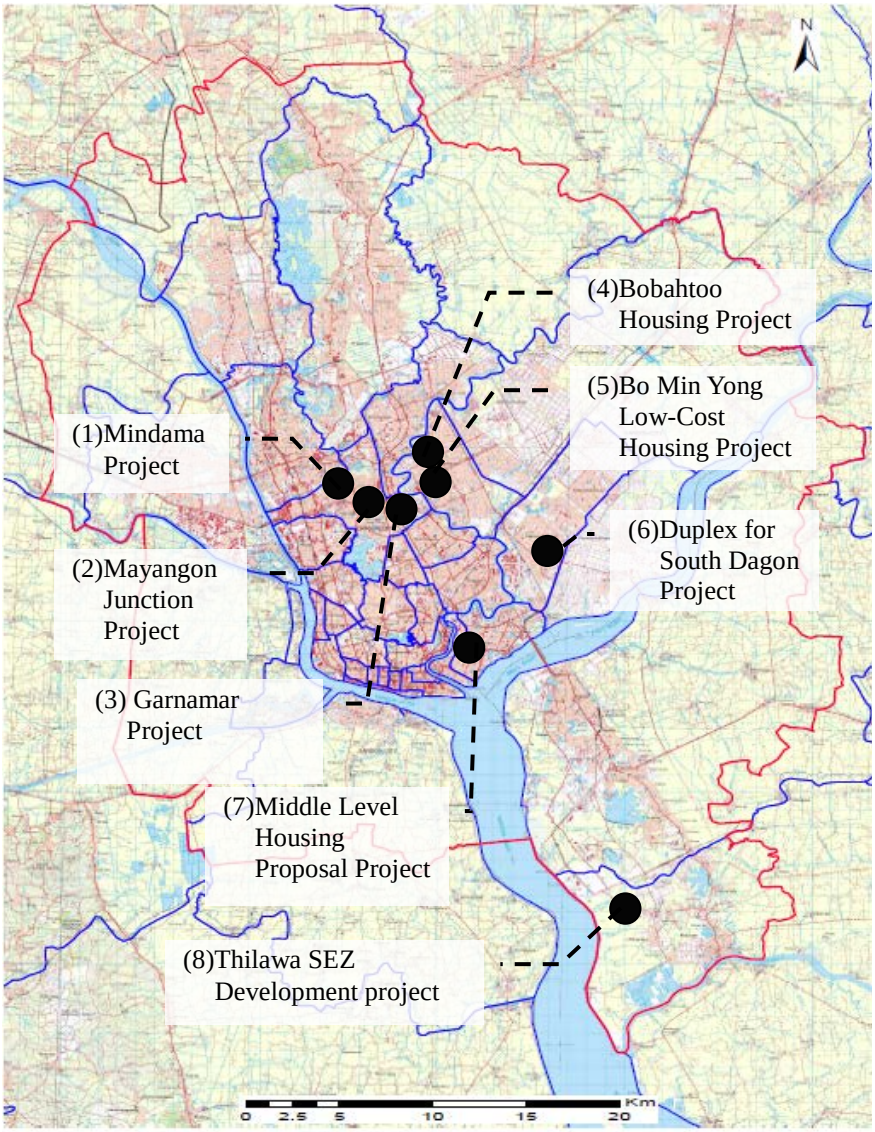
2.4 Review of Relevant Development Plans and Projects

2.4.1 Urban Development Plans and Projects

(1) Yangon City Development Committee (YCDC)

While the population and traffic are much concentrated in the center of Yangon City, several subcenter projects and new urban development projects in suburban areas are currently proposed, as shown in Figure 2.4.1 and Table 2.4.1. For example, the Mindama Project is proposed to create a subcenter zone in the northwest area of Yangon City, along with Mindama Road. The Bo Min Yong Low-Cost Housing Project is proposed for the new urban area in the North Dagon Township, which is in the northern area of Yangon City. Figures 2.4.2-2.4.6 show the sample designs of the subcenter projects of YCDC.



Source: YCDC and JICA Study Team

Figure 2.4.1: Urban Development Projects

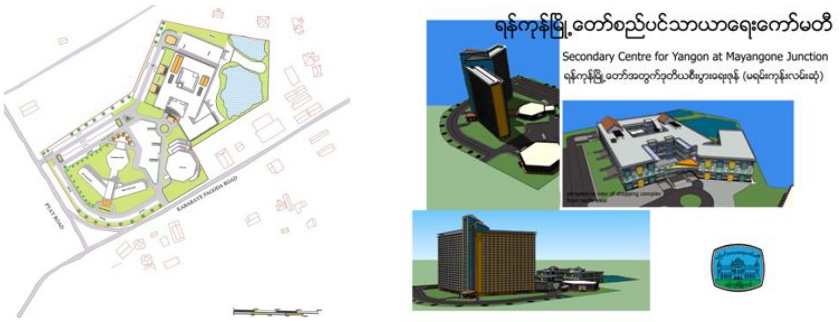
Table 2.4.1: Summary of Urban Development Projects in Yangon City

Site No. in Figure 2.4.1	Department Name	Township	Area (ha)	Planned by	Start Operation	Development Type
1	Mindama Project	Mayangon	13.3	YCDC	Not yet	Shopping Complex, Cinema Hall, Hotel, and Multipurpose Hall
2	Mayangon Junction Project	Mayangon	8.1	YCDC	Not yet	Shopping Complex, Cinema Hall, Hotel, and Multipurpose Hall
3	Garnamar Project	Mayangon	6.8	YCDC	Not yet	Condominium
-	Kyaukyaetwin	Mayangon	20.4	YCDC	Not yet	Shopping Complex and Condominium
4	Babahtoo Housing Project	North Dagon	-	YCDC	Not yet	-
5	Bo Min Yong Low-Cost Housing Project	North Dagon	3.8	YCDC	Not yet	Condominium
6	Duplex for South Dagon Project	South Dagon	7.5	YCDC	Not yet	Duplex
7	Middle-class Housing Project Proposal (Min Nandar Road, Tharkata Township)	Thaketa	7.6	YCDC	Not yet	Condominium
8	Thilawa SEZ Development Project	Thanlyin	2400	JICA	Not yet	Urban Development

Source: YCDC

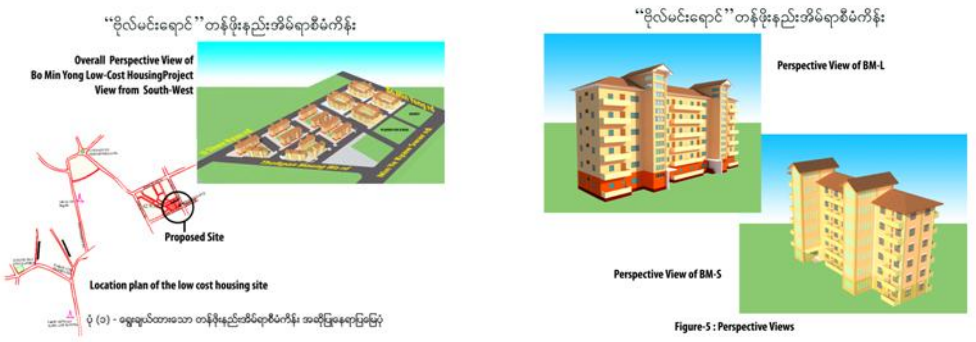
Source: YCDC

Figure 2.4.2: Design of Mindama Project (No.1)



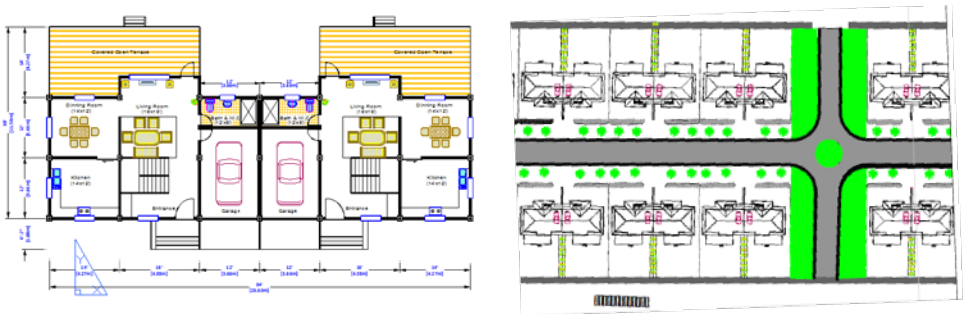
Source: YCDC

Figure 2.4.3: Design of Mayangon Junction Project (No.2)



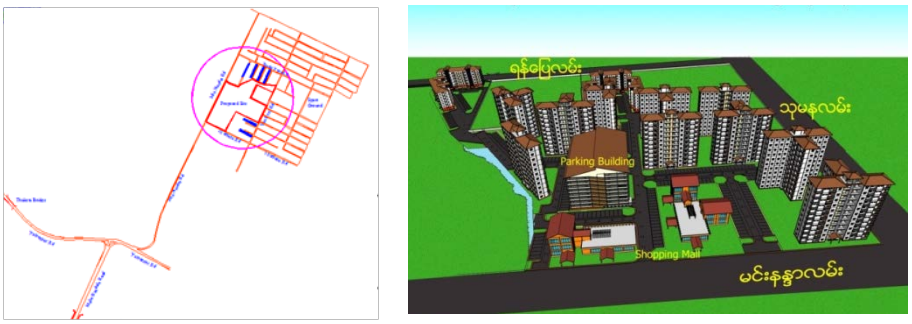
Source: YCDC

Figure 2.4.4: Design of Bo Min Yong Low-Cost Housing Project (No.5)



Source: YCDC

Figure 2.4.5: Design of Duplex for South Dagon Project (No.6)



Source: YCDC

Figure 2.4.6: Design of Middle Level Housing Project Proposal (No.7)

(2) Private corporation

The CBD has a high road density where a lot of old buildings are found. Some private companies started to redevelop old buildings, and at present, some have already been rehabilitated. Information on the relevant development plans of private companies are summarized as follows:

1) YOMA Group

The YOMA Group belongs to the SPA Group, which is listed in Singapore's stock market. The YOMA Group has developed four big projects in Yangon City.

1) FMI Garden Development

FMI Garden Development started in 1995, which was the first project of YOMA Group in Yangon City. The development constructed low-rise houses, which targets the middle-income class. Currently, 2,000 houses were built on a 500-acre area. Plot sizes are in four patterns, namely 40 ft x 60 ft, 60 ft x 80 ft, 80 ft x 80 ft, 100 ft x 100 ft.

Recently, people in the low-income groups live next to the FMI Garden Development, which causes problems to the development as YOMA plans to develop apartments near the Hlaing River.

Source: YOMA Group

Figure 2.4.7: Plan of FMI Garden Development (YOMA Group)

2) Pun Hlaing Golf Estate

The Pun Hlaing Golf Estate which is located near the confluence of the Hlaing River and Pan Hlaing River, was developed in 1995. High-class detached housing units, condominiums, an international school, hospital, and a golf course were included in this development. Half of the detached housing units and condominiums were sold for capital investment. Some condominiums were sold to Japanese clients.

This development was constructed using Singapore and British building codes. Taking advantage of the two rivers, Hlaing and Pan Hlaing, the soil materials for this development were carried directly on-site alongside what was to transport water from the upper reaches of the rivers. This approach was effective since Yangon City has not yet fully developed its road network. The development of the Star City has been carried out utilizing the same development methods.

3) Star City

The Star City is a 135-acre condominium development located in the eastern area of Yangon City near the left bank of the mouth of the Bago River. At about six miles from the CBD, Star City lies half-way between the CBD and Thilawa SEZ Development Project. In the future, the Star City Project will have a ferry terminal and a commercial building in the plan. During the first ten years, 9000 houses will be for sale at US$70,000 (60 m^2) to US$160,000 (160 m^2)

4) FMI City

FMI City project with five buildings will be constructed on a 10-acre site. A five-star hotel, a medium-range hotel, a condominium, and two office buildings will be constructed. Existing

facilities such as the FMI Tower and Miyara Tower will be reconstructed. The schedule will be three years for the first phase, and five years for the second phase with a 25-storey building, where underground and lower floors will be for commercial uses.

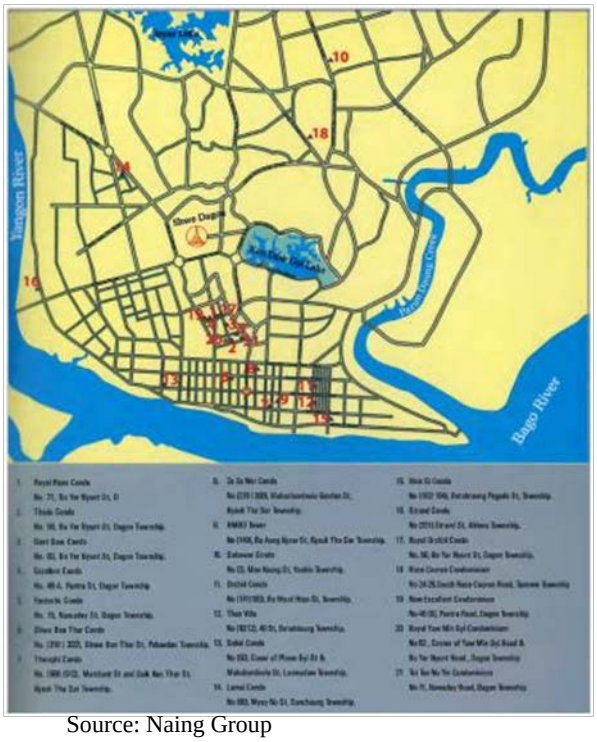
5) Others

In Myanmar, when purchasing a house or condominium, payment must be made in cash. Bank loan system is not commonly practiced for payment. Normally, the price of a house must be paid in two installments. The first one is upon signing of the contract, and the second is on the delivery of the key. In 2013-2014, the loan system is said to be restarted in Myanmar.

2) Naing Group

Naing Group is an enterprise with businesses in Myanmar, Singapore, and China. This group was established in 1996 for real estate, housing development, design and construction management, import of interior and exterior building materials, geological survey, concrete plant, and production of precast concrete. Naing Group's main targets in the real estate business are middle- and high-income groups. In addition, the Naing Group is planning to develop detached houses in small areas in Yangon City, and hotel and tourism facilities in Mandalay, Also, the group plans to redevelop its businesses around the CBD.

The Naing Group also expects to work with Japanese developers and retail traders, especially in the tenant leasing of lower level floors for commercial use.



Source: Naing Group

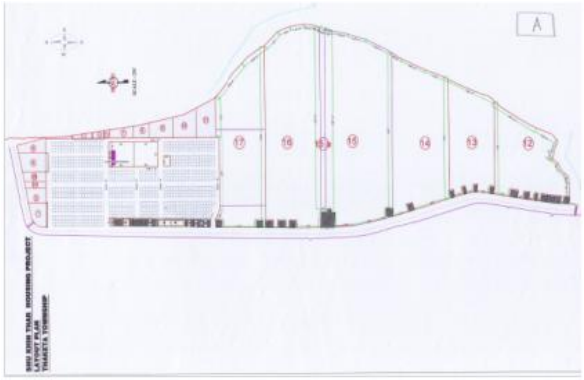
Figure 2.4.8: Location map of Projects (Naing Group)

3) Tet Lann Company Limited

Tet Lann Co., Ltd. (TLC) does business in the development, investment, and construction sectors. While working on housing for middle-income class groups, mainly in Yangon City, TLC was also responsible for the construction of a hospital building in Nay Pyi Taw.

In order to improve slums, TLC built houses with private property investment, as shown in Figure 2.4.9. These houses has been provided free of charge in exchange of land that has been left by this clearance. TLC received the right-of-land use and built a high-rise housing complex for high-income groups, which take advantage of the view of the river. In this redevelopment project, YCDC was involved in the planning and issuance of permits.

In addition, low-income housing projects have been constructed in eight locations in Yangon City, which was the largest development plan of its kind.



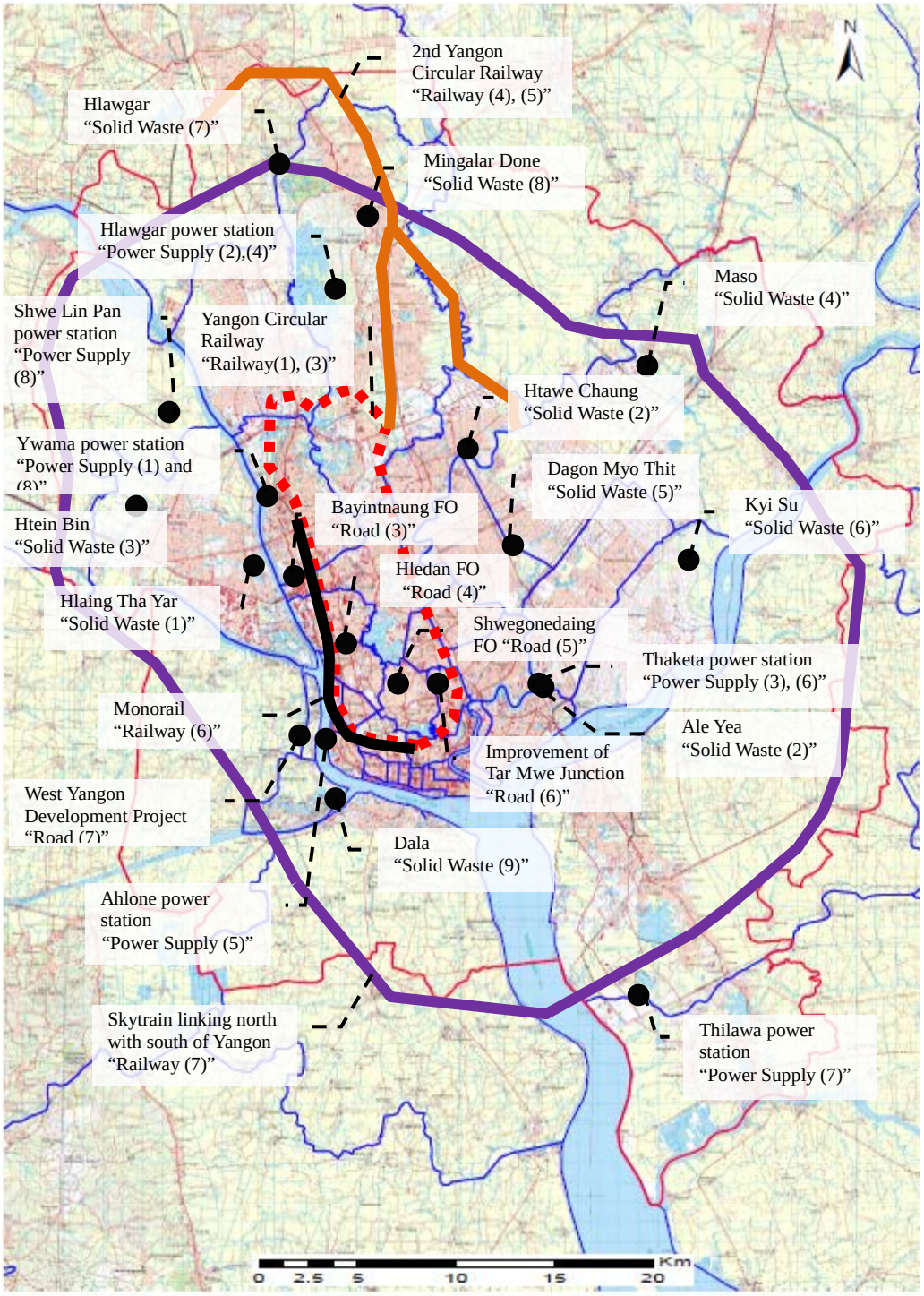
Start of planning: 2006-
Completion: 2008
Place: Thakeda Township
Area: 104 acres
Six floors, reinforced concrete,
48 units in one building,
Total 2,946 units

Source: Tet Lann Co., Ltd.

Figure 2.4.9: Plan of Low-income Houses (TLC)

2.4.2 Infrastructure Projects

The location and features of infrastructure projects in Greater Yangon are located in Figure 2.4.10 and listed Table 2.4.2. In Yangon City, many development plans with donors are informed, but these are only concept or proposal plans. It is necessary much time for doing such plans.



