Yangon-Taungoo) of Yangon-Mandalay Railway Improvement Project has also been under implementation since Japanese ODA Loan agreement signed in September 2014.

4) Port and Logistics

Further expansion of port terminals has been implemented in waterfront areas adjacent to CBD and deteriorates traffic congestion in CBD area.

(4) Supplemental Explanations of the SUDP

Future urban transport network has been proposed considering the impact by major urban development projects. Further details of the existing and proposed transport and logistic networks are described in the report prepared by YUTRA Study.

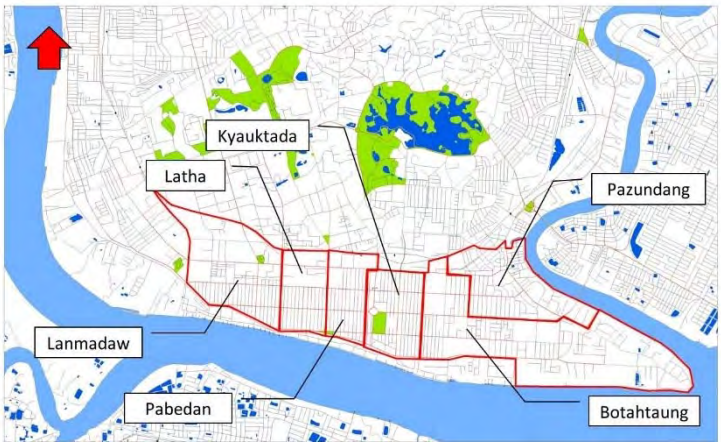
2.5 CBD Renovation

2.5.1 Current Status

(1) Existing Condition

1) Population

CBD is formed six townships. Sule Pagoda, YCDC, many heritage buildings and Maha Bandoola Park are located in Kyauktada Township. Bogyoke Aung San Market and Indian Town are located in Pabedan Township. New development projects named “Landmark Project” and “Junction City” are located in this township. Yangon General Hospital and China Town are located in Latha Township. Lanmadaw Township is located western edge of CBD. Institute of Nursing, University of Medicine and New Yangon General Hospital are located in this township. Botahtaung Township is located eastern edge of CBD. Pazundang Market (YCDC) is located in Pazundang Township.



Source: JICA Study Team

Figure 2.5.1: Boundary of Six Townships in CBD

Existing population and density of each township is shown in following Table 2.5.1. Density of Kyauktada, Pazuntaung and Pabedan Township is over 400 Persons/ha. Many vacant lands are located in Botahtaung Township and density is 171 Persons/ha. Density of Yangon is 71 persons/ha, six townships densities are higher than average density of Yangon.

Table 2.5.1: Population and Density of CBD

	Area			
	Area (km2)	Area (ha)	Population (2014)	Density (Persons/ha)
Total	6.95	695	224,856	-
Kyauktada	0.60	60	29,853	498
Botahtaung	2.40	240	40,995	171
Pazuntaung	1.01	101	48,455	480
Lannmadaw	1.41	141	47,160	334
Latha	0.77	77	25,057	325
Pabedan	0.76	76	33,336	439
Yangon	1,036.00	103,600	7,360,703	71

Source: The 2014 Myanmar Population and Housing Census, Yangon Region: Area, Wikipedia

Numbers of households and household size are shown in following Table 2.5.2. Female-headed household ratio of Yangon Region is 24.3%, and six townships of CBD are over 30%. Household size of Yangon Region is 4.4 persons/family. Botahtaung and Pazuntaung Townships household size is same as Yangon Region. Kyauktada, Lannmadaw and Latha Townships are lower than Yangon Region.

Table 2.5.2: Conventional households and household size

	Conventional households				Population in ・・・・		
	Number	Male-headed	Female-headed	Female-headed households	Conventional households	Institutions	Mean household size
Total	44,458	28,835	15,623	35.1%	193,553	31,303	4.4
Kyauktada	6,120	3,779	2,341	38.3%	25,754	4,099	4.2
Botahtaung	8,397	5,872	2,525	30.1%	36,661	4,334	4.4
Pazuntaung	10,306	6,873	3,433	33.3%	45,347	3,108	4.4
Lannmadaw	8,599	5,418	3,181	37.0%	36,302	10,858	4.2
Latha	4,473	2,679	1,794	40.1%	18,161	6,896	4.1
Pabedan	6,563	4,214	2,349	35.8%	31,328	2,008	4.8
Yangon	1,582,944	1,199,003	383,941	24.3%	6,949,440	411,263	4.4

Source: The 2014 Myanmar Population and Housing Census, Yangon Region

Selected age groups and dependency ratio are shown in following Table 2.5.3. Total dependency of Yangon Region is 24.3%. Six townships dependency ratio is under 29%. Old dependency ratio of CBD is 7 to 9%. These ratios are higher than Yangon Region ratio. Child dependency ratio is lower than Yangon Region.

Table 2.5.3: Selected Age Groups Structure and Dependency Ratios

	Selected age groups and dependency ratios					
	0-14	15-64	65-	Total dependency ratio	Child dependency ratio	Old dependency ratio
Kyauktada	4,287	22,744	2,822	24%	14%	9%
Botahtaung	7,105	30,926	2,964	25%	17%	7%
Pazuntaung	8,177	36,300	3,978	25%	17%	8%
Lannmadaw	5,565	37,879	3,716	20%	12%	8%
Latha	2,735	19,986	2,336	20%	11%	9%
Pabedan	5,945	24,577	2,814	26%	18%	8%
Yangon	1,725,413	5,219,941	415,349	29%	23%	6%

Source: The 2014 Myanmar Population and Housing Census, Yangon Region

Type of ownership of CBD is shown in following Table 2.5.4. Renter ratio of Yangon Region is 27.5%, and six townships renter ratio is lower than YRG Quarters of Botahtaung Township is 2,165 families. It is a characteristic of Botahtaung Township.

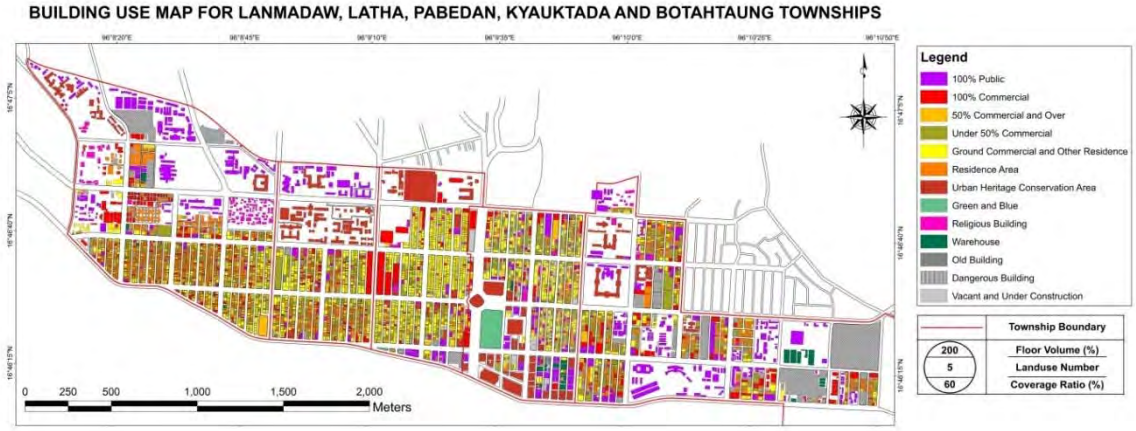
Table 2.5.4: Type of Ownership

	Type of ownership							
	Total	Owner	Renter	(Ratio)	Provided free (individually)	Government Quarters	Private Company Quarters	Other
Kyauktada	6,120	4,207	1,321	21.6%	151	354	32	55
Botahtaung	8,397	4,468	1,337	15.9%	227	2,165	93	107
Pazuntaung	10,306	6,866	2,552	24.8%	321	365	53	149
Lannmadaw	8,599	5,394	1,912	22.2%	343	750	84	116
Latha	4,473	3,192	834	18.6%	170	244	20	13
Pabedan	6,563	4,937	1,215	18.5%	246	82	32	51
Yangon	1,582,944	1,020,778	387,853	27.5%	53,856	77,333	20,288	22,836

Source: The 2014 Myanmar Population and Housing Census, Yangon Region

2) Land use (Building use)

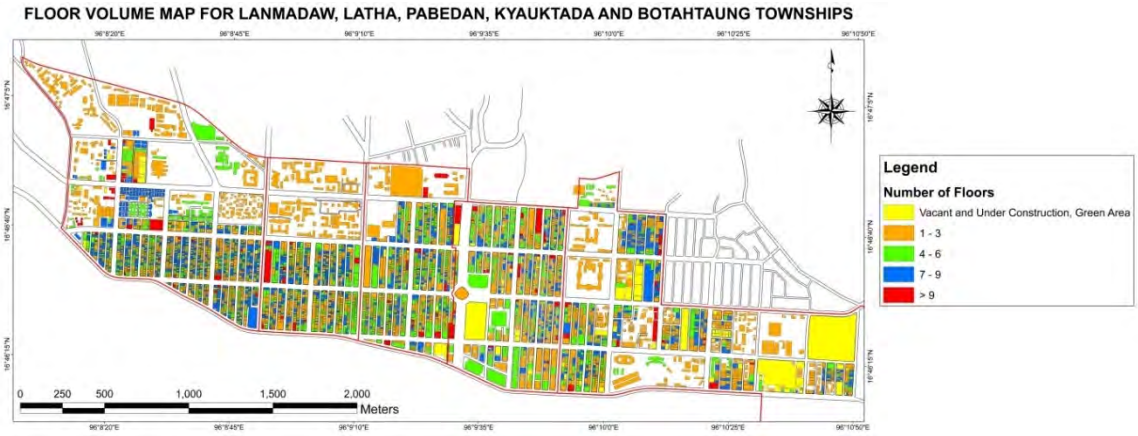
The CBD is the central area of Yangon built during the British rule, formed by the grid - like street from east to west around the Sule Pagoda Street. For the survey on the present uses of buildings, the buildings in CBD were examined according to 13 kinds of uses.
According to the results, the central part of CBD has intensive use for commercial and business purposes along Sule Pagoda Street. Commercial and business land uses are also predominant in the roadside of Strand and Kon Zay Dan streets. The buildings in the central part of CBD follows a patter where the lower floors of a building are for commercial and business uses, while the middle and higher floors are for residential use. However, as one moves away from Sule Pagoda Street to the east or west, the ratio of apartment buildings (no commercial use on the lower floors) becomes higher.



Source: JICA Study Team based on YCDC

Figure 2.5.2: Current Condition of Building Use

In the by - laws of the YCDC, the height of buildings within the CBD is regulated. According to the findings of the building survey on the number of stories in CBD, even the high - rise buildings along the arterial roads, the building height is restricted to be less than twice on the front road width. The height ratio of the buildings to the front road within the inner blocks is regulated with a higher height limit of 2.5 times as that of the front road.



Source: JICA Study Team based on YCDC

Figure 2.5.3: Current Condition of Building Height

3) Traffic condition

CBD road network forms five arterial roads (west – east) and six arterial roads (north – south). Bogyoke Aung San, Anawrahta, Maha Bandoola, Merchant and Strand Streets are arterial roads (west – east). Pyay, Shwe Dagon Pagoda, Sule Pagoda, Pansodan, Thein Phyu and Lower Pazundaung Roads are arterial roads (north – south).
The streets are in a grid pattern at right angles, and neighborhood streets (first to fifty-seven) connect Bogyoke Aung San, Anawrahta, Maha Bandoora and Kanner Road.

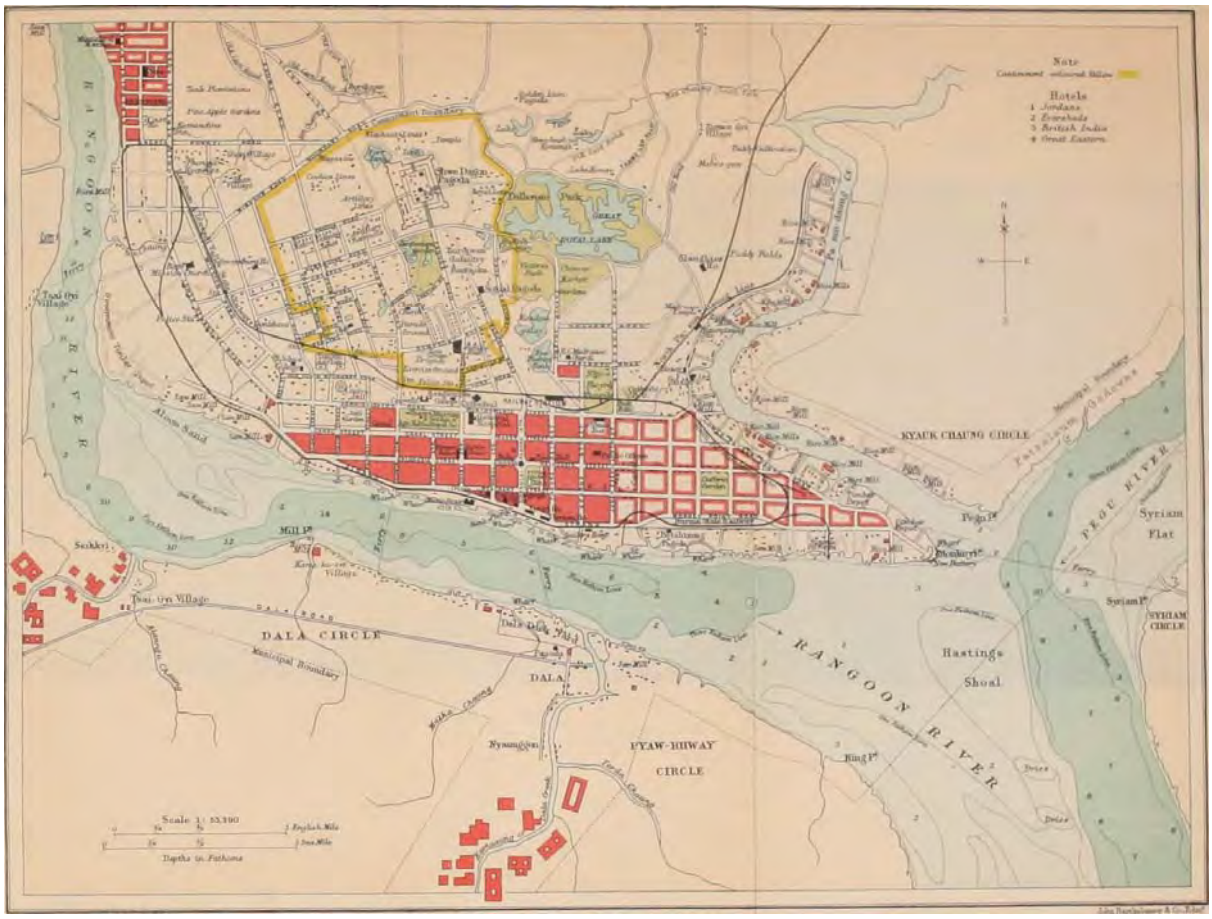
Source: JICA Study Team based on YCDC

Figure 2.5.4: Road Network of CBD

(2) Historic Buildings

'Yangon is the only city in Asia with its historic core [an estimated 2,000 properties that date back from before 1950] largely intact, primarily as a result of decades of political and economic isolation. The city's historic core reflects the rich and cosmopolitan past of the city: pre-colonial structures such as pagodas and temples, grand mansions and administrative buildings dating back to the colonial period and important 20th century architectural heritage. In a long-denied striving for modernization, many of the original properties are now being demolished to make way for modern buildings. Almost invariably this means that original 4-6 story historic properties are being replaced by modern 8-12 story structures transforming the cityscape at a rapid pace, thus putting pressure on the public infrastructure. Local livelihood is changing, developers move in, original residents move out with a severe impact on the cityscape.'

'In an environment where legislation is still being developed and market forces prevail, new development is happening abruptly, often distorting the urban fabric and uprooting the local community. In addition, physical improvements are often confined to buildings only, without much if any, improvement to the public and common spaces. Given the speed of change occurring in the historic core of the city, there is only a short window of opportunity before the unique character of Yangon's city center will be lost forever.'



Notes: Pre-Feasibility Study in three pilot areas' (Cities Development initiative for Asia (CDIA), YCDC, YHT, April 2016)
Source: Historic Plan of Yangon (Rangoon) 1911

Figure 2.5.5: Introduction from 'Heritage-led Urban Regeneration in Yangon

The built heritage of Yangon is varied and extensive. It includes the early pagoda structures which marked the focal points of the early settlements along the river edge, and the city which was planned around them in the 19th century. The latter comprises not only the grid-iron layout of streets, laid out in the 19th century, but also the greener areas to the north to Inya Lake and beyond. There are significant buildings and structures in this area which are also to the heritage of the area.

The Heritage of the area comprises the tangible – buildings and structures - and also the intangible heritage - the communities and rich culture which has grown from inhabiting the city and which is the result of over 150 years of settlement by a variety of ethnic, cultural and religious groups which make up the current population.

The legacy is a heritage which is unique in South East Asia.

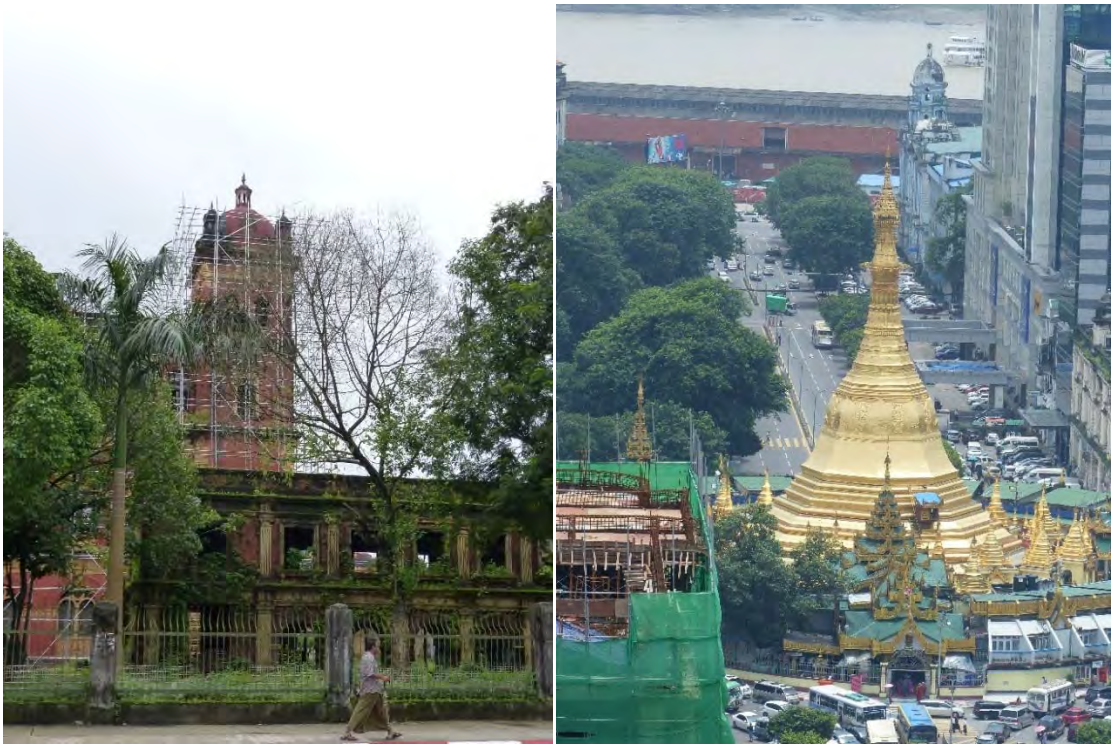
1) 'Heritage Buildings'

To be listed as a heritage building and given legal protection, historic buildings in Myanmar have to be of historic or cultural significance, publicly owned and over 100 years old. 189 such buildings are listed in Greater Yangon. A large proportion of these are in the CBD.

Table 2.5.5: Distribution of Listed Heritage Buildings, Yangon City (reproduced from SUDP 2013, YCDC (JICA))

No.	Township	Admin / Institution	Social Bldg	Commercial Bldg	Residential	Religious Buildings						Total	Ratio
						Christian	Buddhism	Hindu	Muslim	Chinese	others		
1	Latha		2					1	1	3		7	3.7%
2	Lanmadaw	2	3			1			1			7	3.7%
3	Pabedan	6	2	1		2	1	5	5		1	23	12.2%
4	Kyauktada	33		1		2	1		2			39	20.6%
5	Botahtaung	3	3			2	1					9	4.8%
6	Pazundaung					1	1	1	1			4	2.1%
7	Ahlone		1									1	0.5%
8	Kyee Myin Daing						1		1		1	3	1.6%
9	Sanchaung	1	2			2	5		1	1		12	6.3%
10	Dagon	2	5		1	3	6					17	9.0%
11	Bahan	2			2		3			5		12	6.3%
12	Tarmwe					1			2			3	1.6%
13	Mingalar Taung Nyunt			1		3		3	2			9	4.8%
14	Kamaryut		17			1	1					19	10.1%
15	Hlaing							1				1	0.5%
16	Yankin						1	3				4	2.1%
17	Thingangyun					1	2					3	1.6%
18	Mayangone						3					3	1.6%
19	Insein	3	3			1						7	3.7%
20	Mingalardon		1			2	2					5	2.6%
21	North Okkalapa						1					1	0.5%
Total		**52**	**39**	**3**	**3**	**22**	**29**	**14**	**16**	**9**	**2**	**189**	100%
		27.5%	20.6%	1.6%	1.6%	11.6%	15.3%	7.4%	8.5%	4.8%	1.1%	100%	

Notes: Administrative and Institutional Building: Offices, medical centers, etc.
Social Buildings: Schools, hospitals, etc. Commercial Buildings: Hotels, markets, etc.
Source: Edited from the YCDC Heritage Buildings List



Source: JICA Study Team

Figure 2.5.6: Protected Heritage buildings - Sule Pagoda and Ministers' Building (Secretariat)

Not represented on the list of protected heritage buildings are a wide range of other historic buildings which have heritage merit but do not confirm with the criteria adopted for listing e.g. they may be in private ownership or less than 100 years old.

Source: JICA Study Team

Figure 2.5.7: Residential buildings such as these are an important part of the character of the city but are not currently protected by listing

As indicated in the introduction, the character of Yangon's historic core, now its CBD, is created not just by high quality individual buildings but by a range of elements which make up the anatomy of the city center – including the grid of streets and their hierarchy; the discipline and consistent scale of the traditional buildings on those streets; the different building types; and key views and vistas.

Currently there is a significant gap between the historic buildings which are protected by law, and the much wider extent and nature of the historic legacy which gives Yangon its unique character.

Below is a summary of current legal protection for historic built environment.

2) Heritage Legislation

Measures to protect cultural heritage in Myanmar date from the early period of the country's independence after World War 2. Those measures were put in place to protect antiquities which defined the nation's history and identity. However, that protection was limited.

(I) "The Antiquities Act" (Ministry of Culture, 1957)

The 1957 Antiquities Act of Myanmar acknowledges the protection of places of worship.

In common with other countries seeking to protect heritage, the first step in Myanmar was to protect antiquities which define the nation's origins and identity. The law allows the government to decide on a case-by-case basis on the preservation status of a monument. In April 2015, the Government of Myanmar released two heritage protection bills which modify the 1957 Antiquities Act.

The bills protect *"…more than 100-year-old buildings and antiquities across the country—either above or below the ground and water—that have historic, cultural, artistic, antique and archaeological values.*

'Penalties for damaging, removing or destroying heritage buildings and objects would be tougher than under the 1957 Act. The Protection and Conservation of Ancient Buildings Bill states anyone who destroys or damages protected buildings could face prison terms of between 1–7 years.'

(II) The Protection and Preservation of Cultural Heritage Regions Law (Ministry of Culture, 1998, amended 2009)

The process of property designation and property listing on the National Heritage Register are the two currently available operational tools for identifying and protecting historic assets. This law applies to places which have been designated as Protected Areas and ancient buildings or monuments. To achieve this designation the building or monument must be older than 100 years.

A list of 189 designated heritage buildings in Yangon was published in 2001. Whilst this is a step forward in protecting the heritage of Yangon, the law has a number of limitations.

The 100 years old threshold means that a large number of Yangon's 20th century heritage remains unprotected. In particular the rule means that Yangon's heritage from the post-war period – the early years of Myanmar's independence from British rule – is not protected. This was a period of considerable activity in forging a new state and identity which was reflected in the architecture of the period, and there are some notable buildings from this period which could be worthy of protection.

3) Draft / Proposed Heritage Legislation

(I) Historic Building chapter in Myanmar National Building Code (MNBC) (MOC, provisional 2015)

Where a permit is being sought for development proposed to a 'listed' heritage place or property, a conservation management plan and heritage impact assessment may be required.

The purpose of the Historic Building chapter (HBC) is to provide regulation to guide works affecting heritage places during conservation, restoration, rehabilitation, relocation, reconstruction, adaptation; or new works to buildings or properties designated as heritage places or properties within heritage conservation areas.

The CDIS report indicates that *'When passed this piece of legislation will be a major breakthrough in the protection of heritage buildings. According to "Regulations for Historical Buildings (Historical Building Chapter, HBC)"(provisional), authorities can designate areas of significant historical, social, cultural, architectural and scientific values to protect the nature and character of the urban heritage conservation areas, and the developer to submit heritage impact assessment or/and conservation management plan when proposing interventions to historic properties.*

The CDIS report indicates that the law – as other heritage legislation - only applies to the 189 'listed' buildings in Yangon, all of which are said to be in public ownership. It does not apply to buildings in private ownership – including many of high architectural quality. It does not therefore guarantee the protection of buildings which might contribute to the special character and appearance of a heritage area within a dense urban context, such as Yangon's CBD.

(II) Draft Yangon Urban Heritage Conservation Law (YHT 2013) – not yet enacted

This draft law was submitted to the Regional Government by YHT in 2013 to address the lack of sufficient legal background for all categories of urban heritage in the Union level *"Cultural Heritage Regions Law"*. However, it has not yet been enacted.

(3) YHT Activities

YHT is a Non-Governmental Organization promoting the conservation of Yangon's unique urban heritage through advocacy, research and projects. It was founded in 2012 by Dr. Thant Myint-U and a group of like-minded architects, business people, historians, at the occasion of a conference "Towards a Conservation Strategy for Yangon in the 21st Century" at which national and international experts, civil society leaders, and government ministers recognized the urgency of Yangon's quickly disappearing heritage. In a time-span of only three years YHT has grown from a small group of volunteers to a mature organization with a full-time staff of 15 historians, architects and administrative personnel. YHT is supervised by a board of 12 of the country's leading practitioners in the field of planning and architecture. YHT's activities can be broadly be divided in the following three categories:

1) Advocacy & Policy Development

YHT is taking a pro-active role in developing planning guidelines for the downtown area: they are not only advisors on the various committees currently drafting new zoning and land-use plans, but perhaps more importantly, have taken the initiative to draft legislation to best guide development, such as:

- **Proposed Downtown Conservation Area** - YHT has been the key advocate for a designated heritage area with height and density controls in the downtown area. The proposed Downtown Conservation Area covers approximately 2 km^2 and contains almost 3,000 buildings, of which 40% were built before 1945.

Source: YHT Special Development Plan

Figure 2.5.8: Location of proposed Downtown Conservation Area (in red)

Source: YHT 2016

Figure 2.5.9: Boundary of Proposed Downtown Conservation Area

- **Yangon Urban Heritage Conservation Law** - YHT was asked to assist in the drafting of Myanmar's first urban heritage conservation law. This was submitted to the Regional Government in May 2013 and allows, for the first time, urban heritage places such as buildings, parks, streetscapes, conservation areas, moveable objects and archaeological sites to be considered as heritage items. It does not mandate an age by which a place can be considered valuable but instead acknowledges that Yangon's urban heritage has an evolving and diverse value for the community.

- **Advocacy for amendment/expansion of 189 list** – YHT hopes that the 189 lists will become part of its proposed Yangon Urban Heritage Conservation Law and be expanded to include not only individual buildings but several conservation areas where neighborhoods and streetscapes have a collective heritage value. YHT's work has shown that there are many thousands of individual heritage buildings in Yangon and that an area-based approach, providing protection for districts and neighborhoods is required to properly manage Yangon's unique urban heritage.

Source: YHT 2016

Figure 2.5.10: Area of proposed Downtown Conservation Area and Height Controls

- **Heritage-led urban regeneration in Yangon: Pre-Feasibility Study in three pilot areas** *Final Report 05 April 2016.* – This study (the PFS) was to precede the preparation of the Special development Plan (see below). The main focus of the Pre-Feasibility Study was to assess the feasibility of potential tools and instruments that could allow for urban regeneration/adaptive re-use intervention that is more respectful of the historic fabric compared to the current practice of site clearance and new build real estate development.

  - One commercial/cultural area (Pansodan Cluster)
  - Two typical residential areas (Shwe Bontha and Bogalayzay Cluster)

    The team was able to broadly distinguish three types of properties (together representing nearly 30 million sqft in the proposed Downtown Conservation Area, roughly three quarters of the historic urban fabric) which each merit their own intervention approach.
  - 1. Typical tenement buildings with apartment units in *private* ownership

- 2. *Privately* owned (former) commercial/industrial properties that are currently underutilised/vacant
- 3. *Publicly* owned properties that are currently underutilised/vacant

PLANNING GUIDELINES AND FRAMEWORK FOR THE PROPOSED DOWNTOWN CONSERVATION AREA - is a **pre-condition for heritage-led urban regeneration**

1) provides **listing** and **grading** to **prevent demolition** of properties with individual or contributing heritage significance

2) limits height and volume of **new development**

3) assigns **management** and **responsibilities** for the historic environment to **guide** owners, developers and investors in renovating and redeveloping properties

Type	Volume	Potential for revitalisation	Proposed intervention and Recommendations
1 Typical tenement buildings[4] with apartment units in private ownership dating back to pre-1990 [5] 	Estimated total floor space in Downtown Conservation Area GFA ≈ 20 million sq ft Estimated investment value 100-150 million US$	**RETAIN ORIGINAL USE & RESIDENTS –** make upgrading of current unit an attractive alternative to demolition and new construction for residents and owners of buildings. This would help maintain local livelihood and upgrade local living conditions, while conserving the historic streetscape.	**HOUSING MICROFINANCE SCHEME** - Initially sized at US$15 million, the housing microfinance scheme will allow a residents' collective to access a *short term loan* for climate resilient and life safety upgrades and heritage conservation. Major challenges to such a fund are the limiting regulations for MFI's. Proposed Next Steps: - TA for study on best practices for MFI regulations in neighbouring countries.
2 Privately owned (former) commercial/industrial properties that are currently underutilised/vacant 	Estimated total floor space in Downtown Conservation Area GFA ≈ 3 million sq ft Estimated investment value 100-200 million US$	**ADAPTIVE RE-USE** – Change of use into commercial, residential or cultural facilities by owners in partnership with domestic private sector investors: local family offices, 'club' private equity, social impact investors and/or charitable foundations, who are not constrained by insecurity of title/ regulatory framework and or debt financing. The PFS shows, if repurposed for high yield uses, this can be a **FINANCIALLY VIABLE PROPOSITION** for owners (they keep ownership) and these types of investor based on current 'acceptance' of zoning regulations that limit demolition and redevelopment options in downtown area. Over time, if and when **TITLE AND REGULATORY CHALLENGES** are solved and investment takes place in the urban realm, this market could also open up to foreign investors looking for higher returns and security of title.	**HERITAGE UNIT** - at municipal level to provide *information* to potential developers/investors on ownership/plot boundaries, history and heritage value and planning in the area
3 Publicly owned properties that are currently underutilised/vacant 	Estimated floor space in Downtown Conservation Area GFA ≈ 5 million sq ft Estimated investment value 400-600 million US$	**ADAPTIVE RE-USE** – Make refurbishment an attractive alternative for owners (e.g. line ministries) who currently have limited budget and/or capacity to revitalise their heritage assets. Change of use into commercial/residential/cultural facilities by owners in partnership with domestic and foreign private sector investors. Financial viability depends on: • *size* - desirable GFA 15,000-35,000 sqft. Smaller or larger size properties limit marketability • *technical state* – although most properties are structurally sound, years of decay and underinvestment have left some in a derelict state • *type of use* - the more community/low-revenue uses the longer the pay back • *location* - many of these properties are located in prime locations with high levels of visibility, but the ones located off main roads will be less attractive 3A- The PFS suggests that for selected **MEDIUM SIZED AND WELL LOCATED PROPERTIES** the configuration as suggested under 2 would provide a **FEASIBLE DEVELOPMENT OPTION** for both owner (e.g. line ministry) and investor (domestic private sector investors). 3B- For **OTHER PROPERTIES** (including many of the 189 properties) adaptive re-use/refurbishment is **NOT COMMERCIALLY VIABLE AT THIS TIME.**	**HERITAGE FUND (IMMEDIATE) – Sized at $25 million** and managed at the Union-level, the fund would target owners of institutional heritage assets (e.g. line ministries) and comprise of: • **REVOLVING FUND** - at Union level providing *gap financing* to help public sector owners of selected properties to ensure viability of otherwise non-commercially viable refurbishment. • **PROJECT PREPARATION FACILITY** – at Municipal level to provide public sector owners with *ideas* of what their vacant buildings can be used for and provide the necessary technical, legal, design and feasibility *studies* to make them 'investment ready'. **PPP UNIT (MEDIUM TERM)** – at Regional level to *provide capacity* to the line ministries and lead the prioritisation of local and regional development projects, manage the pre-feasibility and feasibility studies to make sites 'investment ready,' and lead the tendering and bidder selection processes. Such a unit would be particularly important in the refurbishment of **ICONIC PROPERTIES** (such as Secretariat, Telegraph Office, Court House etc.) that have significant historic/cultural/social value and may require evaluation of supporting **GRANTS/SUBSIDIES**. Myanmar, though, still does not have the policy, legal and institutional framework for PPPs in place. **PROJECT FINANCE FUND (LONG TERM) –** privately-led commercial funds to provide private sector parties (developers, real estate investors) with opportunities to access *project financing*. Major challenges for such a fund is the lack of a clear pipeline, limited project underwriting capacity at commercial banks, and regulatory limitations on foreign investment. Proposed Next Steps: • Proposed PPTA for a $25 million Heritage Fund. • Proposed TA to develop the legal and institutional framework for PPPs in Myanmar • Proposed TA to develop the legal and institutional framework for PPPs in Myanmar

Source: Pre-Feasibility Study 2016, CDIA/YCDC/YHT

Figure 2.5.11: Appropriate Intervention Approaches and Tools for different building types

While the primary focus of this study was on privately owned buildings, the study also investigated redevelopment opportunities of publicly owned properties and sites and potential for partnerships between public and private sectors. It looked in detail at three pilot areas within the CBD.

It concluded that a heritage-led approach was financially viable for certain building types and proposed approaches and financial tailored instruments which would make the renovation and

adaptive re-use of other building types attractive to owners and investors. The pre-feasibility study provides evidence to support to Yangon Heritage Strategy.

- **The Yangon Heritage Strategy** (formerly known as the Special Development Plan) - YHT started the process in 2015 by leading a multidisciplinary team of local and international experts to bring together a plan for wider Yangon with a focus on the proposed Downtown Conservation Area. The models and approaches to be put forward in this plan are meant to provide ideas for Myanmar Government and YCDC in forming a foundation to make decisions about the appropriateness of new developments, their location, scale and impact in the coming five years, an important transitional period for the development of the city. The plan was published on 12 September and will be reviewed at the next stage of the SUDP study.
- **Conservation Management Plan (CMP)** - YHT has been instrumental in making Conservation Management Plan (CMP) a compulsory requirement for development of the city's iconic historic buildings. Two examples are:
  - **The Secretariat** - Myanmar Investment Commission (MIC) required the site's lease holder, Anwamar Group, to submit a CMP. YHT worked closely with Anawmar on the conservation guidelines within the plan which was executed by Edinburgh-based heritage consultancy, Simpson and Brown.
  - **New Law Courts** - Prime Residence - the developer of the New Law Courts site – also needed to submit a CMP as part of the approval process to convert the NLC into a Kempinski Hotel. This is plan was undertaken by Purcell, out of their Hong Kong office. YHT acted as an advisor on the CMP process.

2) Example Renovation Projects

YHT has initiated and advised renovation projects to showcase how respectful upgrading of historic building can be done in the Yangon context. These projects go beyond physical restoration of buildings and emphasize a holistic approach to preserving the spirit and vitality of neighborhood life with special attention to social exchange and environmental impact. Some recent examples:

Source: JICA Study Team

Figure 2.5.12: 491-501 Merchant Road

- **Merchant Road Restoration Project** – This joint project with Turquoise Mountain Foundation, Canadian Department of Foreign Affairs and Global Heritage Fund is restoring a historic building at 491-501 Merchant Street which is over 100 years old, and has a mix of commercial and residential uses. The restoration project which was completed mid-2016 engages the public and government in a conscious decision making process regarding the development of Downtown Yangon and will provide an example to drive the sympathetic conservation of other historic Downtown buildings.

- **Yangon General Hospital** – YHT is closely involved as an advisor to the architect's team working on the restoration and upgrading of the Yangon General Hospital. The team has adopted a sympathetic approach to the renovation works which stems from the decision to use the original buildings as recovery wards while moving the major operating theatres and care wards to new buildings.
- **Chin Tsong Palace (State Fine Arts School)** – YHT was asked by the Ministry of Culture to provide advice on how to ensure the long-term conservation and use of the State Fine Arts School (the former Chin Tsong Palace). The site is one of the most ornate and impressive heritage buildings in Yangon. The Ministry are hoping to allow limited commercial use of the site to fund future conservation.
- **Former Reserve Bank of India** - YHT is part of the review committee on the current adaptation of the former Reserve Bank of India into Myanmar's first stock exchange.
- **U Thant House** – YHT assisted with the renovation of the residence of former United Nations Secretary – General U Thant. The house, which belongs to the government is a colonial era building which has been renovated for reuse as a museum dedicated to the life of U Thant, as well as a center for public events, such as lectures and seminars.
- **Waziya Cinem**a - Waziya is the oldest cinema in Yangon and is situated the heart of what was once known as "cinema row" in the center of the city. YHT is advising Myanmar Motion Picture Association (MMPA) in their plans to renovate and restore the historical Waziya into a modern cinema and performance arts space in the center of Yangon.
- **Government Press Building –** YHT made a design study for the Ministry of Information for repurposing of the Printing and Publishing Enterprise building (formerly Government Press) at the ground floor level incorporating new public bookshops, cafes, restaurant, multipurpose spaces, car parking and garden courtyard spaces.

3) Public Engagement & Education

A large part of YHT's work is recording Yangon's tangible and intangible heritage and sharing this knowledge to build awareness on the value of heritage. YHT's research and educational outreach activities about Yangon's history and heritage are fundamental to reconnecting residents and locals with the buildings around them. Selected examples:

- **Blue Plaques** – commemorative plaques around Yangon to highlight historical buildings and renowned residents
- **Heritage Walking Tours** - for both locals and international visitors. YHT tours are conducted by YHT's trained tour guides with anecdotes and insights into the history of both buildings and residents. All funds raised through the tours supports YHT's continued advocacy efforts.
- **Exhibitions** - "Global City: Yangon's Past, Present and Future" exhibition sponsored by Prudential showing more than 120 photographs exposing Yangon as the hub of many of the key events in the history of Myanmar revealing Yangon's cosmopolitan past and present.
- **Outreach Projects -** YHT - with the assistance of the New Zealand government - initiated a project to study local residents' opinion on the city that they call home. Polaroid cameras were provided to take pictures of things that residents in three townships value and things they dislike within their environment.
- **Trainings & Workshops -** YHT regularly initiatives training and capacity building in a variety of topics from cultural mapping to conservation techniques and 3D rendering,

typically in collaboration with industry associations like AMA or MES, local universities (YTU, MTU), and/or international universities (HKU, University of Pennsylvania) or architectural practices.

(4) YHT and YCDC

YHT works closely with YCDC. The following extract from the CDIA report describes the relationship:

'Although coming from a different perspective, the two organizations are very much aligned and there is strong mutual respect. Both are very committed and have substantial leverage but limited capacity to undertake the work required. They understand the argumentation of the advocates of a 'different approach to development' in the historic core very well and they recognize the only way to convince them is with well-substantiated alternatives for which they have limited resources and manpower.'

'The two organizations work together in many aspects of what could become the first generation of legislation to manage the city's heritage assets. The collaboration manifests itself at different levels. In the first place there are the formal arrangements:

- YCDC and YHT together with representatives from the Department of Human Settlements and Housing Development (DHSHD), the Ministry of Science and Technology, Japan International Cooperation Agency (JICA), various Union and Regional level ministries and the Association of Myanmar Architects (AMA) – sit on the **zoning committee** for Yangon, established in 2013 to update the current planning framework and consider a comprehensive height control and zoning plan for the city of Yangon.
- Both are involved in the formulation of the **National Building Code** that was kick-started in July 2011, as a result of a joint initiative between MOC and UN-Habitat, the Myanmar Engineering Society. This four years project was completed with a Provisional Building Code in 2015 that included specific articles on heritage buildings (see chapter 5.2). Addtionally YHT advises redrafting other pieces of legislation relevant to the urban built environment such **Protection and Preservation of Cultural Heritage Regions Law** [1998] and the **Antiquities Act** [1957] as well as Myanmar Investment Commission (MIC) controls for development/investment of places with heritage significance in Yangon.'

In addition, there is a continuous working relationship in which the YCDC Planning Unit typically consults YHT for matters concerning heritage in general and the downtown area specifically, such as demolitions, listing and heritage impact assessments.

In the past years there has been a number of capacity building initiatives that have further strengthened the working relationship. Examples are joint capacity building trajectories by UN Habitat (2014) and NUFFIC (June 2014) as well as a more comprehensive EU funded capacity improvement program (2013-15) aimed at strengthening institutional and operational capacities of both organizations in three key areas:

- Enhance quality of urban planning and practice, in particular heritage planning framework;
- Make planning processes more inclusive and accessible to citizens, including awareness raising for heritage conservation; and
- Provide capacity building, data and software to embark on an inventory of heritage buildings.

What transpired from these collaborative capacity building and research initiatives was the urgency of the situation, the unique window of opportunity and the need for guidance on

financial and legal tools and instruments to better guide development in the historic core, but perhaps most important, the willingness of YHT and YCDC's Planning Unit to join forces in progressing this agenda.

2.5.2 Policy for CBD Development

After previous SUDP was published, many urban development projects are planned and implemented. Based on this situation, development policy and the plan are required to realize economically active and environmentally livable CBD of Yangon. In this section, development policies on 4 key sectors such as "Transportation and Road", "Urban and Infrastructure Development", "Heritage and Cityscape" and "Urban amenity and Tourism" are shown.

(1) Transportation and Road "Easy to Move" and "Fun to Walk"

One of the most serious urban problems of CBD in Yangon is chronic traffic congestion. Since many urban functions (such as commercial, office, residence administrative facilities) are accumulated in CBD, so many traffic is concentrating to the CBD. For the reason, traffic congestion is occurred not only traffic peak hour (morning and evening commuting time), but also other daytime along main roads. This situation gives bad effect on walkability of CBD.

Source: JICA Study Team

Figure 2.5.13: Traffic Congestion of Main Road in CBD

It is required that not only reduction of traffic volume in CBD through consideration of well-management of public transportation and so on, but also development of pedestrian-friendly walkway network. To improve current traffic congestion, and provide better environment to pedestrians, **"Easy to Move" and "Fun to Walk"** is proposed as a development policy for Transportation and Road sector.

(2) Urban and Infrastructure Development "Good for living" and "Resilience City"

CBD was developed downtown of Yangon in the middle of the 19th century by Alexander Fraser who was an army engineer from England. After the first development of the downtown, infrastructure had not been reconstructed over 100 years. For example, wastewater in YCDC is collected by ejector system which was constructed by British in 1890. This system has been utilized continuously with periodical modifications for approximately 120 years. Road network of CBD is not changed over 100 years. Many buildings pass 50 years and some of them are over 100 years from establishment. Although YCDC is improving infrastructure of CBD, the work is still covered only some parts of the area and more investment is required to renew old infrastructure. On the other hand, economic activity by private company is pointing also to CBD, improvement of infrastructure is identified as a urgent urban problem. Since this work provides not only better living environment but also disaster resilient space for locals, **"Good for living" and "Resilience City"** is proposed as development policy of Urban Infrastructure Development sector.

Old Building with Weak Infrastructure | **Rubbish at Backyard of CBD** | **Flooding in CBD**

Source: JICA Study Team

Figure 2.5.14: Current Living Problems in CBD

(3) Heritage and Cityscape "Conservation Area" and "Restore the building while living"

As total, 183 historical buildings are located in CBD. And some of them are accumulated along center of CBD (Pansodan Street, Maha Bandoola Park Street, Bank Street and Sule Pagoda Road).

Many new buildings are constructed in CBD. Various design, material and color of buildings are constructed and the landscape of CBD changes with it. Asian cities such as Jakarta, Manila, Singapore lost old buildings and historic area for new development. Batavia that is old center area of Jakarta restarts to repair old buildings. Old buildings and cityscape including such old buildings are very important. In this plan, policies of Heritage and Cityscape are **"Conservation Area" and "Restore the building while living"**.

Source: JICA Study Team

Figure 2.5.15: A Historical Building in CBD

(4) Urban Amenity and Tourism "Most Comfortable Place in Asia" and "Golden Place for tourist"

Source: JICA Study Team

Figure 2.5.16: Cityscape with Big Billboards in CBD

The number of visitors to Myanmar is small. This is primarily due to its current political situation. However, after the junta transferred power to the civilian government, the tourism sector saw an increase in tourism arrivals and in 2012, and tourist arrivals surpassed the one million marks for the first time. CBD has much attractions. Heritage buildings, Sule Pagoda, Market, Street venders, restaurants and Hotels. Disadvantages of the CBD for tourist destination of CBD are narrow pedestrian, unhygienic outdoor eateries, confusing directions or tourist information. CBD is an area that is worth to accept a lot of tourists. In this plan, policies of Urban Amenity and Tourism are **"Most Comfortable Place in Asia" and "Golden Place for tourist"**.

2.5.3 Necessary Actions

(1) Transportation and Road

1) Car Traffic (Inflow) Control

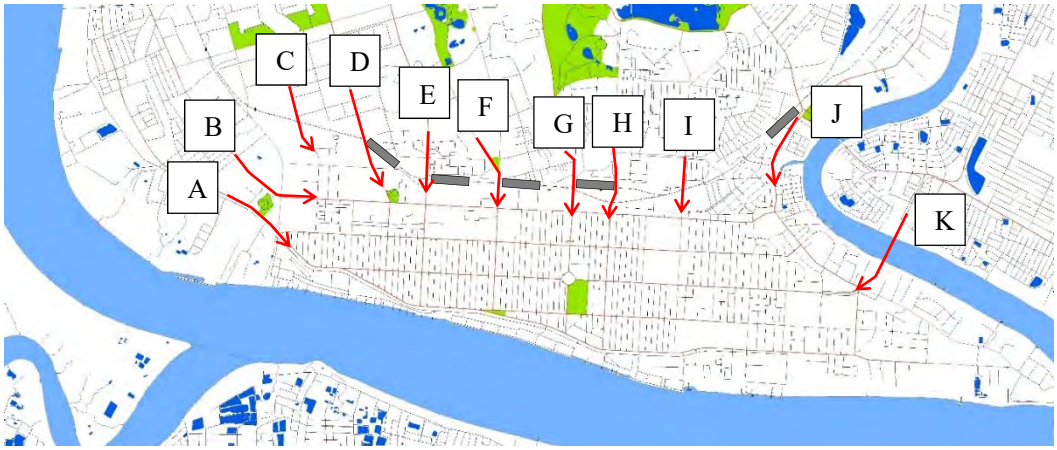
CBD has eleven entrances and fourteen lanes for entrance and same lanes for exit. In CBD, road network forms four one way roads (Bogyoke Aung San Road and Maha Bandoola Road for west to east, Anawrahta Road and Marchant Road for east to west) and five two way roads (Pyay Road, Shwe Dagon Pagoda Road, Sule Pagoda Road, Pansodan Road and Thein Phyu Road) for north to south. Fundamental problems are following.

- Characteristics of road network of CBD is that north-south roads density is high and east-west roads density is low. Almost east-west traffic must use only five roads
- Some functions of CBD (such as markets, Theingyi Market and around the market), offices, commercial and wholesale (material of construction and electrical accessories) are concentrated in west area of Sule Pagoda Road
- Center of population of CBD will be pointed west area from Sule Pagoda Road
- Parking system of CBD is also a factor traffic congestion. About 20,000 parking lots are located on the road in CBD, but all of these parking lots are for residences. Now CBD needs pay-by-the-hour parking lots.

(I) Construction of Multi-modal Node Facilities (Target: 4 Main Points, Central Station, Kandawgalay, Puzundaung and Thakin Mya Park)

About 26 lanes of road for car traffic are networked for entrance of CBD, and same as for exit. First step is to control the point of entry for private cars which their destination is in CBD. JICA Study Team proposes multi-modal node facilities and car parking near these 11 entrances.

Figure 2.5.17 shows the existing 11 entrance locations and cross sections of 11 roads:

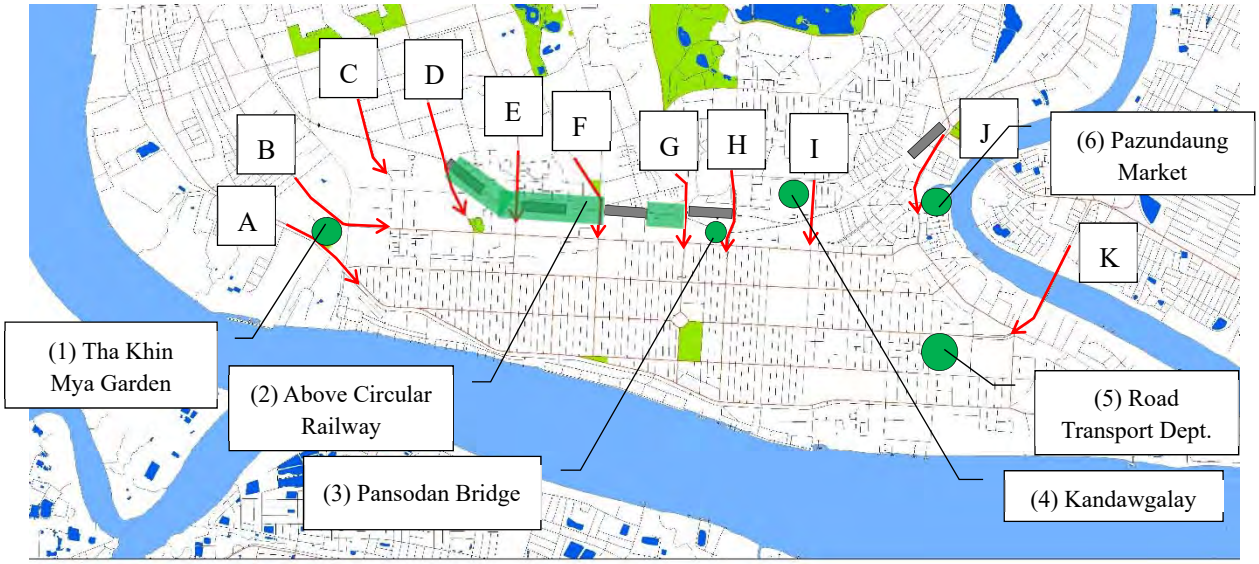


Section	R.O.W.	Num. of Lane	Section	R.O.W.	Num. of Lane
A	30.5 m	6 lanes (3 lanes each)	G	32.45 m	8 lanes (4 lanes each)
B	28.8 m	4 lanes (2 lanes each)	H	17.2 m	4lanes (2 lanes each)
C	11.8 m	2 lanes (1lane each)	I	22.4 m	4lanes (2 lanes each)
D	28.7 m	5 lanes (2 & 3 lanes)	J	22.4 m	4lanes (2 lanes each)
E	17.3 m	4 lanes (2 lanes each)	K	16.6 m	4lanes (2 lanes each)
F	32.5 m	6 lanes (3lanes each)			

Source: JICA Study Team

Figure 2.5.17: Existing Entrance Roads of CBD

JICA Study Team proposes six multi-modal node facilities and car parking. It is very easy to access these facilities by car because of closing with each entrance road. Car drivers and fellow passengers change mean of transportation (car to bus). The followings are the locations of multi-modal node facilities and car parking and existing condition of sites proposed for facilities.



No.1 Name: Tha Khin Mya Garden Area: 2.7 ha Remarks: Undergrounding		No.4 Name: Kandawkalay Area: 1.5 ha Remarks: Multi-stories	
No.2 Name: Above Circular Railway Area: 1,800m * 15m Remarks: Development above railway line		No.5 Name: Land of Road & Transport Dept. Area: N/A Remarks: Multi-stories	
No.3 Name: Pansodan Bridge Area: 0.6 ha Remarks: Develop above railway line		No.6 Name: Pazundaung Market Area: 1.5 ha Remarks: Multi-stories	

Source: JICA Study Team

Figure 2.5.18: Location and Current Situation of Proposed Sites for Parking

(II) Introduction of Restriction Entry (Road Pricing System)

Road pricing system is one of effective way that can control the traffic volume of CBD. This is a first step to solve the traffic congestion. JICA Study Team proposes two road pricing systems and the contents are following.

Table 2.5.6: Road Pricing Systems

Title	Content	Remarks
ERP (Electronic Road Pricing)	ERP is an Electronic Road Pricing System used in managing road congestion. Based on a pay-as-you-use principle, motorists are charged when they use priced roads during peak hours. ERP rates vary for different roads and time periods depending on local traffic conditions. This encourages motorists to change their mode of transport, travel route or time of travel.	 （Photo : Singapore）
Odd-even license plate system	By the end of number of the license plate, it is a way to control the amount of motor vehicles entering the CBD. Residents living in the CBD will be outside the scope of this system. In case of odd number day, cars that plates are even number, they can't enter CBD, and they must park the parking building on the edge of CBD.	 （Photo : Jakarta）

Source: JICA Study Team

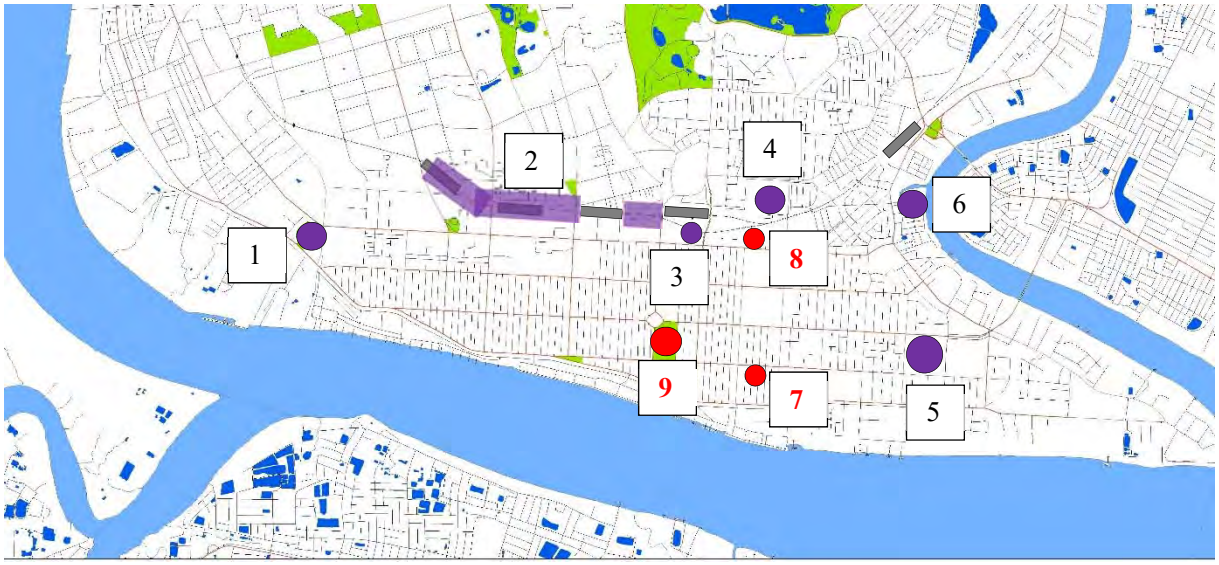
(III) Provision Car Parking Buildings

In CBD, the capacity of parking lots is about 20,000. The numbers of family of CBD are about 40,000, existing capacity of parking lots is about 50% of the whole. This volume of parking lots is for only resident, drivers for work, tourism, taking meal and shopping and need rental parking lot by hour. JICA Study Team proposes some parking buildings in CBD.

Table 2.5.7: List of Proposal Parking Buildings

No.	Name of parking building (Tentative)	Location	Area (ha)
1	Tha Khin Mya Garden underground car park	Fringe of CBD	2.7 ha
2	Circular Bridge car park (above Circular Railway)	Ditto	2.7 ha
3	Pansodan Bridge car park	Ditto	0.6 ha
4	Kandawgalay car park	Ditto	1.5 ha
5	Road Transport Department car park	Ditto	3.8 ha
6	Pazundaung Market car park	Ditto	1.5 ha
7	Bokalay Market car park	Inner of CBD	0.1 ha
8	Chan Myae Market	Ditto	0.3 ha
9	Maha Bandoola Park underground car park	Ditto	2.6 ha

Source: JICA Study Team



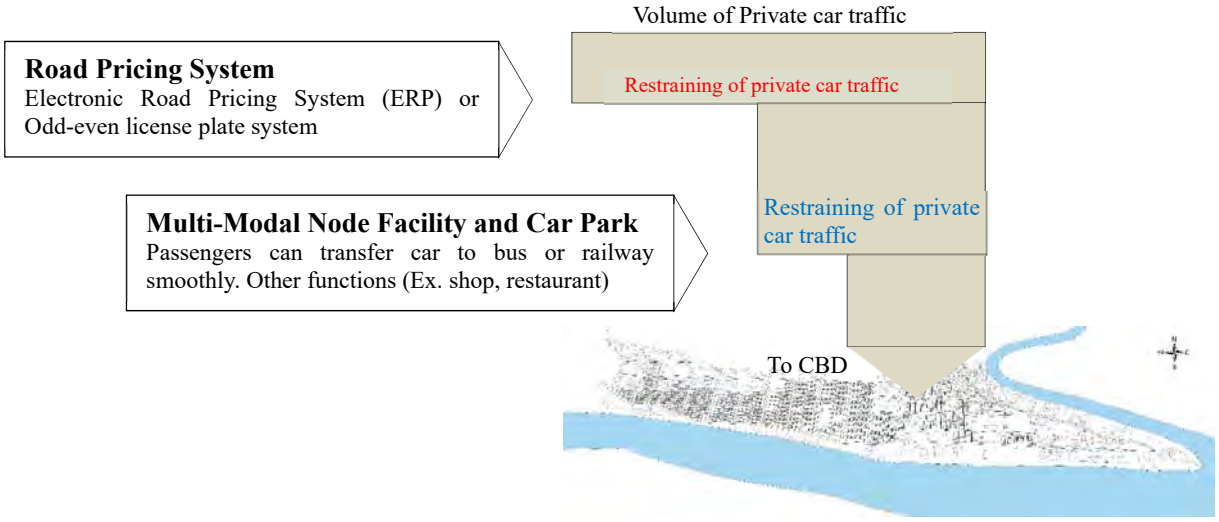
Source: JICA Study Team

Source: JICA Study Team

Figure 2.5.19: The Location of Proposal Car Park

(IV) Step-wise Traffic Control

JICA Study Team proposes the method for suppressing traffic that flows into CBD. First step, Electronic Road Pricing System (ERP) or Odd-even license plate system must be introduced for controlling private car traffic. Second step is to introduce a transit point to transfer from car to bus in multi-modal node facility and car park at the edge of CBD. The policy of restraining traffic is shown in Figure 2.5.20.



Source: JICA Study Team

Figure 2.5.20: Image of Restraining of Private Car Traffic

2) Public Transportation Promotion

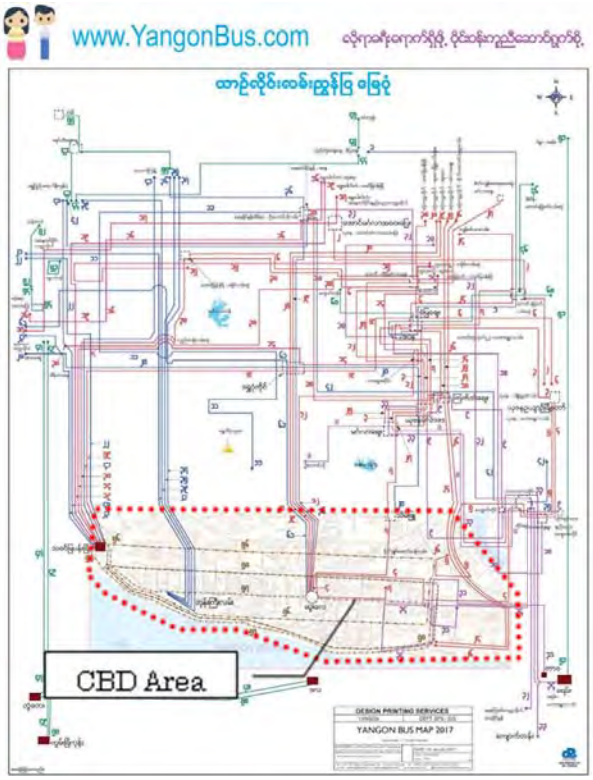
(I) Introduction of Circulation Bus

From 16th January 2017, Yangon's new Bus Service (YBS) has started. Bus routes were reorganized 300 to 60, and 4,000 buses have been operating to all over Yangon District. Six bus routes (Lower Kyee Myin Daing Rd, Pyay Rd, Sule Pagoda Rd, Thein Phyu Rd, Upper Pazundaung Rd and Maha Bandoola Rd) are accessed to CBD, and connect to three circulation bus routes (located by Bogyo Aung San Rd, Anawrahta Rd, Maha Bandoola Rd, Merchant Rd and Kanner Rd).

The new bus service has just started since January and it is difficult to evaluate its effect. However, based on this bus service, JICA Study Team need to propose a better bus service.

It is necessary to improve bus service by interview to dissatisfactions and requests of users.

JICA Study Team proposes some items for a smooth bus service. One of item is Bus Lane. Bus lane is an effective way in order to facilitate the traffic of bus. JICA Study Team proposes to install bus lane in CBD arterial roads.



Source: YRTA HP (http://www.yangonbus.com/)

Figure 2.5.21: New Bus Route Map

Source: JICA Study Team

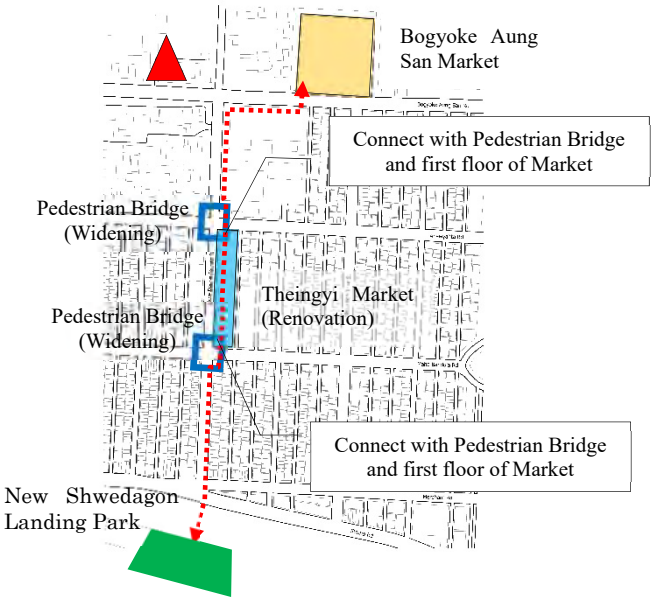
Figure 2.5.22: Photos of Bus Lane (existing road (CBD), Nagoya City and Jakarta City)

Shwedagon Pagoda Road is an old road from Shwedagon Pagoda to CBD. In the report of "Yangon Heritage Strategy (YHT)", this road is important road in Yangon City.

YCDC has a plan of Shwedagon Pagoda Road, too. First floor of Theingyi Market that locate in front of Shwedagon Pagoda Road, JUNCTION City and Bogyoke Aung San Market are connected with sky deck.

Source: Yangon Heritage Strategy, YHT

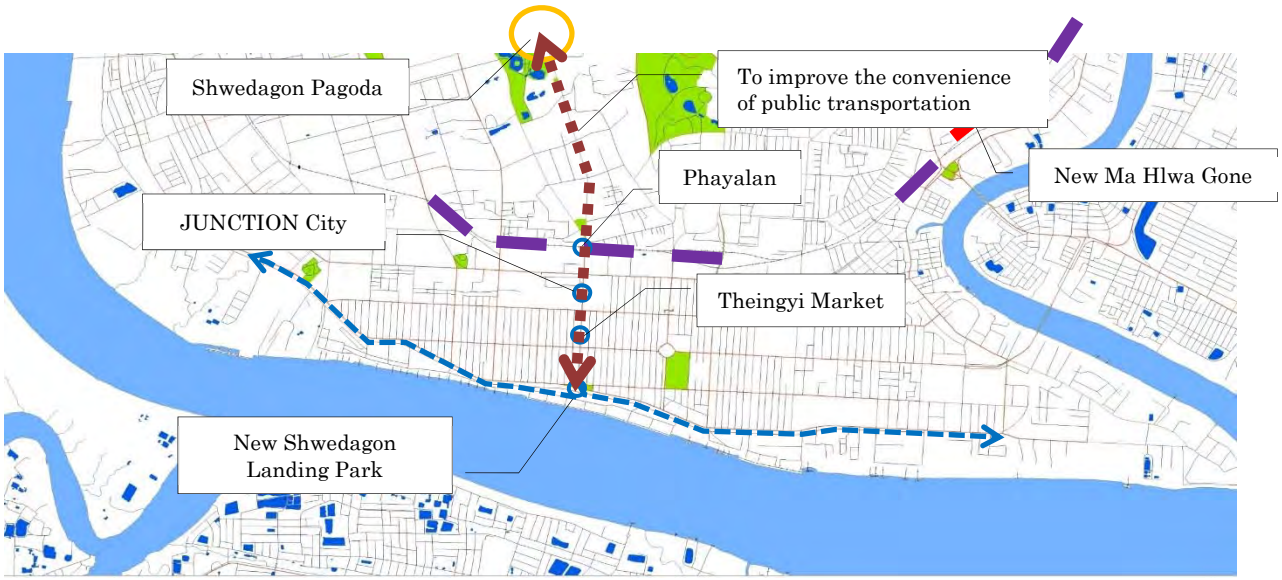
Figure 2.5.23: A Vision for Yangon



Source: JICA Study Team based on YCDC

Figure 2.5.24: The Concept of Sky Deck

Shwedagon Pagoda Road is very important road for the plans of YHT and YCDC, and Shwedagon Pagoda is a symbol of Myanmar people and destination for tourism of forging countries. JICA Study Team proposes to improve the convenience of public transportation system from Shwedagon Pagoda to CBD. This system can bring many worshippers and tourism from Shwedagon Pagoda to Shwedagon Pagoda Landing Park. This system will transport passenger for worship, sightseeing, shopping and work.



Source: JICA Study Team

Figure 2.5.25: Image of New transportation system from Shwedagon Pagoda to Shwedagon Landing Park

(II) Waterway Promotion

To install new Jetty on Pazundaung redevelopment project for commuting (New Pazundaung Jetty will be connected with Bo Aung Gyaw Street and Sule Pagoda Wharf)

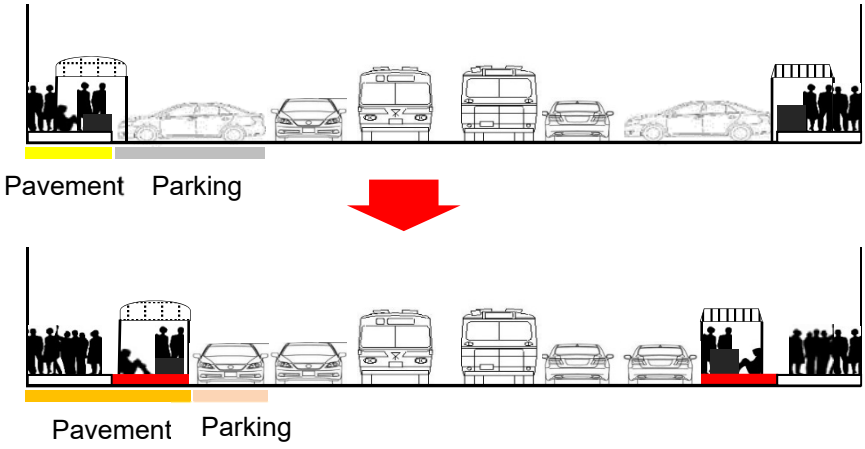
Source: JICA Study Team

Figure 2.5.26: Image of New Tram from Shwedagon Pagoda to Shwedagon Landing Park

3) Arrangement of Parking on the Road and Street Venders

To relocate street venders to food court or new spot, and provide pedestrian spaces

YCDC has a plan of street venders' relocation. New location is Site along Kanner Road. JICA Study Team proposes that some car parking lots will be abolished and some car parking lots to change their system. For example, Maha Bandoola Road car parking lots are at right angles to the road, but we propose that car parking lots layout to be parallel to the road. With this change, the width of the pedestrian will spread 3 m and become about 5 m.



Source: JICA Study Team

Figure 2.5.27: Image of Maha Bandoola Road Elevation

(2) Urban and Infrastructure Development

1) Introduction of Development Regulation and Control

(I) Implementation of the Zoning Code

Zoning Code of Yangon City has not yet been enforced. In the near future, the zoning code will be approved by the government, and regulate the form of new building.

Source: YCDC

Figure 2.5.28: Zoning Code of CBD (Draft)

When Zoning Code is carried out, everybody must be able to access this information easily and correctly. JICA Study Team proposes to make a space or room for reading Zoning Code. Urban Redevelopment Authority (URA) in Singapore, Zoning Code information was edited and everybody can access the code. In Singapore, those who wish can also question about the city planning in URA. Figure 2.5.29 is a photo of URA. Left photo is Zoning Code Book and right one is explanation of Master Plan of Singapore.

Source: JICA Study Team

Figure 2.5.29: Zoning Code Book and Explanation Board of URA in Singapore

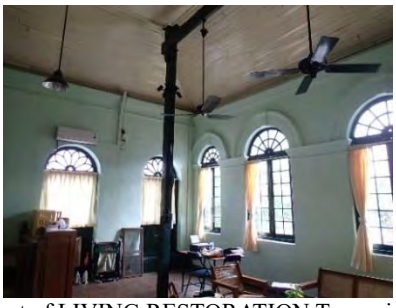
(II) Establishment of Heritage Restoration Scheme and Guideline

Restoration of Heritage Buildings has been carried out in CBD. AYA Bank is next to YCDC building. This building was restored with technical support from YHT. This building was built in 1910 and housed the Rowe & Co. which is a department store in the first half of the 20th century. For over 30 years it held the office of the Department of Immigration and Manpower until 2005. This building applications have changed three times.


Source: YHT Exhibit in display space and HP

Figure 2.5.30: Existing AYA Bank (until 2005 Department of Immigration and Manpower)

On the other hand, there is a case that the building was restored without changing the use of the building. These photos are indoors of 491-501 Merchant Street. This project was done by Turquoise Mountain in partnership with YHT over the year leading to April 2016. This project is different from AYA Bank Project. All residents and shops were not relocated to other places, and after restoration, they moved back to this heritage building. The concept is "LIVING RESTORATION".

Source: right photo, JICA Study Team and left photo report of LIVING RESTORATION Turquoise Mountain

Figure 2.5.31: 491-501 Merchant Street indoor before and after restoration

Some of restoration projects of Heritage buildings are in progress in CBD. Some organizations study restoration projects, and the government has a plan that new function of public service will be installed to heritage buildings.

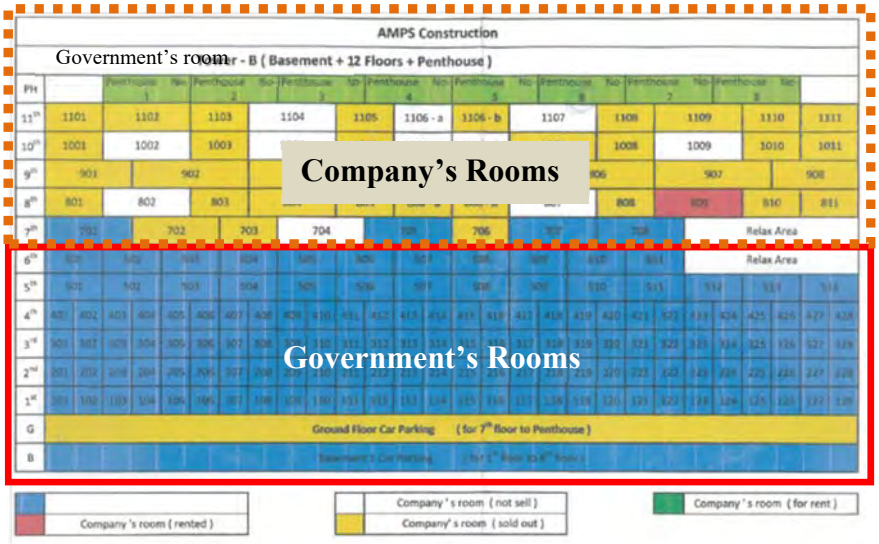

Source: JICA Study Team

Figure 2.5.32: Yangon Division Court and Burma Oil Company Headquarter

(III) Establishment of Government Building Redevelopment Scheme

In CBD, government has several land and residents. Some of them were already redeveloped into new buildings. For example, 50th Street MOC residence redevelopment project is a good example. In this case, public and private company constructed new residence, and families that lived in this place before the redevelopment got new apartments from 1st to 6th floor, and new families live from 6th to 11th floor. The ground floor and 1st to 6th floors are owned by MOC, and above 7th floor is owned by the private company. Such method is good practice about redevelopment in CBD, and this case was introduced through tele broadcast media.

(Before Redevelopment)



(Existing)

Source: Myay Construction Co., Ltd.

Figure 2.5.33: Elevation of 51st Street Housing Reconstruction Project

2) Promotion of Urban Development Activities

(I) Redevelopment of Government Land (Target: Pazuntaung Market, Bokalay Market, etc.)

In CBD, YCDC manages some markets in each township. Some of these markets are redeveloped and became high-rise and multifunctional buildings. Junction Mawtin and Yay Kyaw Market are already redeveloped and the existing market functions are modern supermarket, departmental store and high-rise residence and includes new building. (Figure 2.5.34 left photo is Junction Mawtin and right photo is Yay Kyaw Market)

Source: JICA Study Team

Figure 2.5.34: Cases of market redevelopment, Junction Mawtin and Yay Kyaw Market

In CBD, many old or low-density markets are located. For example, Bokalay Market is low-density and Chan Myae Market is an old market. Pazundaung Market is very large market (Class-A), and the location of this market is very good for new jetty of inland water transportation.

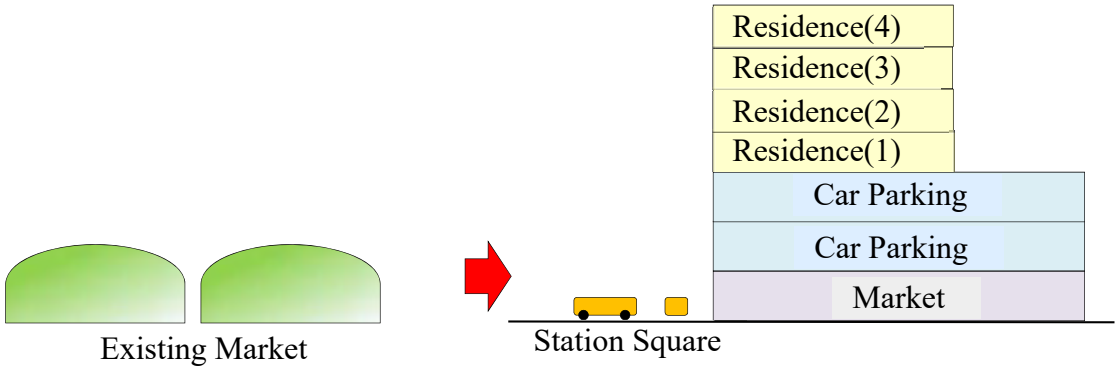
JICA Study Team proposes to redevelop such YCDC markets and install multi-function buildings (market, modern super market, parking lots, new jetty and residence) in CBD.

Source: JICA Study Team

Figure 2.5.35: Location Map of YCDC Markets

Source: JICA Study Team

Figure 2.5.36: Left is Pazundaung Market, Middle is Bokalay Market and right is Chan Myae Market

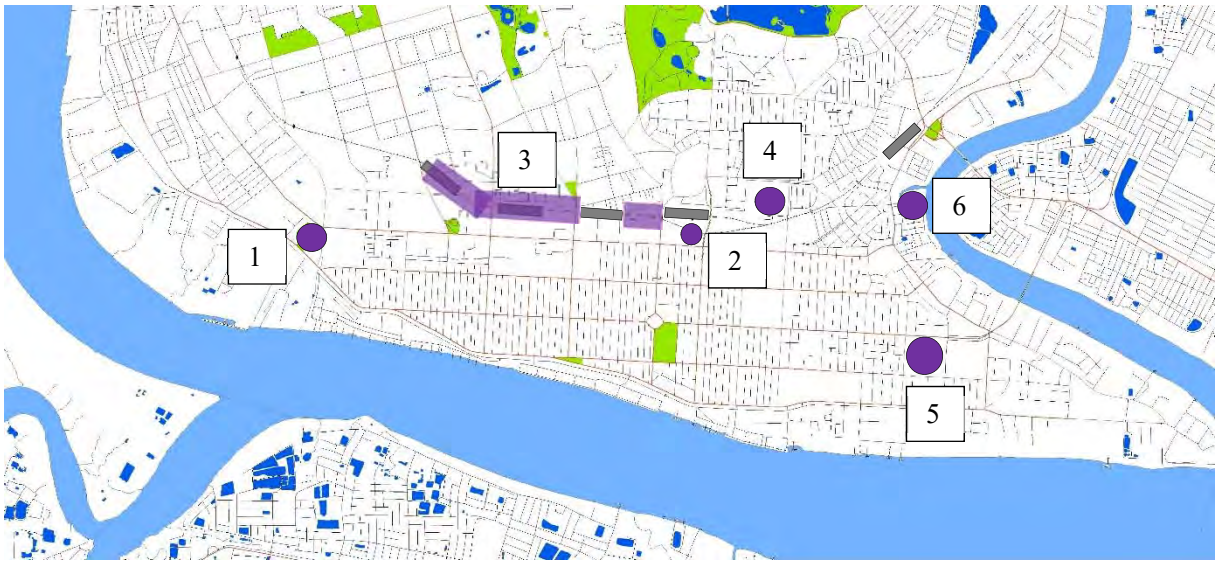


Source: JICA Study Team

Figure 2.5.37: Image of Elevation of Market Redevelopment Plan

(II) Development of Multimodal Nodes

In order to ease the traffic congestion in CBD, it is effective that passengers transfer from the car to public transport in the edge of CBD. JICA Study Team proposes multimodal node in the edge of CBD.