Source: JICA Study Team

Figure 2.4.10: Infrastructure Projects in Greater Yangon

Table 2.4.2: Summary of Infrastructure Projects in Greater Yangon

Sector	Project Name	Planned or Funded by	Year
Road (1)	Under "Yangon City Development Concept Plan" 1) Construction of circular express road 2) Construction of access-controlled multi-level express roads Including, 3) Construction of bridges (or tunnels) across Bago River, Yangon River, and Haling River 4) Link circular express road with inner city road networks	YCDC	2012-
Road (2)	Under "Yangon Structure Plan (Vision 2040)" 1) Construction of the Outer Ring Road Network 2) Construction of the Inner Ring Road Network	DHSHD, MOC	2012-
Road (3)	Bayintnaung Flyover Project	YCDC	Under construction
Road (4)	Hledan Flyover Project	YCDC	Under construction
Road (5)	Shwegonedaing Flyover Project	YCDC	2012-
Road (6)	Improvement of Tar Mwe Junction	YCDC	2012-
Road (7)	West Yangon Development Project; Urban development across Yangon River between Kyeemyindaing and Ahlone Townships	Private	-
Railway (1)	Replacement of Wood Sleeper to Precast Concrete Sleeper for Yangon Circular Railway	Myanmar Government	-
Railway (2)	Procurement and Rehabilitation of Rolling Stocks	Myanmar Railways	2012-
Railway (3)	Improvement of Signaling and Telecommunication System a) Installation of Underground Communication Cable between Yangon and Alone Station b) Kyimyidine Yard Upgrading with all Relay Interlocked and Color Light Signaling Systems	Myanmar Railways	2012-
Railway (4)	Second Yangon Circular Railway Construction Project: Section linking Mingaladon with Nwekhwe	YCDC	2007-
Railway (5)	Second Yangon Circular Railway Construction Project: Section linking Moekyopyit with Dagon University via Nwekhwe	YCDC	-
Railway (6)	Monorail along Bo Gyoke St. and Canal St.	YCDC	2012-
Railway (7)	Skytrain linking the north and south of Yangon (planned in Yangon's Experience in Urban Planning and Yangon City Development Conceptual Plan)	YCDC	2012-
Port and Logistics (1)	Project for the Expansion of Yangon Port in Thilawa Area	JICA/Yen Loan	2015-2025
Port and Logistics (2)	Rehabilitation Project of Dalla Ferry Terminal Jetty	JICA/JICA (Technical Transfer)	-2014
Port and Logistics (3)	Dalla Ferry Boat Rehabilitation Project	JICA/Japanese Grand Aid	-2014
Port and Logistics (4)	Preliminary Study on National Port Development Plan	MLIT/N.A.	-2030
Port and Logistics (5)	Development Project of Yangon Main Port	MPA/Private	2012-2015
Port and Logistics (6)	Thilawa Port Development	JICA/ N.A.	2012-
Power Supply (1)	Yawma Gas Engine Power Station : 55.9 MW (4.3 MW x13 units)	IPP by Caterpillar USA	-2013
Power Supply (2)	Hlawgar Diesel Power Station : 50 MW	IPP	-2013
Power Supply (3)	Thaketa diesel power Station : 50 MW	IPP	-2013
Power Supply (4)	Hlawgar Gas Turbine Power Station : 500 MW	BOT	-2014
Power Supply (5)	Ahlone Gas Turbine Power Station : 360 MW	IPP	-2014
Power Supply (6)	Thaketa Gas Turbine Power Station : 500 MW	BOT	-2014
Power Supply (7)	Thilawa Gas Turbine Power Station : 450 MW	-	-
Power Supply (8)	Yawma or Shew Ling Pan Gas Turbine Power Station : 450 MW	-	-
Power Supply (9)	Five year project: Nov. 2010 to 2015 or 2016 (now under implementation) 1) 66 and 33 kV substations 2) 66 kV transmission line 3) 33/6.6 kV distribution line	YESB	2010-2015 or 2016

Solid Waste (1)	Transfer Station at Hlaing Tha Yar	Not decided yet	-
Solid Waste (2)	Incineration Plant at Ale Yea or Htawe Chaung	Not decided yet	-
Solid Waste (3)	Incineration Plant at Htein Bin	Not decided yet	-
Solid Waste (4)	Final disposal site at Maso	Not decided yet	-
Solid Waste (5)	Final disposal site at Dagon Myo Thit	Not decided yet	-
Solid Waste (6)	Final disposal site at Kyi Su	Not decided yet	-
Solid Waste (7)	Final disposal site at Hlaw Gar	Not decided yet	-
Solid Waste (8)	Final disposal site at Mingalar Done	Not decided yet	-
Solid Waste (9)	Final disposal site at Dala	Not decided yet	-
Telecommunication	OFC Construction Project between Yangon and Mandalay	MPT	Under construction

Source: JICA Study Team

2.5 Overall Analyses and Database Development

To grasp the overall condition of the Planning Area is a basis of urban planning. A database was developed for the Study based on scientific methodologies such as 1) conduct of Household Interview Survey (HIS) and 2) development of Geographical Information System (GIS). Both tasks are required to be accurate and in detail.

HIS was conducted to collect socio economic information relating to household and to know their assessment and opinions on current urban development condition. The results of the survey was organized in a HIS database. The database was utilized not only as an essential database for acquiring existing condition of urban development, but also as an important resource for understanding present evaluation and opinion of people on existing urban services.

GIS was developed based on satellite imageries and field surveys to figure out the geographical condition and locations of urban planning facilities. The results was organized in a GIS database and utilized for describing the natural conditions and the current land use patterns and for analyzing the spatial distribution of socio-economic information and the future land use scenarios.

2.5.1 Household Interview Survey (HIS)

HIS was conducted to collect the samples of 10,000 households which compose 1.0 % of total household in the Planning Area. The sample numbers were decided by Township level and accuracy of the survey was secured by specific Township group. A field survey of HIS was conducted for two months from September to November 2012. Then, the collected answers were compiled in a HIS database in December 2012. Based on the HIS database, various analyses were conducted. The details of the survey methodology are described in Appendix 2.

As the result, the total number of interviewed households reached to 10,069 samples, and the total number of household members amounted to 43,326 persons. This means that the average number of household members were 4.3 persons per household.

The questionnaire for HIS was formulated based on the discussion with counterparts in YCDC, JICA and local consultants. The survey items includes a) socio-economic information of respondent and household members, b) living environment, c) daily transport activities, traffic congestion, public transport and transport policies, d) landscape and historical areas, e) parks/green spaces, f) access to water, g) access to sanitation, h) drainage, i) solid waste collection, j) electricity, k) vulnerability to disasters, (l) overall assessment, and m) vision of future Yangon city. A simple counting analysis was done and the volumes of answers were shown in graphs in Appendix 2.

The cross counting and detailed analyses by gender or by township is described in this section focusing on the following aspects; (1) socio-economic characteristics of respondents, (2) characteristics of household members, (3) characteristics of household, (4) living condition of household, (5) living level of household, (6) opinions on Vision of Yangon City; (7) living condition assessment, and finally compiled into (8) township profile or Urban Karte (Map).

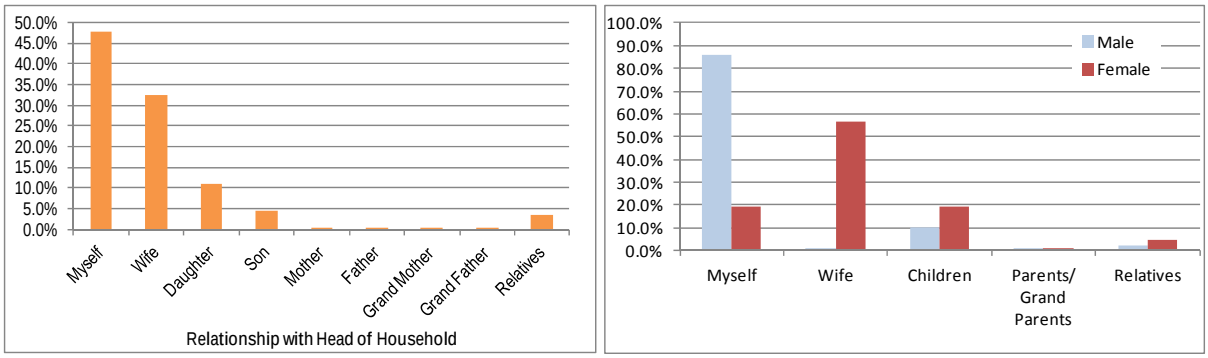
(1) Socio-economic Characteristics of Respondents

The characteristics of the respondents are analyzed and described in this section. However, characteristics of respondents are not always same with the one of household members because the respondent is biased to the person who stays at home at the timing of the interview.

1) Relationship of Respondent with Head of Household

Respondents answering the questions should be the representative of their household. However, the heads of households were not always available in the house during the time of the interview since it was co

nducted in daytime. Figure 2.5.1 shows that almost 50% of respondents were head of household, 30% were wives, while 20% were relatives including daughters and sons. Also, the figure shows that the ratio of female-headed households to the total respondents is 11%.

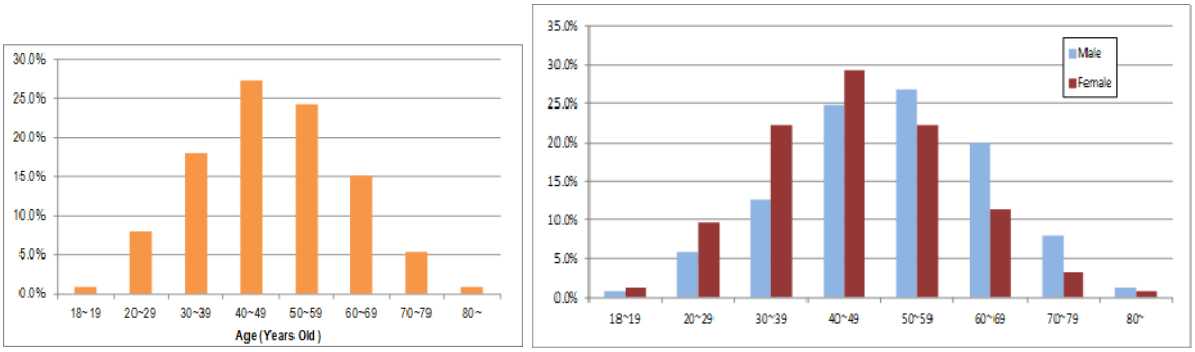


Source: JICA Study Team based on the results of HIS

Figure 2.5.1: Relationship of Respondents with Head of Household by Gender

2) Gender and Age Group of Respondent

The gender ratio of respondents is mostly composed of female aged 40-49 years, as shown in Figure 2.5.2. The reason was considered that the respondents tended to be persons who stay in houses for a long time in a day.



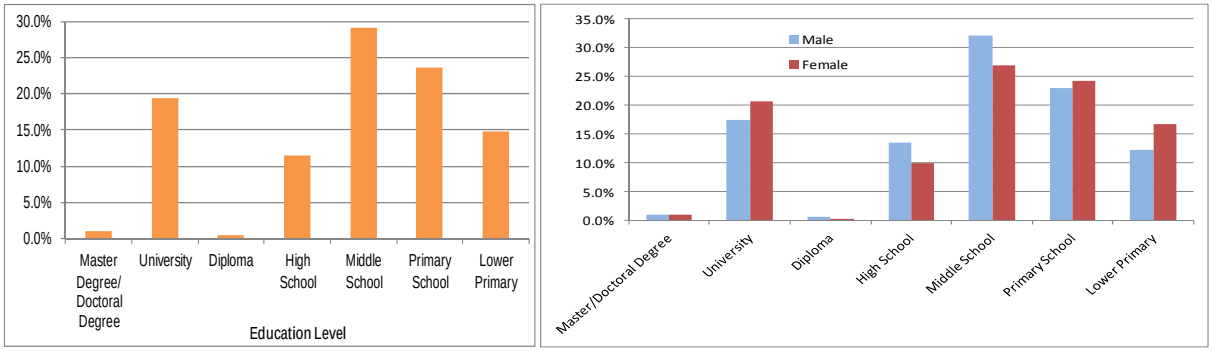
Source: JICA Study Team based on the results of HIS

Figure 2.5.2: Age Group of Respondents by Gender

3) Education Attainment of Respondent

The educational attainments of respondents are mostly middle and lower school, which constitute 68% of the respondents, as shown in Figure 2.5.3. This composition is almost the

same with the one of household members. The cross counting by gender shows that the ratio of high school attainment and middle school attainment of male is higher than those of female. However, those ratios show only the situation of respondent and different from overall situation of household members.

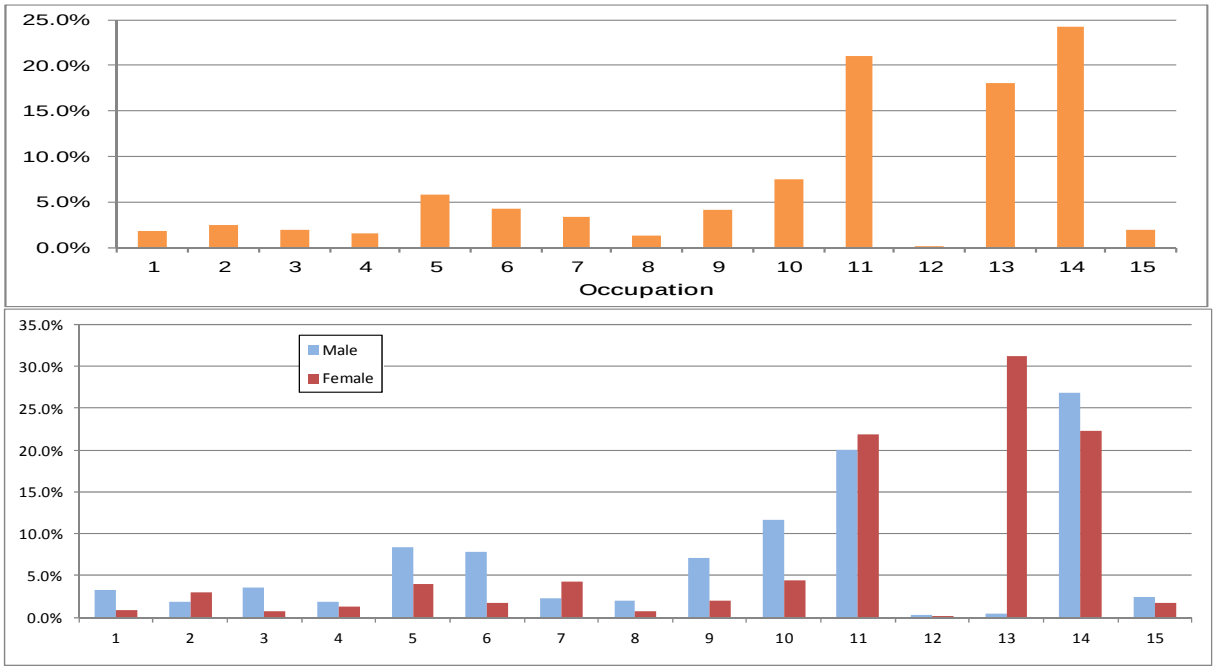


Source: JICA Study Team based on the results of HIS

Figure 2.5.3: Education Attainment of Respondent by Gender

4) Occupation and Employment Sector of Respondent

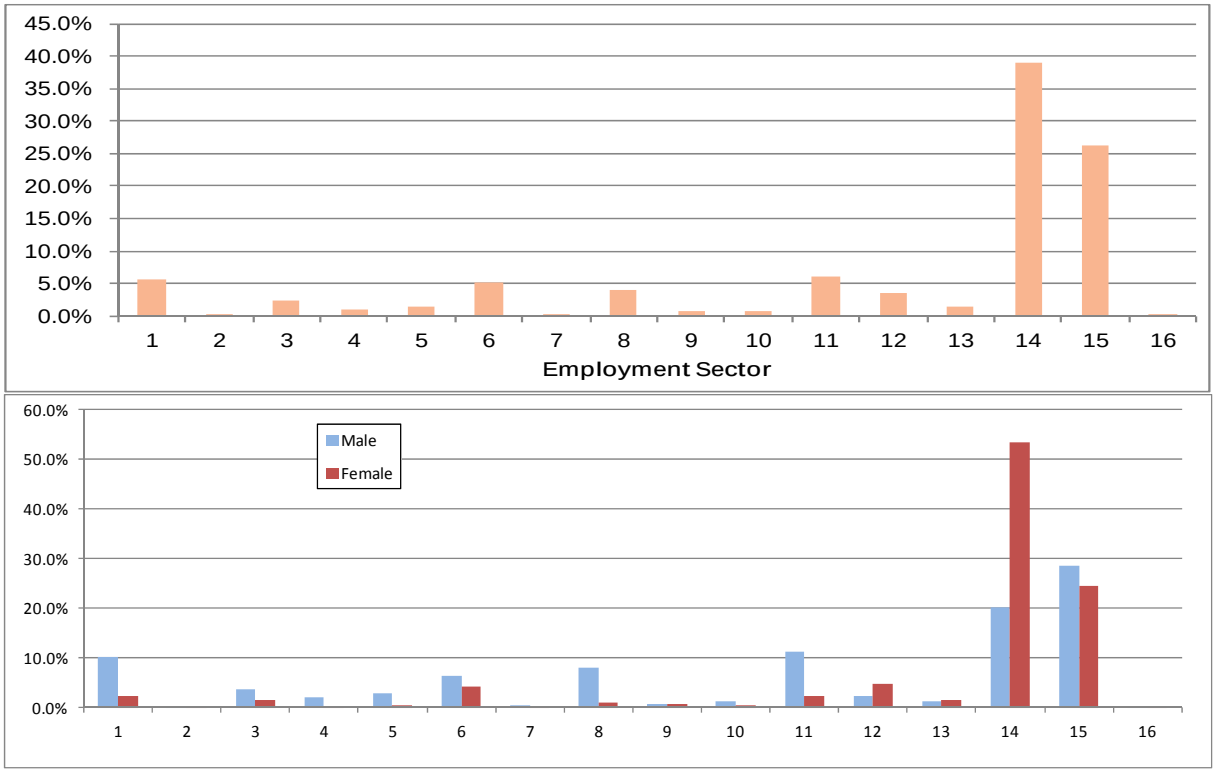
The respondents mostly consist of shop keepers, housewives, and jobless or retired persons. About 63% of respondents stay at home for a long time in a day. Ratio by gender is different depending on the type of occupation and employment sector.



1 Legislators, Senior Officials and Managers
2 Professionals
3 Technical and Associate Professionals
4 Clerical Worker
5 Service Workers, Shop and Market Sales Workers
6 Farmers, Forestry Workers and Fishermen
7 Craft and Related Trades Workers
8 Plant and Machine Operators and Assemblers
9 Laborers and Unskilled Workers
10 Proprietors
11 Shop Keepers
12 Armed Forces Occupation
13 Housewife
14 Jobless/ Retired
15 Others

Source: JICA Study Team based on the results of HIS

Figure 2.5.4: Occupation of Respondents by Gender



1	Agriculture, Hunting, Forestry and Fishing	9	Financial Intermediation
2	Mining & Quarrying	10	Real Estate, Renting & Business Activities
3	Manufacturing	11	Public Administration & Defense
4	Electricity, Gas & Water Supply	12	Education and Training
5	Construction	13	Health & Social Work
6	Wholesales & Retail Trade; Repair of Motor Vehicles, Personal and Household Goods	14	Other Community, Social and Personal Service Activities
7	Hotels & Restaurants	15	Private Households
8	Transport, Storage and Communications	16	Extraterritorial Organizations

Source: JICA Study Team based on the results of HIS

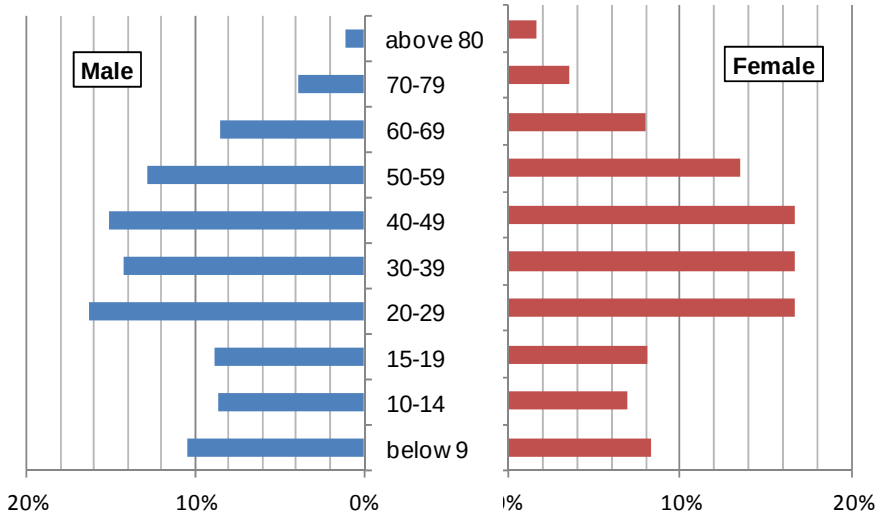
Figure 2.5.5: Employment Sector of Respondents by Gender

(2) Socio-economic Characteristics of Household Members

Socio-economic information of household members was collected by the Survey. Characteristics of household members are analyzed and described in this section. The number of sampled population of 43,326 persons accounts for 0.8% of total population of the Planning Area which amounts to 5,572, 242 persons.

1) Gender and Age Group of Household Members

The population by age group by gender which is shown in Figure 2.5.6 shows that the female population of 30 to 59 years old is larger than male population. This age group can be considered as a labor force. However, considering the employment ratio of labor force shown in Table 2.5.1, employment ratio of female labor force is less than the one of male labor force. In addition, the differences of number of workers between 10-59 years old and 15-59 years old show the workers of 10-14 years old is 2.3% for male and 3.1% for female. Although the differences are small, however, it shows the possibility of gender problem in education attainment.



Source: JICA Study Team based on the results of HIS

Figure 2.5.6: Age Group of Household Members by Gender

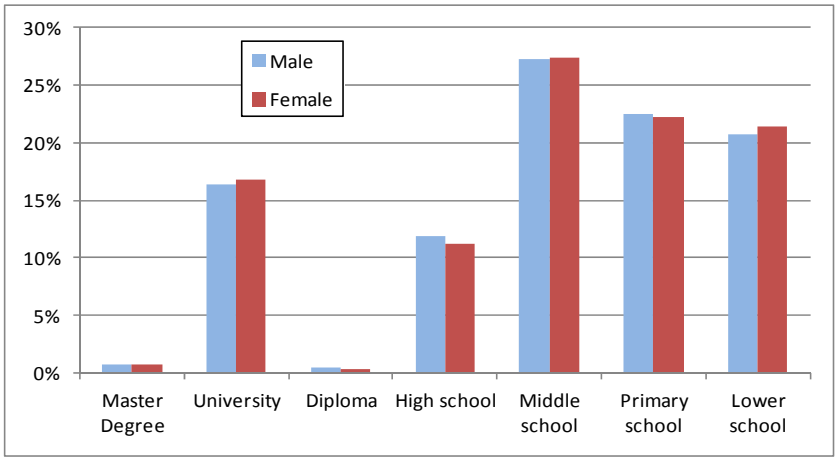
Table 2.5.1 Employment Ratio of Labor Force

	Male		**Female**	
Total Population	19,794		23,529	
Age Group (Years Old)	**10-59**	**15-59**	**10-59**	**15-59**
Labor Force Population	15,032	13,327	18,457	16,829
Workers with Occupation	9,983	9,944	7,955	7,905
Employment Ratio (%)	66.4	74.6	43.1	47.0

Source: JICA Study Team based on the results of HIS

2) Education Attainment of Household Members

As described in above, Table 2.5.1 contains the possibility of gender problem in education attainment. However, Figure 2.5.7 which shows education attainment by gender has not so much differences by gender.