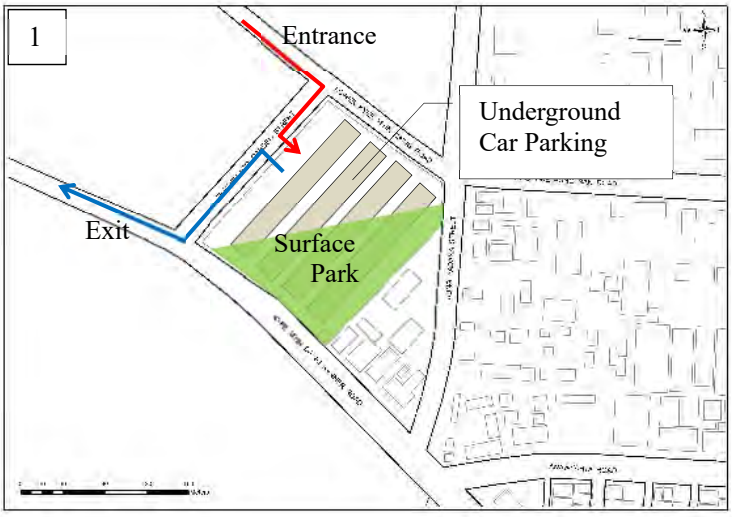


Source: JICA Study Team

Figure 2.5.38: Proposed Multimodal Node Location

I) Car Parking at Underground Space of Thakin Mya Park

Thakin Mya Park Underground Car Parking is west hub of multimodal node. Two main bus routes are installed Kyee Myin Daing Kanner Road and Bogyoke Aung San Street. Entrance of car parking will be connected with Thakhin Mya Garden Street and exit will be connected with Aung Yadana Street. Car users will change transportation from car to bus from here.

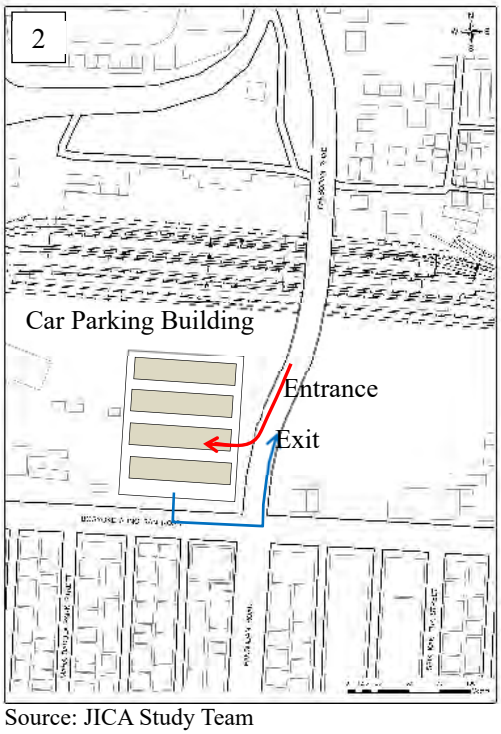


Source: JICA Study Team

Figure 2.5.39: Proposed Plan of Thakin Mya Park Underground Car Parking

II) Side Space of Pansodan Bridge

Pasondan Bridge is a bridge crossing over circular railway. Multi-stories car parking is proposed by utilizing land owned by Myanmar Railway along this bridge.

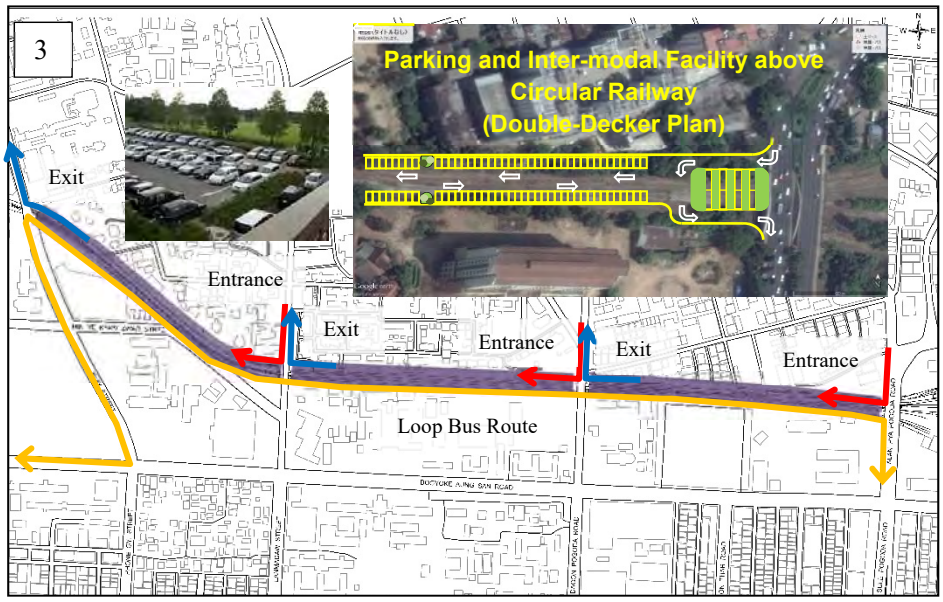


Source: JICA Study Team

Figure 2.5.40: Proposed Plan of Pansodan Bridge Car Parking

III) Upper Space of Circular Railway Line

Circular railway is located in the north edge of CBD. Arterial roads (Pyay Road, Myoma Kyaung Street, Shwe Dagon Pagoda Road, Sule Pagoda Road, Pansodan Street and TheinPhyu Road) cross circular railway. JICA Study Team proposes to use above circular railway for car parking. Entrance and exit will be installed to the end of bridge of three cross points (Pyay Road, Shwedagon Pagoda Road and Sule Pagoda Road). The route of loop buses goes around inside CBD via above circular railway.

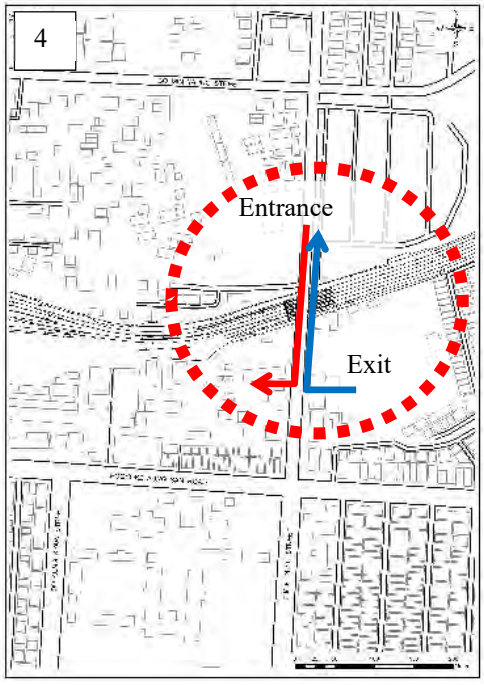


Source: JICA Study Team

Figure 2.5.41: Proposed Plan of Space above Circular Railway

IV) Roadside of Thein Phyu Road

Main bus route is installed on Thein Phyu Road. This road connects CBD and Kan Daw Gyi Lake. Many car-traffics use this road, and JICA Study Team proposes to install multimodal node along Thein Phyu Road.

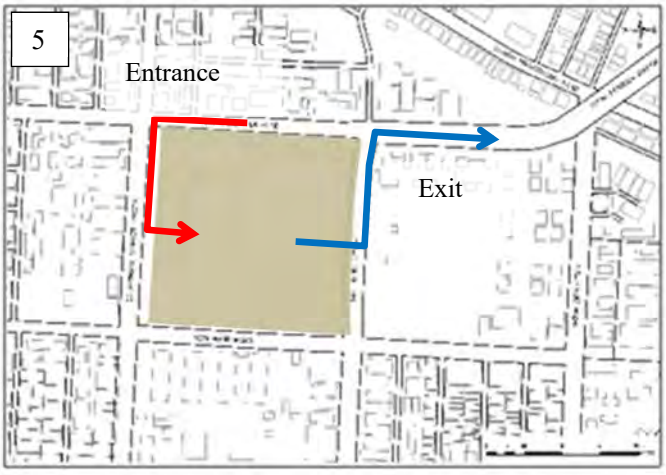


Source: JICA Study Team

Figure 2.5.42: Proposed Plan of Road side of Thein Phyu Road

V) Eastern Part of CBD

This land owner is Road Transport Department. This location is good for multimodal node. Because the arterial roads of Maha Bandoola Road and Merchant Road are close to this land. Car users will be able to transfer from car to bus easily.



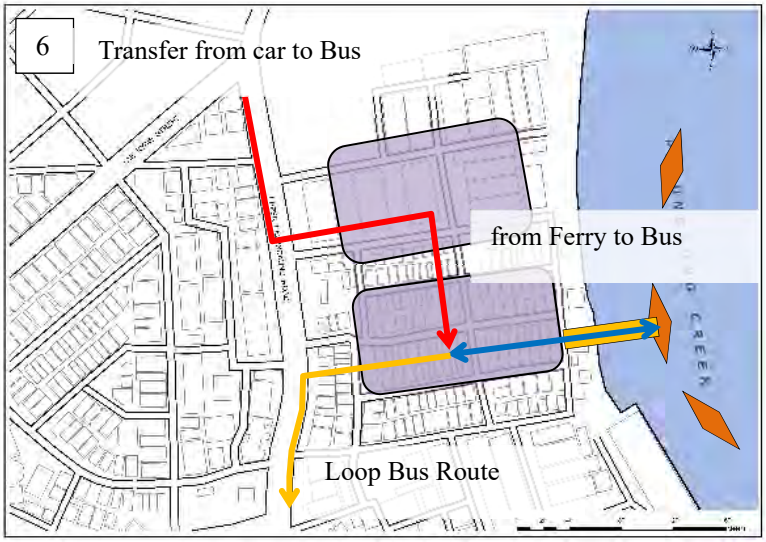
Source: JICA Study Team

Figure 2.5.43: Proposed Plan of Eastern Part of CBD

VI) Puzundaung Market

The location of Puzundaung Market is good for multimodal node. This market has a jetty for fisherman and is close to Upper Pazundaung Road. Upper Pazundaung Road is one of arterial

roads to access to CBD. JICA Study Team proposes to redevelop this market and construct multifunction building.



Source: JICA Study Team

Figure 2.5.44: Proposed Plan of Puzundaung Market

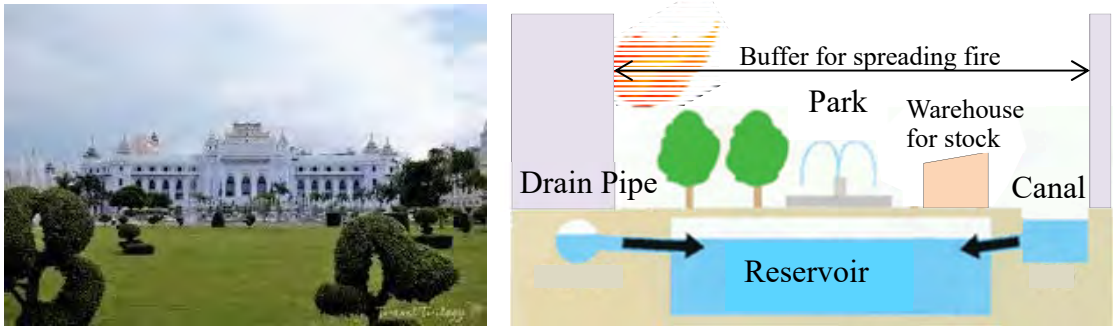
3) Natural Disaster Management

(I) Disaster Risk Assessment

JICA Study Team proposes some damage preventions about cyclone and earthquake. (Refer to "5.1.6 Disaster (Flood & Drainage)". Yangon is the most populous city in Myanmar, and CBD is the most densely populated area in Yangon. About flood and cyclone, JICA Study Team proposes to repair drainage system of CBD. About earthquake, JICA Study Team tried to check evaluation of seismic capacity of one sample building. (Refer to "5.1.6 Disaster Risk Management (Earthquake)").

(II) Construction of Open Spaces for Evacuation Space

The population of the CBD is around 225,000 persons. If big earthquake happens, many victims need shelters. Open spaces of CBD are very important for shelters, and such open spaces must have functions for shelters. JICA Study Team proposes some functions (For example, warehouse for stock of food, tent, fuel, water and blanket, buffer for spreading fire and meeting place for victims.) The space of park is very important for disaster prevention and public facilities. JICA Study Team proposes three-dimensional use of park. For example, the surface of park is for open space, buffer zone and warehouse for stock. Underground space is for reservoir.



Source: JICA Study Team

Figure 2.5.45: Image of Park of Protection against Disasters and Maha Bandola park Reservoir

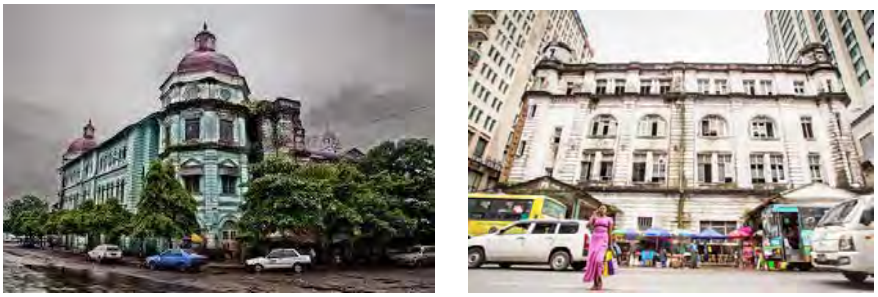
(III) Make a Rule of Disaster Prevention of Old Building for Earthquake-Resistance

JICA Study Team did a test of evaluation of seismic capacity by three buildings. We understood the vulnerability of CBD's old buildings for earthquake. Three buildings that had been subjected to seismic inspection were predicted to collapse due to the earthquake assumed in Yangon. For this reason, it is necessary to conduct earthquake strengthening and to review the buildings plan newly constructed based on earthquake resistance criteria.

(3) Heritage and Cityscape

1) Heritage Conservation and Restoration

a) To specify a boundary of Conservation Area for Heritage buildings (based on Yangon Heritage Strategy)
b) Restoration of one heritage building for restoration project, and add a new function to that building (library, restaurant, museum etc.)



Source: JICA Study Team

Figure 2.5.46: Heritage Buildings in CBD

2) Cityscape Improvement

a) Construction of a system for understanding the maximum height that can be built in CBD.
b) Operation of rule and regulation of design code for advertisement and signboards (based on Yangon Heritage Strategy)
c) Operation of rule and regulation of landscape design (based on Yangon Heritage Strategy)

3) Waterfront and Open-space Development

a) Redevelopment of warehouses and add a new function (For example, market function, convention, restaurant)

(4) Urban Amenity and Tourism

1) Pedestrian Way and Sidewalk Improvement

(I) Development of Pedestrian Road (Target: Maha Bandoola Park Street, Bank Street, etc.)

Maha Bandola Park Street is close to Maha Bandoola Park. This street is located in the center of heritage building conservation area. Existing function of this road is not only car traffic management but also car parking and space of street vender. Existing condition of Maha Bandoola Park Street is not good for pedestrian safety.

JICA Study Team proposes that the function of Maha Bandola Park Street is changed to pedestrian road. Figure 2.5.47 is an image of pedestrian road. In future, Maha Bandoola Park Street function will be harmonized with Maha Bandoola park.

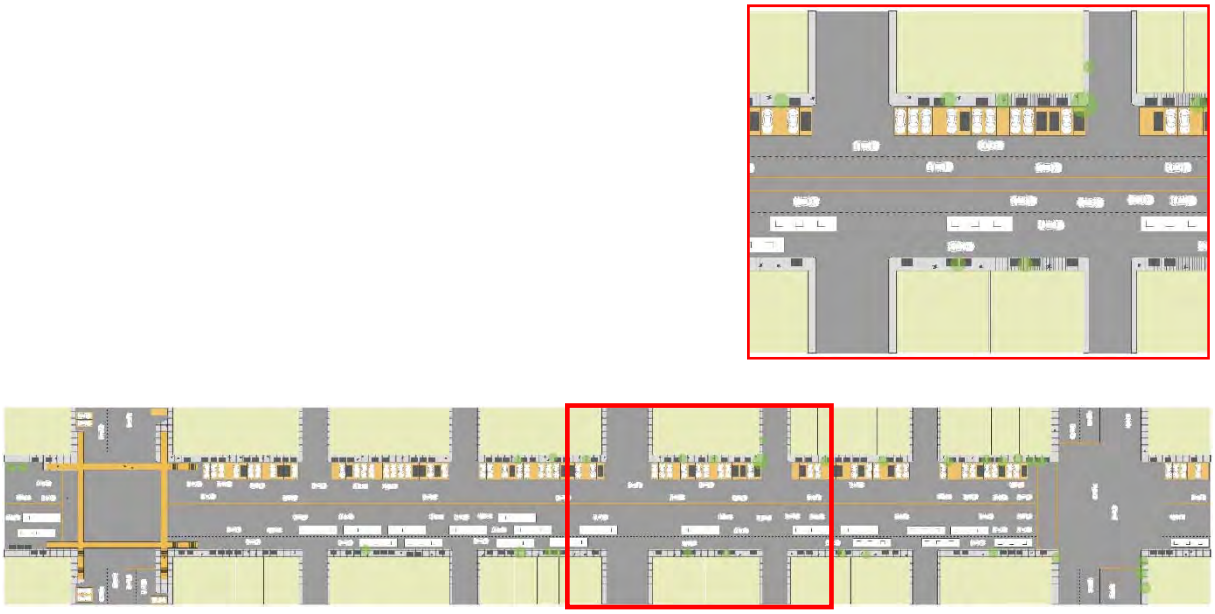
Source: JICA Study Team

Figure 2.5.47: Image and photo of pedestrian Road Maha Bandoola Park Street

(II) Widening of the Sidewalk of the Arterial Road (Target: Maha Bandoola Road, Anawrahta Road, etc.)

Figure 2.5.48 is existing Maha Bandoola Road plan. Car parking lots are met right-angle to road. Such a case, left-most car lane (yellow dotted line) is dangerous that parking car will be in contact with the start-up. In future, it is necessary that CBD become a good area to walk around. Pedestrian walkway must be widened for walkers.

JICA Study Team proposes that car parking system is changed from right-angle to parallel. If the system of car parking change, we will get more about 3 m width space on roadside. Existing pedestrian width is about 2 m, and future Yangon people can get 5 m for pedestrian space.



Source: JICA Study Team

Figure 2.5.48: Existing Road Plan of Maha Bandoola Road

(III) Relocation of Street Venders

In CBD, about 5,000 street venders work on road. YCDC has issued a decree of street vender relocation plan. Deadline of relocation is middle of November, and YCDC sets up transitional measures specified separately. In future, street venders in CBD will relocate to Kanner Road, Maha Bandoola Park Street and Bank Street. The location of new area for street venders is shown in red line in Figure 2.5.49.

Source: JICA Study Team based on YCDC Data

Figure 2.5.49: Stretches for Venders Relocation from Inside CBD

2) Tourism Promotion

(I) Creation of Night Market Streets for Tourists and Locals

Maha Bandoola Park Street and Bank Street are important for future CBD vision. Many Yangon people and tourists concentrate this area for working, taking a rest and walking. JICA Study Team proposes to make a pedestrian from Maha Bandoola Park to waterfront area with these two streets.

At first, JICA Study Team will hold an event on Maha Bandoola Park Street and Bank Street. During this event, cars will not be allowed to use these roads and no parking as well.

These two streets will become streets where cars are shut out temporarily and some events will be held. And if this event's get good evaluation, JICA Study Team insists that these streets function change to pedestrian road.

No.	Listed Heritage Buildings
1	Emmanuel Baptist Church
2	Supreme Court and Yangon Division Court
3	Myanmar Export-Import Enterprise
4	Myanmar Economic Bank
5	Yangon Division Statistics Office
6	Myanmar Economic Bank Branch (2)
7	Yangon Division Office Complex
8	Pension Department
9	Custom House
10	Department of Information and Public Relation

Source: JICA Study Team

Figure 2.5.50: Location of Maha Bandoola Park Street and Bank Street

Source: JICA Study Team

Figure 2.5.51: Plan of Event (Maha Bandoola Park Street and Bank Street)

(II) Installation of the Tourist Information Center (Target: near Sule Pagoda)

In 2003, only 210,000 tourists visited to Myanmar. But in 2013, about 2,040,000 tourists visited. Numbers of tourist increased about 10 times during 10 years. Ministry of Hotels and Tourism estimated a future projection of international arrivals. In this result of projection, about 7,500,000 tourists will come to Myanmar for tourism. The target of government is shown in the following Table 2.5.8.

Around Sule Pagoda is a famous spot for tourist. Many heritage buildings and Maha Bandoola Park are located. These is a good location to install tourist information center. For example, government old building which is a Heritage building (Ministry of Hotels and Tourism) near Sule Pagoda is in a good location to install tourist information center.

Table 2.5.8: Future Projection of International Arrivals, Visitor Expenditure and Tourism Employment

	Conservative		Mid-range		High Growth	
	2015	2020	2015	2020	2015	2020
International Arrivals	1,528,020	2,815,279	1,829,943	3,680,669	3,009,663	7,489,906
Visitor Expenditure (USD Bill)	1.83	3.82	2.19	5.00	3.61	10.18
Tourism Employment	424,450	563,056	n.a.	n.a.	836,018	1,497,801

Source: Myanmar Tourism Master Plan, Ministry of Hotels and Tourism

Source: JICA Study Team

Figure 2.5.52: Image of Tourist Center and candidate of Tourist Center (Heritage Building of Ministry of Hotels and Tourism)

2.5.4 Planning Process

Table 2.5.9: Record of Meetings and Surveys (CBD Renovation)

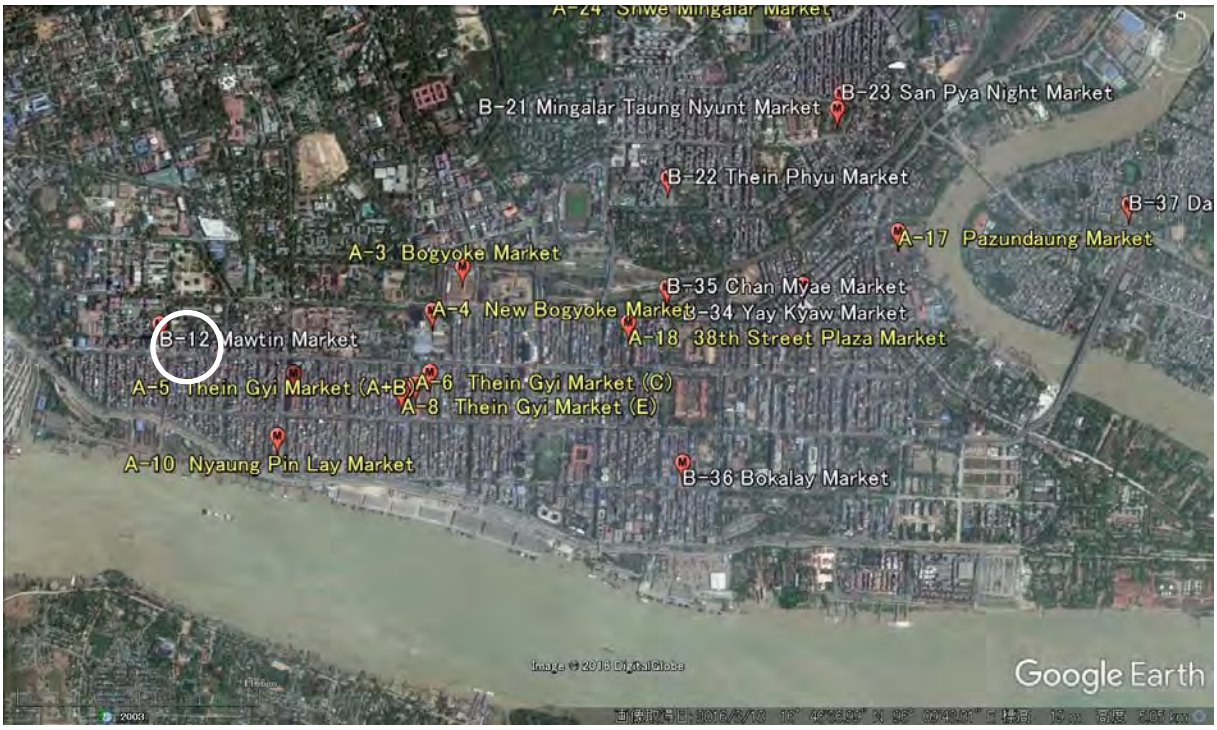
Date	Title	Venue	Agenda
1st Aug 2016 (Mon)	Meeting with JICA Myanmar Office	JICA Office	• Check of contents • Matters that require attention
2nd Aug 2016 (Tues)	Meeting with YCDC (kickoff Meeting	YCDC	• Explanation of Study contents • Requests from YCDC
3rd Aug2016 (Wed)	Meeting with Turquoise Mountain	Heritage Building	• Hearing about Heritage building repair
3rd Aug2016 (Wed)	Meeting with MOC Reconstruction Building	MOC Reconstruction Building	• Hearing about the system of reconstruction
6th Aug 2016 (Sat)	Field survey	Ring Railway	-
13th Aug 2016 (Sat)	Field survey	CBD Area	-
16th Aug2016 (Tues)	Meeting with Turquoise Mountain	Turquoise Mountain Office	• Hearing about Heritage building repair

17th Aug2016 (Wed)	Meeting with YHT, YCDC	YCDC	• Hearing about Heritage building repair (under consideration for repair)
18th Aug2016 (Turs)	Field survey	Myanmar Port	-
20th Aug2016 (Sat)	Field survey	CBD	-
21th Aug2016 (Sun)	Field survey	CBD	-
23th Aug2016 (Tues)	Field survey	CBD	• check the location of CBD's gate
24th Aug2016 Wed)	Meeting with Building Department	YCDC	• check the flow of permission system of building
27th Aug2016(Sat)	Field survey	CBD	• check development site in CBD
30th Oct2016(Fri)	Meeting with Deputy Director	YCDC	• to report the capacity of car parking area on road
1st Nov 2016(Sat)	Field survey	Puzundang Township	• check existing condition of road network of Puzundang
3rd Nov 2016(Mon)	Meeting with Deputy Director	YCDC	• to report the condition of floor volume and coverage of several blocks of CBD
13th Nov 2016(Thurs)	Meeting with transportation division of YCDC	YCDC	• to collect an information of plan of bus network in Yangon
16th Nov 2016(Sun)	Field survey	Puzundang Township	• check road width of Puzundang Township

2.5.5 Supplemental Explanations of the SUDP

(1) Market and Township Office

In CBD, eight YCDC class A Markets and three class B Markets are located. Some markets have been redeveloped. For example, Mawtin Market (Class B, Figure 2.5.53 white circle) have been redeveloped at 2010. Before redevelopment, Mawtin Market was one-storied house, and sold sundries. After redevelopment, semi basement floor is market. In ground floor, first and second floor, a supermarket (City Mart), restaurants and new shops are opened and over third floor is residence.



Source: JICA Study Team based on YCDC Market Department Data

Figure 2.5.53: YCDC Markets Location Map (Class-A, B)

Pazundaung, Bokalay and Chan Myae Markets do not redevelop, but their locations are very good. Pazundaung Market is located beside Pazundaung canal and Pazundaung Station. It is easy and convenience to transit transportation. Bokalay Market locates center of CBD and locates roadside of Marchant Road. YCDC Markets are low density and deterioration.

(2) Street Vender

Figure 2.5.54 presents numbers of street venders of each road in CBD. Looking at this figure, many street venders are opened in part of Anawrahta Road, Maha Bandula Road, 26th Street and 18th Street. 26th Street is neighbor of Thein Gyi Zey Market, and Maha bandula Road is main bus route from north-west area. Anawrahta Road is main bus route from north-east area.

Source: JICA Study Team based on YCDC Data

Figure 2.5.54: Numbers of Street Vender

Figure 2.5.55 presents density of street venders. According to the result of analysis, 17th, 18th, 26th and Shwe Bon Thar Road are high density streets and Anawrahta, Maha Bandoola and Sule Pagoda Roads are high density of street venders, too.

Source: JICA Study Team based on YCDC Data

Figure 2.5.55: Density of Street Vender

(3) Parking

Building that is under construction must install parking lots with regulatory compliance. Some high density buildings that established before carrying out the equipment - duty car - park regulation developed new parking building near the building (Ex. SAKURA Tower and Shangri-la Hotel). The main car parking in the CBD area is a parking on the street. JICA Study Team has counted numbers of parking cars on the road in CBD. Capacity of parking lots in CBD is about 20,500. In CBD, about 45,000 households are living. If all families park a car in CBD, about 24,500 cars parking is insufficient. In addition to this, it is necessary to pay-by-the-hour parking lots and company private parking lots. Figure 2.5.56 is existing parking capacity of each road and street of CBD. According to this output, north- south street (Ex. Latha, Bo Ywe, Shwe Dagon Pagoda street) have big capacity of parking (such a case, car is parking right angle to road). West – East road (Ex. Anawrahta Road, Kanner Road) capacity of parking is lower than north- south street. Maha Bandoola Road (Lan Thit Street to Phone Gyi Street) capacity of parking is 121-196 lots.

Source: JICA Study Team

Figure 2.5.56: Numbers of Lot of Parking cars on the Road

Figure 2.5.57 shows ratio of existing parking lots on the road. Result of survey is similar to Figure 2.5.56.

Source: JICA Study Team

Figure 2.5.57: Ratio of parking capacity on the Road

2.6 Financing Urban Development

(1) Current Status

1) Financial Base of YCDC

YCDC is considered as an independent body raising its own revenues through collecting fees, taxes, issuing licenses, and etc. As sources of funds, YCDC has a number of income generating enterprises including banking services, hotels, markets, condominiums, golf courses, property development and manufacturing of construction material such as bricks and cement.

In recent years, YCDC's budget both on the revenue and expenditure sides have been increasing quite rapidly. Total income of YCDC has dramatically increased by 380% from MMK 58 billion in 2011/2012 to MMK 279 billion in 2015/16. The most increased source is "Capital Income" that has come to be MMK 122 billion (44% of total income) in 2015/2016 that is 20 times as large as the one back in 2011/2012. A budget deficit, once it was as large as -23.4% as percentage to the total expenditure in 2011/2012, has been controlled to be smaller at the level of -1.9% in 2015/2016.

Table 2.6.1: Income and Expenditure Account from 2011-2012 to 2015-2016 (Billion MMK)

Account Title	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2015/2016 % Share by account	increase over 5yrs
Total Income	58	103	146	252	279	100%	380%
Tax and Normal Income	52	95	92	134	142	51%	173%
Capital Income	6	8	53	116	122	44%	1850%
Income from foreign help	0	0	1	2	13	4%	-
Income from debt	0	0	0	0	3	1%	-
Total Expenditure	76	100	146	252	285	100%	275%
Normal Expenditure	36	48	50	68	80	28%	122%
Capital Expenditure	16	52	95	182	190	67%	1070%
Expenditure from Special Fund	24	0	0	0	0	0%	-
Expenditure from foreign help income	0	0	1	2	13	4%	-
Expenditure from debt income	0	0	0	0	3	1%	-
Fiscal Balance (Income-Expenditure)	-18	3	0	0	-5	-	-
Fiscal Balance (as % of expenditure)	-23.4%	3.0%	0.0%	0.0%	-1.9%	-	-

Source: YCDC data.

The total income raised is, however, not always sufficient to cover the whole expenditure of YCDC. When a budget deficit occurs, money from a special fund may be used as it happened in 2011/2012. YCDC also receives financial assistants from international donors that are allocated to specific projects, and cannot be used to cover activity outside of the project scope. These are separately counted as "Income/expenditure from foreign aid" and have increased from 0.63 billion MMK in 2013/14 to 15 billion MMK in 2015/16.

A budget deficit, once it was as large as -23.4% as percentage to the total expenditure in 2011/12, has been controlled to be smaller at the level of -1.9% in 2015/16. Given huge needs for investments in urban renewal and development, however, it is indispensable to further diversify sources of income and enhance a sustainable financial base for urban management.

The structure of YCDC's income in 2015/2016 is as summarized as the Table 2.6.2. There were three major types of income sources. The largest source was "Capital Income" = "YCDC Property Based" (44% of total income) and most of which (33% of total income) was basically onetime-income as shares from sales of real estate development projects where YCDC provided land (virtually as a from of in kind investment) to the private developers. The second largest is "Service Charge Based" that were for cost recovery of public services. The smallest was "Tax Based" (13%) that could be most stable and sustainable sources in the long term perspective.

Table 2.6.2: YCDC Income Account in FY2015/16 (Billion MMK)

Account Title	Descriptions	Income	Share
Tax and Normal Income		141.8	50.8%
Income from Tax	"Tax Based"	36.4	13.0%
Property Tax	Tax levied on properties.	12.8	4.6%
Wheel Tax	Tax levied on automobiles.	13.9	5.0%
Revenue Share	Shared tax from Union tax.	9.6	3.4%
Income from goods selling and services	"Service Charge Based"	99.3	35.5%
City Planning and Land Admin. Department	Land inspection and other fees.	24.5	8.8%
Engineering Department (Buildings)	Real estates rental, inspection,and licence fees.	19.9	7.1%
Engineering Department (Water & Sanitation)	Water supply service charges and other fees.	11.0	3.9%
Administration Department	Various fees	9.3	3.3%
Markets Department	Rental fees and other fees.	7.3	2.6%
Engineering Department (Road & Bridges)	Billboard fees	5.4	1.9%
	Others	1.9	0.7%
Pollution Control and Cleansing Department	Waste Management Sevices	5.0	1.8%
Others		14.9	5.3%
Forfeit and other Incomes		6.1	2.2%
Capital Income	"YCDC Property Based"	122.2	43.7%
Engineering Department (Building)	Construction of Urban Development Buildings	91.3	32.7%
Markets Department	Income from the Construction of New Markets	15.8	5.7%
Urban Planning and Land Admin. Department	Income from the selling of new plots of land	10.9	3.9%
Others		4.2	1.5%
Income from Foreign Help		12.5	4.5%
Income from Loan		2.8	1.0%
Grand Total		279.4	100.0%

Source: YCDC data.

2) Issues in Income Structure

(I) YCDC Property Based Incomes - "Important but must use them carefully"

The most notable characteristic of the income structure of YCDC is the fact that it depends upon "YCDC Property Based" incomes. Given the fact that "Tax Based" income is small and unlikely to be expanded as fast as increase demand for public investment, "Real Estate Based" income shall be the most important source especially in the immediate to short term perspectives. There are 3 points to note regarding "Real Estate Based" incomes.

Firstly, it should be noted that the private sector investments are often essential to develop urban buildings and structures on YCDC's lands to yield economic returns, especially those in high potential urban centers. "No private investment" means "no capital income for YCDC". Thus, private sector participation must be encouraged.

Secondly, it is essential not to provoke real estate speculation. There is nothing wrong with decent rises in real estate prices as results of urban development in conjunction with improvements of public infrastructure. However, once the real estate speculation goes way too far up to the level of "bubble market", negative impacts will be devastating not only on urban development but also on the whole Myanmar economy. There could be many empty buildings and condominiums, many of them often not to be completed. Such non-performing assets are vast waste of resources. Under "bubble" many of average Yangon citizens could never afford to buy their houses. Low cost urban housing is by itself an important area that needs special attention by the public sector.

Thirdly, in order to control speculation, there must be well-designed urban zoning and regulations to impose it. A refined property based taxation system is also essential in order to increase costs for those who benefit from provoking speculative moves.

(II) Tax Based Income - "Property tax could also work as a link to bring rises in real estate values back to public incomes."

As already mentioned, shares of "Tax Based" incomes are very small. The "YCDC Property Based" incomes may neither always be stable nor able to grow at a current pace for a long period of time. Thus, it is recommended to increase shares of "Tax Based" incomes. In the context of expanding the financing sources for urban development, "Property Tax" is the most directly relevant tax item. It is recommended to refine the system of property related taxes and to be prepared to make a solid link between increase in real estate values and tax incomes with long term perspectives.

3) Housing in Yangon - Investment to Alleviate Shortage of Low-cost and Affordable Housing

(I) Huge shortage in low-cost and affordable housing

Yangon, home to more than 5 million people, is also the economic center for much of the country's industry and services, and generates about 20 percent of Myanmar's GDP. Given the fact that the huge influx of population to the city is expected to continue, Yangon faces a housing shortage. While authorities have commissioned several affordable housing projects and MOC is planning to sell more than 1000 low-cost apartments in Yangon and to build and sell 8000 apartments over the next two years, it is far behind the demand for housing for average people.

According to research by the Department of Urban and Housing Development under MOC, while 65% of Yangon's population own their houses, more than 1.8 million or 35% of the population are in need of low-cost housing. It is also estimated that 25% of total population's dwellings are temporary huts and shanties that mainly house the rapidly increasing influx of population attracted by factory work in the city's industrial zones where FDIs are concentrated.

(II) Supply-side of housing - need investment for "K10 million apartments"

The main challenge of low-cost housing is the need for sufficient investment to be able to sell apartments for under K10 million per unit. This is the price range where majority, as much as 60% of Yangon residents according to DUHD's estimates in 2015, who earn K300,000 a month (USD244) or less can afford. At the moment, however, there are no plans to build "K10 million apartments" under current market conditions. Most of the booming construction for housing over the past few years has been at the higher segments of the market.

U Myint Naing, DUHD's assistant director told the news media: "It could be possible to build low-cost homes on state-owned land, with the government providing water and other infrastructure, for less than K10 million per apartment. But given the limitations of the government budget, it would be very difficult to provide enough of them."[10] The government, "supply side" of low-cost housing is in short of budget for investment.

There is another option to increase supply of housing; to develop the rental sector. This "rental" option could be seen as provision of affordable and decent housing for the middle income population while they need some time to save enough money to pay for the first installment (usually 30% of total value) to buy their houses (often apartments).

(III) Demand-side of housing - need better housing loans

For financing the demand side of housing, the Construction and Housing Development Bank (CHDB)[11] is the only development bank that can provide mortgage-type of loans to people to buy houses with the loan period longer than one year and up to 8 years at an interest rate of 12% per year. CHDB also provides finance for the developers of low-cost and affordable housing.

CHDB has recently announced that it will release new policies for selling low-cost apartments to depositors of the bank who can pay 30 per cent of the total value in an initial instalment. Win Zaw, the managing director of the CHDB, told the news media: "People can save their money at the CHDB. They will have a chance to buy apartments through a lucky draw program when they can pay the first instalment. It will take them a long time to save Ks 3 million if they save Ks 10,000 per month. It would take 30 months if they save Ks 100,000 per month. The main point is they will have to save enough money to pay the first instalment."[12] It is estimated by CHDB that monthly saving or repayment amount at 30% of monthly incomes is the viable range for average people.

Given the huge demand for low-cost and affordable housing, however, a scale of provision of loans by CHDB is not large enough, not long enough (8-years repayment is too short), and not affordable enough (interest rate of 12% is too high). These shortcomings are reflections of characteristics of the current sources of funds; short-term and high interest rates. In order for CHDB to provide forms of loans better fit to the needs, it is indispensable for them to have sources of funds with "long-term", "low-interest rate", and "large-scale" in their natures.

There is also a glitch in a legal framework that pauses CHDB a difficulty. Currently, there is no legal framework for "collective ownership" that enables the buyers to register their bought apartments as collaterals for their housing loans. Likewise, CHDB cannot provide real "mortgage" loans to those who buy apartments or condominiums, which more likely the cases for urban areas.

(2) Prospective Sources of Financing

Given very fast pace of expanding economic activities in Myanmar, there are ever growing needs for development in all aspects. As already described in the previous sections of the present report, the Greater Yangon falls short of capacity and quality of its urban infrastructure and services in many ways. Needs for urban infrastructure development, likewise, financing

[10] The Myanmar Times, Friday, 23 September 2016.
[11] The Construction and Housing Development Bank was set up in 2013 under the Ministry of Construction's supervision to providing the loans that could allow more people to afford homes, but so far its success has been limited. The CHDB has opened seven branches in Yangon, Nay Pyi Taw, Mawlamyine and Pathein. Plans are under way to open additional branches in places where the low-cost housing projects are implemented.
[12] Eleven Myanmar, Tuesday, 19 July 2016.

sources are massive. Since existing financial sources alone are not able to finance urban development sustainably, the path to long-term finance is to diversify sources.

In the shorter-term, it is most viable to refine and expand existing forms of financial sources such as YCDC Property Based Incomes in conjunction with FDIs and development banks. In the mid to long-term, the Greater Yangon can be enabled and empowered to explore its untapped potential of "Land-Value-Based Financing" in order to increase and diversify "own-source revenues" in innovative ways such as revising existing property taxes and introducing new urban development tax (city planning tax) for urban centers. Among the other options, it is recommended to explore four prospective sources of financing as described below.

(I) Private Sector Participation - FDIs for short-term investment and capital incomes

One good prospective financial source is to encourage more private participation in urban development. In theory, this can be through loans from commercial banks, issuing municipal bonds or implementing Private-Public Partnerships. Given its immaturity in the banking and financial sectors, however, FDIs shall take prominent roles and shares in private investments for urban development in short-term. In case FDIs or other private investments are implemented in conjunction with use of YCDC's property, these could be good sources of capital incomes for YCDC,

The most important thing to encourage the private sector to invest is to eliminate institutional uncertainties. The private sector is generally ready to come and invest wherever they find it commercially viable. There are, however, some common concerns for them. It is risks of "uncertainty" in the process of investment. These uncertainties are felt mostly due to a lack of clear policy directions, laws and regulations related to real-estate development.

For example, it is widely recognized as one of the largest problems among foreign investors that there is no "building codes" in Myanmar. Instead, early investors applied self-imposed regulations when designing a new structure. In case of "Sule Square", the building construction follows Singaporean building and fire safety codes. While it is technically and physically sufficient to apply Singaporean standards to assure quality of buildings, they still feel some uncertainty where their projects could be unforeseeably put under "halt" by the ad hoc government decisions unless solid building and fire safety codes of Myanmar are in place.

There are three things to do in order to eliminate things that FDIs see as the sources of uncertainty.

- Common and clear understandings based upon urban development plans: urban plans are generically long-term in its vision and goals to achieve how a city is structured. Plans should be revised flexibly to accommodate socioeconomic changes and new needs. But it should not be too often at the level of structural plans that define principles and directions of urbanization.
- Clear and solid rules and regulations (building codes, fire safety codes, land use, incentives, and etc.,): rules and regulations must be clearly written with concrete operational guidelines that do not leave rooms for arbitrary decisions.
- Transparent and consistent application of rules and regulations: rules and regulations must be applied in a transparent and consistent manner. Transparency and consistency make it predictable for investors in estimating time and costs they need to go through process of investments.

(II) Expand Development Bank Financing for Urban Housing: Expand financing capacity for low-cost and affordable housing

Urban housing is one of the most important aspects of urban development. In case of Yangon, at the moment, low-cost and affordable housing is a critical factor of urban development and urban renewal at large. Without accelerated supply of low-cost and affordable housing in Yangon area, those rapidly growing manufacturing and processing industries will soon face shortage of labor. At the same time, potential buyers do not have sufficient savings to buy houses.[13]

Thus, it is recommended to expand financing for low-cost housing by increasing financial capacity of banks that are capable of extending long term housing loans. One option to support this is to do capital injection in a form of "Two-Step Loan" financed by concessional loans by development partners and to establish revolving funds for long-term housing loans at low interest rates. As of December 2016, the CHDB is the only bank that has a development bank license allowing the bank to extend loans longer than one-year repayment period. Recommended actions include the following items,

- Financing for low-cost and affordable housing development projects (supply side).
- Providing housing mortgage loans to the individual buyers (demand side),
- Promote "Housing Savings Account" (generate private savings),
- Establishing revolving funds for long-term and low interest rates – one option to support this is to do capital injection in a form of "Two-Step Loan" financed by concessional loans by development partners.

It is also expected that recently approved "Condominium Law" to be a good starting point to provide a legal basis for condominium owners to have "building unit ownerships" that enables them to take out mortgages on their condominium units. Once a law for "building unit ownerships" is in place, registration (update of ownership documents) and thus, appropriate registration for annual property tax must be part of the conditions to be eligible for housing loans by CHDB (by development banks at large).

(III) Adjust Rates of Existing Taxes and Charges to Their Requirements: Retrieve value-addition of urban development based upon "Beneficiaries Pay Principle"

I) Tax as part of "traffic management"

There are other means where some existing taxes can be used as leading tools to change people's behavior towards policy objectives, such as imposing higher tax rates on "sources" of traffic problems. Raising "Wheel Tax" within Yangon is being considered. Reintroduction of "Parking Tax" can have the same effects.

To ease heavy traffic in Yangon, it is needed to invest in roads. A question is "who should pay for this investment cost". It is fair to assume that car owners are among the top beneficiaries of

[13] In case of southern part of Vietnam, more specifically areas stretching from east of Ho Chi Minh City towards Baria Vhun Tau Province, it was getting increasingly difficult to hire workers for newly built factories by FDIs around 2010. The most prominent reason for this was due to the lack of reasonable housing for workers migrated from rural areas to work in new industrial areas. It made housing conditions too bad and too expensive for many workers to think it was not worth working in these areas while paying very high costs for very poor living conditions. This is exactly what Yangon should not repeat. When factories need workers, workers need decent places to live with payable range of costs.

the roads; likewise they are the ones to bear some extra costs. Reintroduction of "Parking Tax" is another possible option. It is estimated that 20,000 cars stay overnight within CBD of Yangon. They occupy a quite a large space of precious CBD areas. "Parking Tax" could induce cars not to stay within CBD.

II) Adjusting service charges as quality of services improve:

On the other hand, "Water Charges" and "Cleaning Charges" are more of charges for provision of specific public services. Given the present level of charges, they do not fully recover their operational costs and unrealistic to expect them to do so in a short period of time. In case of waste collection, for example, service charges cover around 50% of service costs. Sudden and steep increase of service charges likely to provoke users' resistance. Rather, it is recommended to first improve service levels good enough to raise levels of beneficiaries' "willingness to pay" and then raise charges accordingly.

(IV) Land-value-based Financing: Leverage local assets through Land-value-based taxes

Land-based financing is an underutilized source of funding. Land values typically increase with urbanization that is largely incurred with public investment for urban development. Thus, this "unearned increment" is socially generated. Ways to share this value include value-based annual land taxes, capital gains taxes, developer exactions, and land readjustment. For initial investment for new urban development, developer exactions, such as putting conditions to let developers provide certain amount of lands or investments for public use, are appropriate. However, for financing operation, maintenance in the longer term, stable land value based taxation is indispensable. Given the present conditions in Yangon, there are four options to enhance land-value-based financing.

I) Property Tax

Firstly, the existing annual property tax should be adjusted to be more effective and fair in terms of beneficiaries pay principle. In doing so, "taxable land values" must be linked to changes in current property values. At present, taxable values for "property tax" are set way lower than "roadside values" (in some cases down to 1/5 -1/10) that are used for "stamp duties" levied at the time of property sales. It is recommended that taxable values for annual property tax should be same as the ones for "stamp duties". Instead, the rates of property tax should be lowered to offset large increase in the levels of taxable values in order to avoid drastic increase in the amount to pay. What is important now is to establish links between property tax and current property values rather than raising tax revenues immediately.

II) Urban Development Tax

Secondly, it is recommended to introduce new and additional "Urban Development Tax" for designated high-value zones within CBD and other new urban development areas in accordance with zoning of the city land use plan. It is expected to see more concentrated public investments within CBD and the other new urban centers in order to transform them to a cluster of high-value zones with high density development for urban public transport, commercial activities linked with residential zones. These areas need extra amount of public investment in order to accommodate high-value activities, likewise, additional land-based tax to share extra increment socially. This "Urban Development Tax" should be a "local and objective tax" to be allocated for a special purpose fund such as "Urban Development Fund for Yangon CBD and Urban Centers" that is earmarked specifically for investments within the designated areas where it is levied.

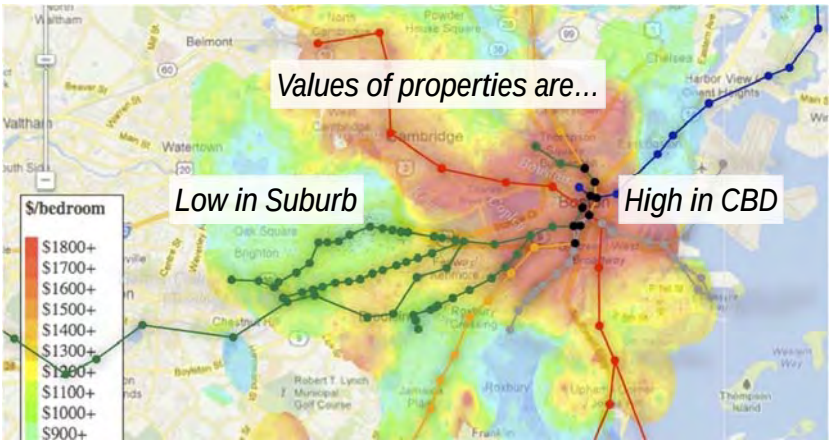
III) Property Trade Tax and Stamp Duty

Thirdly, the rates of Property Trade Tax (Union Tax) and Stamp Duty are too high and should be lowered. For example, low-cost housing unit is worth between MMK 10 million and MMK 12 million in Yangon. In this case, Property Trade Tax and Stamp Duty are levied at 15% and 7% of the property values, respectively. At such high rates, people are likely to be discouraged to either buy houses or pay taxes, likewise, revenues could fall further. In addition, when people do not pay taxes, they are unlikely to update ownership documents, which causing additional problems. It is more important to encourage the people to buy, register houses, and pay annual property taxes for longer period of time than to impose one-time heavy taxes at the time of property trade.

IV) Fiscal Cadaster (Urban Mapping)

Lastly, a transparent and up-to-date fiscal cadaster (urban mapping) is essential in the utilization of land-value-based financing. A fiscal cadaster is a cadaster designed for property tax purposes. That is, it includes those factors required for implementation of a property tax system such as legal description, dimensions, location of boundaries, ownership, description of improvements, and land use. A fiscal cadaster could be integrated with other urban development GIS database that could be a powerful planning tool as well.

Figure 2.6.1 is an example of Boston showing levels of rental costs in different places within urban areas. Major roads, mass transit lines and stations are also shown on the same mapping. Integration of both physical and economic indicators makes the current state and trends of urbanization clearer.



Source: Boston City

Figure 2.6.1: Rental Cost Heat Map in Boston 2013

(3) Planning Process

Table 2.6.3: Record of Meetings and Surveys (Financing Urban Development)

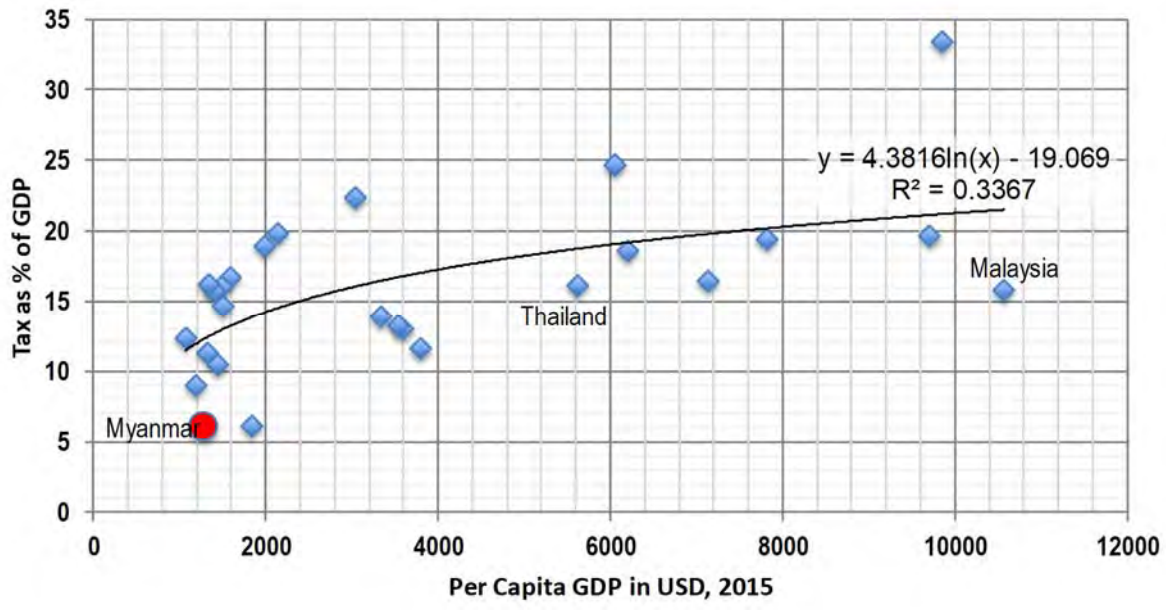
Date	Title	Venue	Agenda
22nd Aug 2016 (Mon)	Meeting with CHDB	CHDB Head Office	• Current status of housing loans. • Current issues in urban housing sector. • Policy direction of CHDB.
23rd Aug 2016 (Tue)	Meeting with Mitsubishi Corporation	Mitsubishi Office	• Problems encountered in on-going "Landmark Project". • Causes of such problems. • Opinions to promote FDIs in urban development.
21st Oct 2016 (Fri)	Meeting with Budget Department	Budget Department, YCDC	• Requested budget data of YCDC. • Definitions of budget items. • Background of capital incomes.
24th Oct 2016 (Mon)	Meeting with Budget Department	Budget Department, YCDC	• Ideas to strengthen the financial base of YCDC. • Prospective areas where financial base can be strengthened and increased. • CBD Development Tax.
27th Oct 2016 (Thu)	Meeting with Assessor Department	Assessor Department, YCDC	• Rates, rules and regulations of Assessor Department. • Differences between tax-bases/rates of Internal Revenue Department and that of Assessor Department. • Attitudes and understandings of local people over taxes and charges. • Opinions to introduce combined GIS database system to collect full coverage of charges and taxes. • Opinions to promote housing loans.
27th Oct 2016 (Thu) Afternoon	Meeting with Water & Sanitation Department	Water and Sanitation Department, YCDC	• Current activities that this department and JICA Technical Cooperation Team are carrying out. • Increasing water charge rates and coverage area.
28th Oct 2016 (Fri)	Meeting with Pollution Control & Cleansing Department	Pollution Control and Cleansing Department, YCDC	• Tax rates of cleansing services. • Responses from people when the cleansing works were planned to perform by private companies with PPP system. • Future plans for collecting and raising cleaning charges. • Garbage collecting system of Japan (Yokohama). • Future plans for handling hospital waste.
31st Oct 2016 (Mon)	Meeting with CHDB	CHDB Head Office	• Concrete procedures needed to introduce two steps loans. • Sovereign Guarantee from MOC. • Property registrations for getting housing loan. • Plans for low cost housings. • Housing Loans for renovation of old buildings.
1st Nov 2016 (Tue)	Meeting with Engineering (Roads and Bridges) Department	Engineering (Roads & Bridges) Department, YCDC	• Tax rates and charges collected from Engineering (Roads and Bridges) Department.
3rd Nov 2016 (Thu)	Meeting with Secretary of YCDC	YCDC Office	• Briefing findings in YCDC budgeting. • Major issue in current tax and charges. • Opinions and prospects to strengthen financial sustainability of YCDC.

4th Nov 2016 (Fri)	Meeting with Engineering (Buildings) Department	Engineering (Buildings) Department	• Financial system of this department. • Problems for shortage of lands. • Prospects when Condominium Law is fully approved. • Numbers and prices of buildings that YCDC constructed.
4th Nov 2016 (Fri)	Meeting with JICA Expert for Housing Policy	Yangon	• Current situations of housing sector. • Prospects when Condominium Law is fully approved. • Issues in housing loans.
4th Nov 2016 (Fri)	Meeting with Engineering (Buildings) Department	Engineering (Buildings) Department	• Financial system of this department. • Problems for shortage of lands. • Prospects when Condominium Law is fully approved. • Numbers and prices of buildings that YCDC constructed.
7th Nov 2016 (Wed) Afternoon	Periodical Meeting with Region Minister	YRG	• Presenting findings and recommendations in strengthen financing capacity for urban development. • Comments on recommendations.
16th Nov 2016 (Fri)	Meeting with Secretary of YCDC	YCDC Office	• Briefing findings and recommendations in strengthening financial base of YCDC. • Comments on recommendations.

Source: JICA Study Team

(4) Supplemental Explanations of the SUDP

1) Tax Revenues in Myanmar



Source: Calculated by JICA Study Team based on World Bank Database.

Figure 2.6.2: Tax Revenues of Mid-income Countries as % of GDP in 2015

According to "IMF 2015 ARTICLE IV CONSULTATION REPORT", Myanmar's tax revenue is 6.7% of GDP that is quite small and depends more on revenues from state owned enterprises that accounts for 9.2% of GDP in 2015. In cases of mid-income countries, total tax revenues as % of GDP are 15-20%. It is important to restructure tax bases to link broader economic activities where the size of economy could be linked with the size of GDP more directly.

In theory, it is income taxes that are directly linked to the size of "Value-additions". While it is very important to enhance taxes linked to incomes, it is also confirmed that costs of taxation are often very high to operate income based tax, especially to keep information basis for individual incomes. That is a largest reason why types of "consumption tax" are important sources in many countries.

It is also discussed in international communities that "property value based taxation" should be utilized more. Especially countries without well-established system for "income-based taxation" yet, including Myanmar, "property-value based tax" is a good option.

2) YRG Budget and Expenditure

The Yangon Region budget for 2014/15 with budget and expenditure data for all the 'Region budget' departments shown in Table 2.6.4, and grouped by Region minister, shows that:

- The total budget for Yangon Region is around 344 billion MMK (or 344 million USD), almost 68 percent of which is generated by YCDC, the amount reflected as revenue (and a modest loan) for YCDC (63.7 percent of total income) and the 10 percent contribution of YCDC-collected income that is handed over as tax to the Region government (being 4.2 percent of total revenue);
- 18.3 percent of the income originates from Union level transfers, in the budget shown partly as income for the Budget Department received from the Union level, and another part as income from the Union for the Region government, being the Constituency Development Fund (MMK 100 million per township, 100,000 USD) and the Poverty Reduction Fund (MMK 1 billion for the Region, 1 million USD).
- All other departments collect at least some income, but the volume of the amounts collected is fairly negligible, with the exception of the amounts collected by MOC in which operates as a state owned enterprise for public works (6 percent of total income).
- In fact, the three main sources of income for the Region (being municipal taxes, Union grants and income for the public works state own company), account for over 92 percent of the total income, while another 4.2 percent is from direct income for the Region government, which could put into question whether the income-generating activities of all these other sources is worthwhile and cost effective, as their contribution is less than 4 percent of total Region government income.

On the expenditure side, the data shows that:

- Over 70 percent of the available resources under the Region budget is spent on municipal services, almost all (69 percent of total expenditure) by YCDC, while the aggregate budget for the 12 townships outside of YCDC is only, 1.1 percent of total budgeted expenditure.
- 49.2 percent of the budgeted expenditure is used for capital investments under YCDC and 20.8 percent of the expenditure budget is for recurrent expenditure under YCDC;
- YCDC, which is using 90 percent of its generated income, is self-sufficient (i.e. revenues cover the costs) while the same applies for the three government owned enterprises (Myanmar salt, Myanmar motion pictures and the public works);

- With the Union grant, the various other departments are able to break even, while the general tax income (17 billion MMK, 17 million USD) is used to top up the capital investment budget of the Region government (from MMK 14 billion to MMK 31 billion - from 14 million USD to 31 million USD).

Overall, the financial data show that the income and expenditure for YCDC totally dominates the Region budget, and that the visibility for other Region ministries, maybe with the sole exception of engineering works under the Ministry of Forestry (12 percent of total expenditure), is fairly limited. By and large the Region budget is the budget of the larger city, which is, in principle, controlled by the Region Hluttaw.

Table 2.6.4: Yangon Regional Government Revenue in FY2014/15 (in million MMK)

No.	Item	Revenue							
		Tax	Revenue gained from regional State-owned enterprises	Other ordinary revenue	Capital	Union grant	Loan	Total	
								in MMK million	as % of total
I. Central organizations				14,939	0	5,500	0	20,439	5.9%
II. Regional Ministries and Departments		0	0	159,316	80,677	57,438	8,713	306,144	88.9%
	Minister of Finance and Revenue	0	0	0	0	57,438	4,503	61,941	18.0%
	Minister of Agriculture & Livestock breeding	0	0	293	0	0	0	293	0.10%
	Minister of Forestry and Energy	0	0	20,673	0	0	0	20,673	6.0%
	- Human Settlement & Housing Development Department			18				18	0
	- Maintenance of Buildings, roads and bridges			3				3	0
	- Public Works (Ministry of construction as enterprise)			20,567				20,567	6.0%
	- Other			85				85	0
	Minister of Development (/urban) Affairs	0	0	137,900	80,677	0	4,210	222,787	64.7%
	- YCDC			134,476	80,677		4,210	219,363	63.7%
	- Development Affairs Organizations			3,424				3,424	1.0%
	Minister of Transport	0	0	15	0	0	0	15	0
	Minister of Rachine affairs	0	0	0	0	0	0	0	0.0
	Minister of Kayin affairs								0
III General taxes (for benefit of regional government)		17,609	66	0	0	0	0	17,675	5.1%
	Tax on alcohol	2,449						2,449	0.70%
	Land tax	15						15	0
	Dam tax	2						2	0
	Forest product tax	111						111	0
	Mineral tax	29						29	0
	Pond tax	472						472	0.10%
	Share of taxes collected by YCDC	14,533						14,533	4.2%
	- Property tax	5,430						5,430	1.6%
	- Wheel tax	9,103						9,103	2.6%
	Revenue Regional state owned enterprises		66					66	0
	TOTAL	17,609	66	174,255	80,677	62,938	8,713	344,258	100%
		5.1%	0.0%	50.6%	23.4%	18.3%	2.5%	100.0%	

Source: As translated and compiled in "The State of Local Governance: Trends in Yangon - UNDP Myanmar 2015"..

Table 2.6.5: Yangon Regional Government Expenditure in FY2014/15 (in million MMK)

No.	Item	Expenditure								% of expenditure covered by income
		Ordinary Expenditure	Interest	Grant	Capital expenditure	Loan repayment	Investment in Organizations	Total		
								in MMK million	as % of total	
I. Central organizations		4,636	0	5,400	32,404	0	0	42,440	12.3%	48.2%
II. Regional Ministries and Departments		114,681	16	15	186,282	172	700	301,865	87.7%	101.4%
	Minister of Finance and Revenue	55	0	0	76	0	0	130	0.0%	47511.9%
	Minister of Agriculture & Livestock breeding	2,632	0	0	42	0	0	2,674	0.8%	11.0%
	Minister of Forestry and Energy	29,978	0	0	14,145	0	0	44,123	12.8%	46.9%
	- Human Settlement & Housing Development Department	1,283			648			1,930	0.6%	0.9%
	- Maintenance of Buildings, roads and bridges	7,237			13,328			20,565	6.0%	0.0%
	- Public Works (Minisrty of construction as enterprise)	20,545			0			20,545	6.0%	100.1%
	- Other	914			169			1,083	0.3%	7.9%
	Minister of Development (/urban) Affairs	71,593	16	0	169,342	172	700	241,822	70.2%	92.1%
	- YCDC	69,412	16		167,665	172	700	237,964	69.1%	92.2%
	- Development Affairs Organizations	2,181			1,678			3,858	1.1%	88.8%
	Minister of Transport	1,304	0	0	3	0	0	1,307	0.4%	1.2%
	Minister of Rachine affairs	42	0	0	1	0	0	43	0.0%	0.0%
	Minister of Kayin affairs									0.0%
	TOTAL	119,317	16	5,415	218,686	172	700	344,305	100.0%	100.0%
		34.7%	0.0%	1.6%	63.5%	0.0%	0.2%	100.0%		

Source: As translated and compiled in "The State of Local Governance: Trends in Yangon - UNDP Myanmar 2015"..

3) Elements of Property Tax Reform

The tax on immovable property is salient and hard to avoid. The virtues of the property tax owe to its relatively low efficiency costs, benign impact on growth, and high score on fairness. It is generally considered to be underutilized in most countries. While there is renewed and widespread interest in property tax reform globally, there are many policy and administrative issues that must be carefully considered as prerequisites for successful property tax reform. Fortunately, property tax has long been in Myanmar already.

According to IMF Working Paper, common elements of a reform strategy would ideally involve the following:

- An in-depth diagnostic analysis that carefully maps present capabilities and identifies policy and administrative weaknesses, combined with policy decisions on the future role of property taxes, particularly as part of a broader decentralization strategy.
- Development of specific tax policy design, with particular focus on the definition of the base, the rate structure, and exemption policy; the key objective should be simplicity with

a minimum of exemptions and other reliefs, for ease of administration and maximum fairness. Also, regular costing of reliefs in terms of revenue forgone is essential.

- Detailed planning of administrative reform, carefully adjusted to individual country circumstances, involving in particular: (1) improved coverage of cadaster or tax register; (2) better valuation, including procedures for regular updating; (3) improved record keeping based on close coordination between agencies involved; (4) improved collection rates though strong enforcement and low compliance costs; and (5) clear decisions on the allocation of responsibilities between the central and local governments with regard to how these core administrative tasks are carried out.

- Property transfer taxes should be reduced or phased-out, and possibly replaced by either the recurrent property tax under reform, or (where administratively feasible) a capital gains tax on property.

- Monitoring device based on quantitative performance indicators: to prevent property tax systems from falling back into disrepair, development of a monitoring device based on quantitative performance indicators is essential. These would ideally include regular assessments of coverage of the tax register, valuation performance, and collection efficiency.

In summary, efficiency and equity considerations combine in providing a strong case for exploring ways to further strengthen the role of property taxes, and in particular recurrent taxes on immovable property. While careful planning of necessary improvements to the basic administrative infrastructure is clearly required to carry out successful reforms in this area, there is a clear scope for assigning a more prominent role to immovable property taxes in the medium to longer term. While data deficiencies preclude accurate estimates of their potential role, it would not seem unrealistic to target a revenue raising potential of about 0.5–1 percent of GDP over the next 5–10 years for many developing countries, but with a much larger potential of about 2 percent of GDP or even higher for many developed countries that today rely only modestly on taxation of immovable property.

4) Comparison of Different Approaches of Property Tax

Depending on their adopted policy objectives, countries differ substantially with regard to their use of the different property tax sources. There are three types of approaches how a country use sources.

a) Some countries place emphasis on providing a stable and substantial source of revenue for sub-national governments through immovable property taxes,
b) Some countries prioritize general revenue raising (by using mainly capital transfer taxes),
c) Some countries enhancing the progressivity and fairness of the overall tax system (by relying on taxes on net wealth or inheritance and gifts)..

Given the current high rates and bases of capital transfer taxes and very low tax bases for annual property taxes, Myanmar is a country using sources more in ways of type (b). In order to make revenue base for YCDC more stable and sustainable, it is recommended to put more emphasis on sources of type (a). It is fortunate that Myanmar does already have a property tax of type (a), so that things to do is to revise its tax base to make it closer to the current property values.

According to available data sources, property taxes are far from being a mainstay of the revenue system in developed, developing, and transition countries. In cases of mid-income countries, total tax revenues as % of GDP are 15-20%. Myanmar's tax revenue is 6.7% of GDP that is quite small and depends more on revenues from state owned enterprises that accounts for 9.2% of GDP in 2015.

The average revenue raising from property taxes is modest in all three main country groupings, but seemingly with a slightly upward trend since the 1970s. The data also suggest that reliance on property taxation (similar to most other taxes) is strongly related to economic development, with the average revenue ratio to GDP in OECD countries being triple that of developing countries.

Table 2.6.6: Level of and Trends in Property Tax Revenues as % of GDP

	1970s	1980s	1990s	2000s
OECD Countries	1.24	1.31	1.44	2.12
Developing Countries	0.42	0.36	0.42	0.60
Transition Countries	0.34	0.59	0.54	0.68
All countries	0.77	0.73	0.75	1.04

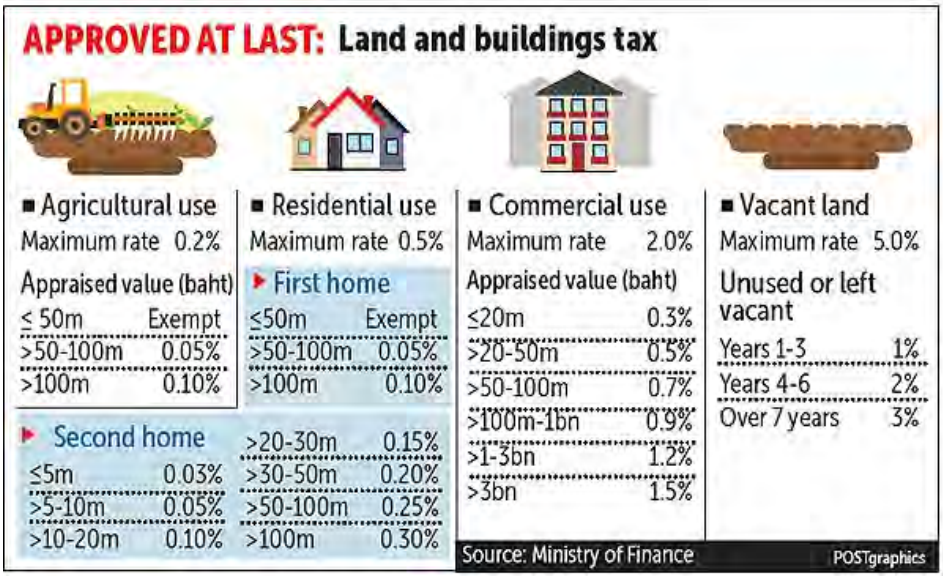
Source: John Norregaard, "Taxing Immovable Property: Revenue Potential and Implementation Challenges, May 2013", IMF Working Paper.

Thailand approved long-awaited land and buildings tax in Jun 2016 and it is expected to generate more than 64 billion baht for government coffers when it takes effect in 2017. In comparison with the current property tax of YCDC, newly introduce property tax in Thailand has some distinctive features that may also be considered by YCDC (or Union and Region levels at large) when it comes to the time to reform their property based tax system.

- Nominal tax rates are lower but tax bases are linked to the current property prices.
- There are built in "progressive" nature that excludes small houses for owners' own residential use are virtually tax exempted while the owner of multiple properties are taxed with higher rates. There are 8,556 residential units that have an appraisal price of more than 50 million baht, mostly in Bangkok and other big cities. That means about 99.96% of residences nationwide are free from the tax liability.
- Given its progressive nature, it is expected that new tax would prompt some landlords who own many plots (often left unused), particularly in prime locations where land values are high, to develop the plots or sell them to avoid paying the high tax rate.

Table 2.6.7: Comparison of Property Tax in Myanmar and Thailand

Country	Descriptions
Myanmar YCDC	1. Total annual value = annual value of the land + annual value of the building + annual value of the machine. (a) Annual value of the land = value of the land x 3% (b) Annual value of the building = value of the building x 6% (c) Annual value of the machine = value of the machine x 6% (f) Total annual value = (a)+(b)+(c) 2. Total property tax = total annual value x 13% (g) General tax (8%) = total annual value x 8% (h) Lighting tax (5%) = total annual value x 5% (i) Total property tax (13%) = (a) General tax (8%) + (b) Lighting Tax (5%) Note: While the municipal act of 1922 mentions "Water Tax" and "Waste and Sewage Tax" as part of property tax, these are not applied at present because "water charges" and "cleanliness charges" are levied by respective service departments. 3. Summary of property tax rates on: "Land" = value of the land x **0.39%** = value of the land x 3% x 13% "Building" = value of the building x **0.78%** = value of the land x 6% x 13% "Machine" = value of the machine x **0.78%** = value of the land x 6% x 13% 4. Annual values of land are set **far lower levels than the current values**.

	For example, there are cases where applied "annual values = taxable value bases" are, "Commercial use: 3,500 MMK/sqft" as oppose to the "current annual value: 26,000 MMK/sqft" thus tax is **"0.05% of the current values" of land**, "Industrial Zone: 1,000 MMK/sqft" as oppose to the "current annual value: 30,000 MMK/sqft" thus tax is **"0.01% of the current values" of land**. 5. Stamp Duty for immovable property sales are quite high. 5%(base rate) + 2% (YCDC) = 7% on sales value.
Thailand	New law approved on June 7, 2016, and be effective in 2017. For "first home" with value less than 50 million THB are tax exempt. For "second home" 30- 50 million THB, a tax rate shall be 0.20%. Tax rates are progressive in accordance with property values and their usage. Unused and vacant land is taxed with higher rates. These arrangements have an effect to induce land use changes in accordance with properties' values and locations, especially in urban centers where more intensive land use is desirable. On the other hand, lower or rates (or tax exemptio) are applied for smaller houses and agricultural land.  Source: Bangkok Post
Japan (Benchmarking)	Property Tax on Land: Value of land x 1/6 x 1.4% (residential use < 200sqm), Property Tax on Building: Value of building x 1/2 x 1.4% (newly build < 120sqm) Registration Tax: Value of property x 2% (for residential use 0.3%)

Source: YCDC Assessors Department, Bangkok Post 08 Jun 2016

5) Detail of the Current YCDC Property Tax

Table 2.6.8: Actual Normal Income of Assessor Department (Million MMK)

No	Account Title	FY-2013-2014	FY-2014-2015	FY-2015-2016
1	Private owned property tax			
	(1) Classified by Townships	231	226	247
	(2) Commercial Purpose Shops + BCC submitted buildings	605	660	894
	(3) Hotel, Motel and Inns	3,190	128	197
	(4) House Rental	1,021	156	160
	(5) Industrial/Economic Zones	155	146	190
2	Property Tax from Myanmar Port Authority		1,487	548
3	Property Tax from other Governmental Departments	311	360	404
4	Property Tax from Buildings levied by Foreign Currency	942	5,353	10,199
	Total	6,454	8,515	12,840

Source: YCDC Assessors Department, Bangkok Post 08 Jun 2016

According to Assessors Department, there are two reasons for steep changes in the amount of income between 2013-2014 FY and 2014-2015 FY.

In 2013-2014 FY, foreign currency amount levied from hotels, motels, inns and house rental was exchanged into Myanmar currency and add it under its account title. Starting from 2015-2016 FY, this account was separated from the total account and put it under the title of "Property Tax from buildings levied by foreign currency".

Another reason is that the currency rate was fixed as 1 USD= 1000 MMK before 2013, August. After that, the currency exchange rate becomes the current price of the Central Bank. This is another reason why YCDC could get more income for this account comparing with 2013-2014 FY.

For "Property Tax from Myanmar Port Authority (MPA)", YCDC announced a notification dated in 2013 that MPA must pay 5% of their total tax income from the area inside YCDC boundary. In 2013-2014 FY, MPA refused to pay that tax and they had to pay for 2 years amount in 2014-2015 FY. That is why the amount of MPA tax in 2014-2015 FY is more than 2015-2016 FY.

6) Tax Rates and Procedures for Property Tax by Assessor Department (description as provided by Assessor Department)

Specifications for levy on property tax

1. Assessor department conduct the levy on property tax upon lands and buildings in 32 townships inside YCDC's boundary with following account titles.

Account Titles

a) Property tax on private property
b) Myanmar Port Authority Property Tax
c) Governmental Departments' Property Tax
d) Property tax levied by Foreign Currency

Directives, Ordinances and Procedures

2. According to the notification (70/98) dated 29-7-1998, Committee released the order to levy the property tax on lands and buildings which are rent with earnest money (guarantee deposit) by the following instructions.

a) To define as total rental fee for one year in which 15% of earnest money is added to annual rental fee.
b) To define as annual rental fee with the inspection of Rental Comparison Method comparing with rental prices of surrounding buildings (or) lands upon the total rental fee for one year.
c) To calculate the annual value by deducting the concessions on derived annual rental fees.

3. According to the clause (d) and (e) from the decision of Coordination Meeting of Assessor Department which was held on 8-12-1998, in order to calculate the property tax by reference no (1902/7185/Si Pin-Ya Pa) and notification (96/98) dated 24-12-1998, the areas which should be defined as minimum areas for lands and buildings are described as follow.

a) In order to levy the property tax, the area of the land must be calculated at least 1200 square feet. If the land is wider than that, property tax must be levied in accordance with wider area.
b) In order to levy the property tax, the area of the building must be calculated at least 625 square feet. If the building is wider than that, property tax must be levied in accordance with wider area.