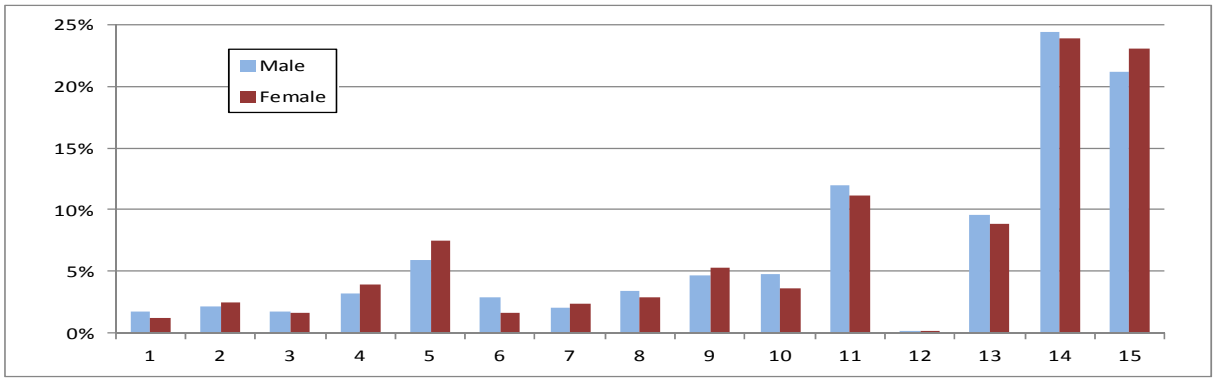


Source: JICA Study Team based on the results of HIS

Figure 2.5.7 Education Attainment of Household Members by Gender

3) Occupation and Employment Sector of Respondent

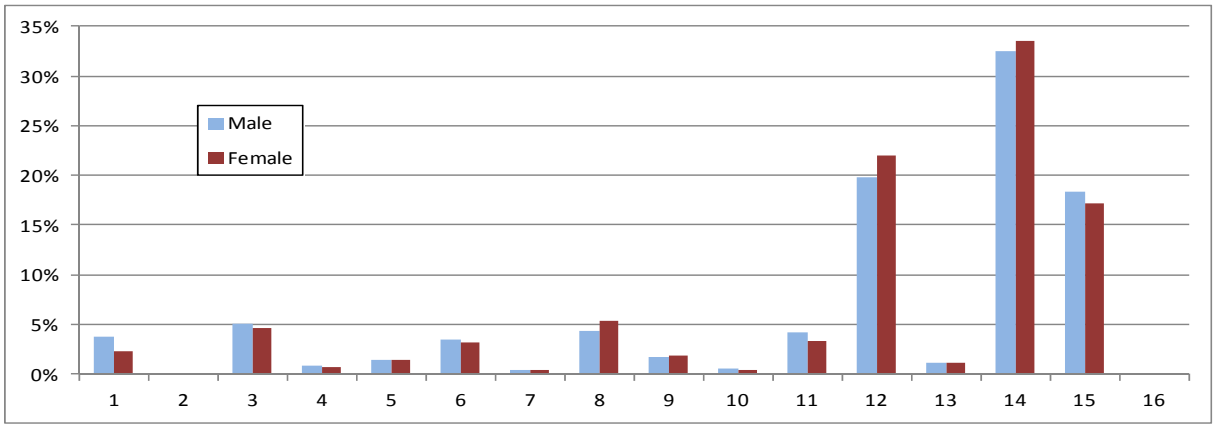
The differences by gender are obvious particularly in "Service workers, shop and market sales workers" of which female population is larger than male population, and "Farmers, forestry workers and fishermen" of which male population is larger than female population.



1 Legislators, Senior Officials and Managers
2 Professionals
3 Technical and Associate Professionals
4 Clerical Worker
5 Service Workers, Shop and Market Sales Workers
6 Farmers, Forestry Workers and Fishermen
7 Craft and Related Trades Workers
8 Plant and Machine Operators and Assemblers
9 Laborers and Unskilled Workers
10 Proprietors
11 Shop Keepers
12 Armed Forces Occupation
13 Housewife
14 Jobless/ Retired
15 Others

Source: JICA Study Team based on the results of HIS

Figure 2.5.8: Occupation of Household Members by Gender



1 Agriculture, Hunting, Forestry and Fishing
2 Mining & Quarrying
3 Manufacturing
4 Electricity, Gas & Water Supply
5 Construction
6 Wholesales & Retail Trade; Repair of Motor Vehicles, Personal and Household Goods
7 Hotels & Restaurants
8 Transport, Storage and Communications
9 Financial Intermediation
10 Real Estate, Renting & Business Activities
11 Public Administration & Defense
12 Education and Training
13 Health & Social Work
14 Other Community, Social and Personal Service Activities
15 Private Households
16 Extraterritorial Organizations

Source: JICA Study Team based on the results of HIS

Figure 2.5.9: Employment Sector of Respondents by Gender

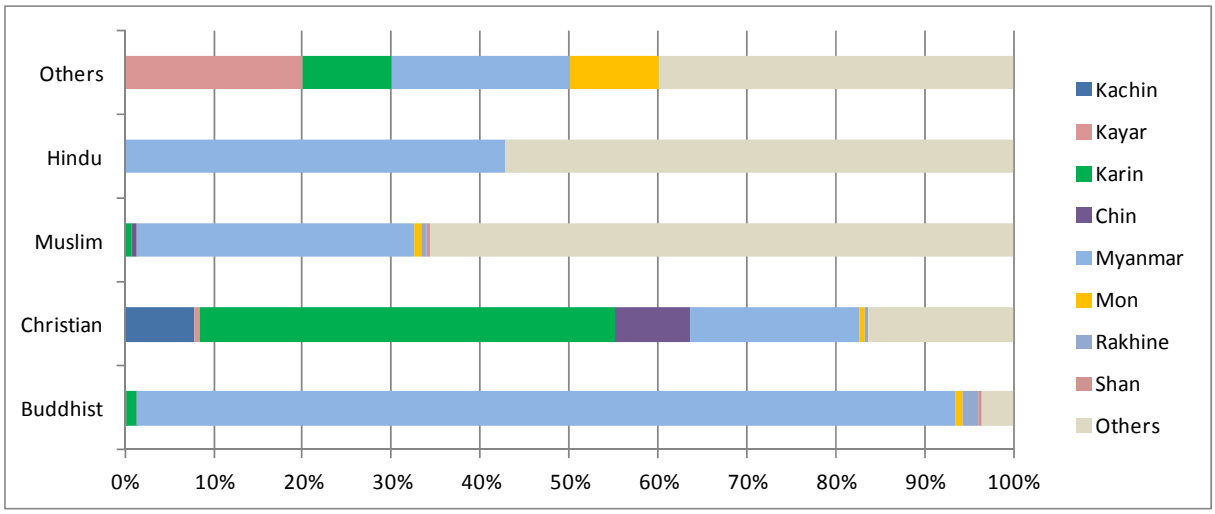
(3) Characteristics of Household

1) Ethnicity and Religion of Household

The ethnicity of the majority or 90% of all respondent households is Bamar (or Burmese), as shown in Figure 2.5.10. The largest within the minority groups are Karen and Rakhine, which consist of 2% for each.

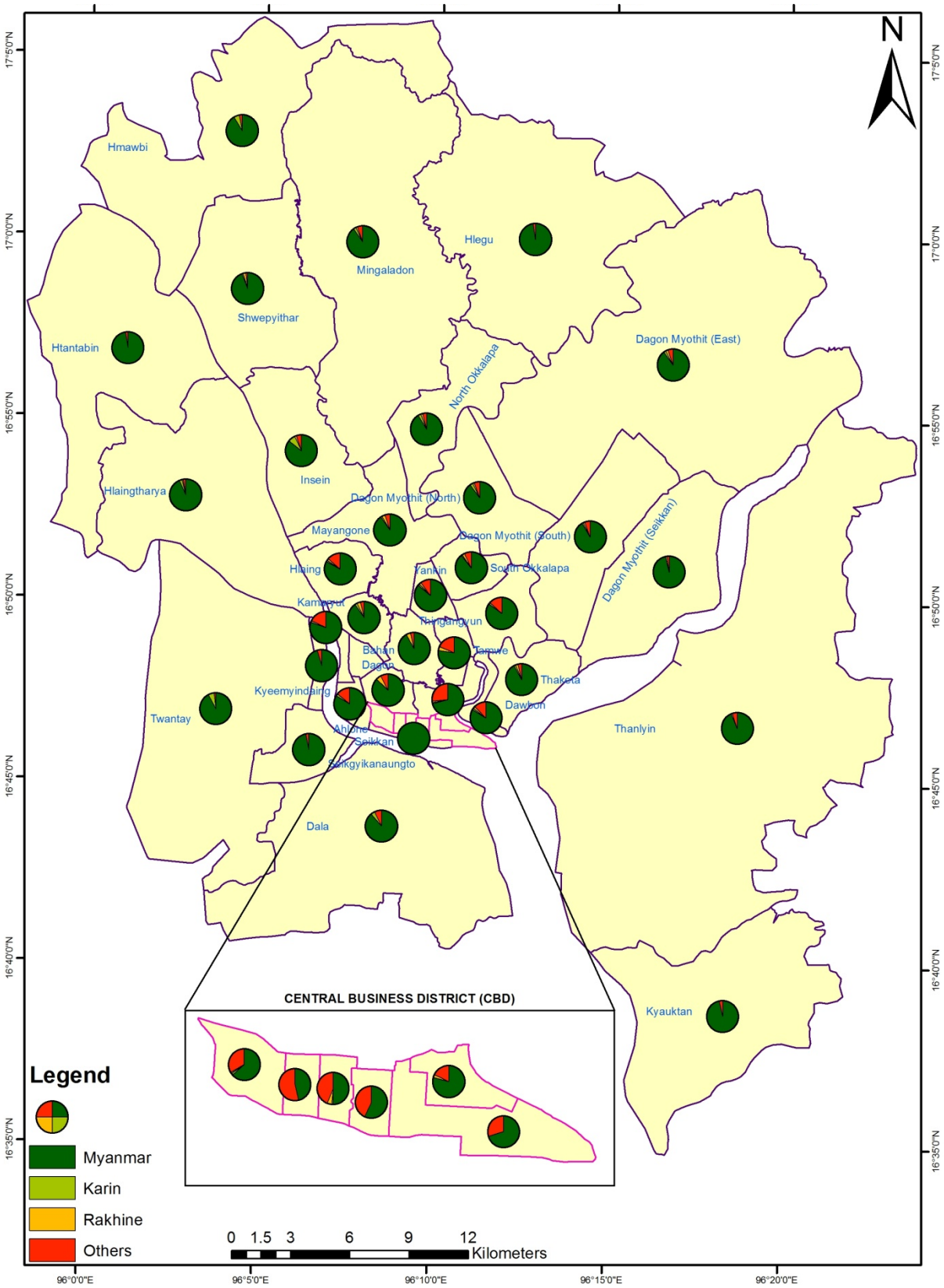
On the other hand, the majority of religion is Buddhist, which consists of 93% of all respondent household, as also shown in Figure 2.5.10. The second largest is Islam, which consists of 4% of all respondents.

Figure 2.5.11 and Figure 2.5.12 show the distribution of ethnicity and religion by Township. Township in CBD and Tarmwe Township has higher ratio of minority group of both ethnicity and religion.



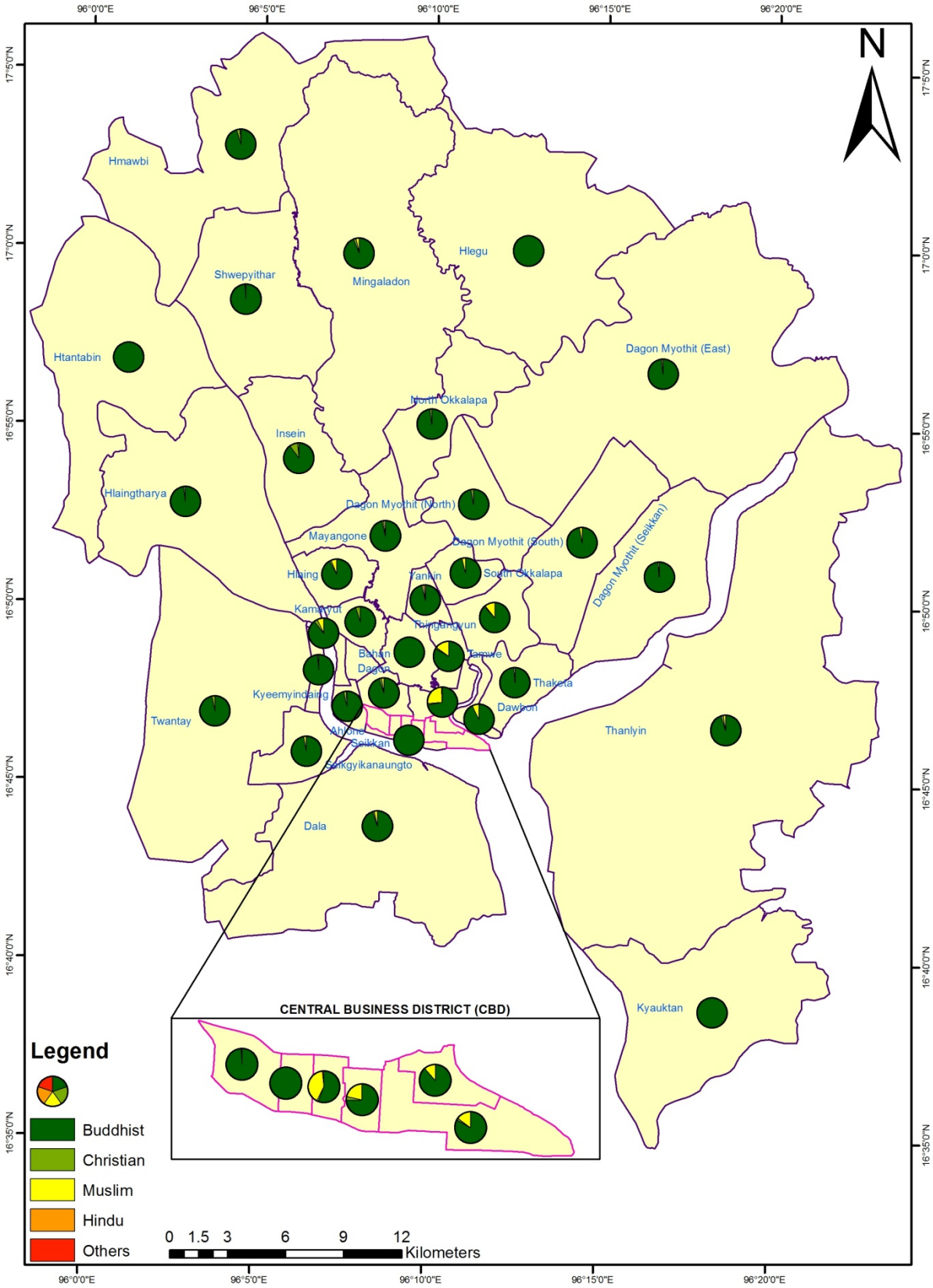
Source: JICA Study Team based on the results of HIS

Figure 2.5.10: Ethnicity and Religion of Households



Source: JICA Study Team based on the results of HIS

Figure 2.5.11: Distribution of Ethnic Group by Township

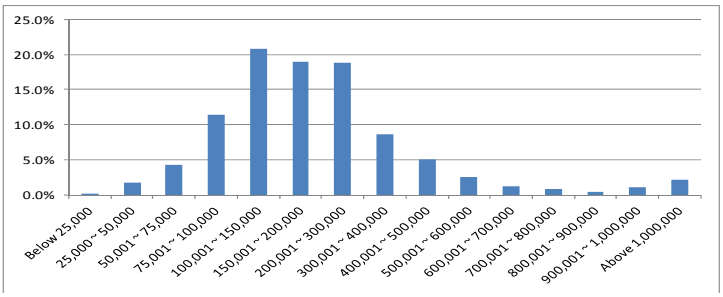


Source: JICA Study Team based on the results of HIS

Figure 2.5.12: Distribution of Religion by Township

2) Monthly Household Income

Monthly household income can be classified into four income groups; those are a) low income group with less than MMK 100,000 per month which accounts for 17.7%, b) middle income group with MMK 100,000 to 200,000 per month which accounts for 39.7%, c) high income group with MMK 200,000 to 500,000 per month which accounts for 32.5%, and d) very high income group with more than MMK 500,000 which accounts for 10.1%.



Source: JICA Study Team based on the results of HIS

Figure 2.5.13: Monthly Household Income

3) Household Monthly Expenditure

The averages of household expenditure are shown in Table 2.5.2. The total expenditure came from the answers by the respondent based on self-enumeration and has no consistency with the accumulation of each expense. The average of total expenditure by household is more than MMK 200,000 per month.

The highest average of expenditure is paid for "Food and Beverage Expenses" that amount to more than MMK 100,000 per month. The second highest average expenditure is "Education" with the average of more than MMK 58,000.

Table 2.5.2: Household Monthly Expenditure

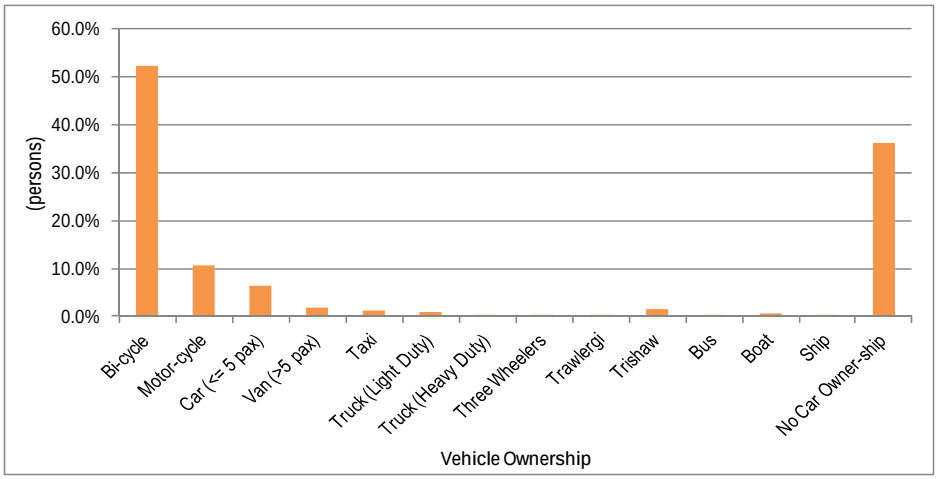
	Education	Clothing	Food and Beverage Expences	Health-care	Telephone Call Charges	Internet Charges	Transportation (Gasoline, Parking, Public Transport Use)
Number of Answered Households	1,381	915	1,192	1,183	1,324	174	968
Maximum	2,000,000	600,000	1,500,000	600,000	600,000	2,000,000	1,000,000
The Smallest Amount	500	500	500	200	200	200	200
Average	58,157	15,509	102,603	22,372	14,317	26,084	24,387

Source of Lighting			Water					
Electricity	Candle, Battery	Fuel Oil for Private Generator of Electricity	For Domestic Use	For Drinking Water	Cleaning Charges	Sludge Removal Service (fee for 1 time)	Miscella-neous	Total Expenditure
2,345	520	90	1,507	1,448	895	6,654	1,126	9,911
1,300,000	70,000	150,000	320,000	150,000	120,000	1,000,000	302,000	5,000,000
200	100	100	150	100	27	50	10	1,000
9,874	0	0	5,693	5,982	1,329	19,932	13,671	216,199

Note: Total expenditure is answered by the respondents directly without consistency of accumulation of each expenses.
Source: JICA Study Team based on the results of HIS

4) Vehicle Ownership of Household

About 60% of households have at least one vehicle or any transport mode such as boats, while 40% of household have none. The most popular vehicle owned by households is bicycle which consists of 41% of all respondent households, if including those without vehicle ownership; or 69% of households, excluding those without vehicle ownership.