4. According to the clause 6(b) (1.2.3) from the decision of the Meeting of YCDC which was held on 17-8-2015, starting from 1-8-2015, in order to calculate the property tax of Governmental Organizations and Private buildings and new buildings for commercial uses by reference no (1902/2203/Si Pin-Ya Pa) and notification (1/2015) dated 27-8-2015, property tax must be levied 3% of one square feet of the land and 6% of one square feet of the building based on township classifications into 23 first class townships and 9 second class townships.

a) First Class Townships – Pazundaung, Botahtaung, Kyauktada, Pabedan, Latha, Lanmadaw, Dagon, Mingalar Taungnyut, Sanchaung, Kamaryut, Tarmwe, Bahan, Yankin, Mayangone, Hlaing, Ahlone, Kyee Myin Daing, South Oakkalarpa, North Oakkalarpa, Thingangyun, Tharketa, Insein and Dawbon townships.
b) Second Class Townships – Shwe Pyi Thar, Hlaing Tharyar, Mingalardon, Dagon Myothit (South), Dagon Myothit (North), Dagon Myothit (East), Dagon Myothit (Seikkan), Dala and Seikgyikhanaungto townships.
c) 1 Square Feet Rates of Lands (MMK)

Township Classification	Main Road	Internal Road/ Street
First Class Townships	1000	800
Second Class Townships	600	400

d) 1 Square Feet Rates of Buildings (MMK)

Township Classification	RC/Steel Structure	Brick/ Brick Nog	Wood/Zinc
First Class Townships	700	600	400
Second Class Townships	600	400	200

5. According to the reference no (1902/2203/Si Pin-Ya Pa) and notification (1/2015) dated 27-8-2015, concerning with high rise buildings,

a) Property Tax must be levied by deduction of the 20% of adjacent lower floor apartment's value up to 5th floor and levied with the value of 5th floor apartment for all apartments upper than 5th floor.
b) For the penthouses, property tax is termed as the 50% of assessed value for that apartment.
c) If the floor area of the upper apartment is not the same with that of lower apartment, 20% of assessed value should be reduced.

d) If there are rooms in the apartment, assessed value of that apartment should be calculated proportionately according to the dimensions of those rooms.
e) Before levying by rooms, rental charge of the land must be calculated as 2000 MMK for first class townships and 1000 MMK for second class townships on (625) square feet area for high rise buildings.
f) For levying the buildings in which escalators are installed, the value of the building is calculated by adding all floors from this apartment into the ground floor.¥

6. According to the decision clause (19), notification (20/2011) from the meeting of Yangon Regional Government which was held on 18-8-2011, general tax and lighting tax which are included in the property tax are levied as 8% and 5% respectively and total 13%.

Property Tax on Private Property

7. Residential Buildings : In accordance with the changing of time, property tax is levied as following rates according to the department notification (1/2015) starting from the 1-8-2015 for residential buildings.

$$\text{Monthly Assessed Value} = \left[\frac{Land\ Area \times 1\ sqft\ rate \times 3\%}{12} + \frac{Building\ Area \times 1\ sqft\ rate \times 6\%}{12}\right] \times 13\%$$

8. Buildings or apartments in which private businesses are running : Although the calculation of property tax for buildings or apartments in which private businesses are running is according to clause (3) which is mentioned above, it is calculated with highest rates, 1000 MMK for 1 square feet of the land and 700 MMK for 1 square feet of the building without considering the classification of townships and types of streets.

9. Rental buildings or apartments : According to the notification (89/96) from the Assessor Department, if the lands (or) buildings (or) apartments are rent with local or foreign currency, taxation is made on the rest as property tax after subtracting the following concession upon the one month rental charges which is mentioned in the contract submitted by the owner.

a) Concession on 10% of income tax
b) Concession on 25% of maintenance expense on net remain charges
c) Concession on 25% of general expense on net remain charges
d) Specify the last remain charges as Monthly Assessed Value
e) Annual Assessed Value = Monthly Assessed Value × 13% (General Tax 8% + Lighting Tax 5%) × 12 Months

10. For the buildings inside Bayint Naung Economic Zone: According to the decision (D) of the meeting with Committee members and Department Heads which was held on 5-2-1999 and notification (41/99), monthly assessed value is calculated with 3% of the value of the land and 6% of the value of the buildings inside Bayint Naung Economic Zone.

Charges are described as follow.

a) 1 square feet rate of the land 800 (MMK)
b) 1 square feet rate of the building 700 (MMK)
c) 1 square feet rate of the brick noggin 600 (MMK)
d) General tax 8%, lighting tax 5% and so total 13% is levied on the calculated monthly assessed value one in 6 months starting from 1-10-2014.

11. Hotel, Motel and Inn: Property tax is levied with foreign currency for hotels in which foreigners are fully invested and with Myanmar currency for hotels, motels and inns owned by Myanmar native people. According to the decision of the Myanmar Investment Commission (18/2011) which was held on 29-9-2011 and notification (54/11) of the Assessor Department

dated 30-9-2011, taxation is made 6% on the rest as property tax upon total monthly rental fees after subtracting the following concessions.

a) 10% income tax
b) 10% trade business tax
c) 10% service charge
d) Rental fee paid to the owner of land or building
e) 4% bank service (Foreigner owned)
f) After subtracting the concessions, taxation is made 6% on the rest as property tax and this tax is recorded as general tax 8% and lighting tax 5%.

12. Detached Housing : According to the notification (89/96) from the Assessor Department, if the lands (or) buildings (or) apartments are rent with local or foreign currency, taxation is made on the rest as property tax after subtracting the following concession upon the one month rental charges which is mentioned in the contract submitted by the owner.

a) Concession on 10% of income tax
b) Concession on 25% of maintenance expense on net remain charges
c) Concession on 25% of general expense on net remain charges
d) Specify the last remain charges as Monthly Assessed Value
e) Annual Assessed Value = Monthly Assessed Value × 13% (General Tax 8% + Lighting Tax 5%) × 12 Months

13. Levy the Property Tax on Apartment, Tower and Residence:

(A) For the apartments, towers and residences in which foreigners are fully invested, total 13% property tax (general tax 8% and lighting tax 5%) is levied on the rest after subtracting the following concession upon the rental fee of the rooms from which the rental fee of the land to respective owners is deducted.

a) Concession on 10% of income tax
b) Concession on 25% of maintenance expense on net remain charges
c) Concession on 25% of general expense on net remain charges
d) Concession on 20% of service expense on net remain charges
e) Taxation is made on the rest as property tax which is levied as 13% Tax (General Tax 8% + Lighting Tax 5%)

(B) According to the notification (103/2016) of Assessor Department, if someone hire land (or) land and building from original owner and lease again with Myanmar (or) foreign currency, taxation is made as following upon the one who lease those properties.

a) Rental charges for the levy period = Myanmar (or) Foreign Currency
b) Concessions
    i. Rental Charges for the original owner during the levy period
    ii. 10% of income tax on net remain charges
    iii. 25% of maintenance expense on net remain charges
    iv. 25% of general expense on net remain charges
c) Net remain charge = Net Value
d) Monthly assessed value = MRV
e) Property Tax = MRV × 13% (General Tax 8% + Lighting Tax 5%)

14. Industry, Workshop and Industrial Zones (Industry/ Economy): In levying the property tax of industries and workshops, taxation is made total 13% (general tax 8% and lighting tax 5%) on the total annual value termed by adding the annual values of land, building and machines. If streetlights are made self-help inside industrial zones, those are not included in taxation.

a) Annual value of land = 3% of land price
b) Annual value of building = 6% of building price
c) Annual value of machine = 6% of machine price
d) Total Annual Value = A + B + C
e) Property Tax = Total Annual Value × 13% (General Tax 8% + Lighting Tax 5%)

Myanmar Port Authority Property Tax (1-01-02)
According to the YCDC law section 31, sub section (E) dated 2013, taxation is made as Myanmar Port Authority Property Tax which is equal to the 5 % of total general income tax that MPA got inside YCDC's boundary.

Governmental Departments' Property Tax (1-01-03)
According to the YCDC law section 31, sub section (F) dated 2013, in accordance with the taxation on lands and buildings owned by governmental departments, property tax is levied by coordination with responsible persons from respective departments.

Property Tax levied with Foreign Currency (1-01-04)
According to the decision (A/54) 1/2 of the meeting with Committee Members, which was held on 14-8-2013 and the reference no 1997/3535/Si Pin – Ya Pa and notification (121/2013) dated 22-8-2013 of Assessor Department, starting from 1-8-2013, property tax for lands, buildings, industries, workshops, hotels, motels, inns and detached housings in which foreigners are fully invested, was levied in Myanmar currency with updated exchange rate of City Bank at the time when the tax payer pay property tax.

7) CHDB "Housing Saving Account" Program (as introduced by Myanmar Times Web version on 5th October 2016)

The state-owned lender started the program in August 2016, which aims to reward dedicated savers with priority when allocating low-cost housing. Customers who manage to accrue a balance of K3 million for a down payment will be first in line when new apartments are sold, and are able to apply for a CHDB loan to cover the monthly payments.

Some 3350 savers have opened accounts since the program started, and around 30 have the K3 million balance that can be used as a down payment, said U Zaw Win, managing director of CHDB.

MOC, which set up CHDB, is planning to sell more than 1000 low-cost apartments, and CHDB is drawing up a list of customers who will be offered the units, U Zaw Win said.

CHDB started the Housing Saving Account program after earlier initiatives were unsuccessful. The bank attempted to lend to low-earners in a joint pilot project with the construction ministry aiming to help people buy K10 million apartments in the Shwe Lin Pan low-cost housing project. But it found that many borrowers struggled to pay back the loans.

"Some people had the K3 million down payment but couldn't make the monthly K120,000 payments," he said. "Others couldn't make the down payment. Although many people wanted to buy the apartments, in reality they didn't have the money. So we've opened the saving account [to encourage people to save up]."

CHDB will offer loans at 12 percent to people with a K3 million deposit, but who need to borrow to make the monthly payments. The bank is also still seeking low interest loans from foreign banks or international financial institutions that it could use to lower the rates on its own lending.

"But that has been difficult to get because foreign lenders are still considering and observing the condition of the country," he said. "Also CHDB bank was only established two years ago."

New CHDB customer Ma Hnin Nu said that she likes the program. In the past savers still had little chance of buying a house, but now she hopes that one day, when her balance hits K3 million, she can buy her own apartment.

"I save a little money in each month to buy an apartment – it's better than not saving anything," she said.

2.7 Capacity Development

2.7.1 Current Status

(1) Urban Planning as a New Concept

Myanmar has entered a new era of urban planning since 2011. The political and economic liberalization has enhanced a strong market-oriented economy, attracting significant volumes of foreign direct investments, imported goods and services, notably imported cars, and rapid urbanization, especially in Yangon, the largest commercial city in Myanmar. Yangon has the highest population density in the country, and expects to face greater pressures through rapid urbanization with high economic growth. In this context, urban planning is one of the most urgent concerns in Yangon to ensure sustainable urban development as the commercial capital. Urban planning can be described as a technical and political process concerned with the welfare of people, control of land use, design of the urban networks and lifelines and protection of the environments.

However, the concept of urban planning is still new in Myanmar. The laws, policies and executives' capacities are still in transition. MOC is currently preparing for the national legal and policy frameworks in urban development to meet such emerging demands for sustainable development in the country. They include the Condominium Act approved in the early 2016, the draft Urban and Regional Development Planning Bill, which contains planning permission and zoning regulation, the draft National Building Code Bill, the draft National Housing Development Bill, which includes urban redevelopment in housing sector, and the draft National Construction Industry Development Board Bill. In advance to such the forthcoming frameworks at national level, YCDC introduced the Notification No. 9/1999 (Buildings and Structure) and No. 3/2001 (Urban Planning and Land Use) to deal with the emerging needs in the earlier era, and further has drafted the Zoning Regulation in Yangon, recently.

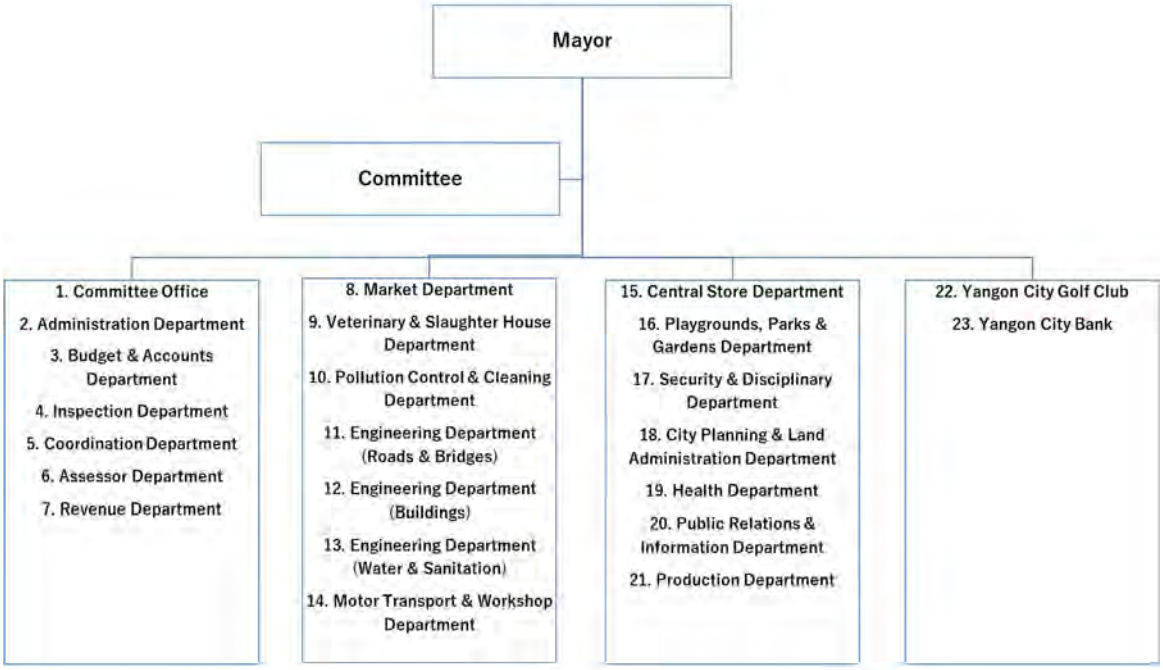
While Myanmar has demonstrated significant progress in preparation for the legal and policy frameworks in urban development for the past few years, there have remained some concerns on the executives' capacities for its implementation and enforcement. This section explores the current situations of organizational capacities and human resources in urban development of Yangon.

(2) Stakeholders/Actors in Urban Development in Yangon

1) YCDC

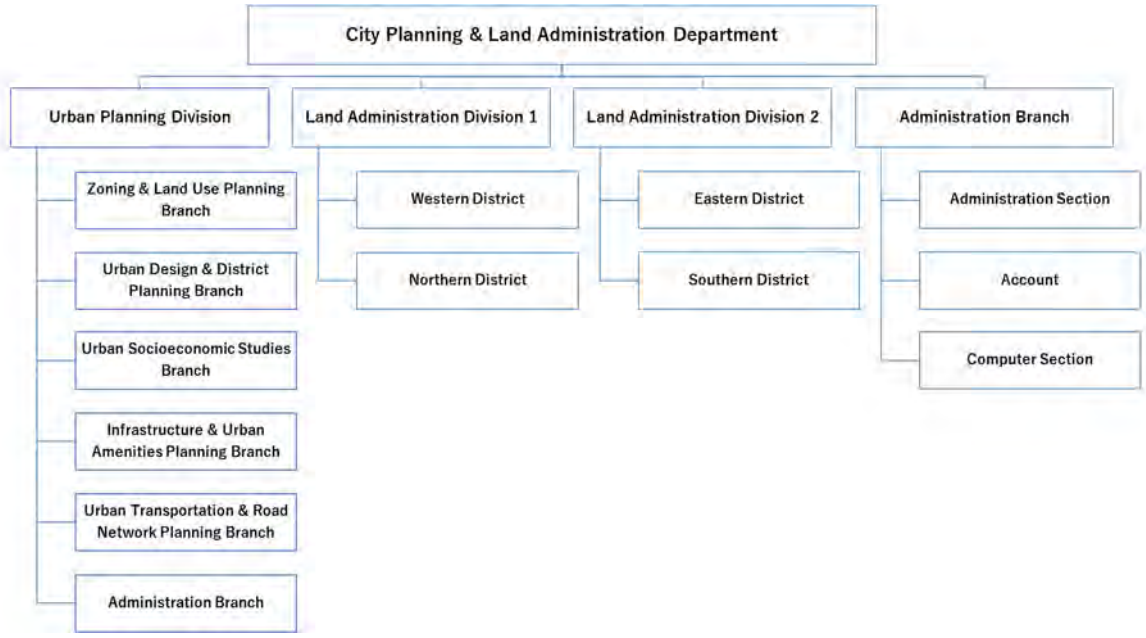
YCDC is a municipal authority in Yangon which plays a central role in urban planning, development and management through interacting with a variety of stakeholders/actors in public and non-public sector. It was established in 1990. YCDC is responsible for service deliveries in Yangon City, which covers 33 out of 45 Townships of Yangon Region. YCDC has been constituted by the City of Yangon Development Act 1990 issued by the State Law and Order Restoration Council and the Yangon City Municipal Law 2013 approved by the Yangon Region Hluttaw or Parliament. YCDC is also responsible for duties stipulated in the Rangoon Municipal Act 1922. The Budget of YCDC in FY2014/15 was around MMK 238 billion and accounted for

almost 70 percent of YRG Budget[14]. YCDC notably generated over 90 percent of the total revenue by themselves.



Source: JICA Study Team Modified from YCDC Home Page. Sept. 2016. [http://www.ycdc.gov.mm/]

Figure 2.7.1: Organization Structure of YCDC



Source: JICA Study Team Modified from YCDC document

Figure 2.7.2: Organization Structure of Urban Planning Division under City Planning & Land Administration Department, YCDC

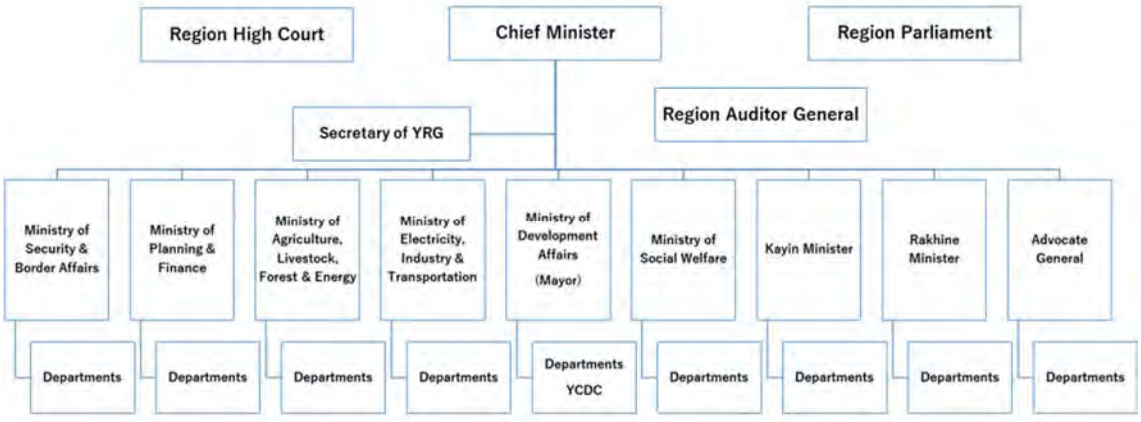
[14] UNDP. (2015). 'The State of Local Governance: Trends in Yangon'. Yangon: UNDP Myanmar.

The Mayor is a head of YCDC and also acts as the Minister of Development Affairs of YRG. The member of the Committee includes the Mayor, the Secretary, the Joint Secretary, and two committee members. YCDC is supervised by the Ministry of Development Affairs of YRG. YCDC consists of the Committee Office, twenty departments, the Yangon City Golf Club and the Yangon City Bank (See Figure 2.7.1). They provide public services in 33 Townships of Yangon Region, including regulatory services and service deliveries in roads, bridges, drainages, water supply, sanitation, sewage, buildings, markets, waste management, park and street management, land administration etc.

In 2012, the Urban Planning Unit was newly established at YCDC to deal with emerging urban development issues through enhancing comprehensive planning approach. Later, the Unit was transformed to the Urban Planning Division under the Land Administration Department, that is now called as the City Planning and Land Administration Department. The Urban Planning Division consists of 6 branches: including Zoning & Land Use Planning Branch; Urban Design & District Planning Branch; Urban Socioeconomic Studies Branch; Infrastructure & Urban Amenities Planning Branch; Urban Transportation & Road Network Planning Branch; and Administration Branch (See Figure 2.7.2).

2) YRG

YRG was established in 2011 as one of 14 Regions and States in Myanmar. There are the Region Hluttaw (Parliament), the Region Cabinet, the Region High Court and the Region Auditor General in Yangon Region. The Region Cabinet consists of the Region Chief Minister and 9 Region Ministers, including the Region Minister of Development Affairs who is also the Yangon Mayor. YRG provides public services through its regional ministries, such as security and border affairs, planning and finance, agriculture, livestock, forestry and energy, electricity, industry and transportation, development affairs, social affairs, Rakhine, Kayin and advocate general (See Figure 2.7.3).

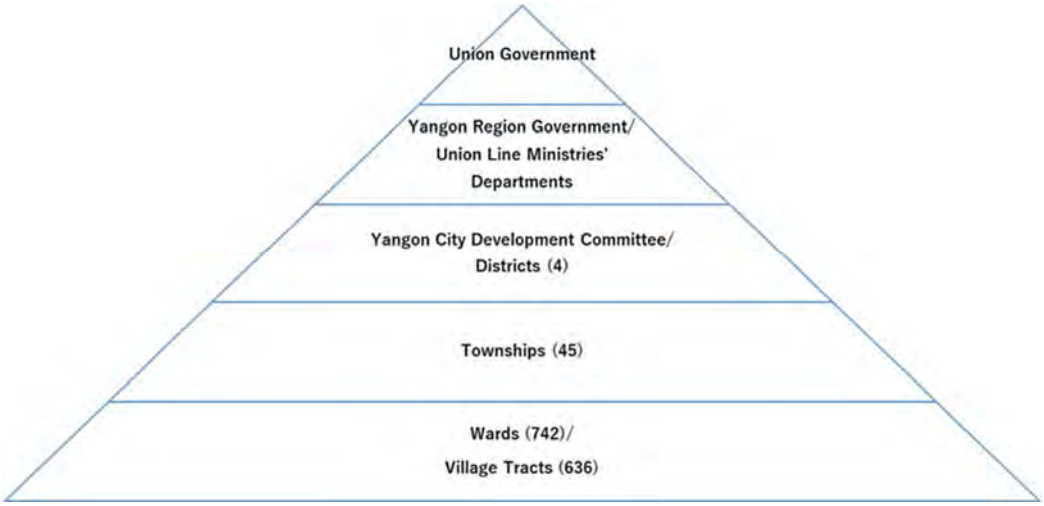


Source: JICA Study Team modified from YCDC document and UNDP. (2015). 'The State of Local Governance: Trends in Yangon'. Yangon: UNDP Myanmar.

Figure 2.7.3: Governance Structure of YRG

The Yangon Region has four layer administrative structures under the Union Government: the Region Government, 4 Districts, 45 Townships and 742 Wards/636 Village Tracts (See Figure 2.7.4). The General Administration Department (GAD) under the Ministry of Home Affairs

(MOHA) is central to the local administrative system from Union to Ward/Village Tract level[15]. The GAD covers tax collection, land management, assorted registration and certification processes.



Source: JICA Study Team

Figure 2.7.4: Governance Structure of Yangon Region

Besides this GAD's administrative line from Union to ward/village tract level, there are other parallel administrative channels in Yangon Region. One is the Union line ministries' departments/agencies in Yangon Region that are responsible for service deliveries in education, health, electrical power, industry etc., which are budgeted and administrated by Union line ministries[16]. In urban development sector, MOC has Yangon branches, consisting of the Department of Urban and Housing Development (DUHD), the Department of Building Administration, the Department of Highways and the Department of Bridges. There are also the Urban Research and Development Institute (URDI) and the Construction and Housing Development Bank (CHDB) in Yangon to facilitate urban development from research and banking perspectives. In addition, there are some public entities and authorities for service deliveries in Yangon Region, like the Yangon Electricity Supply Corporation (YESC), the Myanmar Post and Telecommunications (MPT), the YRTA, the Myanmar Port Authority (MPA), the Myanmar Railways (MR), the Inland Water Transport (IWT) etc.

YCDC is the other administrative channel which provides municipal services, such as water and sanitation, waste management, roads and bridges, buildings, parks, markets and land management. YCDC also dispatches their staff to 33 Townships of Yangon Region to provide advisory and technical support to Townships to enhance effective service deliveries in their responsible areas. In this context, YCDC has some degrees of influence on Townships where the GAD has generally dominated over the country.

3) MOC

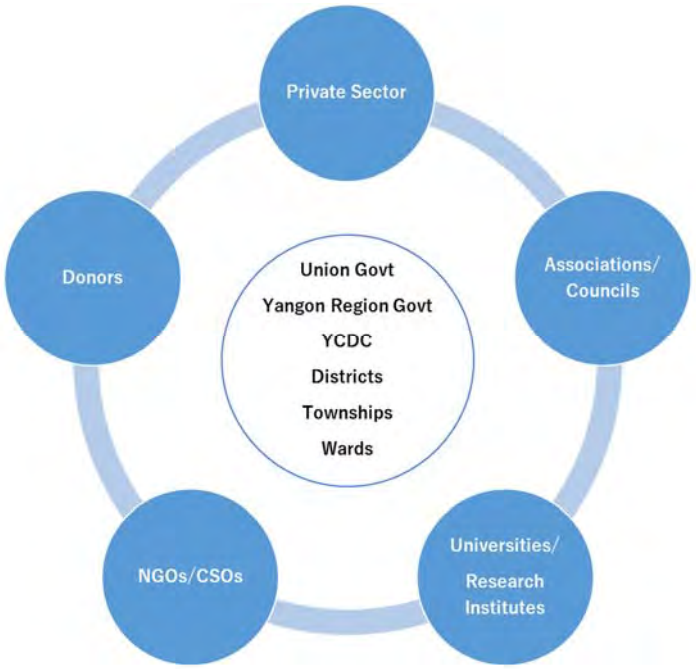
MOC is responsible for undertaking the legal, policy, and planning framework in urban planning, development, and management at the national level. The Department of Urban and Housing Development (DUHD) under the MOC plays a central role in this area, and has 14

[15] Chit Saw and Arnold. (2014). 'Administering the State in Myanmar: An Overview of the General Administration Department'. Yangon: MDRI-CESD & Asia Foundation.
[16] It should be noted that some information may be already old or no longer relevant as a result of the on-going Ministry Reforms.

region and state branches, including Yangon branch, and 19 district level planners in the country to support local governments for implementing urban and regional policies and plans. There are other relevant departments in urban development, such as the Department of Building Administration, the Department of Highways and the Department of Bridges, which have also region and state branches in the country.

4) Non-State Actors

Government largely depends on non-state actors that are functionally interdependent on each other. In fact, there are a variety of concerned stakeholders/actors in urban development who have strong influences to the implementation of urban development plan. They include the private sector (real estate developers, construction companies, commercial banks, transport companies etc., associations (Myanmar Engineering Council, Myanmar Engineering Society, Myanmar Architects Council, Association of Myanmar Architects etc.), universities (Yangon Technological University, Yangon University etc.), Non-Governmental Organizations/Civil Society Organizations (Committee for Quality Control and High Rise Building Construction Projects, YHT etc.) and donors (UN Habitat, ADB, EU, Japan, South Korea, France etc.) (See Figure 2.7.5). Obviously, the private sector is the major player in urban development through financial investments, constructions, operations and maintenances in buildings and transport and lifeline infrastructures. Associations and universities produce the pool of human resources in civil engineering, architecture and other areas, and provide information, knowledge, skills, technology, and research and survey. NGOs/CSOs and donors provide advocacy, technical and financial support to government and other stakeholders for sustainable urban development.



Source: JICA Study Team

Figure 2.7.5: Major Stakeholders/Actors in Urban Planning in Yangon

(3) Capacity Development for Organizations and Human Resources

Capacity development can be described as capacity for handling issues, such as one identifies issues, sets goals, and achieves these. Capacity consists of a variety of elements for handling issues, such as

an individual's knowledge and techniques and organizational capabilities of the affiliated institutions, as well as related policy institutions and social systems[17]. While human resources were mainly focused in the SUDP 2013, this study emphasizes the importance of organizational capacity for the implementation of the SUDP 2016, treating human resources as one of the key elements of the organizational capacity.

There are three main questions to analyze the current situations related to capacity development around the SUDP:

- What is the progress of the implementation of the SUDP 2013?
- What are the main factors that has affected the performance of the implementation of the SUDP 2013? and
- What are lessons learnt, key elements and areas for capacity development at YCDC to facilitate the effective implementation of SUDP 2016 towards the attainment of the goals of the Yangon Future Vision 2040?

In order to find answers for the above questions, capacity assessment was conducted through key informant interviews, a questionnaire survey, focus group discussions and direct observation with the main stakeholders in urban development in Yangon during the period of August to December, 2016.

1) Progress of Implementation of SUDP 2013

The Strategic Urban Development Plan of Greater Yangon (SUDP) 2013 was made by YCDC with support from JICA during the period of 2012 to 2013. The SUDP was officially approved by the Yangon Region Cabinet in 2013. To identify what is the progress of the implementation of the SUDP since 2013 can be an entry point to analyze the current situation from a perspective of capacity development in organizations and human resources. It is important to ensure what does work and doesn't work for the last three years and draw lessons learnt for the implementation of the forthcoming SUDP 2016.

The concept of urban planning was introduced in Myanmar in 2011, and its legal and policy frameworks and executive capacities are currently in the period of transition. The SUDP may be the first comprehensive urban plan in Yangon for recent years to meet emerging demands for urban development associated with political and economic liberalization. In fact, the SUDP enhanced Myanmar to open a new era of urban planning through providing vision, strategy and plan for Yangon urban development in the long term. The SUDP also caused the establishment of a new unit, the previous Urban Planning Unit, now the so-called Urban Planning Division at YCDC to ensure a role and responsibility for urban planning through such an institutional change. In this regard, the SUDP has played a significant role to forward urban development at planning and institutional level in Yangon.

While offering a blue picture of urban development in the long term, the SUDP also suggested 77 projects proposed in 13 sectors related to urban and infrastructure development in Yangon. It includes urban development and management (11projects), social services (3 projects), urban landscape and heritage (5 projects), parks and greenery (2 projects), capacity development (5 projects), urban transport (21 projects), road networks (5 projects), railways (5 projects), port and logistics (6 projects), water supply (6 projects), sewerage and drainage (2 projects), solid waste management (5 projects), and telecommunication (1 project). The matrix of 77 projects

[17] JICA Research Institute. (2008). 'Capacity Assessment Handbook: Project Management for Realizing Capacity Development'.

provided outlines, preliminary estimated costs and implementation schedules of the proposed projects.

However, it is unlikely for the 77 projects to be implemented in line with the SUDP. Rather, some projects are implemented, following their own sector plans and priorities. For instance, water supply has one of better performed sectors in the implementation among 13 sectors that the SUDP has covered. The Engineering Department (Water Supply and Sanitation) at YCDC is the main responsible entity. This performance can be explained by JICA's firm commitments to the sector through providing supports in making the water supply master plan and its implementation by grant, loan and technical cooperation projects in line with their sector master plan.

It is also identified that there is no monitoring framework so that the Urban Planning Division, YCDC is unable to track the progress of the implementation of the 77 projects. In fact, many projects, especially in urban infrastructure and transport sector, fall into the responsibilities of other ministries/agencies. Hence, it is difficult for the Urban Planning Division to track the progress without the monitoring framework agreed with those ministries/agencies.

In summary, the implementation of the SUDP for the last three years has shown mixed results. On the one hand, the SUDP has attributed to building the urban planning framework and institutional arrangement in Yangon. On the other hand, it has faced some challenges in the implementation and monitoring and evaluation due to lack of consensus among the major stakeholders/actors in the planning process.

2) Main Factors for Performance of Implementation of SUDP 2013

Following the findings in the above, this section identifies what are the main factors that affect the performance of the SUDP's implementation. The main factors are assessed in relation to the SUDP, organizations and human resources as follows.

(I) SUDP 2013

Despite the fact that the SUDP 2013 was officially approved by the Yangon Region Cabinet, it is found ownership of the SUDP is weak. In the formulation process of the SUDP, consultation process was undertaken through the steering committee meetings of YCDC, a couple of launching workshops with stakeholders, mainly YCDC and MOC officials or staff, held in Yangon and Naypyidaw around 2013. However, it is not necessarily the case that all officials or staff currently know about the SUDP due to partially staff reassignments during the past three years. At the same time, it implies that the SUDP may not be well operationalized or internalized by/within YCDC. In fact, some departments at YCDC pointed out that the SUDP is a plan for the Urban Planning Division or JICA while the departments have their own plan or priority in the sector. It shows that the SUDP is likely to be considered as one of the sector plans rather than a top of planning hierarchy in urban development in Yangon. Furthermore, the majority of the other stakeholders, such as the private sector, associations, universities, NGOs, and donors, told that they had never seen the SUDP although some of them were aware of it through the media or having interviews with the SUDP 2013 study team in data collection. Many indicated a language barrier with English. In fact, there is no Myanmar version of the SUDP. Others pointed out the SUDP doesn't align with the government format as the government plan, and provides overwhelming technical information. Furthermore, it is significantly pointed out that there were less consensuses with sector departments, ministries and authorities as the urban plan or a top of the planning hierarchy and less consultations with non-public key stakeholders in Yangon. Moreover, there were no action and monitoring and evaluation (M&E) frameworks for the 77 projects: responsible authorities were not appointed, resources for each project were not indicated and the projects were not prioritized.

(II) Organizations

The 2008 Constitution defines the roles and responsibilities of the Union Government and the Region/State Governments respectively, but there is no statement about YCDC. Instead, YCDC has been constituted by the City of Yangon Development Act 1990 and the Yangon City Municipal Law 2013 under the military rule and the Yangon Region Parliament. This might challenge the legal status of YCDC as the largest local service provider in the country.

The Urban Planning Unit was newly established at YCDC in 2012, and later transformed to the Urban Planning Division under the City Planning and Land Administration Department. Nevertheless, the Urban Planning Division has not yet been constituted by YRG and the Ministry of Planning and Finance (MOPF). As a result, there is limitation to hire permanent officials at the Division, but relies on temporary contract staff who might be less motivated through weak financial and non-financial incentives. In fact, many staff who worked previously resigned from their jobs probably when due without renewals, and have been replaced by new contract staff who might follow in the same way. In addition, the current organizational structure of the City Planning and Land Administration Department has limited the mobility and function of the Urban Planning Division as a planning division to play a catalytic role in the process of urban planning, implementation and coordination with the other YCDC departments, YRG and non-state actors.

According to non-state stakeholders, YCDC has offered less customer-centered services with high transaction costs. There are less coordination mechanisms within YCDC so that the customers are required to visit each relevant department to clear each stage in order to accomplish one business. In the case of a high-rise building permit, some indicated it took more than one year to obtain the permit, while taking over three months to get a high-rise building completion certificate. The Engineering Department (Buildings) is a focal point to issue a building permit; however, an applicant needs to visit relevant departments and other authorities to clear each stage and is often required to make presentations to each department every time. In the case of Singapore, some indicated that it might take only two weeks to obtain a building permit through the online application system. In this context, there is room for improvement to drastically reduce waiting time for such permits and certificates through improving transparency in the procedures and coordination between YCDC departments and with other authorities.

(III) Human Resources

Human resource development in urban planning is still in transition. Although the existing pool of human resources in civil engineering and architect needs to be further expanded, there are urgent needs on human resource development in the field of urban planning, development and management. The Department of Urban and Housing Development (DUHD), MOC recently made the Five-Year Capacity Development Plan. It emphasizes some prioritized areas, such as capacity building and training, urban research and advocacy, formulation of national urban development strategies, formulation of housing development strategies, pilot action plan for master plan development and strengthen GIS units. In the field of capacity building and training, it prioritizes the following areas: urban planning guidelines and planning regulations, infrastructure needs assessment (prioritization) for primary and secondary cities, housing needs assessment for primary and secondary cities, disaster risk reduction integration into land use planning, municipal financing and PPP, and city development strategies and capacity development plans. MOC has also established the Urban Research Development Institute (URDI) in Yangon as a think tank with support from UN Habitat. They focus on the area of urbanization, urban development, housing and disaster risk reduction through policy advice, capacity development and urban research.

The Urban Planning Division, YCDC has faced similar challenges with a limited number of officials/staff who are able to understand overall urban planning. The URDI/UN Habitat have

provided training programs to the Division although their main targeting groups are MOC and others. Among the YCDC's departments, the Urban Planning Division is one of the most popular destinations to attract donors' support due to their great expectations to the Division in urban planning. In fact, there are a variety of training opportunities offered by donors. Among them, learning by doing training programs, such as NUFFIC, seemed to be more demanded than lecture oriented training programs.

Until 2011, there was no university to teach urban planning but civil engineering and architecture. However, some university, like the Yangon Technological University, has launched urban planning course to reflect emerging demands for urban planning associated with the recent political and economic changes. Nevertheless, the new course is still far from popular, like civil engineering, due to weak demand in the employment market. The university expects to see emerging booms for the urban planning course in near future.

3) Lessons Learnt for SUDP 2016

This section concludes what are lessons learnt from the implementation of the SUDP 2013 and for the forthcoming SUDP 2016 to ensure more efficient and effective implementation. To strengthen inclusive ownership of the SUDP 2016 among the major stakeholders in urban development, it is recommended for YCDC to seek any possibility of an endorsement from not only YRG but also the Union Government to enable it to coordinate sector, public land and redevelopment issues related to Union line ministries.

In order to do so, firstly, the SUDP 2016 may be more simplified, to some extent aligned with the government format and importantly translated into Myanmar for expected readers, such as the Cabinet members, government officials and other stakeholders. Secondly, the SUDP 2016 might build more consensus with other departments of YCDC and relevant regional authorities/departments for each sector through aligning with their existing sector plans, priorities and projects. In this process, proposed projects might be prioritized while indicative resources and responsible implementation authorities may be addressed. Finally, the SUDP 2016 may be finalized through undertaking inclusive consultation processes with a wide range of stakeholders, such as associations, NGOs, donors, the private sector, research institutes, the media etc., to reflect voices of the people into the city plan, especially from socio-cultural perspectives.

Capacity for implementation is always a challenge. In fact, the performance of the implementation of the SUDP 2013 has shown mixed. Hence, it is important to make sure what are lessons learnt from the previous experience and feedbacks to the forthcoming SUDP 2016 for its effective implementation. Despite the establishment of UPD at YCDC, UPD has still faced a great limitation because it has yet been constituted by YRG and the Ministry of Planning and Finance (MOPF). As a result, UPD has faced great difficulties to have sufficient numbers of permanent officials and undertake effective coordination with other YCDC's departments and the non-state actors in urban planning, development and management. To strengthen inclusive ownership of the SUDP among all stakeholders, it is necessary to have sufficient consultation process with the other YCDC departments and the non-state actors in terms of harmonizing with the existing sector priorities and building the comprehensive monitoring and evaluation framework in urban planning.

2.7.2 Planning Process

Table 2.7.1: Record of Meetings and Surveys (Capacity Development)

Date	Title	Venue	Agenda
15th Aug, 2016 (Mon)	Interview with JICA Expert for Urban Planning, YCDC	YCDC, Yangon	• Current status of institutions and human resources
16th Aug, 2016 (Tue)	Interview with Head, Zoning & Land Use Planning Branch, YCDC	YCDC, Yangon	• Current status of institutions and human resources
16th Aug, 2016 (Tue)	Interview with Director, Urban Planning Division, YCDC	YCDC, Yangon	• Current status of institutions and human resources
22nd Aug, 2016 (Mon)	Interview with JICA Expert for Water Supply, YCDC	YCDC, Yangon	• Current status of institutions and human resources
22nd Aug, 2016 (Mon)	Interview with President, HCDB	HCDB, Yangon	• Current status of institutions and human resources
23rd Aug, 2016 (Tue)	Interview with Vice Representatives, Mitsubishi Corporation Myanmar	Mitsubishi Corporation, Yangon	• Current status of institutions and human resources
26th Aug, 2016 (Fri)	Four Interviews with Officials/Staff, Urban Planning Division, YCDC	YCDC, Yangon	• Current status of institutions and human resources
1st Sept, 2016 (Thu)	Interview with Head, Zoning & Land Use Planning Branch, YCDC	YCDC, Yangon	• Current status of institutions and human resources
1st Sept, 2016 (Thu)	Interview with Head, Urban Design & District Planning Branch, YCDC	YCDC, Yangon	• Current status of institutions and human resources
1st Sept, 2016 (Thu)	Interview with Head, Urban Socioeconomic Studies Brach, YCDC	YCDC, Yangon	• Current status of institutions and human resources
1st Sept, 2016 (Thu)	Interview with Head, Infrastructure & Urban Amenities Planning Branch, YCDC	YCDC, Yangon	• Current status of institutions and human resources
1st Sept, 2016 (Thu)	Interview with Head, Urban Transportation & Road Network Planning Branch, YCDC	YCDC, Yangon	• Current status of institutions and human resources
2nd Sept, 2016 (Fri)	Interview with Head, Administration Branch, YCDC	YCDC, Yangon	• Current status of institutions and human resources
2nd Sept, 2016 (Fri)	Interview with Director, Urban Planning Division, YCDC	YCDC, Yangon	• Current status of institutions and human resources
2nd Sept, 2016 (Fri)	Interview with Director, Land Administration Division, YCDC	YCDC, Yangon	• Current status of institutions and human resources
2nd Sept, 2016 (Fri)	Interview with Head, City Planning and Land Administration Department, YCDC	YCDC, Yangon	• Current status of institutions and human resources
5th Sept, 2016 (Mon)	Interview with Head, Engineering Department (Buildings), YCDC	YCDC, Yangon	• Current status of institutions and human resources
5th Sept, 2016 (Mon)	Interview with Head, Engineering Department (Water and Sanitation), YCDC	YCDC, Yangon	• Current status of institutions and human resources
5th Sept, 2016 (Mon)	Interview with Head, Engineering Department (Roads and Bridges), YCDC	YCDC, Yangon	• Current status of institutions and human resources
5th Sept, 2016 (Mon)	Interview with Head, Administration Department, YCDC	YCDC, Yangon	• Current status of institutions and human resources
6th Sept, 2016 (Tue)	Interview with Head, Pollution Control Department, YCDC	YCDC, Yangon	• Current status of institutions and human resources
6th Sept, 2016 (Tue)	Interview with Head, Playground, Parks and Garden Department, YCDC	YCDC, Yangon	• Current status of institutions and human resources
6th Sept, 2016 (Tue)	Interview with Head, Budget and Accounts Department, YCDC	YCDC, Yangon	• Current status of institutions and human resources
6th Sept, 2016 (Tue)	Interview with Head, Assessor Department & Coordination Department, YCDC	YCDC, Yangon	• Current status of institutions and human resources
7th Sept, 2016 (Wed)	Interview with Head, Markets Department, YCDC	YCDC, Yangon	• Current status of institutions and human resources
7th Sept, 2016 (Wed)	Interview with Head, Department of Urban and Housing Development, MOC, Yangon Branch	MOC, Yangon	• Current status of institutions and human resources
7th Sept, 2016 (Wed)	Interview with Director, General Administration Department, YRG	YRG, Yangon	• Current status of institutions and human resources
7th Sept, 2016 (Wed)	Interview with Director, Department of	YRG,	• Current status of institutions

Date	Title	Venue	Agenda
	Planning, YRG	Yangon	and human resources
7th Sept, 2016 (Wed)	Interview with Director, Department of Budget, YRG	YRG, Yangon	• Current status of institutions and human resources
8th Sept, 2016 (Thu)	Interview with District Executive Officer, Eastern District Office, YRG	Eastern District Office, Yangon	• Current status of institutions and human resources
8th Sept, 2016 (Thu)	Interview with Township Executive Officer, North Okkalapa Township Office, Eastern District, YRG	North Okkalapa Township Office, Yangon	• Current status of institutions and human resources
9th Sept, 2016 (Fri)	Interview with Township Executive Officer, Seik Kan Township Office, Western District, YRG	Seik Kan Township Office, Yangon	• Current status of institutions and human resources
9th Sept, 2016 (Fri)	Interview with Ward Officer, Seik Kan Ward Office, Seik Kan Township, Western District, YRG	Seik Kan Ward Office, Yangon	• Current status of institutions and human resources
9th Sept, 2016 (Fri)	Interview with Township Executive Officer, Dala Township Office, Southern District, YRG	Dala Township Office, Yangon	• Current status of institutions and human resources
12th Sept, 2016 (Mon)	Interview with Chairman, Committee for Quality Control and High Rise Projects (CQHP)	CQHP, Yangon	• Current status of institutions and human resources
12th Sept, 2016 (Mon)	Interview with Director, YHT	YHT, Yangon	• Current status of institutions and human resources
12th Sept, 2016 (Mon)	Interview with President, Association of Myanmar Architects (AMA)	AMA, Yangon	• Current status of institutions and human resources
13th Sept, 2016 (Tue)	Interview with Vice President, Myanmar Engineering Society (MES)	MES, Yangon	• Current status of institutions and human resources
13th Sept, 2016 (Tue)	Interview with Pro Rector, Yangon Technological University (YTU)	YTU, Yangon	• Current status of institutions and human resources
13th Sept, 2016 (Tue)	Interview with Associate Professor, Geography Department, Yangon University (YU)	YU, Yangon	• Current status of institutions and human resources
14th Sept, 2016 (Wed)	Interview with Assistant Director, Urban Research and Development Institute (URDI)	URDI, Yangon	• Current status of institutions and human resources
14th Sept, 2016 (Wed)	Interview with Urban Planning Specialist, UN-Habitat	UN-Habitat, Yangon	• Current status of institutions and human resources
14th Sept, 2016 (Wed)	Interview with Project Team Leader, Asian Development Bank	URDI, Yangon	• Current status of institutions and human resources
15th Sept, 2016 (Thu)	Interview with Compliance & Approvals Manager, First Myanmar Investment (FMI)/SPA Project Management Services	FMI, Yangon	• Current status of institutions and human resources
15th Sept, 2016 (Thu)	Interview with Manager, Shwe Taung Group	Shwe Taung, Yangon	• Current status of institutions and human resources
16th Sept, 2016 (Fri)	Interview with General Manager, Capital Development	Capital Construction, Yangon	• Current status of institutions and human resources
19th Sept, 2016 (Mon)	Interview with Deputy Directorate Generals of Divisions, Department of Urban and Housing Development (DUHD), MOC	MOC, Naypyidaw	• Current status of institutions and human resources
19th Sept, 2016 (Mon)	Interview with Director, Housing Development Division, DUHD, MOC	MOC, Naypyidaw	• Current status of institutions and human resources
19th Sept, 2016 (Mon)	Interview with JICA Expert for Housing Policy, DUHD, MOC	MOC, Naypyidaw	• Current status of institutions and human resources
20th Sept, 2016 (Tue)	Interview with Director, Department of Road Transportation and Administration, MOTC	MOTC, Naypyidaw	• Current status of institutions and human resources
20th Sept, 2016 (Tue)	Interview with Deputy General Manager, Myanmar Railways (MR), MOTC	MR, Naypyidaw	• Current status of institutions and human resources

Date	Title	Venue	Agenda
20th Sept, 2016 (Tue)	Interview with Deputy Director General, Department of Planning, Ministry of Planning and Finance (MOPF)	MOPF, Naypyidaw	• Current status of institutions and human resources
21st Sept, 2016 (Wed)	Interview with Director, Budget Department, MOPF	MOPF, Naypyidaw	• Current status of institutions and human resources
21st Sept, 2016 (Wed)	Interview with Directors, General Administration Department (GAD), Land Administration Department, & GAD-YRG, Ministry of Home Affairs (MOHA)	MOHA, Naypyidaw	• Current status of institutions and human resources
21st Sept, 2016 (Wed)	Interview with Deputy Director, Agricultural Land and Survey Department, Ministry of Agriculture and Irrigation (MOAI)	MOAI, Naypyidaw	• Current status of institutions and human resources
23rd Nov, 2016 (Wed)	Focus Group Discussions with Senior Officials, Urban Planning Division, YCDC	YCDC, Yangon	• Current status of institutions and human resources
25th Nov, 2016 (Fri)	Focus Group Discussions with Heads f Branches, Urban Planning Division, YCDC	YCDC, Yangon	• Current status of institutions and human resources
2nd Dec, 2016 (Fri)	Meeting with JICA Myanmar Office	JICA, Yangon	• Draft Presentation to Chief Minister of Yangon Region
7th Dec, 2016 (Wed)	Meeting with Chief Minister of Yangon Region	YRG, Yangon	• Presentation to Chief Minister of Yangon Region
9th Dec, 2016 (Fri)	Meeting with MOC	MOC, Yangon	• Presentation to MOC
12th Dec, 2016 (Mon)	Interview with Deputy General Manager, Myanmar Port Authority (MPA), MOTC	MPA, Yangon	• Current status of institutions and human resources
12th Dec, 2016 (Mon)	Interview with JICA Expert, MPA, MOTC	MPA, Yangon	• Current status of institutions and human resources
14th Dec, 2016 (Wed)	Meeting with Director, Urban Planning Division, YCDC	YCDC, Yangon	• Current status of institutions and human resources
15th Dec, 2016 (Thu)	Meeting with JICA Expert, Urban Planning, YCDC	YCDC, Yangon	• Current status of institutions and human resources
16th Dec, 2016 (Fri)	Meeting with Secretary, YCDC	YCDC, Yangon	• Presentation to Secretary, YCDC
23rd Dec, 2016 (Fri)	Consultative Workshop on SUDP	YCDC, Yangon	• Preparation for the workshop

Source: JICA Study Team

2.8 Legal and Administrative Framework

2.8.1 Law and Regulation of YCDC

(1) City of Yangon Development Law

This law was enacted in 1990 and ordered the formation of YCDC in order to carry out the development works of the city of Yangon, and stipulated YCDC shall lay down the policy, give guidance and implement the following duties and responsibilities (Section 7):

- Preparation of civil projects and new cities;
- Administration of lands;
- Determination only of the population which should be allowed to settle properly;
- Construction, repair and demolition of buildings, squatter buildings, and squatter wards;
- Demolition and re-settlement of squatter huts, squatter buildings, and squatter wards;
- Construction of roads, bridges, and maintenance thereof;
- Stipulation of conditions for traffic, parking of vehicles, and slow moving vehicles;
- Construction of gardens, parks, playgrounds, and recreation centers, and maintenance thereof;
- Carrying out works for the lighting of roads;
- Carrying out works for water supply;
- Construction of reservoirs and pipelines, and maintenance thereof;
- Carrying out works for sanitation;
- Carrying out works for public health;
- Construction, maintenance, and administration of markets;
- Stipulation of conditions for road side stalls; and
- Carrying out precautionary measures against fires.

The law also gives YCDC the following powers (Section 9):

- Demarcating and re-demarcating the territorial limit of the City of Yangon Municipality;
- The right to operate works independently with funds owned by the committee;
- Prescribing, reviving, assessing, and collecting duties and taxes with their rates relating to development works, in accordance with the existing laws;
- The right to apply the foreign currency derived from the lease of building, lease of lands or by other means, for development works;
- The right to carry out works contributing to city development by making contracts with local and foreign organizations and with local and foreign individuals;
- The right to take loans and grants from the government or from foreign organizations, and being responsible for its payment;

- The right to carry out works by forming sub-committees work-wise;
- Arranging modern methods and systems in order to carry out the development works effectively;
- Exercising the powers conferred under the City of Yangon Municipal Act, rules, and bylaws;
- Exercising the powers conferred from time to time by the chairman of the State Peace and Development Council;

It is noteworthy that YCDC can demarcate and re-demarcate the territorial limit of its own, prescribe and collect duties and taxes of its own within the existing laws, and has the power to engage in development projects under a contract and take loans/grants for the development of the city.

(2) Bylaws of YCDC

It is confirmed that there are 24 bylaws in effect in YCDC which have been enacted between 1995 and 2001. The contents of the bylaws cover all spheres of the city's administration front, varying from management, urban planning to infrastructure, and commercial registration. Among them, there are four bylaws that are directly related to the urban planning by YCDC. Generally, the bylaws define the basic procedures to be followed, but do not provide details of which such procedures are to be carried out. The latter is mostly given in the form of regulations as detailed in item (5).

Table 2.8.1: Bylaws of YCDC Related to Urban Planning

Name	Main Stipulation
Bylaw on Town Planning and Land Use (No3/2001)	- Land management - Formulation of city development plans - Land use in accordance with the city development project/ plan - Issuance of lease, license and permits, renewal and cancellation - Assessment of tax, revenue, collection, exemption, and subsidization of tax for land - Land confiscation, and buy and transfer of land - Management of non-moveable/ fixed infrastructure - Records, prescribe forms, maintenance of records, and duplication - Land survey - Removal of squatters and trespassers - Appeal
Bylaw on Building and Construction (No.9/1999)	- Permission and application for construction - Issuance of license - Buildings owned by the committee - Buildings inappropriate or dangerous for residences - Trespassing tax - Sign boards and advertisement ads - Prohibitions
Bylaw for Commerce and Markets	- Supervision of the development affairs - Restrictions
Bylaw for Garden and Recreation	- Gardens - Playgrounds - Prohibitions

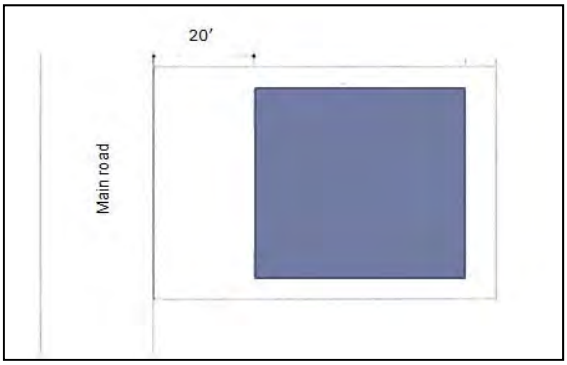
Source: YCDC

(3) Regulations related to Urban Planning

YCDC manages the new buildings at the time of application for contraction based on a set of regulations. The legal nature of these regulations is yet to be found out in detail.

1) Setback from Main Roads

When a building is to be built along any of the main roads, it must have a setback area of 20 feet (6.0m) for clearance to any structure. This regulation applies to the main roads, such as Pyay Road, Kaba Aye Road, University Avenue Road, and U Wisara Road.

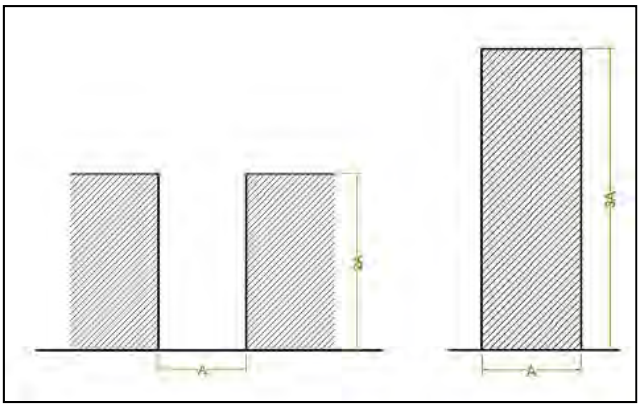


Source: YCDC

Figure 2.8.1: Set-back to Main Road

2) Height of Buildings

There are two types of limits to the height of buildings. One is in relation to the frontage road, in which the height of the building cannot exceed twice the width of the frontage road. It is to be noted that there are a number of existing old buildings, particularly along narrow streets in CBD, which are in violation of this regulation, although there is a provision to mitigate this limit. The other type of limit relates to the shape of the building itself, in which the height of the building cannot exceed thrice the length of the building. Up to what extent these principles have been applied in providing building permission, is yet to be found out.



Source: YCDC

Figure 2.8.2: Height of Building

3) Zoning Regulation

In the reserved area around Shwe Dagon Pagoda, buildings with more than six stories are prohibited. The regulation says that anybody who would like to go beyond this must apply to the Union Government for permission.

Table 2.8.2: Bylaws of YCDC Related to Urban Planning

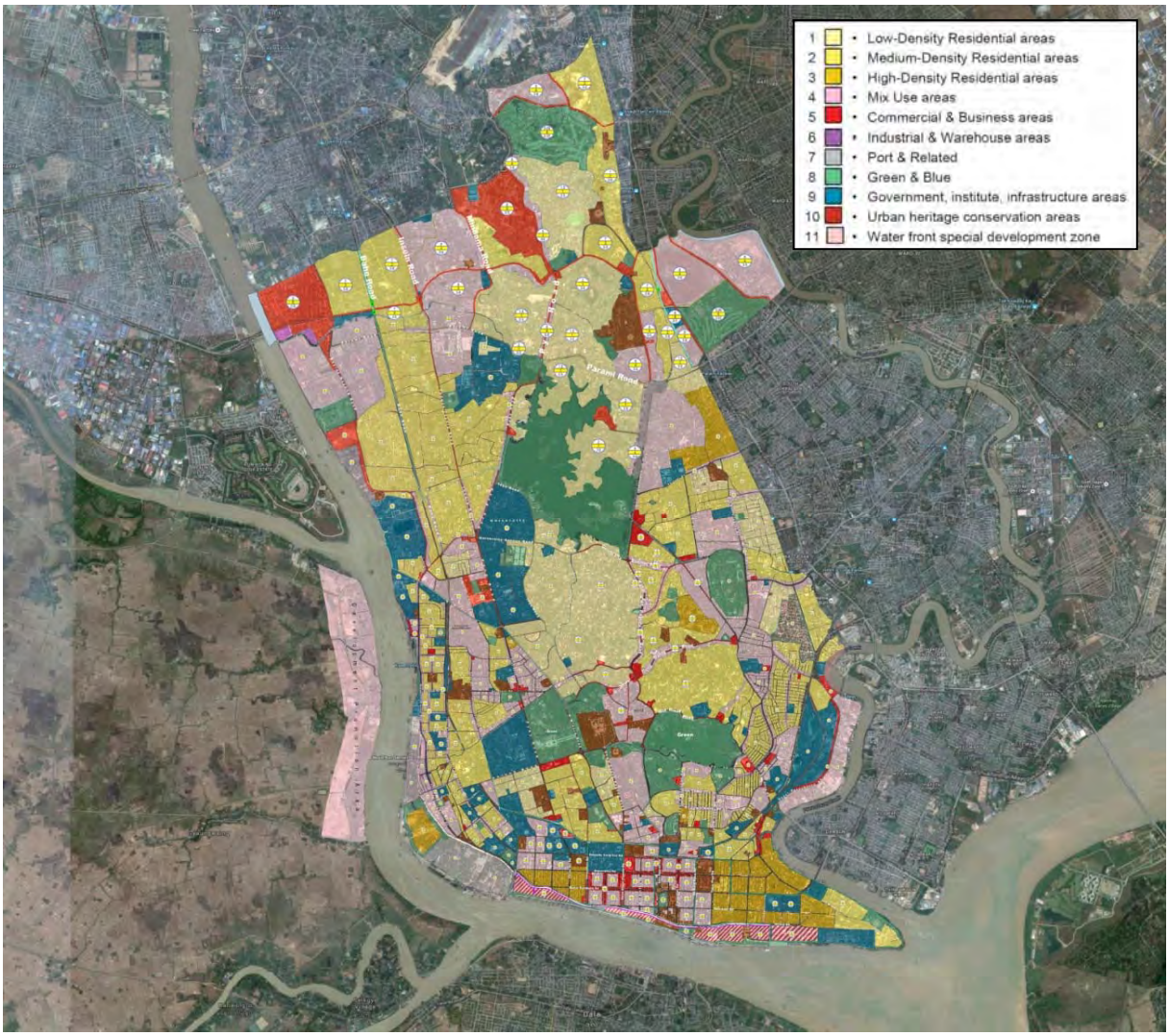
	**Reserved Areas for Shwe Dagon Pagoda** ● Construction of more than six-story buildings is never allowed. If someone wants to construct buildings with six or more stories, he needs to apply to the State Government of the Republic of Union of Myanmar. ● Reserved area boundaries are: East - Alanpya Pagoda Road, Zoological Garden Road, Kan Road, Factory Road, Nat Mauk Road, and Kaba Aye Road; North - Dama Saedi Road; West - Pyay Road; and South - Min Ye Kyaw Swa Road, Circular Railways Tracks, Yaw Min Gyi, and U Phoe Hlaing from Shwe Dagon Pagoda Junction.

Source: YCDC

In addition to it, YCDC has been trying to introduce new zoning regulation covering existing built-up area of Yangon City since 2012 by "Yangon City Comprehensive Land use, Zoning and Urban Design Review Working Committee" organized by the former Mayor. Although being drafted and proposed in December 2013, this zoning regulation has not yet been in enforcement due to strong oppositions. Under new administration, this matter was raised again and will be revised. The regulation includes land use, BCR (building cover ratio), FAR (floor area ratio), and building height.

Although the regulation has not been enforced yet as of March 2017, the Engineering Department (Building) of YCDC applies this draft regulation for building permission system in order to instruct permission applicants to follow it. The target area, which is currently 18 townships out of 33 townships of YCDC, will expand all of townships.

Engineering Department (Building) of YCDC made "Land Usage and Building Height Regulation" as an internal document.



Source: JICA Study Team integrated based on date of Engineering Department (Building) of YCDC

Figure 2.8.3: Draft of Zoning Regulation of Yangon

2.8.2 Law and Regulation of Union Government

(1) Drafted Urban and Regional Development Planning Law

Drafts of "Urban and Regional Development Planning Law" have been submitted from MOC to the Union Attorney General Office four times as of February 2017, and MOC received comments on it and modified it each time. According to forecast of MOC, the draft law might be submitted to the Parliament around June 2017 as the fastest.

The focal aim of the law can be said to define the urban development plan which direct future urban image and framework. According to the draft, the objectives of the law are:

- To formulate the development plans within the country systematically and to have management systems powerful enough to implement the development plans;
- To reduce the development gap among the regions within the country;

- To support the security of the State, health, safety, economic development, culture, and higher living standards of the people;
- To harmonize the land use appropriation in urban areas with policies related to the use of land resources of the country effectively for future development and conservation;
- To implement the land use based regional plans systematically incorporating sector-wise plans formulated for socio-economic development; and
- To become land use based that can support sustainable economic development of the country.

The law defines some kinds of plans to be formulated and approved by Union or regional governments. These are "National Urban System Plan", "Region/State Urban System Plan" "City/Town Conceptual Plan", "Master Plan" and "Detail Plan, Special Area Plan". The urban development plan of the Greater Yangon which was made in this study will be most suitable with the idea of "City/Town Conceptual Plan" in this law.

Source: DUHD, MOC

Figure 2.8.4: Hierarchy of Plans defined in Draft of Urban and Regional Development Planning Law

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, Yangon is Grade A as shown in Table 2.8.3

Table 2.8.3: Bylaws of YCDC Related to Urban Planning

Grade	Definition	Target 3 Cities
Grade A	CDC – 3 cities	Yangon, Mandalay, NPT
Grade B	District Level >20,000 pop, Township 40,000-100,000 pop (70 no)	
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

(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. By provision of the rules and regulation, which has been finalized in March 2017, enforcement of this law is expected to commence. 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 UAGO. 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. The supervisory authority of the law is the Department of Building, MOC. Current status of the code is to complete revising as of 2016 version based on 2012 and in the phase of public hearing from the chief engineers of each Region/State Government after the confirmation of the Minister of MOC. Since the MNBC is a sort of operational guideline, not a law, MOC intends to allow Region/State to modify the MNBC which MOC drafted according to situation and needs of each Region/State.

Since this code covers zoning and planning permission, it should be referred more in detail urban design in the implementation stage of SUDP, since the code shall 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 and almost finalizing as of February 2017. The supervisory authority of the law is the Department of Building, MOC. 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.

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.

Chapter 3: Conducted Works

3.1 Pilot Project

3.1.1 Background

As mentioned in the section 2.5 above, a lot of heritage buildings, especially those in CBD, comprise the character of Yangon. To make Yangon more attractive, utilization of the heritage buildings in CBD will have a large advantage, however positive preservation activities including YHT have only just begun and the values of the heritages have not yet been fully utilized. In addition, most of the streets in the CBD are occupied by passing and parked car, which disturbs amenity of the area as well as attention to beautiful cityscape with heritage buildings.

Renovation of heritage buildings in current use with private owner and implementation of regulation for car free area to make a profit for the whole community are generally difficult, because it affects people's right who own the buildings or use cars in the area. In such case, it is effective and commonly used in other countries to implement some pilot projects before actual implementation to make a trial and enhance community's understanding for social benefit including the people with established interest. If the pilot project is approved widely by the community, the next step will go into depth.

3.1.2 Trial Event "Yangon Living Street Experience"

At evening of 10 and 11 December 2016, this SUDP survey implemented a trial event "Yangon Living Street Experience" at a part of Maha Bandoola Park Street and Bank Street in Kyauktada Township. The objectives of this event are to provide an opportunity for Yangon people to rediscover amenity of pedestrian street and value of heritage buildings. During the event, cars are prohibited to enter and street performances including traditional dance, exhibition about Yangon's history and night market attracted a lot of people.

Around 90,000 people visited the event during the event time, 17:00-21:00 of both days. During the time, a questionnaire survey was conducted to get people's opinion about not only the event itself but also city improvement activities including making pedestrian street, creating park and restoration of heritage buildings.

Detail information including its results is described in Final Report II of this SUDP survey.

Source: JICA Study Team

Figure 3.1.1: A Scene of Yangon Living Street Experience

3.2 Capacity Assessment

3.2.1 Urban Planning as a New Concept

Myanmar has entered a new era of urban planning since 2011. The political and economic liberalization has enhanced a strong market-oriented economy, attracting significant volumes of foreign direct investments, imported goods and services, and rapid urbanization over the country. Yangon is the largest city with the highest density in the country, and expects to face greater pressures by rapid urbanization. According to the 2014 Population Census, there are about 7.4 million population and 723 people per square kilometer in Yangon Region, which account for 14.4% of total population and 3.5 times higher than Mandalay Region, the second largest region, in the density. This indicates urban planning is one of the most urgent concerns in Yangon to ensure sustainable urban development and management.

Despite this, there is the major challenge in readiness for urban planning to meet such rapid urban development. In fact, there is no effective legal system in the country. The Ministry of Construction (MOC) is currently prepared for the national legal and policy frameworks, such as the Condominium Act, approved in the early 2016, the National Building Code Bill, the Housing Development Bill, the National Construction Industry Development Board Bill etc. Notably, the Urban and Regional Development Planning Bill and its Rules and Regulations, including zoning and planning regulations, are also under preparation by the MOC.

While a zoning framework is prepared at the Union level, the zoning regulation and planning permission system are developed and undertaken by local authorities. In advance to the above bills, the Yangon City Development Committee (YCDC) introduced the Notification No. 9/1999 (Buildings and Structure) and No. 3/2001 (Urban Planning and Land Use), and has drafted the zoning regulation in Yangon. However, they don't provide effective guidance and development controls. In this regard, zoning regulation and planning permission system are highly required for urban development and management in Yangon.

While the legal and regulatory frameworks in urban planning have been gradually prepared for the last few years, there have remained another major concern on weakness of implementation and enforcement capacities, in order to control the flows of surging direct investments to real estates for sustainable urban development in Yangon. In this context, this section has capacity assessment on the Urban Planning Division (UPD) under YCDC which is the most concerned organization in urban planning in Yangon.

3.2.2 Objectives

The objectives of a capacity assessment are to identify what capacities already exist and what additional capacities may be needed for UPD under YCDC to achieve the goals of the Yangon Future Vision 2040 through the implementation of the Strategic Urban Development Plan of Greater Yangon (SUDP). The capacity assessment provides better understanding of the existing capacities as well as the capacity needs that can serve as inputs for the formulation of the Project Design Matrix or the logical framework. It can also set baseline for monitoring and evaluation in the process of the capacity development.

There are three main questions to provide the guidance of the capacity assessment for urban development and management of UPD under YCDC as follows:

- What are existing capacities that UPD has developed since its establishment?
- What are desired capacities for UPD to enhance sustainable urban development in the Greater Yangon? and
- What inputs are needed for the formulation of the capacity development response through

external assistance?

3.2.3 Conceptual Framework

(1) Capacity Development

In recent years, capacity development has been growingly recognized as one of the most essential factors for development in general, and urban development in particular. According to the OECD (2006), 'capacity development' is defined as 'the process whereby people, organizations, and society as a whole, unleash, strengthen, create, adapt, and maintain capacity over time'[18]. Capability is deemed as one for handling issues, such as one identifies issues, sets goals, and achieves these[19]. Capacity consists of a variety of elements for handling issues, such as an individual's knowledge and techniques and organizational capabilities of the affiliated institutions, as well as related policy institutions and social systems' (See Figure 3.2.1).

The 'Quito Declaration on Sustainable Cities and Human Settlements for All' has also emphasized that capacity development should be promoted as 'a multifaceted approach that addresses the ability of multiple stakeholders and institutions at all levels of governance, and combines the individual, societal, and institutional capacity to formulate, implement, enhance, manage, monitor, and evaluate public policies for sustainable urban development'[20]. However, it should be noted that it requires long term efforts to enhance capacity development at all levels of stakeholders who contribute to urban development. Therefore, it is important to have a long-term strategy and its action plan for capacity development to ensure proper urban planning, design, financing, development, governance, and management for sustainable urban development.

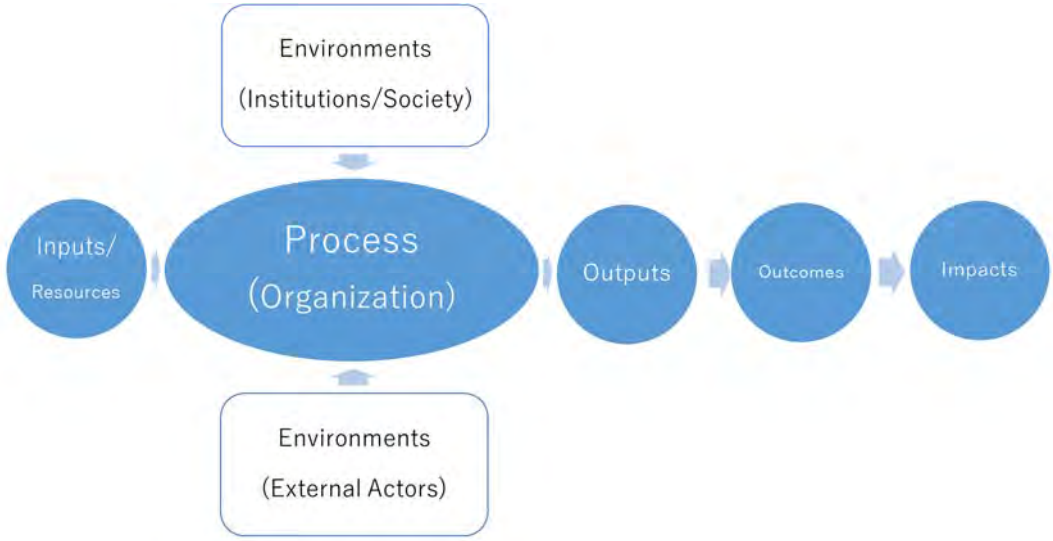
Source: JICA Study Team
Figure 3.2.1: Concept of Capacity Development

(2) Organization as Open System

An organization can be viewed as an open system, which is a group of components or departments that interact with and depend on each other for attaining a common goal of the organization through result chains: transforming inputs and resources into outputs, outcomes and impacts (See Figure 3.2.2). In this process, an open system interacts with the environments that include external actors (central and

[18] OECD. (2006). 'The Challenge of Capacity Development: Working Towards Good Practice'. Paris: OECD Publishing.
[19] JICA. (2008). 'Capacity Assessment Handbook: Project Management for Realizing Capacity Development'. Tokyo: JICA Research Institute.
[20] UN Habitat. (2016). 'Habitat Ⅲ: New Urban Agenda'. Quito: UN Habitat.

local governments, citizens, Non-Governmental Organizations (NGOs), Civil Society Organizations (CSOs), academic institutions, the private sectors, donors etc.), institutions (legal, regulatory and policy systems etc.) and society (economic, social and cultural contexts). The performance of the organization largely depends on a way to adopt and influence the changing environments. Better performance allows the organization to obtain more resources and incentives from the environments and produce outputs for further performance and growth.



Source: JICA Study Team modified from EC. (2005). 'Institutional Assessment and Capacity Development: Why, what and how?'.

Figure 3.2.2: Organization as Open Space

3.2.4 Methodology

Capacity assessment was undertaken through the following methodology at the Urabn Planning Division (UPD) under YCDC during the period of August, 2016 to February, 2017. Firstly, literatures were reviewed to understand its context. Secondly, stakeholder anaysis was conducted to identifiy who were the main stakeholders/actors in uraban development sector in the Greater Yangon, and how YCDC interacted with them in the process of the SUDP's implementation. Thirdly, organizational capacity was examined qualitatively through key informat interviews and diect observation in line with the check list for the key dimensions on organizational capacity. Key informants were identified through the stakeholder analysis. Direct observation also helped verify findings from the qualitative analysis and the other analysis during the period of this study. Fourthly, organizational capacity was assessed through problem anaysis, objective analysis and other analysises for formulation of the project design matrix. Two focus group discussions, inlucuding a group of seniour officials and one of branch heads, were held at UPD. Finally, this study makes recommendations to YCDC and other related stakeholders for fostering capacity development for sustainable urban development and management in the Greater Yangon under the implementation of the SUDP 2016. The capacity development strategy and its action plan are proposed to undertake concrete actions towards the Yangon Future Vison 2040.

3.2.5 Targeting Group

The Urban Planning Division (UPD) at YCDC is a targeting group for this capacity assessment. UPD is responsible for facilitating effective urban planning in Yangon. It was initially established as the Urban Planning Unit in 2012, and was later transformed to UPD under the City Planning and Land Administration Department. The Urban Planning Division consists of 6 branches: including Zoning & Land Use Planning Branch; Urban Design & District Planning Branch; Urban Socioeconomic Studies

Branch; Infrastructure & Urban Amenities Planning Branch; Urban Transportation & Road Network Planning Branch; and Administration Branch (See Figure 3.2.3).

The Yangon City Development Committee (YCDC) is a municipal authority which is responsible for urban development and service deliveries in Yangon, which covers 33 out of 45 Townships of Yangon Region. YCDC was established in 1990, and it has been constituted by the City of Yangon Development Act 1990 issued by the State Law and Order Restoration Council and the Yangon City Municipal Law 2013 approved by the Yangon Region Hluttaw or Parliament. It is also responsible for duties stipulated in the Rangoon Municipal Act 1922. The Budget of YCDC in FY2014/15 was around MMK 238 billion and accounted for almost 70 percent of the YRG Budget[21]. YCDC notably generated over 90 percent of the total revenue by themselves.

The Mayor is a head of YCDC who also acts as the Minister of Development Affairs of the Yangon Region Government (YRG). The member of the Committee includes the Mayor, the Secretary, the Joint Secretary, and two committee members. YCDC is supervised by the Ministry of Development Affairs of YRG. YCDC consists of the Committee Office, twenty departments, the Yangon City Golf Club and the Yangon City Bank (See Figure 3.2.4). They provide public services in 33 Townships of Yangon Region, including regulatory services and service deliveries in roads, bridges, drainages, water supply, sanitation, sewerage, buildings, markets, waste management, park and street management, land administration etc.

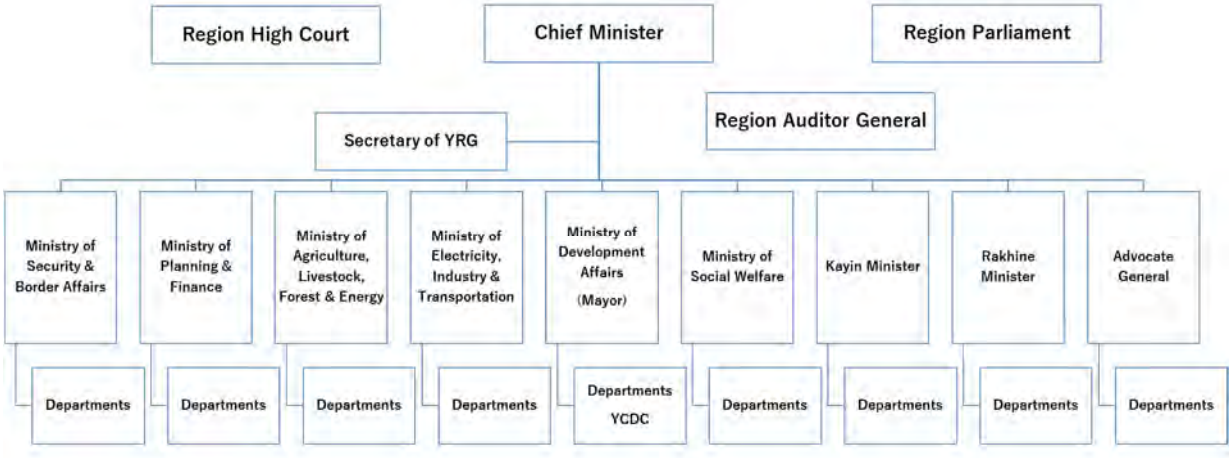
[21] UNDP. (2015). 'The State of Local Governance: Trends in Yangon'. Yangon: UNDP Myanmar.

Source: JICA Study Team Modified from YCDC document

Figure 3.2.3: Organization Structure of Urban Planning Division under City Planning & Land Administration Department, YCDC

Source: JICA Study Team Modified from YCDC Home Page. Sept. 2016. [http://www.ycdc.gov.mm/]

Figure 3.2.4: Organization Structure of YCDC



Source: JICA Study Team Modified from YRG document

Figure 3.2.5: Organization Structure of YCDC

The Yangon Region Government (YRG) was established in 2011 as one of 14 Regions and States in Myanmar. There are the Region Hluttaw (Parliament), the Region Cabinet, the Region High Court and the Region Auditor General in Yangon Region. The Region Cabinet consists of the Chief Minister and nine Ministers. YRG provides public services through its sector departments, such as security and border affairs, planning and finance, agriculture, livestock, forestry and energy, electricity, industry and transportation, development affairs, social affairs, Rakhine, Kayin and advocate general (See Figure 3.2.5). YCDC is supervised by YRG.

YRG doesn't have any mandates and functions for urban planning in real term. However, YRG is currently preparing for establishment of a new agency, Yangon Urban Planning Authority (YUPA). Once YUPA is ready for being functional, it is likely to have the division of labor between YUPA and YCDC in terms of urban policy/planning and implementation for which YCDC currently takes responsible.