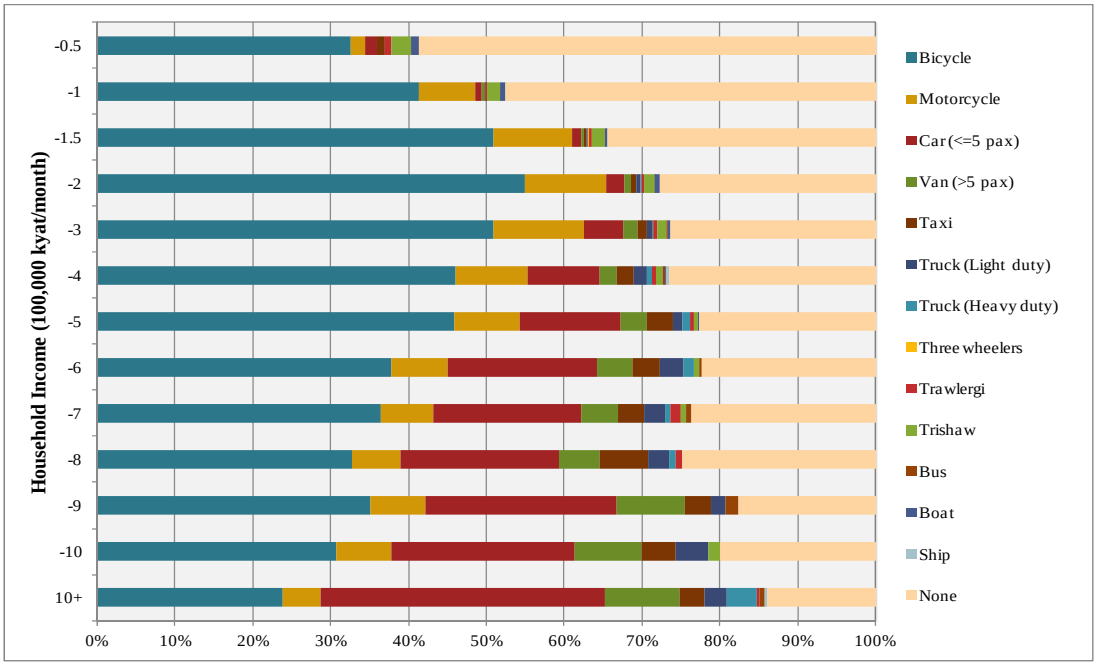


Source: JICA Study Team based on the results of HIS

Figure 2.5.14: Vehicle Ownership of Household

5) Household Income and Vehicle Ownership

The ratio of households with vehicle ownership is very much different by level of monthly household income. The higher income group has higher vehicle ownership. Low income group consists of 60 % of households with no vehicle ownership, besides very high income group consists of approximately 40% of households with private 4-wheels car ownership.



Source: JICA Study Team based on the results of HIS

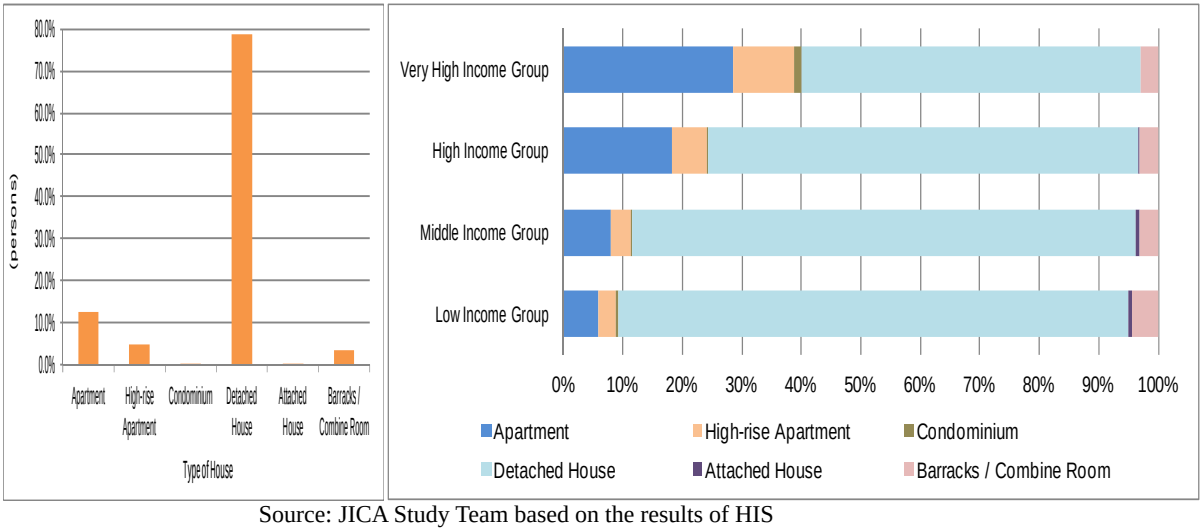
Figure 2.5.15: Vehicle Ownership and Household Income

(4) Living Condition of Household

1) Type and Structure of House

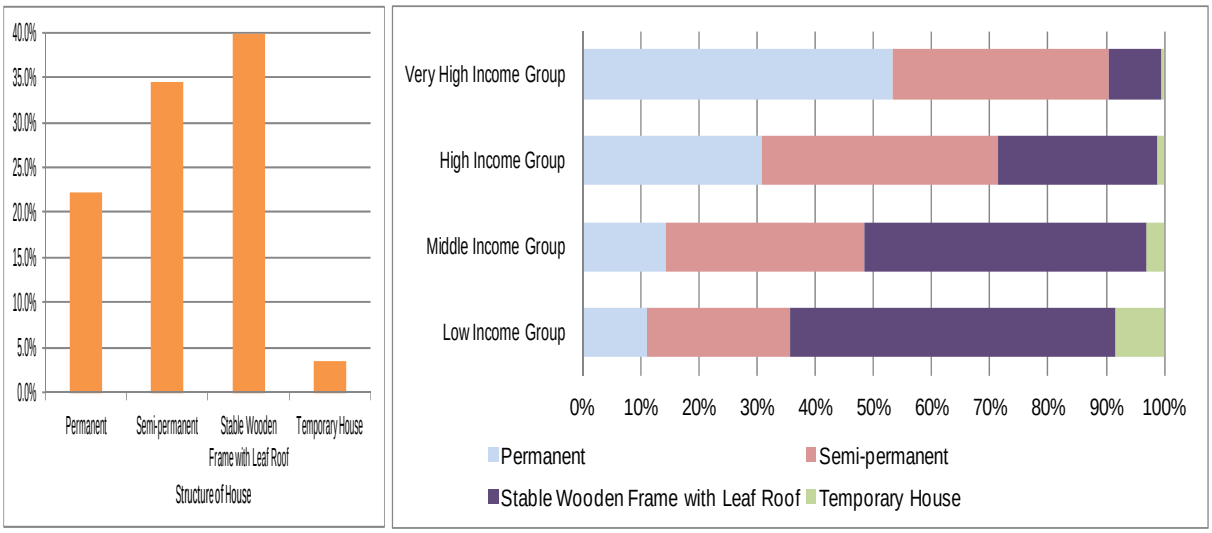
About 79% of all respondent households live in detached house. The type of house varies by income group as shown in Figure 2.5.16. The households with higher income group are living more in apartment or high-rise apartment.

On the other hand, most houses are made of stable wooden frame with leaf roof, and semi-permanent materials, those account for 74% of the total number of houses. In general, type of house has a correlation with structure of house, i.e. if type of house is apartment, we can consider that its structure is permanent. Therefore, the structure of house by income group shown in Figure 2.5.17 shows the same tendency with Figure 2.5.16.



Source: JICA Study Team based on the results of HIS

Figure 2.5.16: Type of House by Income Group



Source: JICA Study Team based on the results of HIS

Figure 2.5.17: Structure of House by Income Group

2) Ownership of House

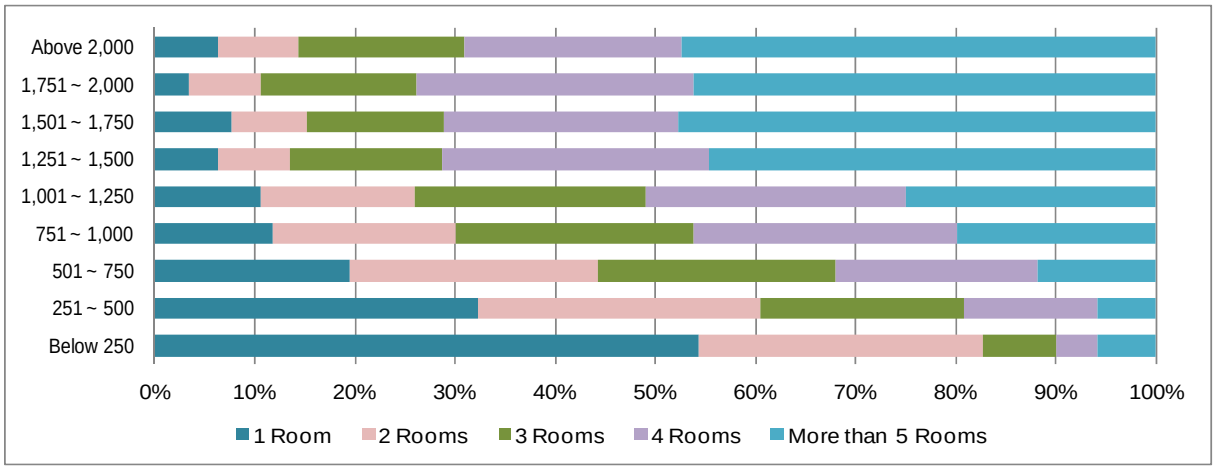
About 84% of households has housing ownership as shown in Figure 2.5.18. The higher income group owns more self-owned housings. Besides, the ratio of ownership of land owned by themselves exceeds 60%.

Source: JICA Study Team based on the results of HIS

Figure 2.5.18: Ownership of House by Income Group

3) Living Space and Number of Rooms

The average floor area per household is 720 square feet. The number of rooms is depending on the living space as shown in Figure 2.5.19. The house with larger spaces has more rooms. More than 40% of houses with over 1,250 square feet has more than 5 rooms.



Source: JICA Study Team based on the results of HIS

Figure 2.5.19: Living Space and Number of Rooms

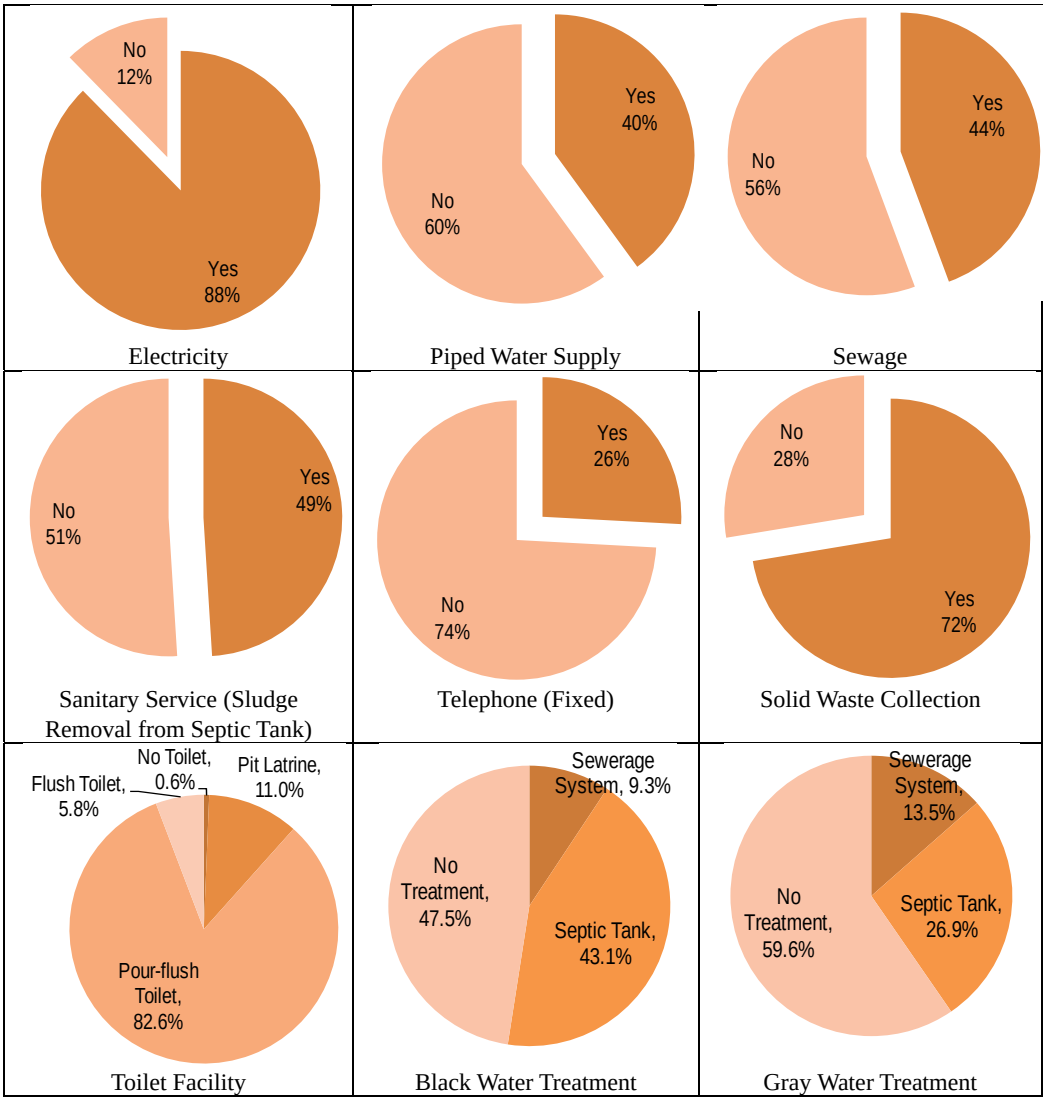
(5) Living Level of Household

1) Connectivity to Urban Services

The accessibility of households to urban services is summarized in Figure 2.5.20. Since the answers from respondents are depending on their understanding, those ratios may be different from actual infrastructure coverage ratios.

Electricity has the highest connectivity ratio of 88%. The second highest connectivity is provided by solid waste collection service which accounts for 72%. Besides piped water supply, sewage, sanitary service has lower connectivity of less than 50%. The lowest connectivity is provided by fixed telephone service which accounts for 26%.

Regarding the sanitary condition, about 83% of household has pour-flush toilet and 6% has flush toilet. Besides the household which utilizes sewerage system is only 9% for black water treatment and 14% of gray water treatment.

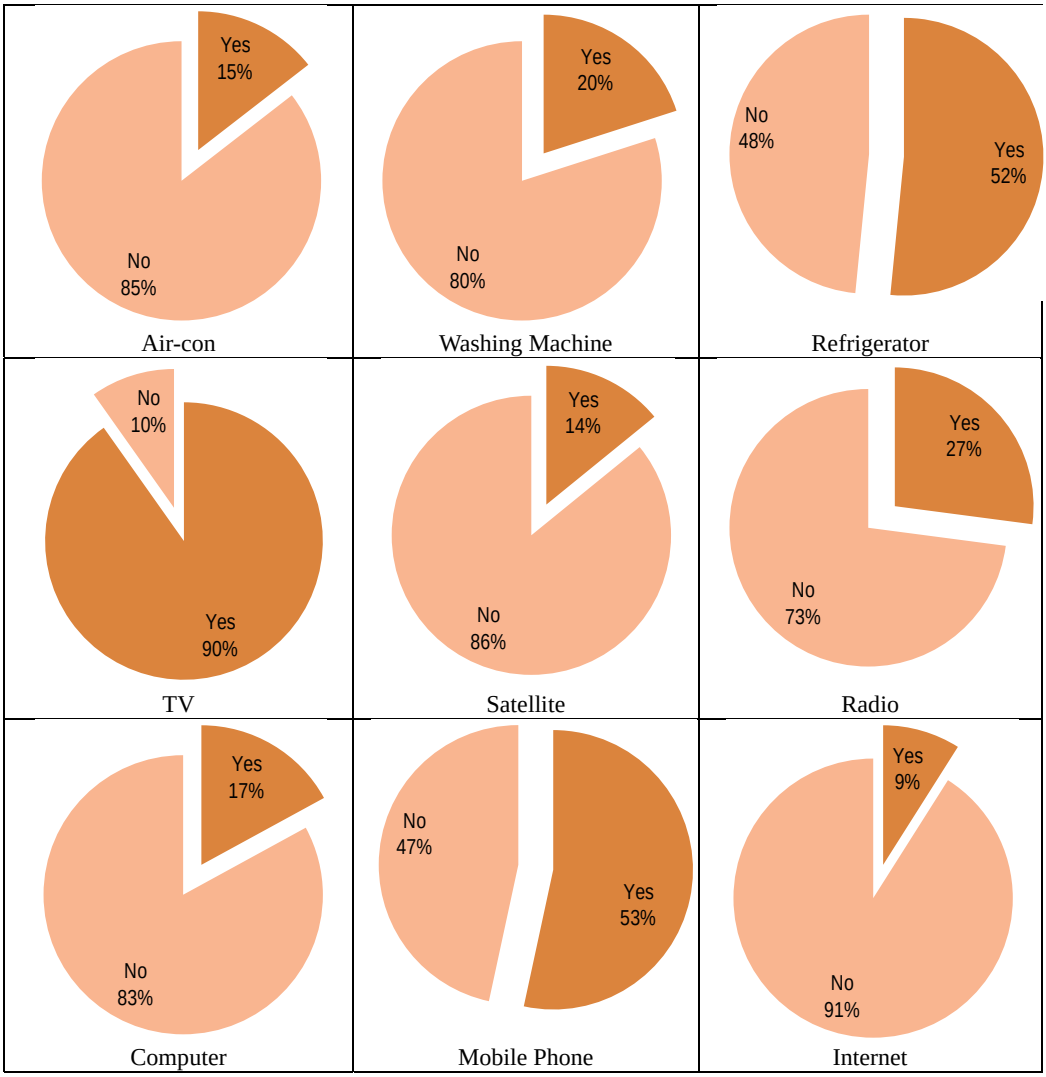


Source: JICA Study Team based on the results of HIS

Figure 2.5.20: Connectivity to Public Facilities

2) Ownership of Electrical Equipments

The electric equipment owned by households is shown in Figure 2.5.21. TV is the most popular electric equipment which accounts for 90% of households. On the other hands, ownership of satellite is still low which accounts for 14%. The second popular electric equipment is mobile phone which accounts for 53%, while fixed telephone is owned by 26% of households as described in the following section. Refrigerator is also owned by 52% of household.



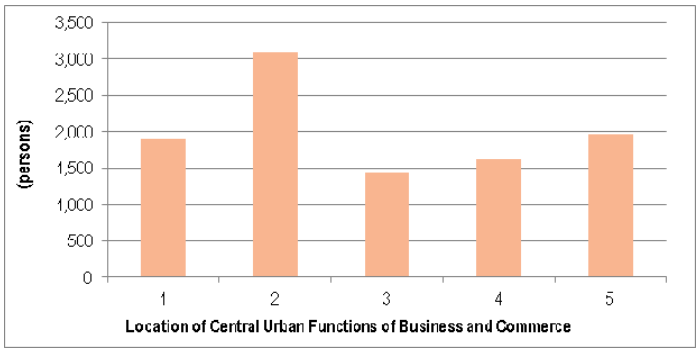
Source: JICA Study Team based on the results of HIS

Figure 2.5.21: Ownership of Electric Equipment

(6) Analysis on the Vision of Yangon City

1) Location of Central Urban Functions of Business and Commerce

Almost 30% of households support the redistribution of the location of central urban functions to several new sub-centers with mid-rise buildings (about 5-15 floors).



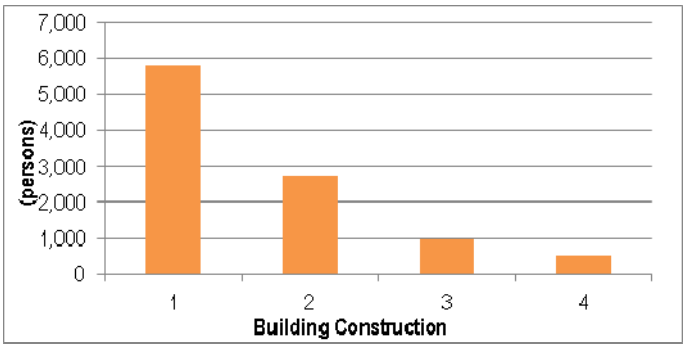
1 Some business and commercial functions will be redistributed to several new sub-centers in high-rise buildings (more than 15 floors)
2 Some business and commercial functions will be redistributed to several new sub-centers in mid-rise Buildings (about 5-15 floors)
3 Business and commercial functions will be concentrated in existing CBD and inner urban area in high-rise buildings
4 Business and commercial functions will be concentrated in existing CBD and inner urban area in mid-rise buildings
5 Undecided

Source: JICA Study Team based on the results of HIS

Figure 2.5.22: Location of Central Urban Functions of Business and Commerce

2) Building Construction

More than half of the household support the strict control of building construction in designated areas.



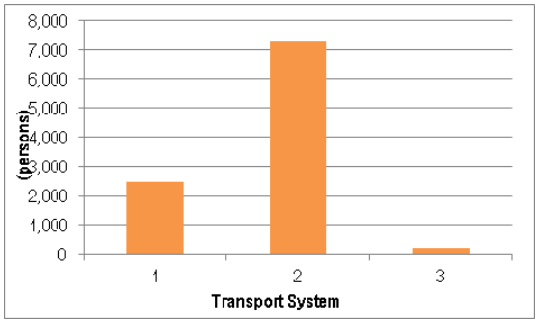
1 Building construction (height, size, etc.) will be strictly controlled in designated areas such as Shwedagon Pagoda surrounding area
2 Building Construction (height, size, etc.) will be controlled in the whole Yangon Area
3 Any Buildings can be constructed freely at owners' will
4 Undecided

Source: JICA Study Team based on the results of HIS

Figure 2.5.23: Building Construction

3) Transport System

More than 70% of households support the improvement of road network infrastructure more than the improvement of public transport networks.