3.2.6 Existing Capacities for Urban Development

(1) Current Structure of UPD

In 2012, the Urban Planning Unit was established in YCDC and later upgraded to the Urban Planning Division (UPD) under the City Planning and Land Administration Department. To serve a city population of 5.2 million people in Yangon, there are 180 constituted official numbers in UPD, according to the revised organizational structure of the Division (See Table 3.2.1 and Figure 3.2.6). The constituted official number was increased from 100 officials to 180 officials in 2016.

The revision of the constituted official number includes 65 senior officials and 115 junior officials (65-115) in UPD: 1 Deputy Head of Department, 6 Assistant Heads of Department, 20 Division Heads, 38 Section Heads (2 Computer Programmers, 1 Account, 23 Assistant Engineers, 12 Section Heads), while 10 Computer Programmers, 55 Sub Assistant Engineers, 5 Land Surveyors, 16 Assistant Computer Programmers, and 29 Upper Clerks (See Figure 3.2.6). They are allocated to the following six branches: 31 officials (11 senior officials - 20 junior officials or 11-20) in the Zoning and Land Use Planning Branch, 33 officials (12-21) in the Urban Design and District Planning Branch, 29 officials (10-19) in the Socioeconomic Studies Branch, 29 officials (11-18) in the Infrastructure and Urban

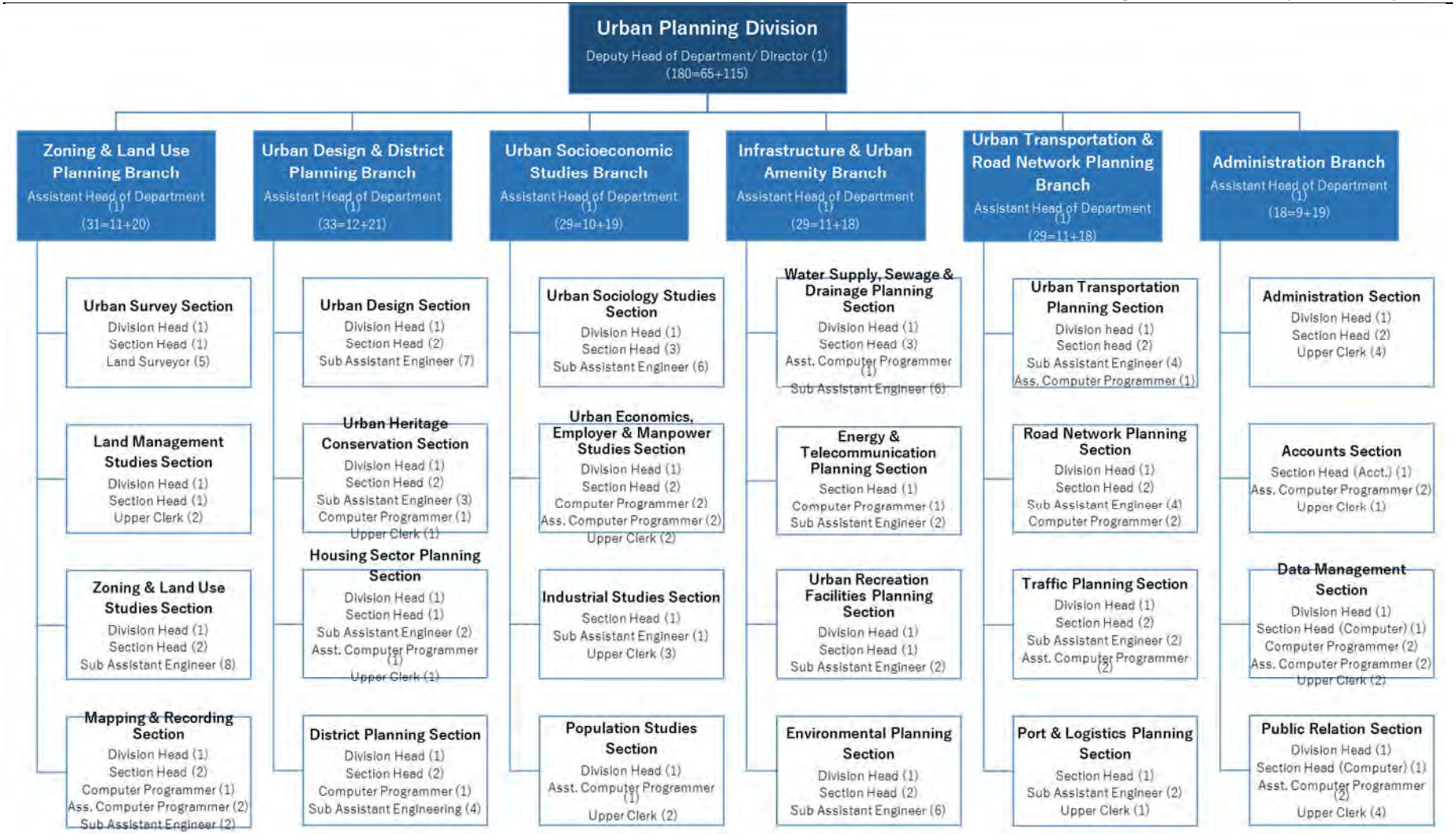
Amenity Branch, 29 officials (11-18) in the Urban Transportation and Road Network Planning Branch, and 28 officials (9-19) in the Administration Branch.

Table 3.2.1: Comparison of Revised and Previous Official Number of Employees at UPD

	No of Section	Senior			Junior					Total
		Deputy Head/ Assistant Head	Division Head	Section Head, *(Engineer, Computer Accountant)*	Computer Programmer	Sub Assistant Engineer	Land Surveyor	Asst. Computer Programmer	Upper Clerk	
Deputy Head/ Urban Planning Division	-	1 (1)	-	-	-	-	-	-	-	1* (1)**
Zoning & Land Use Planning Branch	*4* *(4)*	1 (1)	4 (4)	6 (6)	1 (1)	10 (4)	5 (-)	2 (1)	2 (1)	31 (16)
Urban Design & District Planning Branch	*4* *(4)*	1 (1)	4 (4)	7 (7)	2 (1)	16 (5)	0 (0)	1 (1)	2 (0)	33 (19)
Urban Socio-economic Studies Branch	*4* *(4)*	1 (1)	3 (3)	6 (4)	2 (1)	1 (5)	0 (0)	3 (1)	13 (1)	29 (16)
Infrastructure & Urban Amenities Planning Branch	*4* *(4)*	1 (1)	3 (3)	7 (6)	1 (1)	16 (6)	0 (0)	1 (1)	0 (0)	29 (18)
Urban Transport-ation & Road Network Planning Branch	*4* *(4)*	1 (1)	3 (3)	7 (6)	2 (0)	12 (5)	0 (0)	3 (2)	1 (0)	29 (17)
Administration Branch	*4* *(4)*	1 (-)	3 (1)	5 (5)	2 (1)	0 (0)	0 (0)	6 (1)	11 (5)	28 (13)
Total	*24* *(24)*	7 (6)	20 (18)	38 (32)	10 (5)	55 (25)	5 (0)	16 (7)	29 (7)	180 (100)

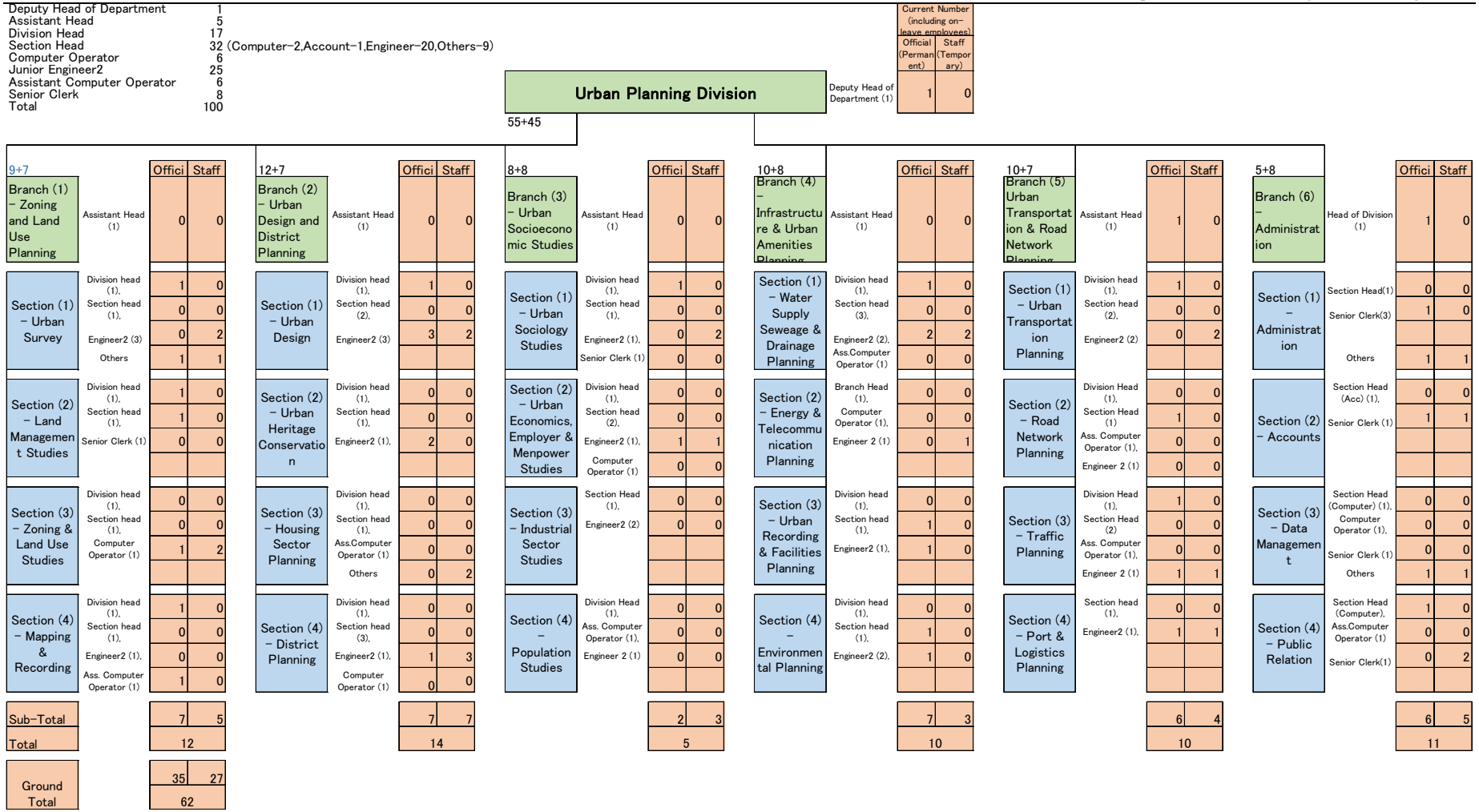
Source: JICA Study Team Modified from YCDC Document
Note: * 1 or without (): Revised Constituted Official Number of Employees in 2016
** (1) or with (): Previous Constituted Official Number of Employees before 2016

The above figures are based on a revised version of the constituted official numbers of UPD that has been recently updated. Compared with the previous version, it can observe UPD's strategy in urban planning through human resource allocation (See Table 3.2.1). The total constituted official numbers of UPD has increased from 100 (55 senior officials and 45 junior officials/55-45) to 180 employees (65-115). It indicates that UPD is seeking more junior workforces, including sub-assistant engineers, assistant/computer programmers, upper clerks and land surveyors (as a new post), to meet surging amounts of urban planning works in Yangon. On the other hand, it is found that UPD allocates around 30 officials to each branch equally. It indicates UPD considers all existing branches are equally important although the Deputy Head of Department has indicated that the two branches, such as the Zoning and Land Use Planning Branch and the Urban Design and District Planning Branch would be more important in the future.



Source: JICA Study Team Modified from YCDC document

Figure 3.2.6: Revised Organization Structure 2016 of UPD



Source: JICA Study Team Modified from YCDC document

Figure 3.2.7: Revised Organization Structure 2016 of UPD

In terms of real number of official/staff, UPD is currently hiring only 62 officials and staff, including on-leave officials/staff, which account for only 34.4% against the constitute numbers of 180 officials (See Figure 3.2.7). They include 35 officials and 27 contract staff (35-27). They are allocated to the following six branches: 12 officials (7-5) in the Zoning and Land Use Planning Branch, 14 officials (7-7) in the Urban Design and District Planning Branch, 5 officials (2-3) in the Socioeconomic Studies Branch, 10 officials (7-3) in the Infrastructure and Urban Amenity Branch, 10 officials (6-4) in the Urban Transportation and Road Network Planning Branch, and 11 officials (6-5) in the Administration Branch. Nonetheless, there are some numbers of on-leave officials/staff mostly each branch, and nearly half of the officials/staff are contract staff who might be less motivated to work for UPD in the long-term due to less financial and non-financial incentives.

(2) Current Capacities of UPD

1) General

Since its establishment, UPD has accumulated some experiences as a planning division through dealing with emerging works on urban development in the Greater Yangon since 2011. UPD currently has only 60 officials/staff to provide technical advices and services in urban planning. Nevertheless, there is large room for UPD to strengthen their capacities in urban planning.

Firstly, they have few experiences to formulate and operate a land use regulation, a zoning regulation and a planning permission system while a building permission has been undertaken by another department, the Engineering (Building) Department of YCDC. Secondly, their capacities are still in transition for conducting urban survey, such as collecting the primary and secondary data, verifying, processing and storing the data, data mapping and the use of the data for land use, zoning and planning regulations. Thirdly, they have limited coordination capacities as a planning division with YCDC implementation departments, such as the Engineering Departments (Buildings, Roads and Bridges, and Water and Sanitation), the Pollution Control and Cleansing Department etc., due to partially their constitutional status. They have great limitations to coordinate with other Union Ministries, such as the Myanmar Port Authority (MPA), the Myanmar Railways (MR), the Ministry of Home Affairs (MOHA), the Ministry of Agriculture, Livestock and Irrigation (MALI), other line ministries/agencies for urban planning, land use regulations, urban facilities and urban development projects in planning consistency in the Yangon municipality territory. Furthermore, UPD is expected to enhance inclusive ownership and strategic capacity through strengthening effective networking with YRG, the MOC and professional societies, such as The Committee for Quality Control of High Rise Building Construction Projects (CQHP), the Yangon Heritage Trust (YHT), the Myanmar Engineering Society (MES), the Association of Myanmar Architects (AMA), the Yangon Technological University (YTU) and the Yangon University (YU). They are also required to improve transparency in guidelines and procedures for planning and building controls and services to attract foreign and domestic direct investments by the private sector. Finally, the UN Habitat, the EU, the ADB, Japan, South Korea and France are the major development partners to support UPD's capacity development for sustainable urban development in Yangon.

2) Zoning and Land Use Planning Branch

The Zoning and Land Use Planning Branch is responsible for urban survey, land management studies, zoning and land use studies, and mapping and recording. The zoning and land use maps were produced with the Ministry of Construction and other professional societies for drafting the Zoning and Land Use Bill, which proposes to divide Yangon into 10 zones and to define 30 to 35 percent of the city's total land area for new high-rise buildings and apartments and 20 percent for recreation open space for the public. Urban survey was also conducted for the

Dagon City Project and the Kan Thar Yar Project. They are currently building the data map system while collecting more comprehensive data from urban survey.

To some extent they are now able to create a new data map with coordinate information based on satellite image and survey data although they have parallel versions which need to be harmonized. In addition, they have not yet built any system to update data regularly. They are expected to establish the urban information management system, which consists of data map and various kinds of information, such as information of real estate registrations, buildings, statistics etc.

3) Urban Design and District Planning Branch

The Urban Design and District Planning Branch is responsible for urban design, urban heritage conservation, housing sector planning and district planning. Pilot township development plans were produced with the Ministry of Construction and other professional entities. The Yangon Urban Heritage Conservation Bill was drafted with the Yangon Heritage Trust and others. While the Department of Urban and Housing Development, the Ministry of Construction takes responsibility for land use planning and urban design at country level as well as on the MOC own lands in Yangon, they take charge of the Yangon municipality area. However, their scope for land use planning and urban design are often limited to YCDC own land in Yangon.

A limited number of the officials have capacities to conduct basic urban survey through quantitatively identifying the current situation of the city by a field survey, but not as the branch. They are currently collecting data for the Central Business District through a field survey to build the data map for district planning, and need to further expand for the other districts of the Yangon municipality. In the medium and long term, they need to strengthen capacities for the city planning area, including urbanization control area and urbanization promotion area, urban land readjustment and urban redevelopment.

4) Urban Socioeconomic Studies Branch

The Urban Socioeconomic Studies Branch takes charge of urban sociology studies, urban economies, employment and manpower studies, industrial studies and population studies. They mainly rely on the secondary data of socio-economy, employment, industry and population to analyze trends and projections for framing urban structure in the medium and long term. They also provide basic inputs for land use planning, urban planning, urban design and other planning. Nevertheless, they have a limited analytical capacity with five officials/staff appointed, including two on-leave officials.

5) Infrastructure and Urban Amenities Planning Branch

The Infrastructure and Urban Amenities Planning Branch takes charge of water supply, sewerage and drainage planning, energy and telecommunication planning, urban recreation facilities planning, and environmental planning. They collect data of urban infrastructure and utilities from the first responsible departments and public entities, like the Engineering Departments (Water and Sanitation), the Playgrounds, Parks and Gardens Department, and the Pollution Control and Cleansing Department under YCDC, and the Department of Meteorology and Hydrology, the Department of Irrigation, the Yangon Electricity Supply Cooperation etc. They analyze these data for trends and needs for urban facilities, such as the public space, water, sanitation and sewerage, from urban planning perspectives. Like the other branches, however, they have faced limitation to collect data from those responsible department and public organizations timely.

6) Urban Transportation and Road Network Planning Branch

The Urban Transportation and Road Network Planning Branch has responsible for urban transportation planning, road network planning, traffic planning, and port and logistics planning. They collect data from the Engineering Department (Roads and Bridges), the Myanmar Railways, the Myanmar Port Authority, and the Inland Water Transport while they provide GIS mapping data to them. They also collect data of time and speed of buses using GPS loggers. Similarly, they have also faced some difficulties to collect date from these responsible departments and authorities timely. In addition, the Yangon Region Transport Authority has taken over the first responsibility for overall transportation planning in Yangon Region since 2016. It has created another challenge in redefining the branch's roles and the division of labors.

7) Administration Branch

The Administration Branch takes charge of administration, accounts, data management and public relations. They manage staff administration and accountings, and submit the attendance and daily reports to the Director for review and record. There is still room for improvement on efficient administration capacities.

3.2.7 Capacity Challenges of UPD

The current structure and capacities of UPD described in the above have entailed the capacity limitations of UPD. In fact, UPD is currently facing great difficulties to respond to rapid urbanization that has generated growing demand for the legal and administrative processes that underpin urban development. The quality of urban planning and regulatory services largely depends on administrative capacities. There is a summary of the capacity constraints at UPD which might possibly prioritize areas for capacity development to enhance sustainable urban development in the short and medium term.

- Despite strong demands for controlling and encouraging the private investment inflows to Yangon, YCDC is unable to undertake effective urban planning mainly due to weakness of the legal and administrative frameworks and capacities.
- YCDC has less experiences to enact regulations through undertaking coordination at the council and public hearing to formulate legal consensus. For instance, YCDC has been unable to enact the draft zoning regulation through conducting this process.
- The organizational structure and staffing of UPD don't reflect the actual needs. The arrangement of staffing doesn't take into account the actual amounts of works required at UPD. For example, the Infrastructure & Urban Amenities Planning Branch and the Urban Transportation & Road Network Planning Branch under UPD rarely carry out designation and planning of urban planning roads and urban facility planning that may be ones of the main duties and responsibilities.

Brown (2015)[22] has similarly identified a number of challenges and opportunities associated with urban planning and regulation as municipal capacity as follows:

- Strategy planning is often based on national development objectives that do not take into account local issues. While metropolitan plans may channel directions for urban growth, housing development and major infrastructure, local plans can identify potential development sites and protected areas.

[22] Brown, A. (2015). 'Planning for Sustainable and Inclusive Cities in the Global South: Topic Guide'. Birmingham: GSDRC, University of Birmingham.

- Development regulation often assumes that development should be authorized centrally, through transparent and accountable decisions. These assumptions are unrealistic when most urban building is informal. In these contexts, development control should focus on priority areas (e.g. to identify land for housing or ensure environmental protection).
- Action planning has led to a number of innovations that are redefining the potential for urban intervention. These include urban design and new spatial forms, participatory planning, and land regularization and upgrading.
- Planning for megacities poses challenges for vertical and horizontal policy coordination. Strategy should focus on key metropolitan functions such as transport infrastructure, solid waste disposal and trunk sewerage and water provision.

Moreover, UPD has faced some limitations on institutional arrangements and human resource management in urban planning as follows:

- YCDC is a service delivery administrative body rather than a municipality without authority for policy decision making for which YRG takes responsible.
- UPD is one of the Divisions under the City Planning and Land Administration Department. The Head of Department and many of the officials or staff has executive professional background in land administration rather than urban planning.
- There are a limited number of permanent officials at UPD.
- There are not enough numbers of officials/staff who have tertiary educational background especially in the field of urban planning and civil engineering.
- Officials/staff have shown much interests in learning urban design skills and analytical works which must generally be outsourced to the private sector in the future.

Avis (2016)[23] has also pointed out the common challenges on institutional and human resource management in urban governance in the below:

- complex and unclear organizational structures;
- unclear delegation of tasks between managing authorities and intermediate bodies;
- insufficient capacity and power within coordinating bodies to fulfil their role;
- weak governance arrangements for holding managers accountable for performance, controlling corruption and avoiding undue political influence over project selection and staff appointments;
- high staff turnover rates and lack of appropriately qualified and experienced staff − often as a result of patronage systems;
- poor administrative capacity of municipal governments, especially smaller local authorities;
- lack of expertise leading to issues of compliance with complex national and international regulations e.g. public procurement, aid and environmental legislation;
- limited analytical and programming capacity, including insufficient capacity (and political backing) to deliver result-oriented strategies.

[23] Avis, W. R. (2016). 'Urban Governance: Topic Guide'. Birmingham: GSDRC, University of Birmingham.

The effectiveness of municipal government in urban planning depends on resources, skills, structures and management processes. However, UPD under YCDC has faced the capacity challenges in all dimensions. Hence, it is important to prioritize areas for capacity development in the short, medium and long term, respectively. In this regard, it is recommended to focus on development controls, such as zoning and planning regulations, as the prioritized area for capacity development in the short and medium term. This is because of its urgent needs for urban development in Yangon context. Once the legal and regulatory frameworks are endorsed by the union and regional governments, the capacity development of law enforcement may require relatively less time (in the short and medium time), compared with the other areas of capacity development, such as urban planning that requires the longer time (in the medium and long time), including the revision of the existing urban plan and making a new urban plan. Capacity development for urban design may be also less prioritized because it can be outsourced to the private sector.

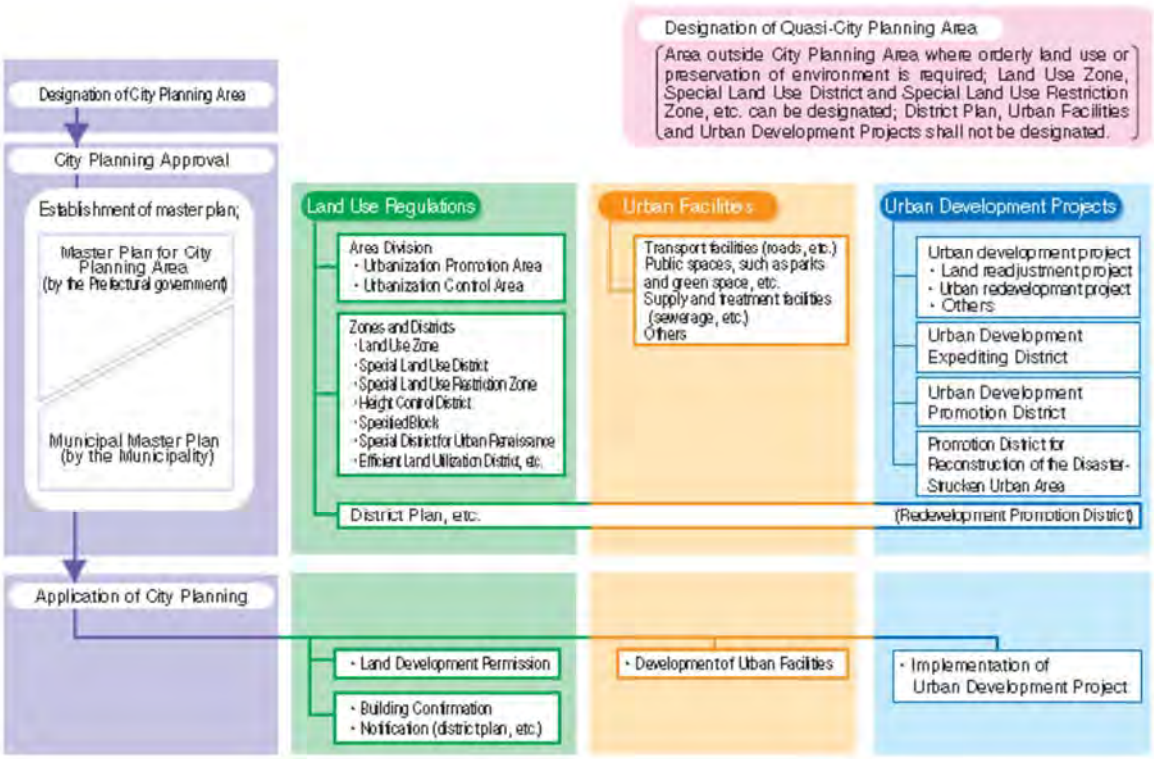
Furthermore, it is important to enhance institutional reform and human resource arrangements at UPD and YCDC in order to meet changes in public needs. It ensures performance accountability, transparent decision-making and inclusive ownership in urban development. Nonetheless, institutional reforms largely depend on strong political will and require the long-term efforts. Therefore, it is important to support the reforms, but it may limit the scope of support in the reforms which are related to the regulatory services.

3.2.8 Empirical Framework

(1) Functions of Urban Planning at Municipality

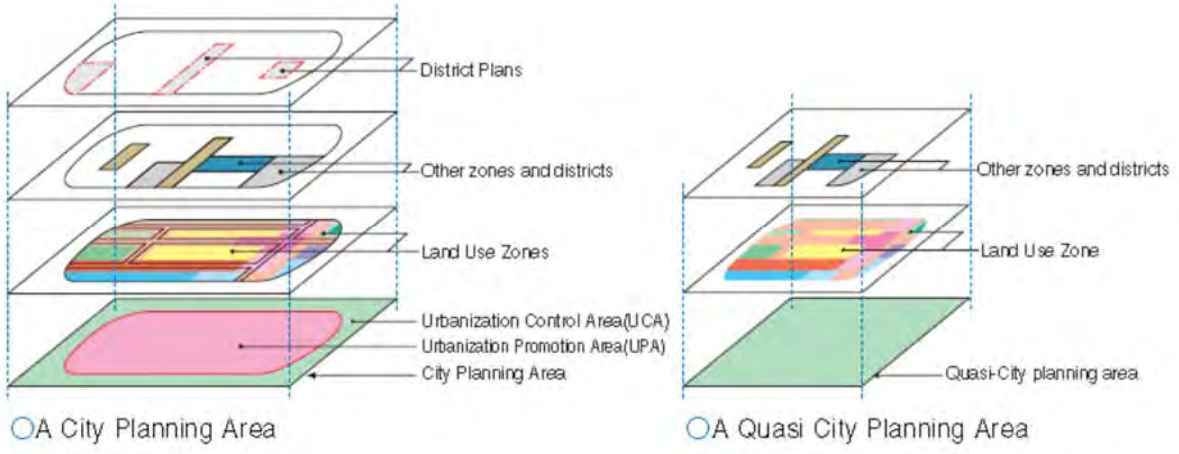
Urban governance is the process by which governments, including local, regional and national governments, and stakeholders collectively decide how to plan, finance and manage urban areas. Its elements include: city-national interface; municipal capacity; role of the private sector; and political systems and institutions[24]. In developing countries, municipal governments are often facing challenges in urban planning due to a lack of up-to-date mapping; weak development control and enforcement powers; out-of-date planning processes; and limited compliance with land-use regulation. In fact, where governance and oversight are weak, much urban development takes place outside formal frameworks.

[24] Avis, W. R. (2016). 'Urban Governance: Topic Guide'. Birmingham: GSDRC, University of Birmingham.



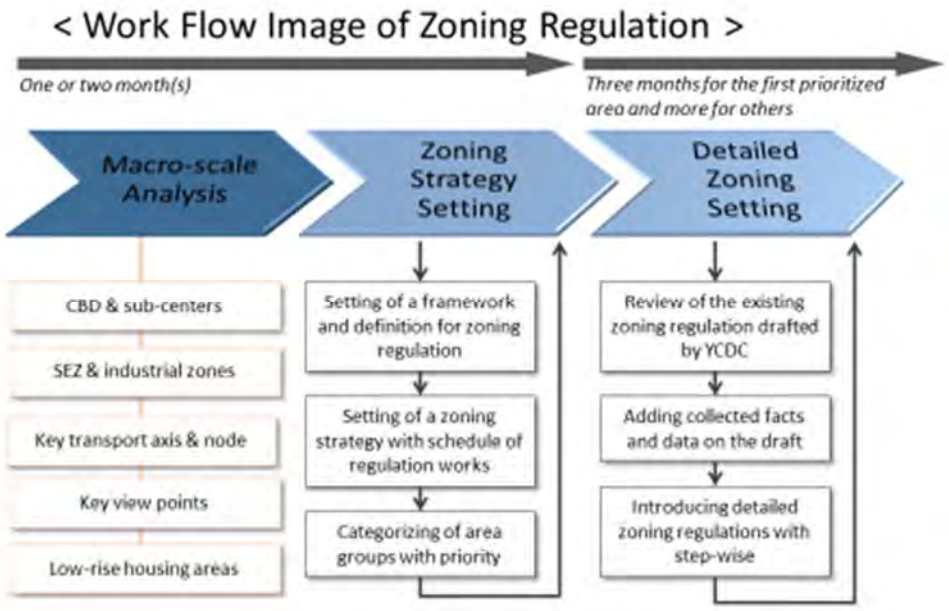
Source: Ministry of Land, Infrastructure and Transport. (2003). 'Introduction of Urban Land Use Planning System in Japan'.

Figure 3.2.8: Structure of Urban Planning System



Source: Ministry of Land, Infrastructure and Transport. (2003). 'Introduction of Urban Land Use Planning System in Japan'.

Figure 3.2.9: Concept of Land Use Planning System



Source: JICA Study Team

Figure 3.2.10: Work Flow Image of Zoning Regulation

In this context, there are variously different measures for urban planning which are applied to each area by municipal governments that depend on local circumstances under urban planning law. Land use system includes a wide range of measures on different dimensions and the rules of land use are usually decided by a combination of individual measures. For example, structure of urban planning system and a concept of land use planning system in Japan are presented as follows (See Figure 3.2.8 and Figure 3.2.9)[25]. In the zoning regulation, there are three steps in the work flows, consisting of macro-scale analysis, zoning strategy setting and detailed zoning setting. The macro-scale analysis includes CBD and sub-centers, SEZ & Industrial zones, key transport axis and node, key view points, and low-rise housing areas. The zoning strategy setting includes setting of a definition and framework for zoning regulation, its time framework, and categorizing area group. The detailed zoning setting consists of review of the existing zoning regulation, reflecting new facts and data, and introducing the new zoning regulation.

(2) Model of Urban Planning: Case of Kobe City, Japan

It might be useful to define the model of the urban planning for a concerned department at the municipality to identify what are desired capacities and its capacity gaps for pursuing urban development. This section provides some reference, like scopes of the selected duties and responsibilities and manpower, at the Housing and Urban Bureau of the Kobe City Municipality that serves a city population of 1.54 million people and may be one of the best performers in urban planning in Japan.

Regarding to the number of the employees at the Housing and Urban Bureau, the Kobe City Municipality, there are 474 officials in total (See Table 3.2.2). Out of the total, there are 321 skilled officials, including 180 architects and 83 civil engineers while 153 officials support administration.

[25] Ministry of Land, Infrastructure and Transport of Japan. (2003). 'Introduction of Urban Land Use Planning System in Japan'. Tokyo: MLIT.

Table 3.2.2: Organization Structure and Human Resources at Housing and Urban Bureau, Kobe City Municipality

	No of Section	Admin	Civil Engineer	Architect	Electrical	Machinery	Others	Total
Administration Office	-	16	1	-	-	-	-	17
Planning Department	*4*	11	32	32	1	0	3	79
Transport Policy Department	*1*	4	12	0	0	0	0	16
Urban District Department	*4*	49	29	18	1	0	0	97
Housing Department	*4*	55	2	33	5	7	0	102
Building Guidance Department	*4*	13	2	48	1	2	2	68
Architectural Technology Department	*3*	5	3	47	19	13	2	89
Total	*20*	153	83	180	28	23	7	474

Source: JICA Study Team Modified from Kobe City Municipality's documents

There are six departments and the Administration Office in the Bureau: the Planning Department, the Transport Policy Department, the Urbanization Promotion Department, the Housing Department, the Building Guidance Department, and the Architectural Technology Department. The selected duties and responsibilities of each department are presented as a reference in the following Table 3.2.3.

1) Urban Planning, Planning Regulation, Zoning Regulation, and Development and Town Planning

The duties and responsibilities in the Planning Department, the Kobe City Municipality, are highly relevant to UPD, YCDC to function as a planning division. They include city planning; planning regulation and development planning; zoning regulation; detailed development plan; and town planning. In fact, UPD is required to revise the SUDP every five years so that capacity for city planning needs to be fostered. UPD is also expected to play a central role to enforce planning and zoning regulations once approved by parliament. In order to provide seamless service deliveries from zoning and planning permission to building permission, it is important to ensure effective coordination with the Engineering Department (Buildings) that is currently responsible for building controls and services. UPD is also requested to make basic development plan for sub-center development, new town development and CBD development.

2) Land Readjustment and Urban Redevelopment

The Urbanization Promotion Department, the Kobe City Municipality, takes charge of the implementation of urban development projects through land readjustment and urban redevelopment. They are relevant to the duties and responsibilities of UPD, YCDC, in the medium and long term once the legal framework is introduced in Myanmar. In this case, it is necessary for UPD to strengthen capacities in these areas through conducting research in order to prepare for meeting the forthcoming public needs.

3) Transport, Housing and Building

Transport policy, housing policy and support, and building confirmation are handled by the Transport Policy Department, the Housing Department and the Building Guidance Department, respectively, at the Kobe City Municipality. Although these fields are not the first responsibilities for UPD under YCDC, it is crucial that UPD undertakes monitoring and

administering in the progress of the implementation of the urban development projects as a planning division through coordination with other public entities or department, such as the Yangon Region Transport Authority (YRTA), the Ministry of Construction (MOC), the Engineering Department (Buildings), and the other entities or departments.

Table 3.2.3: Duty and Responsibility of Housing and Urban Bureau, Kobe City Municipality

Department	Selected Duties and Responsibilities
Planning Department	**City Planning** ・ Survey and basic planning on urban planning ・ Decision on urban planning and approval of urban planning project ・ Public hearing, briefing sessions, awareness raising and public relations in urban planning ・ Implementation of environmental impact assessment related to urban planning, and decisions on contact and adjustment with related organizations
	Planning Regulation and Development Planning ・ Permit and guidance on construction activities, etc. in line with the urban planning law ・ Examination of land use purpose based on the land use planning act ・ Examination and guidance of development activities based on the provision of urban planning law ・ Reception, guidance and adjustment concerning proposals based on the urban planning law and urban regeneration law ・ Contact and adjustment concerning the development plan with the independent administrative agency Urban Regeneration Organization and other related organizations ・ Examination and guidance of notification of action concerning district plan ・ Guidance and adjustment concerning urban revitalization
	Zoning Regulation ・ Area classification prescribed in urban planning law ・ Regional districts prescribed in urban planning law ・ District plan prescribed in city planning law
	Detailed Development Plan ・ Survey of city facilities and basic plan ・ Survey of urban development and redevelopment and basic plan ・ Survey of streets etc. and basic plan ・ Survey of planned development park and survey on basic plan and other town planning and basic plan
	Town Planning ・ Awareness raising, support and training of town development in the region ・ Survey and planning on town development in the region ・ Survey and research on urban landscape ・ Awareness raising and promotion of landscape formation in the region ・ Coordination of urban landscape improvement project ・ Urban center planning and adjustment on revitalization of waterfront and landscape formation ・ Survey, research, dissemination and enlightenment of universal design related to building and town planning
Transport Policy Department	**Transport Policy** ・ Survey of urban transportation system and basic plan ・ Comprehensive adjustment concerning the improvement of public transportation system ・ Investigation and basic planning of railways etc. ・ Investigation possibility of new transportation method
Urbanization Promotion Development	**Redevelopment Projects** ・ Business enlightenment and public relations ・ Examination of compensation for business ・ Authorization and oversight by regulation of law ・ Project survey, planning and adjustment ・ Permission for building acts etc. under the provisions of law ・ Design of buildings, etc. accompanying business, implementation and inspection of construction ・ Management and disposal of construction facilities etc. related to business and collection of usage

	fee etc. ・ Attracting and coordinating enterprises, etc. related to business plan and disposition of holding floor ・ Management of land acquired etc. in accordance with business etc. ・ Study of streets accompanying business, planning of construction, consultation on design, inspection and transfer
	Land Readjustment Projects ・ Business enlightenment and investigation ・ Compensation fee and direct examination review ・ Compensation for loss accompanying acquisition of real estate related to business ・ Project survey, planning and adjustment ・ Overall management of project progress management, guidance ・ Permit and guidance on building acts etc. according to the provisions of law ・ Adjustment and dispute with right holder concerning residential land etc. after disposal of substitution related to business ・ Management and disposal of municipal buildings related to business ・ Project and roadway improvement Survey of streets etc. according to street business, planning of construction, design and inspection ・ Survey and adjustment of construction related work and management and handover of public facilities ・ Conversion plans involved in the project and design of interchange
Housing Department	**Housing Policy and Support** ・ Research on housing policy ・ Adjustment on municipal housing ・ Administrative procedures pertaining to assistance applications for municipal housing construction, large-scale repair etc. ・ Subsidies for private rental houses ・ Loan redemption of housing new construction funds, housing renovation funds and housing acquisition funds ・ Planning and implementation of support measures for private housing ・ Housing consultation service ・ Kobe City Housing Financing System
	Municipal Housing ・ Administrative procedures pertaining to enforcement of construction and facility construction of municipal housing etc. ・ Acquisition, management and disposal of real estate ・ Survey and plan for management of municipal housing etc. ・ Communication and coordination with related organizations related to the construction of municipal housing etc. and surrounding residents ・ Examination of construction and facility construction of municipal housing etc. ・ Survey, estimate, design, supervision, inspection and evaluation of construction work, maintenance and repair of municipal housing etc ・ Technology development, investigation and research of construction work of municipal housing etc. ・ Survey, estimate, design, supervision, inspection and evaluation of electric equipment, machinery, water supply and sanitation facilities construction, maintenance and repair of municipal housing etc. ・ Survey and plan concerning management of municipal housing ・ Recruitment and selection of residents of municipal housing ・ Management of buildings of municipal housing, maintenance and transfer of premises, collection and storage of usage fees etc.
Building Guidance Department	**Building Confirmation** ・ Reception of Building Confirmation Application Form, Building License Application Form etc ・ Planning and investigation related to building administration ・ Contact and adjustment with related organizations concerning building administration ・ Contact, coordinate, and guidance to Designated Confirmation Inspection Body ・ Examination and inspection of compliance with Building Standards Relation Regulations for Building Confirmation and Plan Notification ・ Review of the safety of the premises of the building ・ Examination of the structure and proof stress of buildings and on-site inspection ・ Regular report of building equipment, guidance and safety review ・ Enlightenment concerning prevention of breach of building standards law and communication and

	adjustment with related organizations ・ Investigation of buildings in violation of Building Standard Law and monitoring of buildings ・ Popularization and enlightenment of quake resistance etc
Architectural Technology Department	Architectural Confirmation ・ Contact and adjustment concerning building technology ・ Development, research, improvement and diffusion of building technology
	Architectural Technology Development ・ Planning, survey, advice and estimate of city-owned buildings ・ Survey, planning, advice and collection of materials concerning maintenance and preservation of municipal buildings ・ Examination of construction work of the city-owned building ・ Management, operation and improvement of municipal building information system
	Municipal Building ・ Planning, survey, advice and estimate of city-owned buildings ・ Survey, planning, advice and collection of materials concerning maintenance and preservation of municipal buildings ・ Examination of construction work of the city-owned building ・ Management, operation and improvement of municipal building information system

Source: JICA Study Team Modified from Kobe City Municipality's documents.