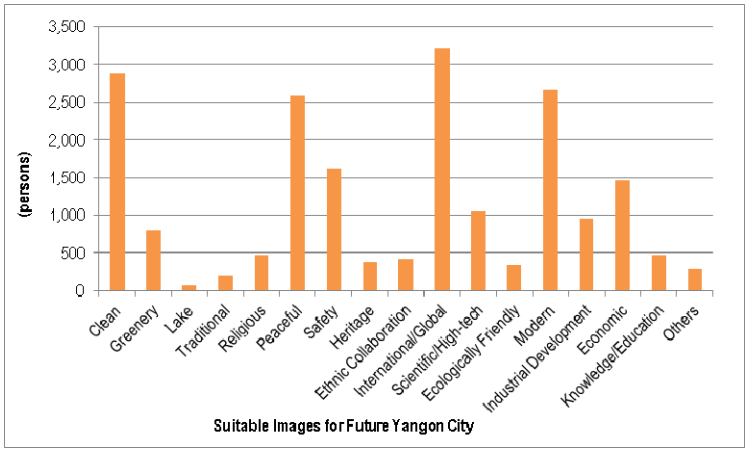
1 Public transport network improvement (bus, railway, inland water transport, etc.)
2 Road network infrastructure improvement
3 Undecided

Source: JICA Study Team based on the results of HIS

Figure 2.5.24: Transport System

4) Suitable Image for Future Development

The top four images that the future Yangon City should have as selected by the respondents are clean, peaceful, international/global and modern images. These are followed by the images that Yangon should be a safe and economic city.



Source: JICA Study Team based on the results of HIS

Figure 2.5.25: Suitable Images for Future Yangon City

(7) Living Condition Assessment

Simple counting analysis shows the volume and ratio of alternatives by question. However, even the analysis precisely reveals the characteristics and current situation of households, it seems to be too detailed to grasp the overall situation at a glance. Therefore, in order to understand the situation of each Township easily and to compare with the other Township and international standards, the methodology applied was based from a previous JICA project called HAIDEP[1], which was conducted in Hanoi, Vietnam from December 2004 to March

[1] The Comprehensive Urban Development Programme in Hanoi Capital City of the Socialist Republic of Vietnam

2007. The methodology is called as township profile, or Urban Karte, including a Living Condition Assessment.

1) Overview of the Methodology of Living Condition Assessment in HAIDEP

The analysis was conducted based on various indicators obtained from the results of HIS in HAIDEP and the GIS database. The analysis categorized the indicators into five factors, which consist of four factors from the notion of living conditions defined by World Health Organization (WHO) in 1961, and a factor that was generated reflecting recent development trends. The factors are (i) convenience and accessibility, (ii) safety and security, (iii) health and wellbeing, (iv) amenity, and (v) capability. Based on the indicators, each factor was assessed and the score was calculated. The total score for the five factors is the integrated score that explains the level of overall living conditions based on objective indicators.

At the same time, the satisfaction of the people with each factor was gathered from HIS respondents who where 20,000 household heads were sampled from the total 900,000. Satisfaction was also translated into scores depending on the level of satisfaction.

By comparing the scores obtained from the objective analysis and the subjective (satisfaction) judgment of the people, both the government and the people can share an understanding on the gap between the two levels and develop the corresponding actions and measures to improve the living conditions.

2) Definition of Factors and Indicators for the Living Condition Assessment

The factors and indicators for the Living Condition Assessment should be carefully selected based on various indicators which can be obtained during the Project, including the HIS, GIS and Township data of Ministry of Home Affairs and the Yangon Regional Government which is recorded by Ward/Village office and submit to Township office. These reflect the current situation in Yangon City and determine the suitable factors to conform to the current international trend. These data will be compiled into a simple and easy-to-understand model in the Urban Karte. The factors and indicators were selected to show the current situation of living conditions, and the gap between the government and residents as referred to HAIDEP.

The selected factors are similar to HAIDEP with the addition of a factor on social service. Such factors include the following:

i) Convenience and Accessibility: This includes basic convenience necessary for people to participate in daily activities and to have access to information.

ii) Safety and Security: This refers to safety from risks, emergencies, and accidents, and to the protection of life and property from disasters and crimes.

iii) Health and Well-being: This ensures that people have access to basic and health services in order to increase their resistance to diseases and have an improved wellbeing.

iv) Amenity: This allows people to enjoy certain basic social and cultural freedoms as well as a comfortable environment.

v) Capability: This looks at people's assets and abilities to increase their capacities - "the more assets, the less vulnerable… [where] vulnerability is linked closely to asset ownership."

vi) Social Service: This looks at the gap and conditions available social services as assessed by the residents.

The indicators have been carefully examined and appropriately selected for the Living Condition Assessment, as shown in Table 2.5.3.

Table 2.5.3: Indicators Selected for Living Condition Assessment in Yangon

Factors	Definition	Indicators	
		Objective	Subjective
Convenience and Accessibility	This includes basic convenience necessary for people to participate in daily activities and to have access to information.	Household with Electricity Connectivity (% of HH)	Assessment on Power Supply Services
		Road-to-Area Ratio (%)	Assessment on Road Condition
		Bus Service Area Coverage (%)	Assessment on Accessibility to Bus Stop
		Households with internet Connectivity (% of HH)	Assessment on Telecom Services
		Households with Telephone or Mobile Phone Connectivity (% of HH)	Assessment on Telecom Services
Safety and Security	This refers to safety from risks, emergencies, and accidents, and to the protection of life and property from disasters and crimes.	Number of Police Officers per 1,000 Population (#)	Assessment on Safety and Security
		Households with Secure Tenure (% of HH)	Assessment on Housing
		Traffic Injuries per 10,000 Population (#)	Assessment on Traffic Safety
Health and Wellbeing	This ensures that people have access to basic and health services in order to increase their resistance to diseases, and to have an improved wellbeing.	Households with Piped Water Connectivity (% of HH)	Assessment on Water Supply Services
		Households with Toilet and Sanitation Facilities (% of HH)	Assessment on Sanitary Condition
		Households with Solid Waste Collection Service (% of HH)	Assessment on Solid Waste Collection Services
		Hospitals per 1000 Population (#)	Assessment on Access to Health Care
Amenity	This allows people to enjoy certain basic social and cultural freedoms, as well as a comfortable environment.	Recreational Facilities per 1000 Population (#)	Assessment on Access to Entertainment Facilities
		Parks and Green Spaces per 1000 Population (ha)	Assessment on Parks and Greenery
		Average Living Space per Capita (m^2)	Assessment on Housing Condition
		Population Density per Residential Area (person/ha)	Assessment on Tranquility
Capability	This looks at people's assets and abilities to increase their capacities - "the more assets the less vulnerable" [where] vulnerability is linked closely to asset ownership.	Monthly Household Income (MMK)	Assessment on Housing
		Household with Internet Connectivity (% of HH)	Assessment on Telecom Services
		Household with Mobile Phones Connectivity (% of HH)	Assessment on Telecom Services
Social Service	This looks at the gap and conditions of available social services as assessed by the residents.	School per 1000 Population (#)	Assessment on Living Environment of Primary Schools
		Religious Buildings per 1000 Population (#)	Assessment on Living Environment of Primary Health Cares
		Markets per 1000 Population (#)	Assessment on Access to Market

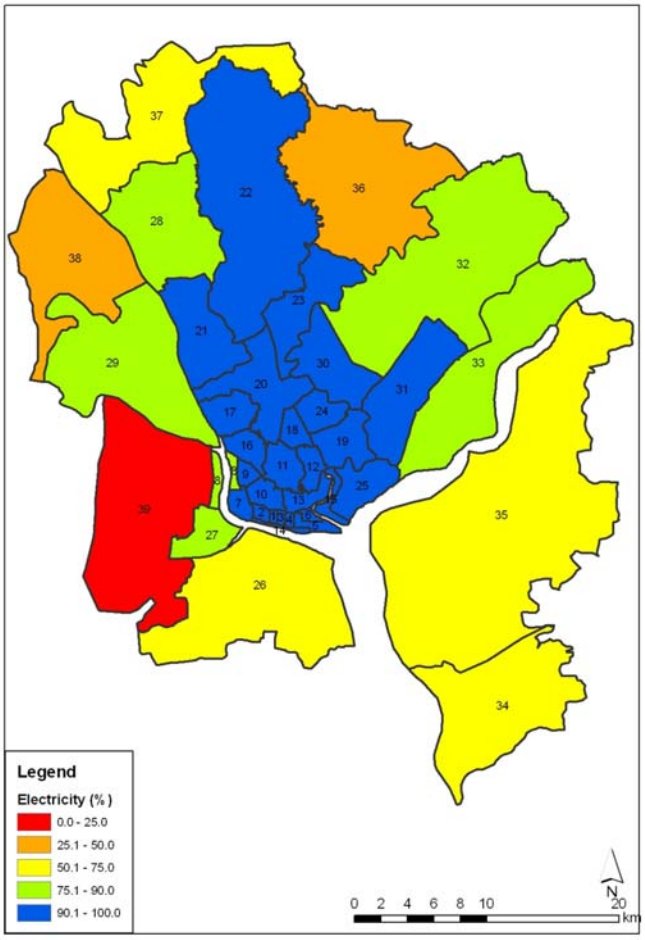
Note: HH-household
Source: JICA Study Team

3) Analyses on Each Indicator by Township

1) Indicators in "Convenience" Factors

i) **Households with Electricity Connection (% of HH)**: This indicator shows the percentage of households that is connected to electricity service.

In Townships within YCDC more than 90% of households connect to electricity services except 7 Townships of newly developed areas and southern and western side of Yangon River and Hlaing River. In the periphery area, the percentage of households connected to electricity services attains less than 50%.

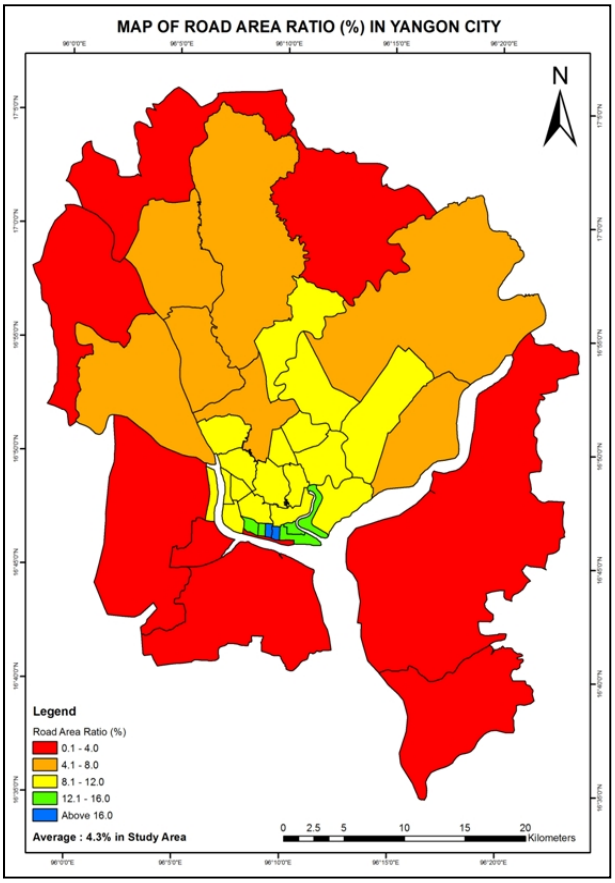


Source: JICA Study Team based on the results of HIS

Figure 2.5.26: Map of Electricity (%) in Yangon City

ii) **Road Area Ratio (%)**: This refers to the percentage of paved road with the net land area (excluding water surface). This is generally used as an indicator to measure the level of development of a city. This area was calculated based on GIS maps.

Most of townships nearby the CBD area are served by adequate paved roads. The road area ratio (%) of these areas is the highest among the 39 townships, which is more than 12%. In contrary, a few townships, particularly located in the outer/border of Yangon City, is still caught by lack of paved roads condition. It reveals that the development progress in Yangon City is still centralized, mainly limited to the CBD area. It is therefore, a wider and comprehensive road improvement projects should be prioritized by the government, especially to be conducted in outer townships of Yangon City. The better road infrastructure in outer/border areas, the better economic connectivity between Yangon City and neighboring cities happened. Thus, the intensity of trades, migrations, and capital flows between Yangon City and other regions could increase steadily.

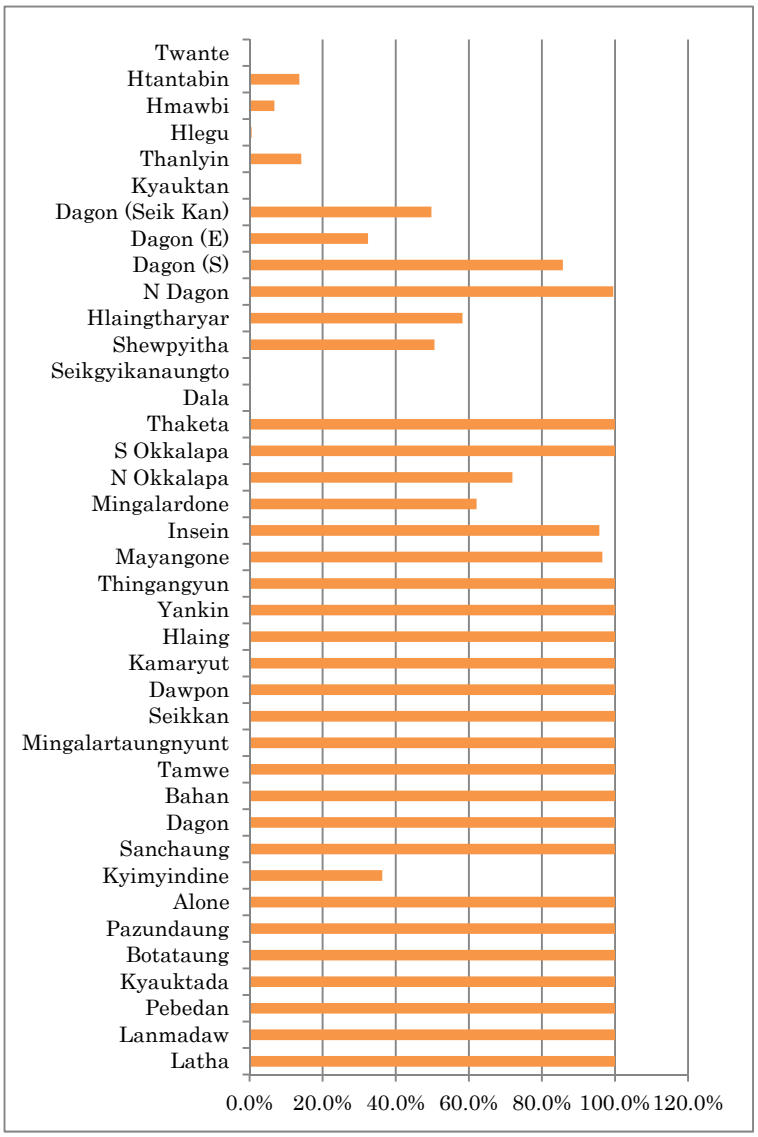


Source: JICA Study Team based on the results of HIS

Figure 2.5.27: Map of Road Area Ratio (%) in Yangon City

iii) **Bus Service Area Coverage (%)**: This indicator shows the percentage of area covered by bus service. The service zone is considered as certain distance (calculated based on walking trip) from a bus route. Bus routes were taken from a Ma Hta Tha bus route map obtained by the Study Team, however, the other bus routes operated by the other cooperatives were not included because of data limitation. Therefore, this indicator shows the bus service area under only Ma Hta Tha management.

Townships nearby the CBD area have been covered by bus transport networks. Bus network, is moreover, also integrated with other public transport modes such as railways, taxis, and water ferries. People living in these areas could easily travel by bus than those living in the northen and southern borders townships of Yangon City. In fact, those border townships (such as Hlagu, Dala, Hmawbi, and Twante) are still faced by limited bus services. The coverage of bus transport networks in these area is less than 30%. However, the overall bus service coverage in Yangon City is fairly low, with only less than 50%.

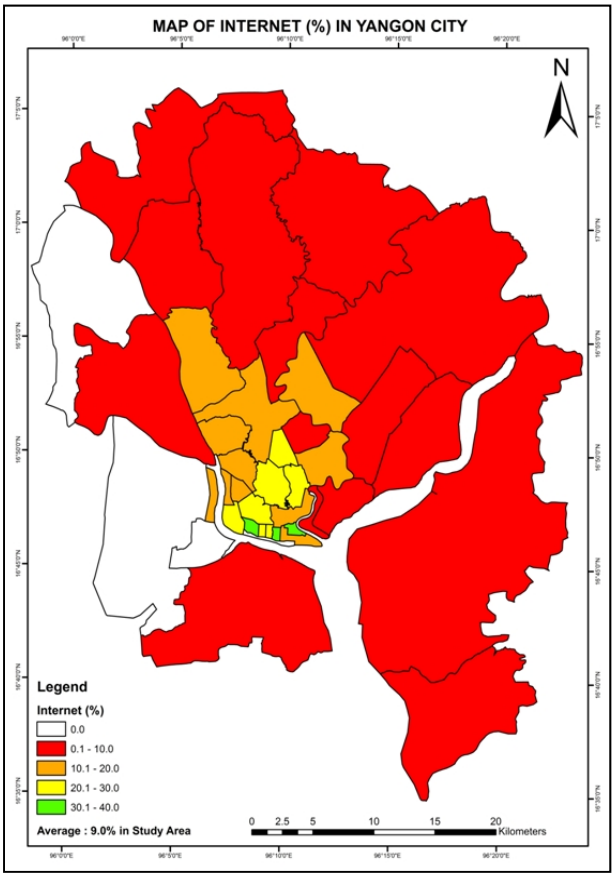


Source: JICA Study Team based on the results of HIS

Figure 2.5.28: Bus Service Area Coverage (%) in Yangon City

iv) **Households with Internet Connectivity (% of HH)**: Availability and accessibility to information is one of the important factors to measure convenience of people's life. As TV has already spread widely, internet was selected to evaluate people's accessibility to information. Internet connection per 1000 population was calculated as an indicator calculated from HIS result.

In general, internet usage is still limited in Myanmar. Many people are not entirely familiar using internet for their activities, especially to communicate, sharing news and information each others. Furthermore, number of people with ability to operate internet is also limited. However, this infrastructure begins to grow in Yangon City along with rapid development and modernization of the country. Although the percentage of internet accessibility in many townships is still less than 20%, in CBD area, most of residents enjoy internet through personal connections in their houses, offices, as well as through collective connections provided by local internet cafes, which mostly scattered along the business and commercial areas.

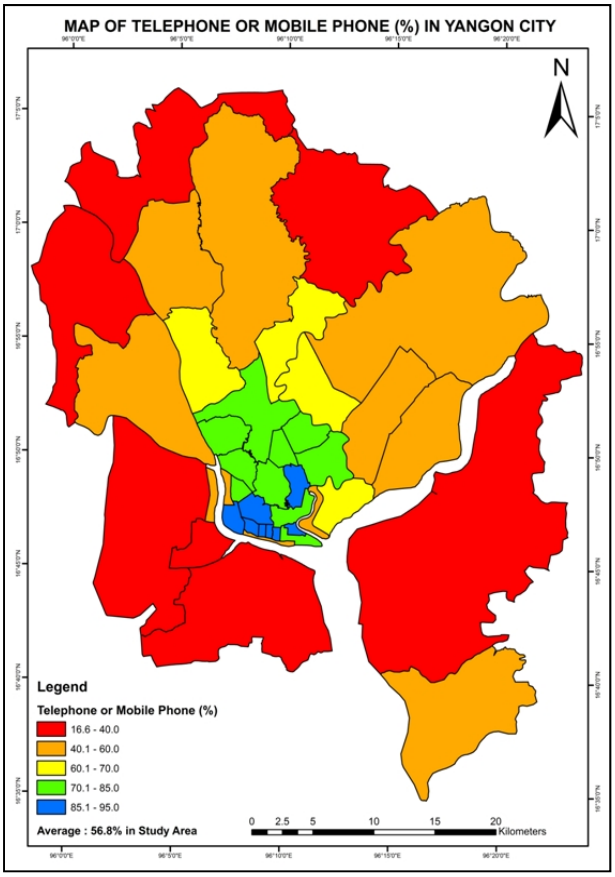


Source: JICA Study Team based on the results of HIS

Figure 2.5.29: Map of Internet (%) in Yangon City

v) **Households with Telephone or Mobile Phone Connectivity (% of HH)**: Use of telecommunication may enhance convenience of life to a great extent. Telephone (or landline phone) was selected as the media. However, mobile phones have become reasonably available and easily obtainable for people. Therefore, the ratio of households with telephones or mobile phones was calculated as an indicator from HIS result.

Unlike internet, usage of telephone and mobile phone in Yangon City is more advanced. At least, in overall, more than 15% of households are connected to this infrastructure in each township. Moreover, in the townships nearby CBD, the ratio of telephone connectivity attains 70-90%. Therefore, it is generally assumed that residents in Yangon City are relatively linked each other by telephone as the major communication means.



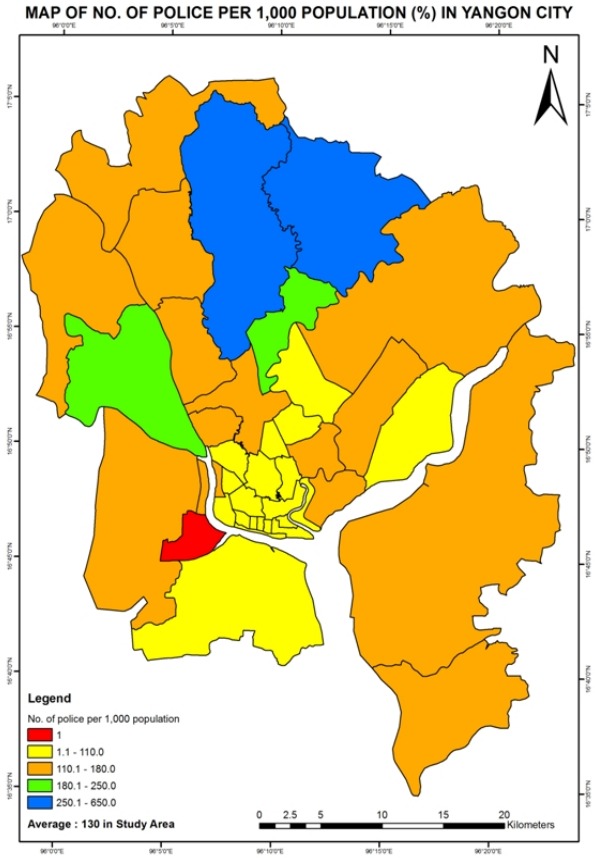
Source: JICA Study Team based on the results of HIS

Figure 2.5.30: Map of Telephone or Mobile Phone (%) in Yangon City

2) Indicators in "Safety & Security" Factors

i) **Number of Police per 1,000 Population (#)**: Peoples' daily lives are secured by police. The number of police officers per 1,000 population was selected to show the availability of police presence. The source of this indicator was Township Data of Ministry of Home Affairs and the Yangon Regional Government.

The average number of police per 1,000 population in overall Yangon City is 130 police. However, unlike the high percentage of infrastructures availability, the proportion of police tends to be fewer in the townships surrounding CBD. High population number and density is the main reason. It is only 1-110 police per 1,000 residents. To deal with a higher crime percentage that usually happened in the central area, number of police is essential to be increased. High rate of urbanization and dynamic business growth are the main factors determining crimes increase, and hence security should be improved.

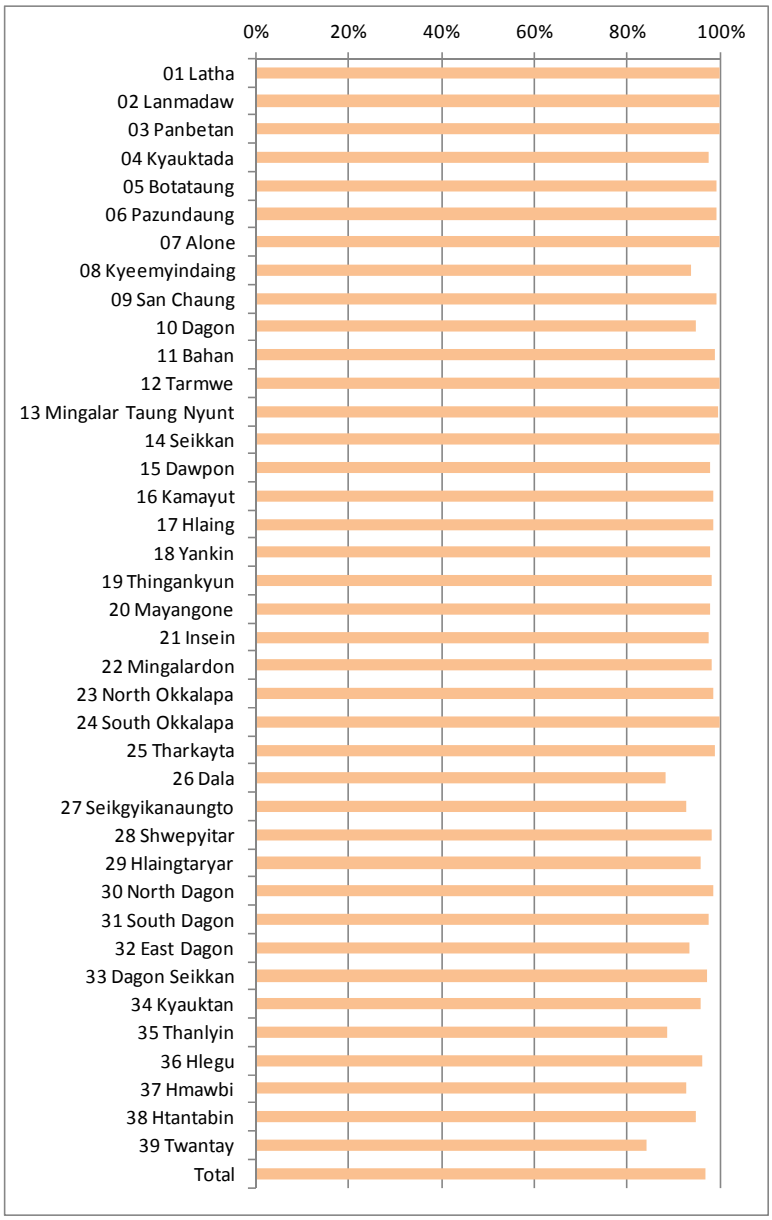


Source: JICA Study Team based on the results of HIS

Figure 2.5.31: Map of No. of Police per 1,000 Population (%) in Yangon City

ii) **Households with Secure Tenure (% of HH)**: Having a secure place to live or secured tenure is one of the important factors in measuring security conditions. This indicator used the result of HIS response, which asked for the structure of houses. Permanent, semi-permanent, and stable wooden framed house with leaf roof were calculated as secure tenure while temporary house was calculated as insecure.

In Yangon City, percentage of households with secure tenure is generally ranges between 95-100%. However, 6 Townships which are located in the south of Yangon River and periphery area account for less than 95%. In particular, those of Dala, Thanlyin, and Twantay Townships are less than 90%.



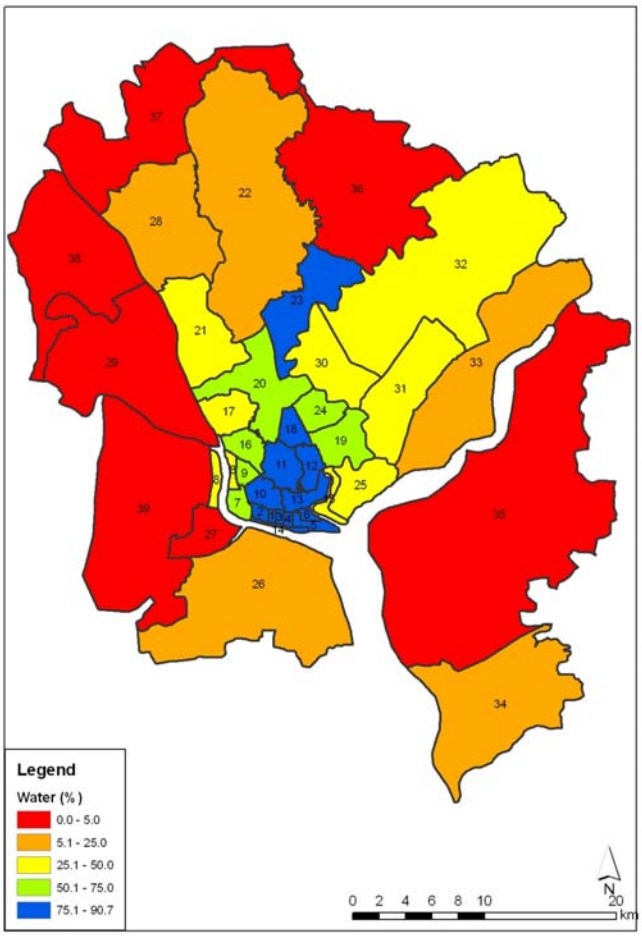
Source: JICA Study Team based on the results of HIS

Figure 2.5.32: Map of HHs with Secure Tenure (%) in Yangon City

3) Indicators in "Health & Wellbeing" Factors

i) **Households with Piped Water Connectivity (% of HH)**: This indicator shows the percentage of households that have connection to piped water supply. The data was obtained from the HIS, which asked for each household's connectivity to piped water supply service.

Townships surrounding CBD have their households covered by adequate piped water with percentage more than 75%. As for townships in outer/periphery areas, especially western borders, are still living traditionally with rain and river waters, and not covered by piped water. Hence, health improvement is the main issue to be addressed in such remote townships.

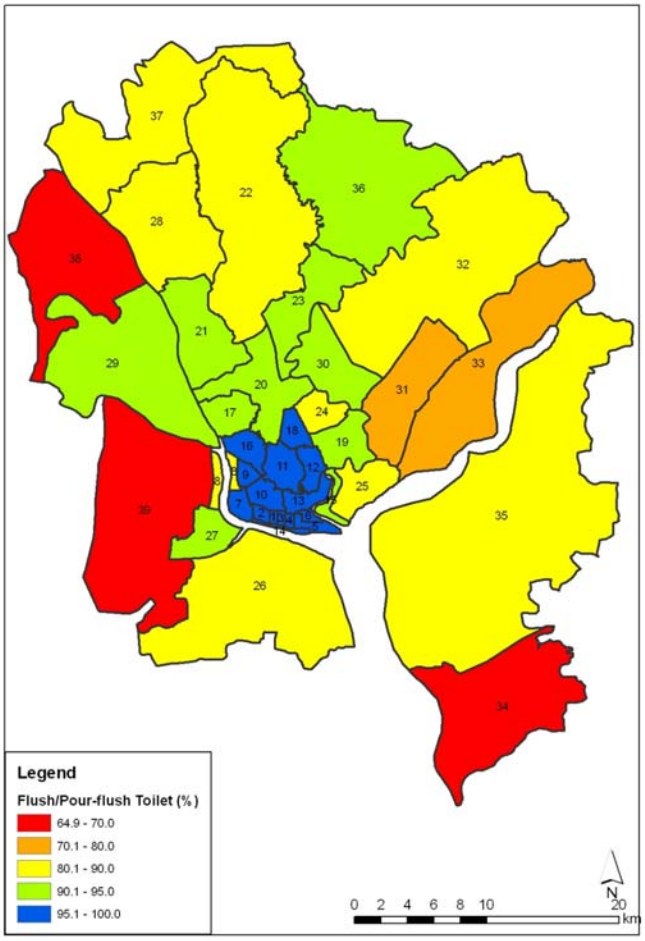


Source: JICA Study Team based on the results of HIS

Figure 2.5.33: Map of Pipe Water Supply (%) in Yangon City

ii) **Households with Toilet and Sanitation Facilities (% of HH)**: This indicator shows the percentage of households that have their own toilet or sanitation facilities in their houses. The data was obtained from the HIS, which asked for each household's availability of sanitation facility.

There is a good portrait of health living in Yangon City, in terms of sanitation. Most of its households' houses are supported by toilet/sanitation facility with flush or pour-flush type. Its average reaches to 88%. The percentage by Township is relatively high in CBD and adjacent areas, on the other hand, those of townships in periphery area such as Htantabin, Twantey, and Kyauktan are less than 70%.

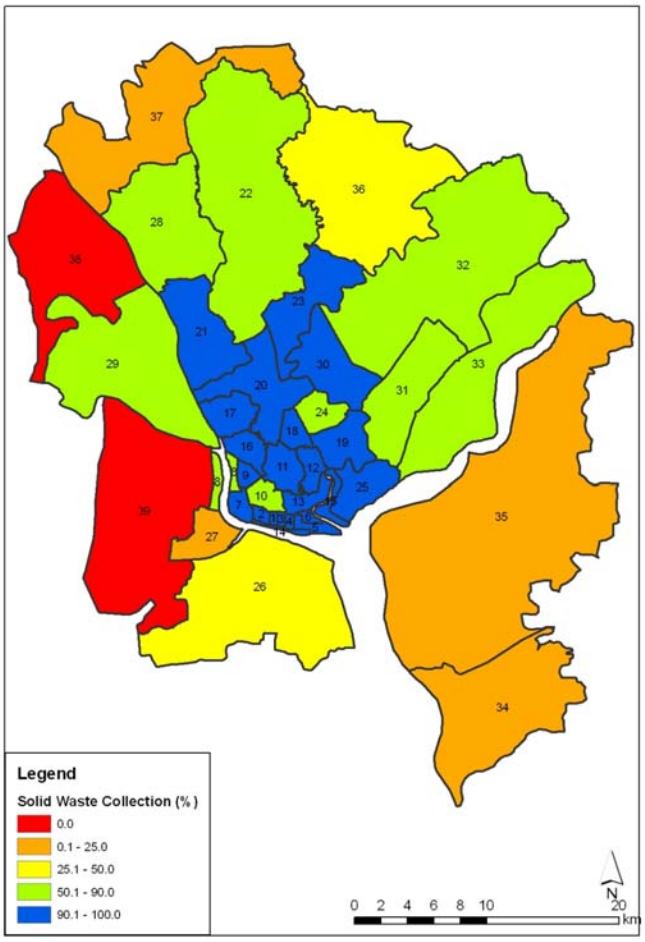


Source: JICA Study Team based on the results of HIS

Figure 2.5.34: Map of Toilet Facility (%) in Yangon City

iii) **Household with Solid Waste Collection Service (% of HH)**: This indicator shows the percentage of households that are being provided with solid waste collection services. The data was obtained from the HIS result on the replies for availability of solid waste collection service.

Solid waste collection is one of crucial systems that should be provided by a settlement, to keep the sustainability of their health environment. In overall Yangon City, approximately 72% households covered by solid waste collection system. Moreover, households in a few townships nearby the CBD and adjacent areas are covered more than 90%. However, in several outer townships (western part townships), percentage of households covered by solid waste collection system is less than 50%, and thus, it needs to be appropriately improved.

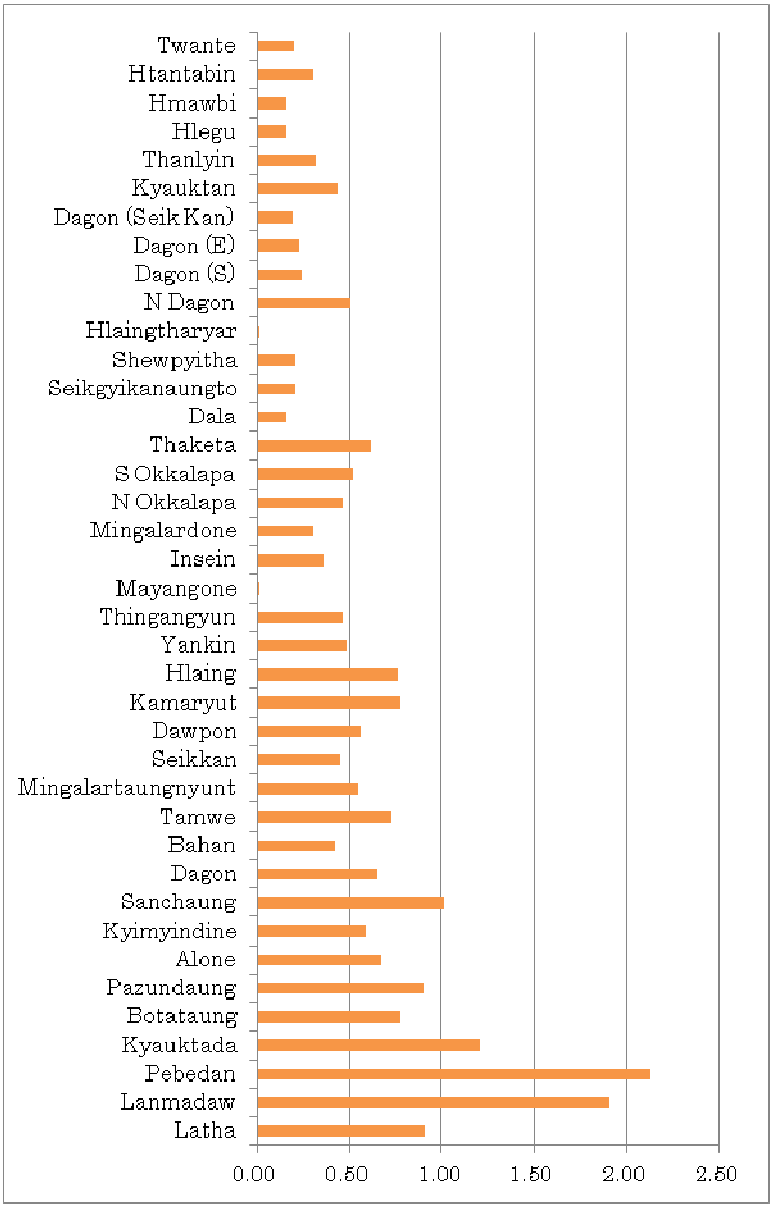


Source: JICA Study Team based on the results of HIS

Figure 2.5.35: Map of Solid Waste Collection (%) in Yangon City

iv) **Hospitals per 1000 Population (#)**: Number of hospital beds can be an ideal indicator as introduced in major international benchmarks. However, due to data limitation, only the number of hospitals and health centres per township was obtained from Township Data of Ministry of Home Affairs and the Yangon Regional Government.

According to the township data, number of hospital per 1,000 population in each township is still limited. In most townships, number of hospital per 1,000 population only less than 0.5, which means one hospital in a township could serve more than 1,000 population, or several townships do not have hospital. In this case, many people living in townships without and/or with inadequate services of hospital would travel to CBD area to take health services.



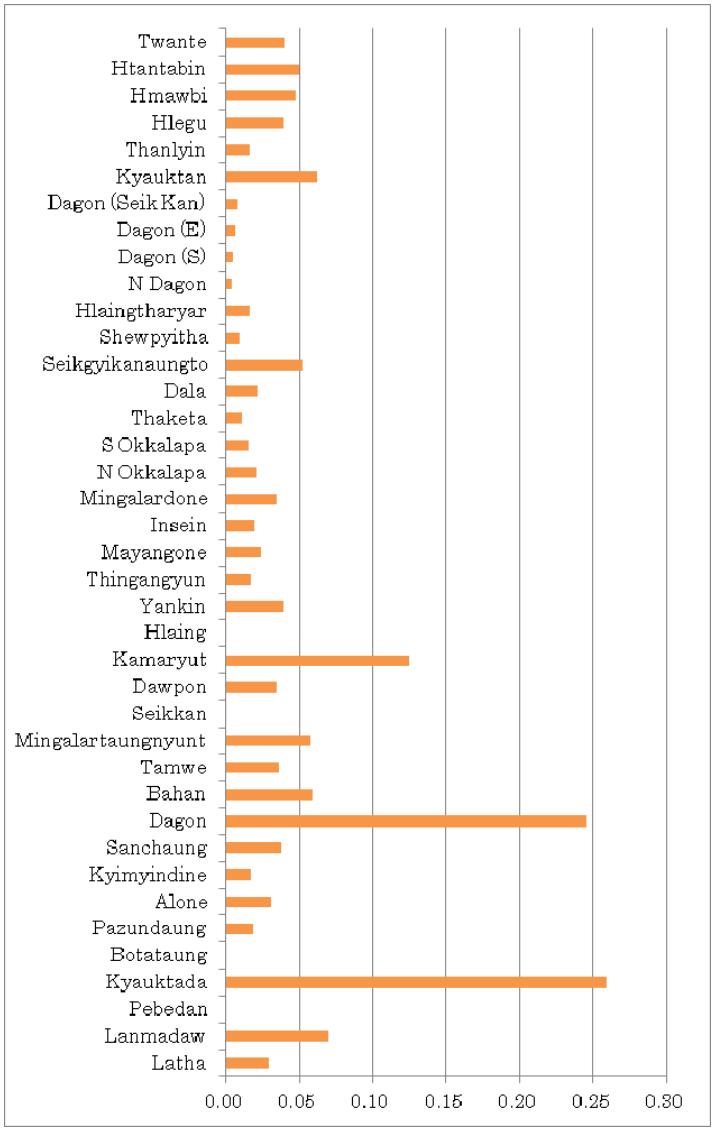
Source: JICA Study Team based on the results of HIS

Figure 2.5.36: Hospital per 1,000 Population (%) in Yangon City

4) Indicators in "Amenity" Factors

i) **Recreational Facilities per 1000 Population (#)**: This indicator shows the number of recreational facilities per 1000 people in a township. Recreational facilities include information on cinema, parks, and playgrounds, which are available from Township Profile.

Cinema is classified as tertiary (luxury) recreational facility or conditional public goods, in which people have to pay specific ticket tariffs to enjoy its services. Meanwhile, park and playground are types of primary recreational facilities, or pure public goods, which people can usually enter the facilities without any payments – free. Although in some cases these facilities might be charged by retribution or tax, the tariff is usually very cheap and affordable. It is therefore, park and playground is essential to be provided in each township, hence people from wider economy class can get its benefit. As for cinema, it could be potential markets for CBD and commercial areas, where a lot of people with medium-high economy class are concentrated and usually looking for tertiary leisure activities.

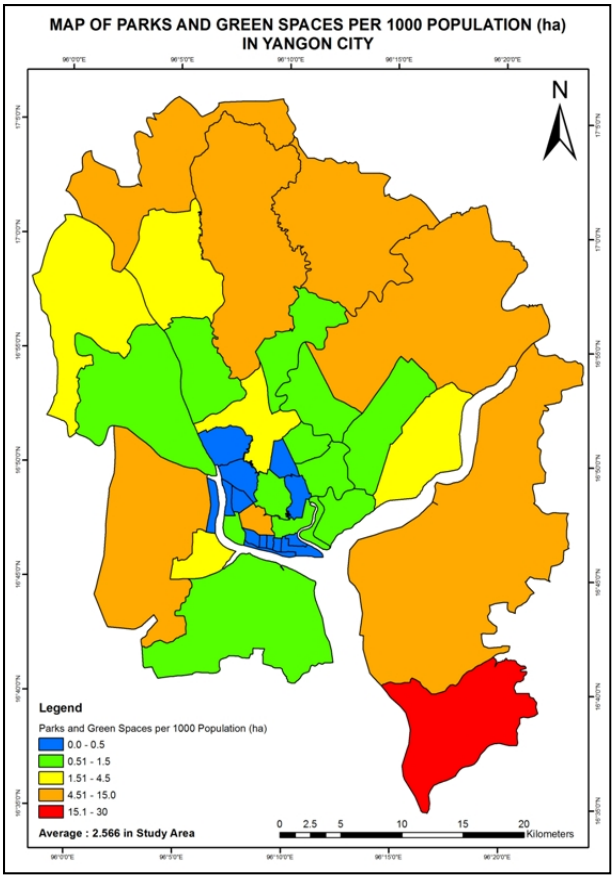


Source: JICA Study Team based on the results of HIS

Figure 2.5.37: Recreational Facilities per 1,000 Population (%) in Yangon City

ii) **Parks and Open Spaces per 1000 Population (ha)**: This indicator shows the area of parks and green areas shown in land-use map obtained from the GIS. The number indicates the area of parks and green areas per 1000 people in a township.