3.2.9 Desired Capacities for Urban Development

Urban planning can be described as a technical and political process concerned with the welfare of people, control of land use, design of the urban networks and lifelines and protection of the environments. In this line, the Urban Planning Division (UPD) is expected to play a crucial role in facilitating effective urban planning through encouraging inclusive ownership with the public sectors and the non-state actors, including civil society, the private sector, professional society, and the others. UPD is responsible for undertaking two major planning tasks, including delivering regulatory services and administering the effective implementation of the urban development plan, the SUDP, towards the attainment of the goals of the Yangon Future Vision 2040. UPD and other relevant departments in YCDC will follow the policy guidance made by YRG.

(1) Desired Structure of UPD

To enhance realization of urban planning, UPD under YCDC needs to be upgraded to an independent department through being endorsed by the Yangon Region Government (YRG) and the Ministry of Planning and Finance (MOPF). At the same time, UPD also needs to be appointed as a top of the hierarchy of YCDC's planning under the Committee members. It will provide an enable environment for UPD to function as an urban planning department to enforce the land use, zoning and planning regulations and to coordinate YCDC's sector departments, other public sectors and non-state actors in the implementation of the SUDP. At the same time, YCDC is likely to need to undertake restructuring of administrative bodies through reducing the number of departments and entities and reallocating human and financial resources to the prioritized activities, including urban planning, land use regulations, urban infrastructure facilities and services, and urban development projects.

For the desired structure of the division, UPD also needs to undertake organizational reforms. It is anticipated that the duties and responsibilities under the Zoning and Land Use Planning Branch and the Urban Design and District Planning Branch will increasingly become important for meeting growing urbanization issues in the Yangon municipality. On the other hand, the rest of branches, such as the Infrastructure and Urban Amenities Planning Branch and Urban Transportation and Road Network Planning Branch, is likely to be less significant because they are not the first responsible authorities in urban facilities and transportation. Rather, they are expected to enhance coordination between urban planning and urban facilities with the Engineering Departments (Roads and Bridges,

Water and Sanitation, and Buildings), the Yangon Region Transport Authority (YRTA) and other entities. In this regard, both branches could be meagered into one branch as one of the options.

(2) Desired Duty and Responsibility of UPD

YCDC is a municipality that delivers regulatory services in urban planning, entailing zoning restrictions, planning permission, floor space indices, and construction standards in Yangon. While the Engineering Department (Buildings) remains the responsibility of building controls and services, UPD is expected to take charge of the forthcoming regulatory services, such as zoning regulation and planning permission, through controlling them from professional views of urban planning.

The Zoning and Land Use Planning Branch can make responsible for zoning regulation, planning regulation in the short and medium term and city planning area regulation in the medium and long term. The zoning regulation divides YCDC municipality's territory into residential, commercial, industrial, mixed, and other districts that are separate from one another for the most part with the use of property. The planning regulation controls the use of land and buildings, the appearance of buildings, landscaping considerations, highway access and the impact that the development will have on the general environment. City planning areas, such as urbanization promotion area and urbanization control area, are necessarily classified, and land use regulation is conducted. Other regulations and guidelines in urban planning also need to be developed and enforced by UPD to realize sustainable urban development.

The Urban Design and District Planning Branch can take responsible for town and district planning and urban development project planning in the short and medium term. They include planning, basic design and management for Central Business District (CBD) development, new town development, Transit-Oriented Development (TOD), sub-center development and other development projects. The Branch can also seek additional responsibilities for urban land readjustment and redevelopment in the medium and long term. The urban land readjustment and redevelopment will be one of the most critical issues to expand streets, create public places and build a for the realization of sustainable urban development through the consolidation of fragmented plots, ownerships and interests by YCDC for their unified planning, servicing and subdivision with the sale of some of the new plots for cost recovery and the redistribution of other plots to the landowners.

The proposed new branch meagered between the Infrastructure and Urban Amenities Planning Branch and the Urban Transportation and Road Network Planning Branch can take charge of administering the implementation of urban transportation, facilities and infrastructure projects through effective coordination with the Engineering Departments (Roads and Bridges, Water and Sanitation, and Buildings) and other departments of YCDC, YRG, and central ministries and agencies as well as non-state actors.

It is suggested that the Urban Socioeconomic Studies Branch can act more than conducting socioeconomic survey and research, but also adding two main tasks, including urban planning, monitoring and evaluation and revision of the SUDP, and urban information system management.

There are more details of expected duties and responsibilities for each branch of UPD in line with proposed restructuring with given tentative branch names in the below (See Table 3.2.4).

Table 3.2.4: Duties and Responsibilities under Proposed UPD Reforms, YCDC

Branch	Duties and Responsibilities
Zoning and Planning Permission Branch (←Zoning and	**Land Use and Zoning Regulation** ・Research, planning and enforcement for city planning area division (urbanization promotion area and urbanization control areas) ・Research, planning and enforcement for zoning regulation ・Coordination with relevant organizations concerning land use and zoning regulation

Land Use Planning Branch)	・Public hearings, briefing sessions, awareness raising and public relations **Planning Permission** ・Inspection, guidance and enforcement for planning permission ・Coordination with related organizations concerning planning permission ・Inspection, guidance and enforcement for district planning
Urban Design and District Planning Branch	**Development Project Planning and Management** ・Survey, planning and management for development projects ・Basic planning, design management, permission and guidance for municipal properties ・Coordination and negotiation with proprietors pertaining to the projects ・Management and disposal of municipal properties **Town Development Promotion** ・Survey, planning and basic design for district planning and township planning ・Survey, awareness raising and promotion of landscape protection ・Planning, basic design and management for Central Business District (CBD), waterfront development and landscape protection ・Planning for Transit-Oriented Development (TOD), Sub-center development ・Research for land readjustment and urban redevelopment
Planning and Survey Branch (←Urban Socioeconomic Studies Branch)	**Urban Planning (SUDP)** ・Survey, planning, monitoring and evaluation, and revision of the SUDP ・Coordination with related organizations concerning the SUDP ・Public hearings, briefing sessions, awareness raising and public relations about the SUDP ・Coordination with housing policy **Urban Planning Survey and Urban Information System Management** ・Planning, implementation and update of urban basic survey ・Establishment, management and update for urban information system (GIS mainstreaming)
Infrastructure, Transportation and Utilities Planning Branch (← Infrastructure and Urban Amenities Planning Branch (←Urban Transportation and Road Network Planning Branch)	**Development Projects Planning** ・Survey, planning and coordination for infrastructure projects and social services ・Project monitoring, guidance and inspection **Support for Urban Planning (SUDP)** ・Comprehensive coordination concerning infrastructure development and social services in line with SUDP planning ・Merger with Urban Transportation & Road Network Planning
	Development Project Planning ・Survey, planning, and coordination for road and transportation projects ・Project monitoring, guidance and inspection **Support for Urban Planning (SUDP)** ・Comprehensive coordination concerning transportation system in line with SUDP planning ・Examination of possibility of new transportation system ・Merger with Infrastructure & Urban Amenities Planning
Administration Branch	・General affairs of UDP, administrative contact, coordination, improvement, budget management, safety and health etc.

Source: JICA Study Team

3.2.10 Capacity Development Response

(1) Action-Oriented Capacity Development

To promote urban development in the Greater Yangon in line with the SUDP, capacity development for urban development and management needs to be strengthen in UPD under YCDC. In this context, the desired capacity and the existing capacity of the UPS are identified and reviewed to formulate the capacity development response. The organizational capacity of UPD was assessed. It was found that lack of proper organizational structure and weak coordination capacity were the most challenging issues that UPD had faced as a planning division, followed by less capacities to formulate and enforce the rule and regulatory services, such as land use and zoning regulation as well as planning permission. To foster capacity development in such fields, technical cooperation project is proposed for ensuring effective implementation of the SUDP 2016 as follows:

a) **Proposed Technical Cooperation Project**

Capacity Development Project for Urban Development and Management in the Greater Yangon

b) **Counterpart**

- Yangon Region Government (YRG): Yangon Urban Planning Authority (YUPA) (forthcoming)
- Yangon City Development Committee (YCDC): Urban Planning Division (UPD) under City Planning and Land Administration Department, Engineering Department (Building), and other relevant departments

c) **Target Group & Area**

5.21 million population in Greater Yangon

d) **Project Period:**

3 years (2017 to 2020)

e) **Project Purpose**

Capacity for urban development and management is strengthened in counterpart organizations in charge of development permission and building permission system.

f) **Overall Goal**

Urban development in the Greater Yangon is promoted in line with the Strategic Urban Development Plan of the Greater Yangon (SUDP).

g) **Output**

a) To Review Organization Structure in Urban Development and Management
b) To Enhance Enforcement of Zoning Regulation System
c) To Facilitate Planning Permission System

h) **Activity**

a) Output 1: To Review Organization Structure in Urban Development and Management

- To support reviewing the organization structure in charge of urban development in Yangon
- To support reviewing necessary duties and responsibility of each of existing department/division in accordance with the work flow of urban development in YCDC
- To propose a desired department/division, if necessary

b) Output 2: To Enhance Enforcement of Zoning Regulation System

- To support data survey for urban development and establish GIS database system
- To support conducting macro-scale analysis
- To support formulating zoning strategy
- To support setting detailed zoning regulation

c) Output 3: To Facilitate Planning Permission System

- To support simplifying and transparent procedure such as one-stop service of planning permission and building permission
- To support drafting development technical standards, and to brush-up through case-study projects
- To support finalizing the development technical standards
- Traffic & Road (including Traffic Impact Assessment)
- Water, sanitation & solid waste management
- Park & public facilities
- Townscape & environment (townscape impact simulation)
- Disaster risk management & fire service
- To support enforcing the regulation through By-law of YCDC

3.3 Building Seismic Diagnosis

3.3.1 Building Overview Targeted for Seismic Diagnosis

The following are issues regarding earthquake-resistant design in Myanmar.

a) **Myanmar National Building Code:** Currently there is no building standards law in place. Myanmar National Building Code (hereinafter called 'MNBC') is still in process of creation. This is going to be enacted into law in the future.

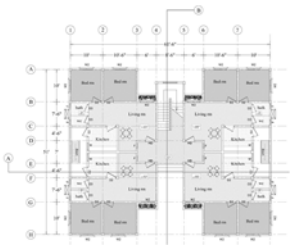
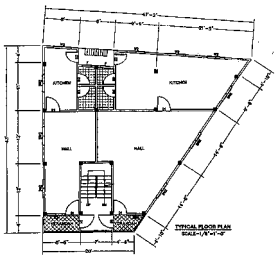
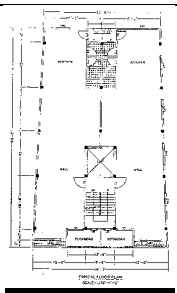
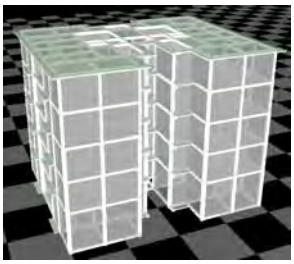
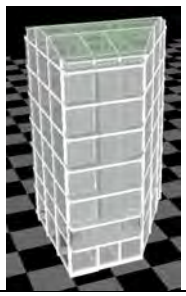
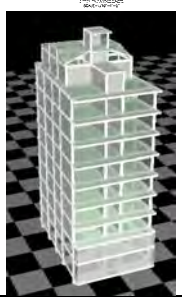
b) **Committee for Quality High-rise Building Project:** Currently, YCDC is examining nine to twelve stories buildings in Yangon city with the instruction of the Committee for Quality High-rise Building Project (hereinafter referred to as "CQHP). This institution is not based on any laws either. Majority of the CQHP basically refers to Uniform Building Code 97 (hereinafter referred to as "UBC97"), and there is not much detailed description. However, some items such as fixing length of slab RC are specifically stated in Burmese language, while detailed seismic design method is not. Under the circumstances, it is assumed that seismic design standards are not widely recognized among local designers.

c) **Reference Code :** Both MNBC and CQHP are created by partially revising United States' design criteria. MNBC is based on the American Society of Civil Engineer 7 (hereinafter referred to as 'ASCE7') while CQHP is based on the UBC97. Difference in design methods adopted by ASCE7 and UBC97 may cause confusion when the MNBC is officially legislated.

d) **Problems of Application Procedures at YCDC:** The building lower than eight stories does not require seismic design.

Aiming at evaluating seismic properties of buildings currently under construction in Yangon, seismic diagnosis was conducted for following three building as listed in Table 3.3.1. None of the buildings adopt seismic design.

Table 3.3.1: Building Overview Targeted for Seismic Diagnosis

Building name	4U5S	Six stories building	Eight stories building
Year built	Under construction	2009	2009
Building scale	Five stories (Structurally six stories)	Six stories (Structurally eight stories)	Eight stories (Structurally twelve stories)
Structural type	RC rigid-frame structure (Brick wall)	RC rigid-frame structure (Brick wall)	RC rigid-frame structure (Brick wall)
Drawing			
Analytical model			

Source: JICA Study Team

3.3.2 On-site Survey Result

(1) Overview

4U5S (Hlaing Tharyar Township) is a building under construction. We have performed on-site survey on following items. On-site survey was conducted on August 11, 15 and 22.

a) Confirm construction status
b) Obtain sample of concrete and rebar
c) Hearing from contractor
Contractor's name: U Khin Maung Myint Construction (mid-sized contractor)

Source: Google Earth Pro

Figure 3.3.1: Location map of surveyed site

(2) Drawing Comparison Survey

a) According to on-site office, 27 buildings are to be constructed in 4U5S. Combined with other plans, Hlaig Thar Yar Township will hold total 88 buildings to be constructed. Construction status varied for each building, some have completed construction of building frame while others have completed RF construction.
b) After comparing submitted drawing (Obtained from MOC) and drawing used on-site (hereinafter referred to as 'on-site drawing'), we confirmed that column section of 1st floor is not consistent. The column size is changed from 14"x14" to 12"x14" (305-355mm). Rebar diameter is also changed. Construction itself is performed almost in accordance with the on-site drawing.
c) On-site drawing had supplementary information such as reinforcement arrangement that was missing on the submitted drawing.
d) RF slab layout is same as drawing.
e) Block layout is same as drawing.
f) Aperture layout is same as drawing.


Source: JICA Study Team

Figure 3.3.2: Building's exterior appearance

(3) Deterioration Degree and Construction Status

a) No aged deterioration since the building is under construction.
b) Column rebar is decentered from the center of mold form and covering depth is different between left and right.
c) Confirmed fixation length for hoop falling short.
d) Spacer is used only in some areas, and even when it's used the concrete piece is not fixed (might move while casting). We observed such cases where insufficient construction accuracy is achieved for maintaining design strength.
e) Vibrator is inserted askew.
f) We observed honeycombed concrete in columns that came immediately out of mold form. This is assumed to be due to concrete blending, grain size of coarse aggregate (quality of material used) and inappropriate use of vibrator.


Decentered column rebar


Unfixed spacer


Vibrator inserted askew


Honeycombed column

Source: JICA Study Team

Figure 3.3.3: Photo from construction site

(4) Others and Hearing Result

1) Concrete

a) Beam and slab concrete is produced in factory.
b) Concrete for column and foundation is mixed on site.
c) Mortar for brick wall is using side-mixed concrete.
d) Blending details as below.
Column, Slab, Beam;
Cement: Sand: Aggregate = 1:2:4 → Water:30L (When 1 is equivalent to 1 bag (50kg))
Lean Concrete(footing);

Cement: Sand: Aggregate =1:3:6 → Water:36L (When 1 is equivalent to 1 bag (50kg))
Wall(mortar);
Cement: Sand: Aggregate =1:2:0

e) Cement for side-mixing is using Elephant (made in Thai).
As for blending of side-mixed concrete, they are using a plastic case to measure instead of using proper scale to accurately weigh the ingredients. (See Figure 3.3.4)
f) Gravel of 0.25-2.5 inches in diameter (5-64mm) is used.
g) Well water is used for blending.
h) Specimen is created for testing strength.
i) Specimen is 6 cubic inch size. It's removed from mold form after one day and cured in water on site. On the 30th day it is carried to testing site for test. 2-3 specimens are used.
j) Slump test is adopted for fresh concrete.
k) Mold form is removed after one day for column, and one month for beam and slab.
l) Vibrator is used to avoid honeycombed concrete.
m) In summertime water is sprayed on the casted slab to prevent cracking. After casting, the slab is covered with plastic sheet for 24 hours.


Source: JICA Study Team

Figure 3.3.4: Side-mixed concrete

2) Rebar

a) Rebar is put on wood pieces so that it does not touch the ground. (Rust was observed on the surface of rebar stocked outside exposed to rain.)
b) Rust in rebar is removed before using.
c) Bending work is done on site.
d) Rebar is produced abroad.


Source: JICA Study Team

Figure 3.3.5: Material storing situation

As above, on-site investigation revealed issues where submitted drawing and on-site drawing are not consistent, and problematic construction quality regarding construction technologies and

storage of construction material. The buildings under construction are not likely to have sufficient building strength as described in the design documents. Improvement of such construction qualities is one of the challenges concerning construction situations in Myanmar.

3.3.3 Investigation on Material Quality

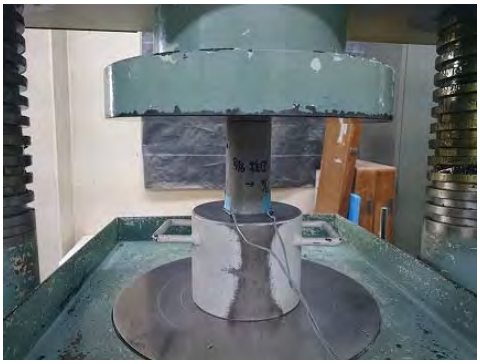
(1) Material Strength Verification

To verify strength of materials used for the buildings, following samples were obtained at newly constructed building (4US5) to be put to a material test in Japan. The test was conducted in Tsukuba Architecture Test Research Center under Center of Better Living.

a) Concrete (Three types, three samples each)
   1. For column (Side-mixed)
   2. For beam and slab (Factory-mixed)
   3. Mortar for wall (Side-mixed)
b) RC (Three samples): Column rebar φ16
c) Brick (One sample): For wall

Obtained samples

Test preparation



Compression test

Samples after test

Source: JICA Study Team

Figure 3.3.6: Material Test Performed

The test result is shown in Table 3.3.2. Refer to Test Report (appendix) for more detailed test result.

Table 3.3.2: Material Test Result

	Compression Test Result (N/mm^2)	Average Value (n) (N/mm^2)	Standard Deviation (σ)	Estimated Strength (n−σ/2) (N/mm^2)	Design Standard Strength (Fc) (N/mm^2)	Adopted Strength (N/mm^2)
1. For column (Side-mixed)	26.7	42.3	13.9	35.4	17.2	17.2
	53.3					
	46.9					
2. For beam and slab (Factory-mixed)	46.9	44.7	4.0	42.7	17.2	17.2
	40.1					
	47.0					
3. Mortar for wall (Side-mixed)	18.4	16.6	1.8	15.7	—	15.7
	14.8					
	16.7					

	Yield Point (N/mm^2)	Average Value (n) (N/mm^2)	Standard Deviation (σ)	Estimated Strength (n−σ/2) (N/mm^2)	Yield Strength (σy) (N/mm^2)	Adopted Strength (N/mm^2)
RC	502	489	51	464	275	275
	532					
	433					

	Compression Test Result (N/mm^2)
Brick	8.2

Source: JICA Study Team

Concrete used for building frame (1. and 2.) was confirmed to be above the design standard strength specified in the drawing. RC too exceeded the strength level stated in the drawing. As observed above, it was verified that the materials used for the buildings satisfy the design standard strength.

(2) Concrete Factory Visit

1) Overview

There are three major concrete factories in Yangon. Of them, the team visited and inspected two factories including HIGH TECH CONCRETE Co., LTD. (hereinafter referred to as “HTC”) and SCG Myanmar Concrete and Aggregate Co., Ltd. Since the results were similar, we hereby pick up inspection result from HTC as follows.

a) Factory name: HIGH TECH CONCRETE Co., LTD.
b) Date of visit: 9:00-12:00, 17th August 2016

Source: JICA Study Team

Figure 3.3.7: Factory appearance

2) Result of Hearing

(I) Concrete

a) HTC produces G10-60 (every 5 levels) concrete (G: Grade)
b) For a size of five stories building, G25 concrete is used in general.
c) Grade conversion calculation complies with CQHP.
d) Concrete blending is decided based on ATSM. Blending ratio differs depending on grade.
e) Well water is used for mixing.
f) Daratod17 and Super20 are used as additive. Daratod17 is used for low-grade concrete, and both are used for G35 concrete or above.
g) Another additive is added in case it needs to wait for more than 3 hours until casting or in case of underwater concrete.

(II) Cement

a) Following 4 products are used for cement.
(1) Mountain Brand, (2) Red Lotus (3) Diamond (4) Apache
b) (1) - (3) are made in Thai and (4) is produced by STC, HTC's group company (Mandalay).
c) Usually they use (1) - (3) products, but if they are short of supply (4) is used.
d) Quality of each product is equivalent.

Source: JICA Study Team

Figure 3.3.8: Cement storage situation

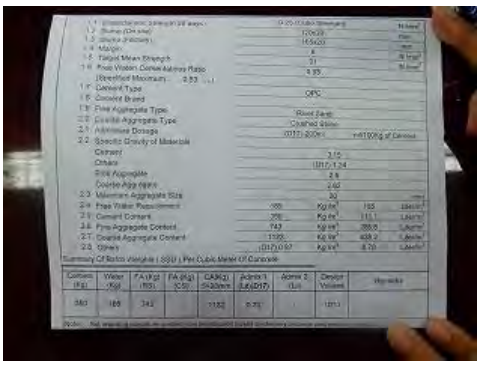
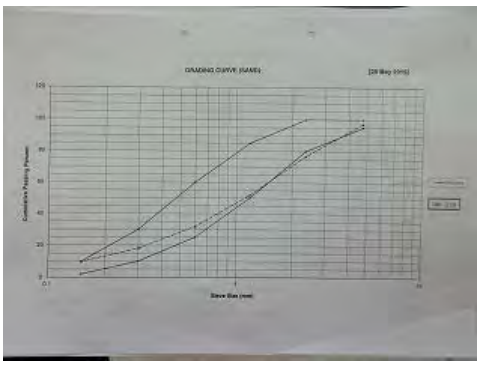
(III) Aggregate

a) Below two products are used for sand.
(1) River Sand (Thilawa river), (2) Crashed Sand (Mow la Myaing)
Moisture testing is conducted against sand to be used. 3 times a day for each.

b) Below two products are used for gravel.
(1) River Single (Ayeyarwaddy River), (2) Crushed Stone (Mow la Myaing)
For construction gravel of about 5-25mm is used.
c) In ASTM (2) is the standard product. As for (1), cumulative passing percentage does not satisfy permissible value.
d) However, many of the local contractors use (1) for construction instead of (2) which is expensive. Japanese or Chinese contractors engaged in large-scale building construction use (2).
e) They purchase (2) product after being cleansed. (1) is used without treatments because it is already clean at time of purchasing.


Source: JICA Study Team

Figure 3.3.9: (Left) Aggregate storage situation, (Right) Crushed Stone

Source: JICA Study Team

Figure 3.3.10: (Left) Blending table sample, (Left) Fine-grade testing for crushed sand

(IV) Concrete Test

a) Testing is also conducted in factory.
b) HTC conducts concrete test for three times, after 3, 7 and 28 days. (2 specimens in each test)
c) If testing for each stage does not meet predetermined strength, the building is demolished for repairing.
d) Testing device is calibrated twice a year.

(V) Mortar (Cement) Test

a) Test is conducted whenever they receive new cement.
b) Consistency testing and strength testing is conducted.

c) Blending ratio is as follows; Cement: 500g, Sand: 1375g, W/C=0.485
d) Specimen for strength testing is 2 cubic inch size.
e) It's removed from mold form on the second day and cured in water. They conduct testing for 4 pieces on the third day, and 2 pieces on the 28th day.


Source: JICA Study Team

Figure 3.3.11: (Left) Concrete Compression Test, (Right) Consistency Test

Material management (cement and aggregate) and various tests are adequately performed and quality is sufficiently ensured in the concrete factory we visited. However, due to cost issue, they sometimes use aggregate material whose quality does not satisfy ASTM standards, which needs to be improved.

3.3.4 Building Evaluation Approach

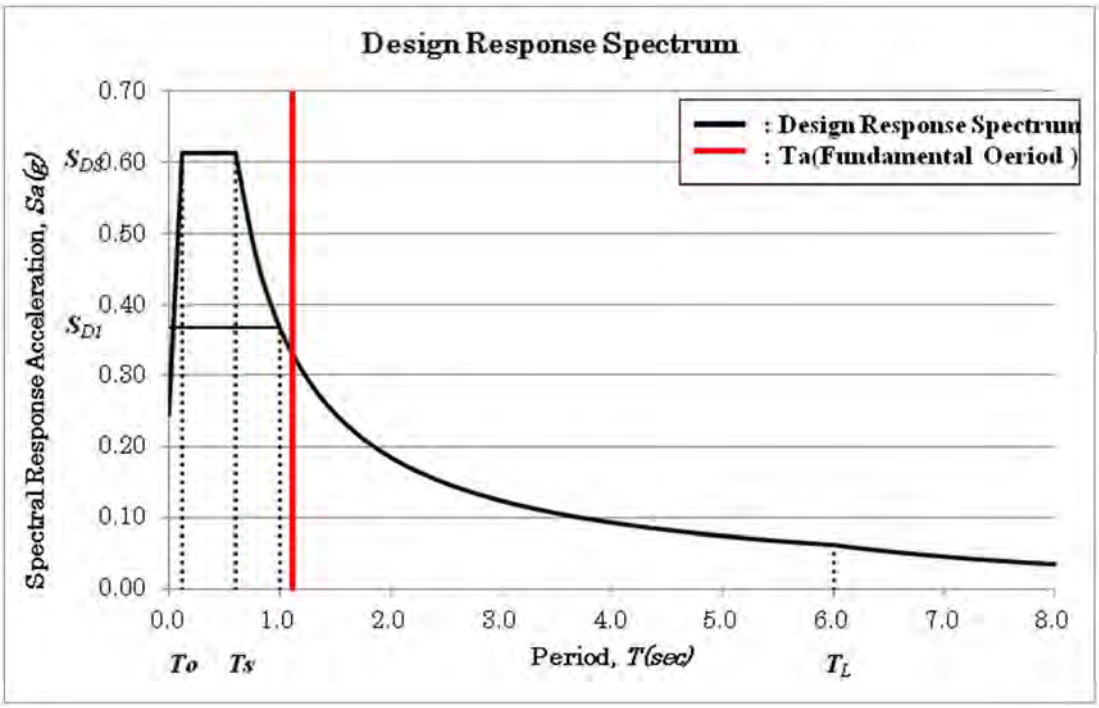
This seismic diagnosis was conducted by comparing and examining assumed seismic force in Yangon and building's horizontal bearing capacity (ultimate yield strength). The assumed seismic force in Yangon was calculated based on the Myanmar National Building Code 2016 (MNBC). Two target values were set as follows. The structure type is "Intermediate reinforced concrete moment frames" and Ω0 is 3.0.

a) In case of medium earthquake: External force calculated by MNBC
b) In case of major earthquake: Value for medium earthquake x Member examination extra rate Ω0

Table 3.3.3: Assumed Seismic Force for Each Building (Target Value)

	Building Height	Natural Period	Base Shear Coefficient	
		Ta	Medium earthquake Cs	Major earthquake Co2
4U5S	17.0m	0.60s	0.122	0.336
Six stories building	20.9m	0.72s	0.102	0.306
Eight stories building	34.1m	1.12s	0.066	0.198

Source: JICA Study Team



Source: JICA Study Team

Figure 3.3.12: Design Response Spectrum and Natural Period of Eight Stories Building

3.3.5 Calculation of Building's Horizontal Bearing Capacity

(1) Seismic Diagnosis Methods in Japan

In Japan, following methods[1)] are proposed for diagnosing seismic capacity of old buildings. As the degree gets higher, the diagnosis becomes more detailed. Since old buildings in Japan tend to have large beam cross-section and result in column/RC collapse, second level screening procedure is often adopted as simplified diagnosis.

Table 3.3.4: Seismic Diagnosis Methods in Japan

Diagnosis Method		Calculation of horizontal bearing capacity	Assumed Collapse Type
First Level Screening Procedure	Simplified Diagnosis	Tabulation of column/RC wall cross-section area	Column, RC wall
Second Level Screening Procedure		Tabulation of column/RC wall bearing force	Column, RC wall
Third Level Screening Procedure	Detailed Diagnosis	Incremental analysis	Column, RC wall, Beam, etc.

Source: JICA Study Team

a) First level screening procedure: Floor area/ (0.7a x Column cross-section area + 2.5a x Wall cross-section area)
b) Second level screening procedure: Tabulation of column bearing force assuming column collapse type
c) Third level screening procedure: Detailed examination through load incremental analysis

1) Standard for Seismic Evaluation of Existing Reinforced Concrete Buildings, 2001, Published by: The Japan Building Disaster Prevention Association

However, buildings in Yangon (target buildings) have larger column cross-section compared to beam cross-section and are expected to result in beam collapse type. Since it is not appropriate to adopt the same simplified diagnosis practiced in Japan, we hereby propose a seismic diagnosis tailored for Yangon that assumes beam collapse.

On the other hand, incremental analysis is conducted as another measure to calculate building's horizontal bearing capacity. Yield strength of members such as column, beam and RC wall is calculated to detail to conduct elastoplastic incremental analysis. This can provide relatively accurate horizontal bearing force and is widely used in Japan for designing newly constructed buildings. However, this method requires too many calculation processes to promote in Myanmar, which implies many challenges such as improving calculation knowledge/technologies as well as dissemination of analysis program. For comparison with the simplified diagnosis, incremental analysis (detailed diagnosis) result is also shown below.

(2) Seismic Diagnosis for Yangon

Assuming possibility of beam hinge, use below formula to calculate each floor's horizontal bearing capacity Qu.

- Beam ultimate yield flexural capacity

$$Mg = 0.9 a_t \cdot \sigma_y \cdot d$$

Conditions are as follows

a_t : Tensile RC cross-section area(mm^2)

Slab RC of 1m width is to be taken into account.

This is also applicable to others including one way slab.

σ_y : Tensile RC yield point (mm^2)

d : Effective beam depth (mm) , Beam depth－50mm

- Stiffness-based balancing (With column cross-section being equal, balancing is done by member length) *Refer to a figure on the left

$$M_1 = \frac{H_2}{H_1 + H_2} Mg \quad M_2 = \frac{H_1}{H_1 + H_2} Mg$$

,

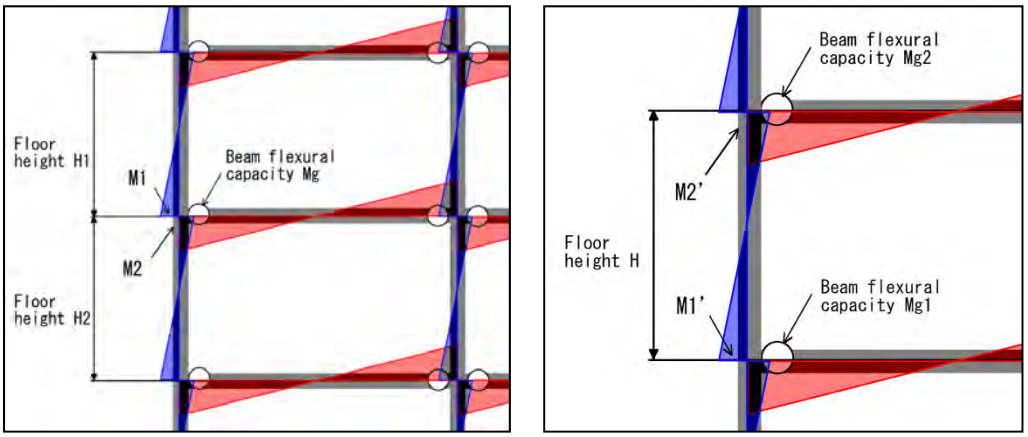
- Column shear force *Refer to a figure on the right

$$Qc = \left(M_1' + M_2' \right) / H$$

- Horizontal bearing capacity

$$Qu = \Sigma Qc$$

$$Qu = \left(\sum M_1' + \sum M_2'\right) / H = \left(\frac{H_2}{H_1 + H_2} \sum Mg_1 + \frac{H_1}{H_1 + H_2} \sum Mg_2 \right) / H$$



Stiffness-based Balancing　　Column Shear Force

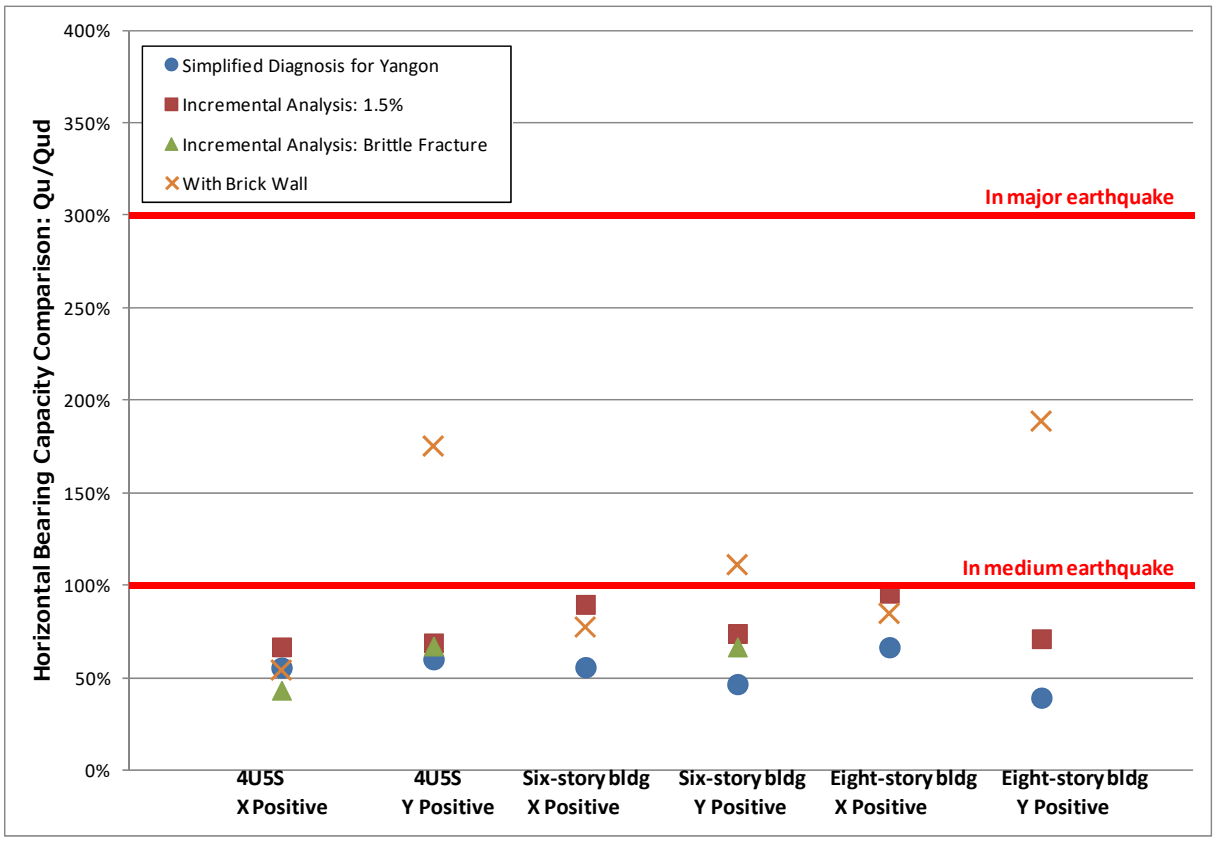
Source: JICA Study Team

Figure 3.3.13: Seismic Diagnosis for Yangon

However, if beam size on the first floor is large (e.g. building with continuous footing foundation), the first floor might not have beam hinge. Considering that, if beam depth on the first floor is larger in size than column height, column hinge instead of beam hinge should be assumed when calculating the yield strength.

(3) Seismic Diagnosis Result

Figure 3.3.14 represents comparison of Qud=First floor's seismic force in medium earthquake and Qu=Horizontal bearing capacity.



Source: JICA Study Team

Figure 3.3.14: Seismic Diagnosis Result

a) The result shows that all the building have a risk of collapse in case of medium earthquake. It is preferable to reinforce the buildings.
b) Brick wall might fall sideways in case of earthquake, reinforcement and countermeasures are preferred.
c) It was confirmed that the building's horizontal bearing capacity improves if the brick wall does not fall sideways (if the brick wall can be considered as a load bearing wall).
d) A building with layer of short columns beneath beam on the first floor might collapse earlier than the columns on the first floor. It is necessary to reinforce by adding RC wall or longitudinal brace.
e) According to the calculation, it was confirmed that some beams in two buildings out of three are already yielded by stationary load. Since there is a risk that floor crumbles when heavy load is put on, some countermeasures need to be taken.
f) Buildings such as school, hospital, city office and fire department should be designed/reinforced to withstand major earthquake. It is also preferable that residences are designed and reinforced to withstand at least medium earthquake.
g) Even though the proposed seismic diagnosis for Yangon assesses the building's horizontal bearing capacity lower than incremental analysis, the result is similar to the one of incremental analysis. This diagnosis is much easier to conduct than the incremental analysis, therefore is deemed effective as a simple method for diagnosing seismic capacities of buildings in Yangon.