Similar to other developing cities in Southeast Asia, Yangon City is not avoided from rapid and less-organized spatial utilization circumstances, which usually against the availability of green and open spaces. After getting the decrease of green open space, a city is usually faced by environmental degradation. The degradation produces some negative impacts such as social problems and environmental problems among others urban floods and high levels of air pollution may follow this way. These considerations might be faced by Yangon City in the near future. Currently, the total size of green and open spaces in townships nearby CBD is less than 1 hectare per 1,000 population.

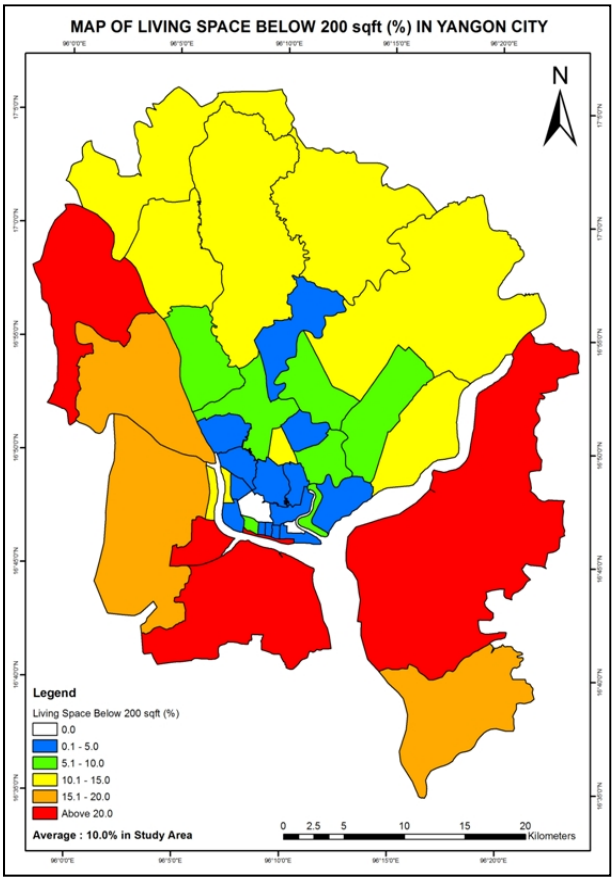


Source: JICA Study Team based on the results of HIS

Figure 2.5.38: Map of Parks and Green Spaces per 1,000 Population (Ha) in Yangon City

iii) **Average Living Space per Capita (m^2)**: Decent size of a housing unit is one of the important factors for comfortable living. Thus, this indicator is essential in measuring the level of amenity. Based on the HIS, the average living space per Household was calculated based on area of living space and number of households.

The problem of living space is found in the outer/periphery townships. There are about 20% households are still living in small houses with less than 200 sqft. Their houses, moreover, are in poor conditions with only constructed by temporary materials. However, in the CBD area and adjacent townships, number of households living in small houses with less than 200 sqft is only 0-5%. It reveals that on the average, households living in the CBD area occupy more comfortable decent houses than those living in the suburban townships.

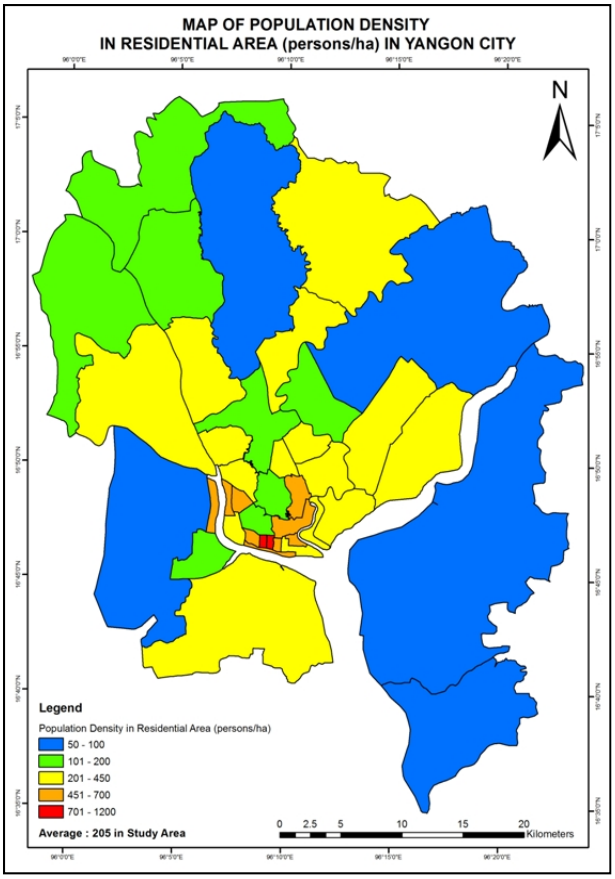


Source: JICA Study Team based on the results of HIS

Figure 2.5.39: Map of Living Spaces Below 200 sqft (%) in Yangon City

iv) **Gross Population Density (person/ha)**: Density can determine living condition. Population density per residential area was calculated per township. There are merits and demerits for both dense and dispersed living environment depending on the local condition. However, considering that high density results to an unfavourable housing environment in Yangon City, less density was considered as better living environment in this assessment.

Similar to the nature of other developing cities in Southeast Asia, the highest density rate of Yangon City is found in the downtown (CBD area and adjoining townships). It is approximately 700-1,200 population/ha. Meanwhile, other townships - especially in suburban areas (outer/periphery areas), the average density is only 50-400 population/ha. Such high density levels lead to the swift growth of apartment and condominium in the city, particularly in the CBD area.



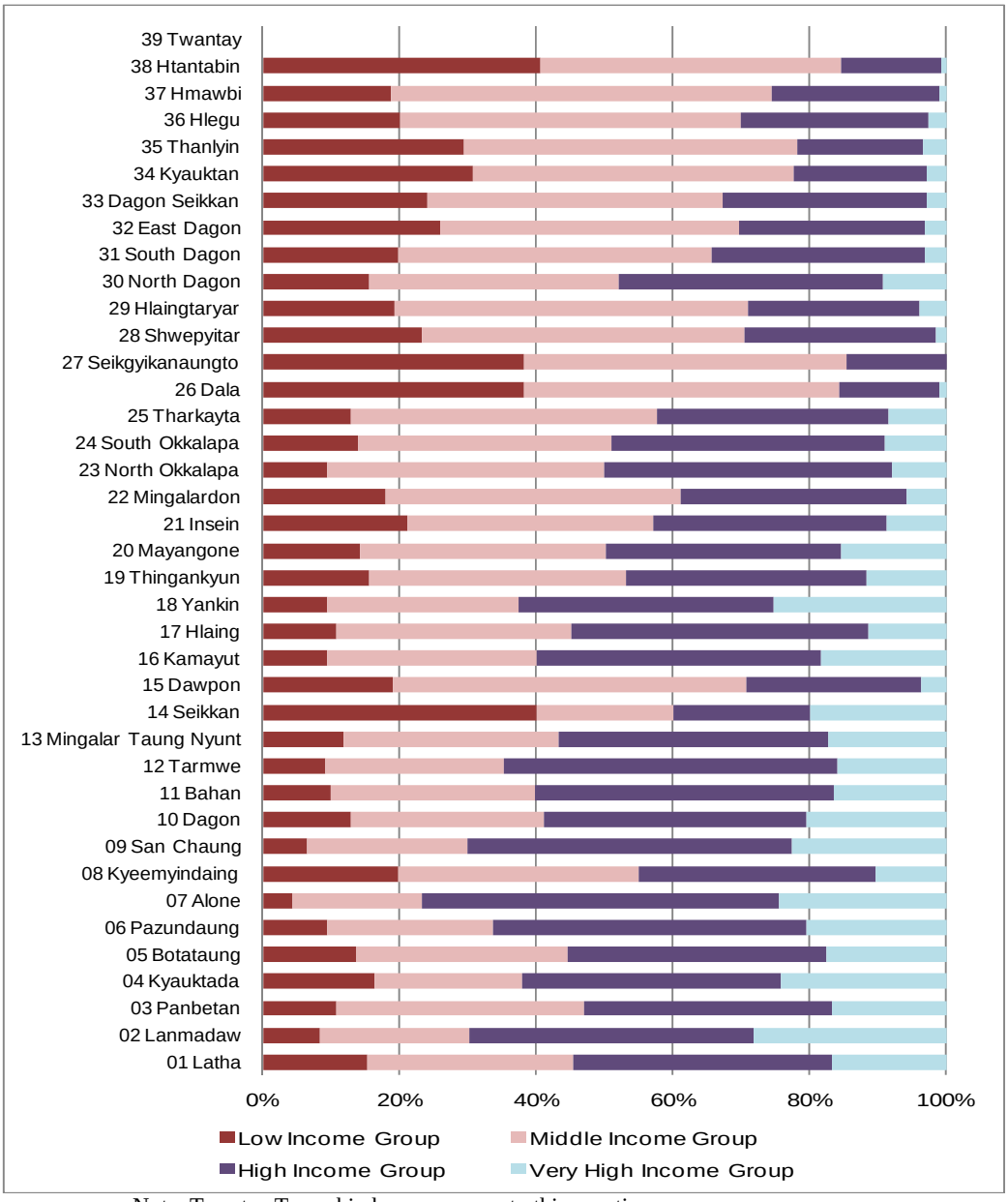
Source: JICA Study Team based on the results of HIS

Figure 2.5.40: Map of Population Density in Residential Area (Person/Ha) in Yangon City

5) Indicators in "Capability" Factors

i) **Monthly Household Income (MMK)**: Financial capability of people is an important factor to determine the potential of Yangon in developing its economy as well as improving the living conditions. The data was obtained from HIS which asked for monthly income of each household. .

Distribution of income group by Township shown in Figure 2.5.41 shows that the ratio of low income group is high in Seikkan, Dala, Seikgyikanaungto and Htantabin Townships. On the other hand, the ratio of very high income group is higher in Lanmadaw, Kyauktada, Alone and Yankin Township.

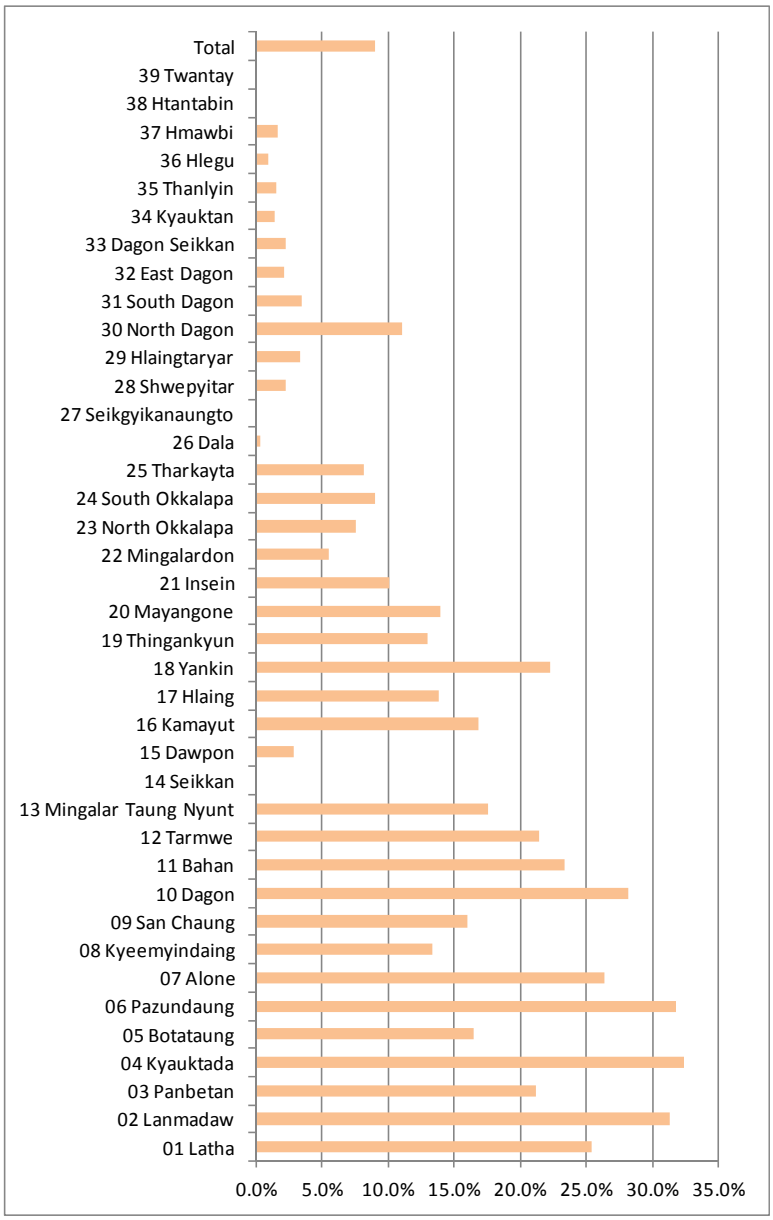


Note: Twantay Township has no answer to this question.
a) low income group: less than MMK 100,000 per month
b) middle income group: MMK 100,000 to 200,000 per month
c) high income group: MMK 200,000 to 500,000 per month
d) very high income group: more than MMK 500,000
Source: JICA Study Team based on the results of HIS

Figure 2.5.41: Household Income Group by Township

ii) **Household with Internet Connectivity (%)**: This refers to the ratio of people who have internet access. Internet is now an essential method in obtaining information; therefore, the capability to access updated information is important. The data was obtained from HIS regarding households' accessibility to internet services.

As shown in Figure 2.5.29, percentage of households who connect to internet is mostly high in CBD area and low in periphery area. The township wise connectivity is shown in Figure 2.5.42. As described in the previous item, more than half of households in CBD area are classified in high or very high income group. Therefore, internet connectivity is depending on the household's income level.

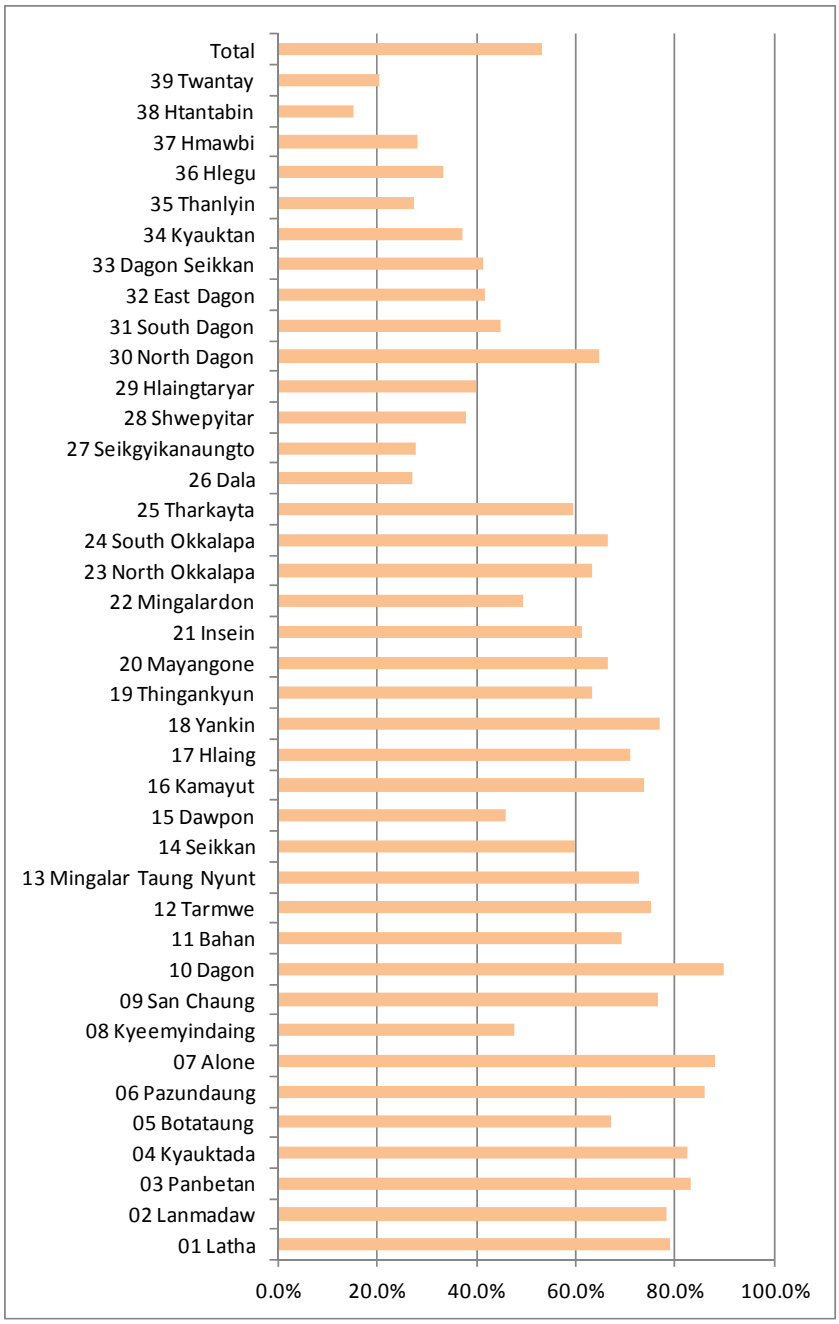


Source: JICA Study Team based on the results of HIS

Figure 2.5.42: Household with Internet Connectivity

iii) **Household with Mobile Phone Connectivity (% of HH)**: The number of people who owns mobile phones was calculated based on HIS result. Mobile phones are becoming essential for communication and business, thus, this indicator can be an aspect in determining the capability of Yangon citizens. The data was obtained from HIS asking for ownership of mobile phone.

Comparing to internet, the percentage of household connected to mobile phone is relatively higher particularly in the periphery areas and newly developed townships.



Source: JICA Study Team based on the results of HIS

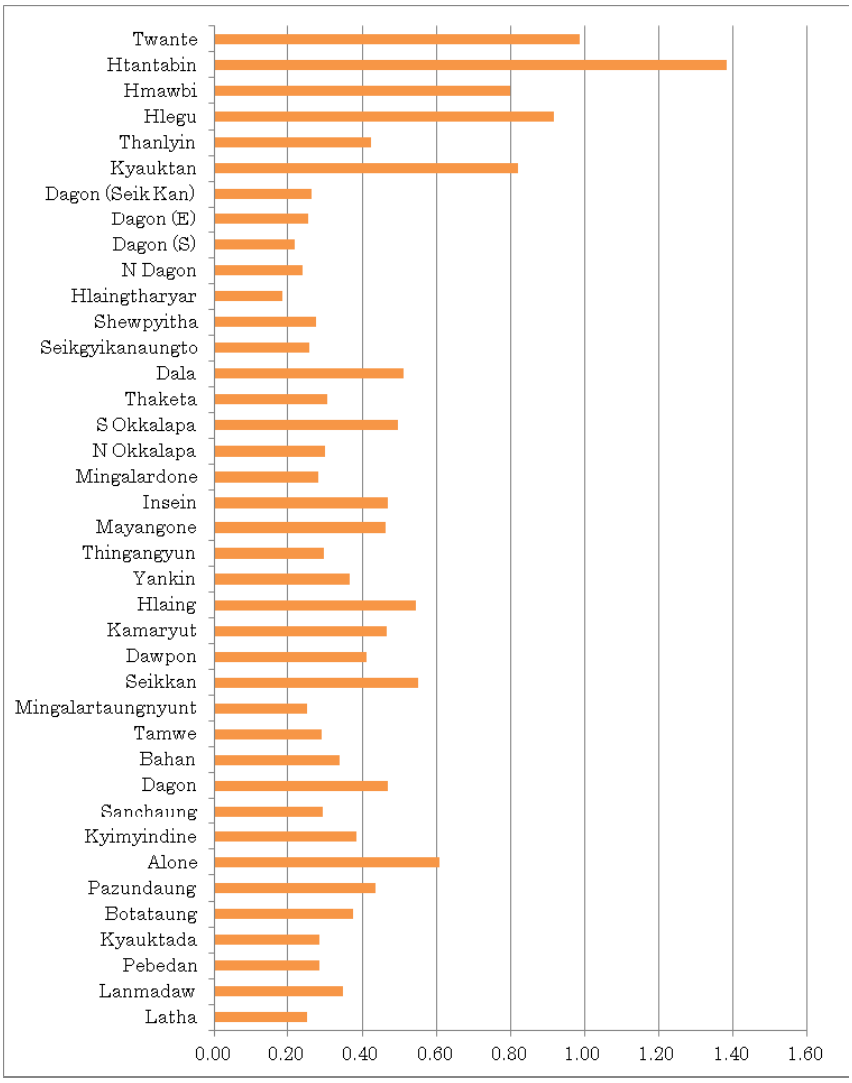
Figure 2.5.43: Household with Mobile Phone Connectivity

6) Indicators in "Social Services" Factors

Overview of the distribution of these indicators by township is organized in the Appendix.

i) **Schools per 1000 Population (#)**: This indicator refers to the accessibility to and availability of basic education. Ratio of five-year old children who are attending school out of total population of five-year old children was obtained from the Statistics of Township reported by township offices.

Yangon City has the best educational facilities and the highest number of qualified teachers in Myanmar. Based on township data, it is estimated that most of township in Yangon City have already at least one elementary school. Recently, a number of partner countries such as United States, Indonesia, and China introduced a concept of international school to Myanmar, which also becomes a popular education facility alternative for Yangon City residents.

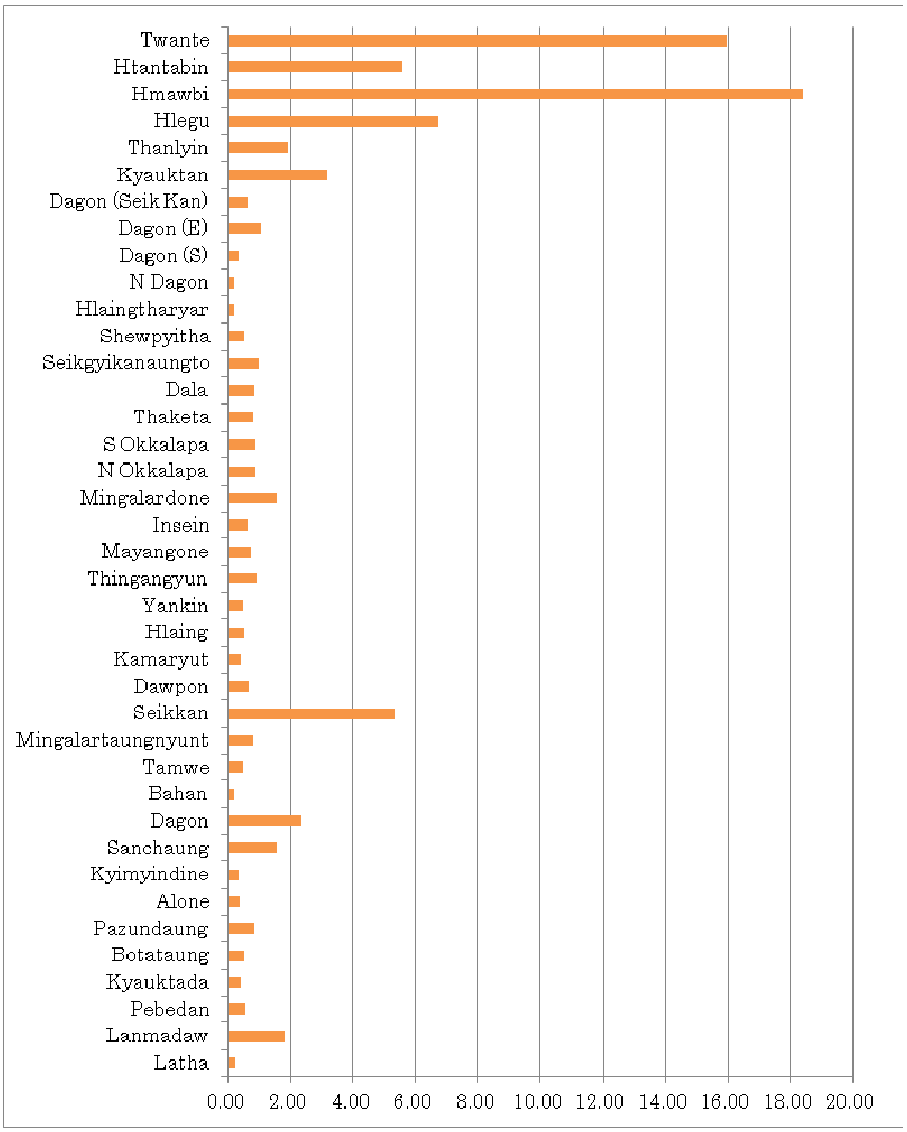


Source: JICA Study Team based on the results of HIS

Figure 2.5.44: Map of Number of Schools per 1000 Population in Yangon City

ii) **Religious Buildings per 1000 Population (#)**: Religion is essential for the people in Yangon. Therefore, this indicator is selected to assess the social service level of each township. The data was obtained from Township Data of the Ministry of Home Affairs and the Yangon Regional Government.

In Yangon City, there is a lot of Pagoda and Buddhism Temple serves Buddhism adherents (the highest population in the country, about 94%). Meanwhile, the minorities such as Hindu and Islamic adherents, are also well accommodated in the city, which indicated by the presence of India-Hindustan Temples and Islamic Mosques in adequate numbers. Generally, the availability of religious facility does not reflect a certain number per township. However, their presences are easily seen along the main streets of Yangon City, especially near the CBD and housing areas.

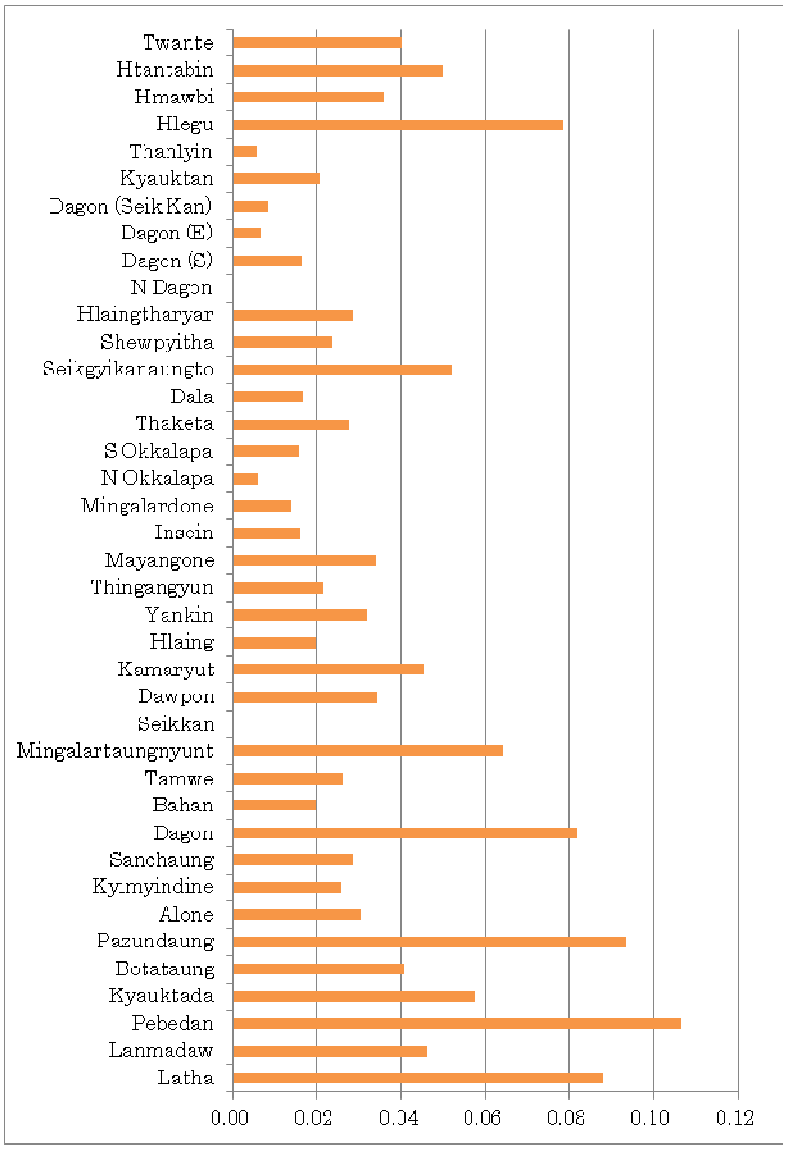


Source: JICA Study Team based on the results of HIS

Figure 2.5.45: Map of Religious Facility per 1,000 Population in Yangon City

iii) **Markets per 1000 Population (#)**: Market is essential for the people's everyday living. The data was obtained from the Township Data of Ministry of Home Affairs and the Yangon Regional Government.

In addition to provide local residents' basic needs, markets also serve as a means of business that allows residents to get economic benefits from trading activities. Therefore, the existence of markets is very essential in Yangon City. In fact, there are local markets and regional markets, where local markets usually involve small and medium traders from their surrounding area, and regional markets are established under large, national, or consortium companies. Based on township data, a market in Yangon City could serve more than 1,000 population, and those are located near housing areas (for local markets), and along the main streets, commercials and business areas (for regional markets).



Source: JICA Study Team based on the results of HIS

Figure 2.5.46: Map of Market per 1,000 Population in Yangon City

(8) Township Profile (Urban Karte)

The Urban Karte was prepared based on the various development indicators collected throughout the Project and the results of the Living Condition Assessment by township. The Urban Karte provides many indicators required for urban planning in a single sheet (2 pages in A4 format). The first page contains a brief description of a township's characteristics, a figure showing the land use pattern, and a fact sheet that covers the following: location and geography, demographic data, household information, industrial figures, infrastructure, land use (2012), safety and security, education, health, religious, and entertainment. The second page contains the results of the Living Condition Assessment represented by a table, a hexagram, and a summary diagnosis. Urban Karte was compiled in Appendix 2.

(9) Key Findings and Main Issues to be addressed

1) Lack of Computerized Household Registration System

Every household should be registered at the ward office where they are currently living in. There are three kinds of registration status: i) permanently registered households, who own land and house, ii) temporarily registered households, who rents houses or rooms at least for a week, and iii) non-registered households who do not declare their residence or immigrants. It would be impossible to identify all non-registered households. In addition, household registration system has not yet been computerized, and it makes a grasp of accurate number of household information remains difficult. Computerization of household registration is necessary to improve the efficiency of office works and to provide accurate statistics.

2) Lack of Organized Statistic System

In Myanmar, the last Census was implemented in 1983 and it has not been updated officially. Therefore, collection of standardized and simultaneous information in Township or Ward/Village base is difficult. Moreover, as described in above, since statistics by Township is not computerized, reliability of statistics from Township office is very low even they collect statistics periodically from Ward/Village office. However, Township Profile in this Study was compiled based on these data because the other data source was not available. Although the latest Census will be held in 2014, an accurate and continuous statistic system should be developed in Ward/Village level.

3) Necessity of Reviewing and Updating the System of Township Profile

Township Profile is an essential tool to grasp the local conditions and issues which can be bases for urban development policy planning. This composed of statistic information and results of social survey such as household interview. Both should be reviewed and periodical updated or improved by an integrated system. That system should be established and maintained properly.

4) Regional Unbalances of Households' Connectivity to Urban Service and Ownership of Electric Equipment

Connectivity to urban services differs by Township and its location whether in CBD or periphery area. In particular, Townships outside of YCDC have not been equally provided urban services up to now. Moreover, ownership of electric equipment is normally depending on the economic potential of household, hence, the ownership of several electric equipments have not yet progressed. A balanced provision of urban services and improvement of economic potential of household are essential of future urban development.

2.5.2 Updating Topographic Data and Creation of GIS Data

Topographic maps and geographic information data sets were updated from the 1:10,000 and 1:50,000 scales for urban planning, which based on the adjustment with YCDC and Myanmar Survey Department. In order to provide the latest information, data maintenance was carried out with reference to the latest high resolution satellite images:

(i) Geographic information was updated from 1:50,000 scale topographic maps to get a quick overview of the entire Greater Yangon. With reference to satellite imagery, data from 1:50,000 scale aged vector maps were modified to reflect the latest land use changes.

(ii) Information from 1:10,000 scale maps that will be used as basis in the study of transportation planning and other sectors will be compiled. The main contents of the data are road network, address locator, and topographic data that incorporate the current state of the survey results of place feature and names.

(1) Settlement of the Planning Area and purchase of satellite image.

The JICA Study Team purchased the latest high-resolution GeoEye satellite image that covered 1,500 km^2 of the final settlement area to update the existing data, which is based on 1:50,000 scale topographic maps. Furthermore, this satellite image will be used as reference in order to derive GIS data at a scale of 1:10,000. Figure 2.5.47 shows the areas covered by the updated topographic data and created GIS data as traced in the satellite image. Figure 2.5.48 shows the index of ortho image areas.

(2) Placing order of field verification survey

Field verification survey was executed by a Myanmar company, which was awarded as a contractor through competitive bidding following JICA's guidelines.

The field verification survey has been prepared and planned through the following steps:

- The orthorectified GeoEye images have been prepared in 1 x 1 km tiles,
- The software Ashtech MobileMappers were configured and tested,
- The GIS attributes have been designed and loaded into the units with Ashtech MobileMappers, and
- GIS point attributes have been pre-located in the GIS software and loaded into Ashtech MobileMapper for the field survey.

Height accuracy of existing topographic map data were inspected by the contractor for 300 points at discrete places in Greater Yangon adopting real time kinematic (RTK) GPS leveling survey method as shown in Figure 2.5.49.

Using the purchased satellite images, the contractor prepared the database files for the development of GIS. A handheld GPS device was used to collect necessary information in the field after verifying the horizontal accuracy of rectified orthorectified satellite images for ten points in specified locations. The check point survey has been completed for the project on field verification of YCDC. First, ten photo-identifiable points, which can be located in the field were selected from GeoEye orthorectified mosaicked imagery. Then, GPS RTK or static observation method was used for surveying ten check points based on the control datum of Myanmar Survey Department.

The accuracy was mentioned in the contractor's survey report (Appendix 3.1).

The contractor completed the works on 18th November 2012.

(3) Update of map data and development of GIS data in Japan

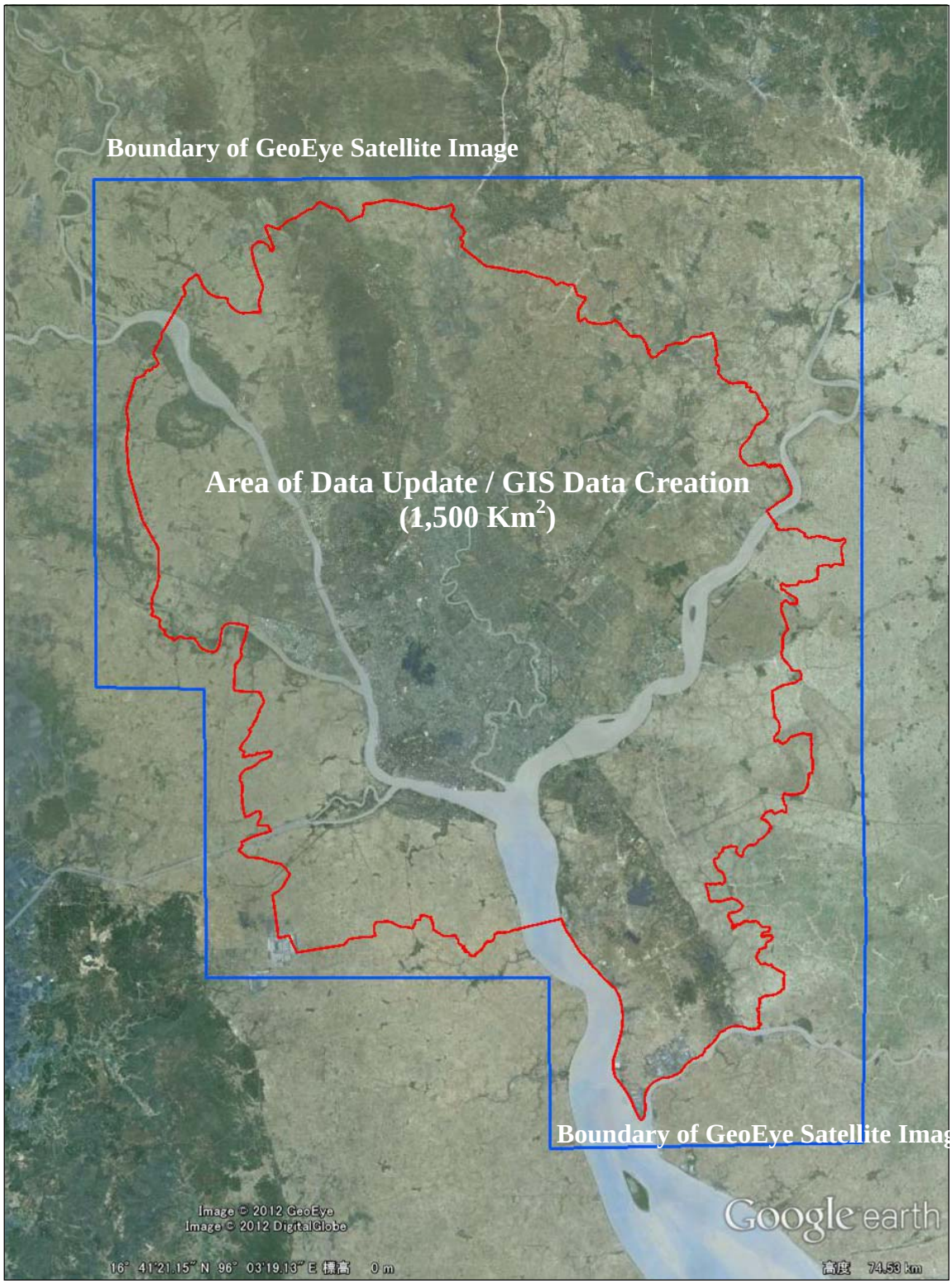
The JICA Study Team prepared the latest 1:50,000 scale land use map (refer to Figure 2.5.50) and topographic map (refer to Figure 2.5.51) by editing change on the existing 1:50,000 topographic map data. The existing data was prepared from the aerial photographs taken in 2002 based on results of the field information that was acquired by contractor.

During the preparation phase, existing data based on 1:50,000 scale topographic maps was super-imposed on the ortho-rectified GeoEye satellite imageries (spatial resolution: 0.5 m). The change features extracted by visual interpretation were edited as shown in Appendix 3.2. This edited GIS data is used as the base geospatial information for each sector in the master planning.

For editing existing data, the result of 1:50,000 scale topographic mapping project conducted in 2004 by JICA was used. Furthermore, we updated the existing 1:50,000 scale topographic map based on recommendation from YCDC. The updated topographic map was provided to the Survey Department in order to be used for development planning.

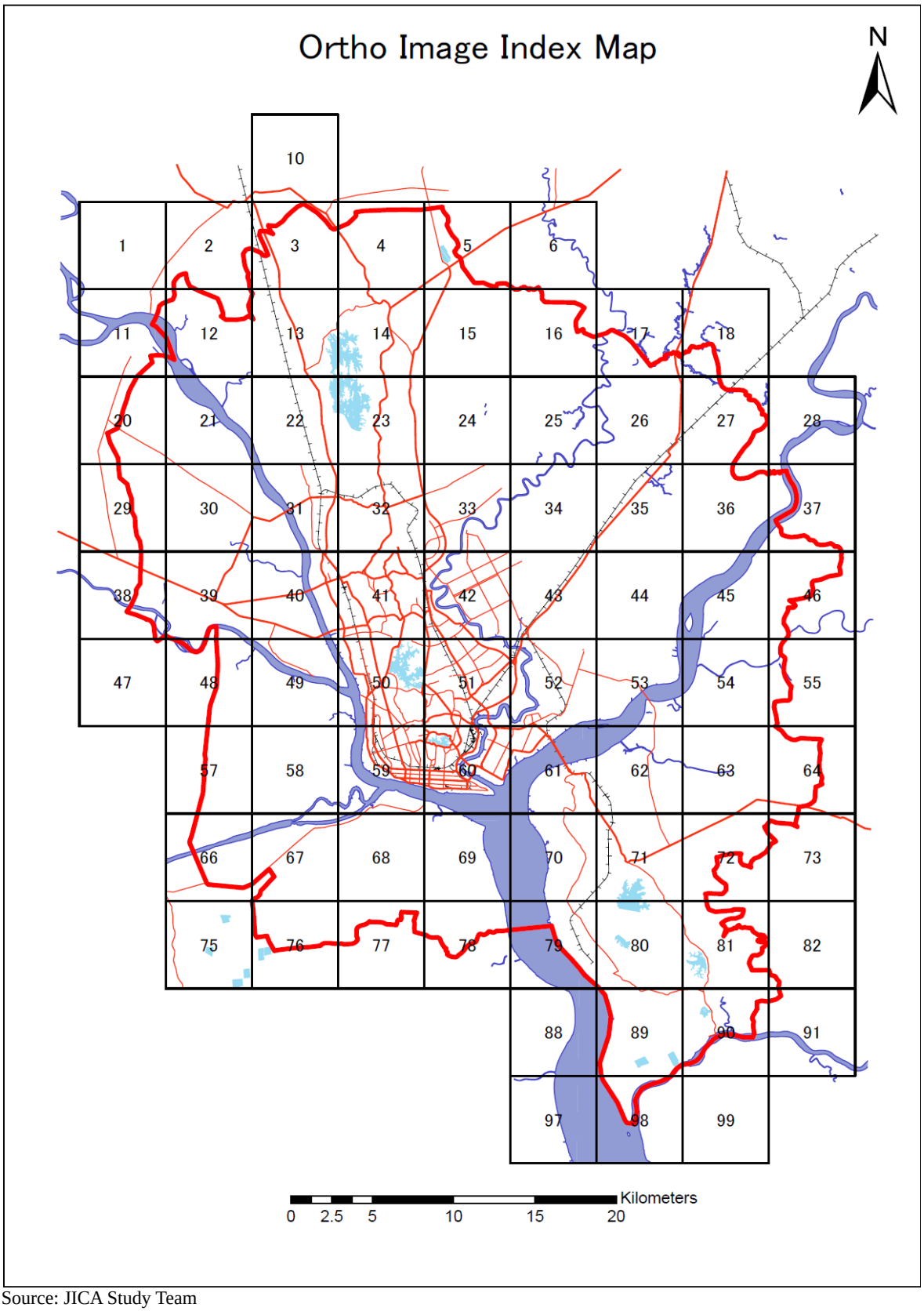
In parallel with the updating of 1:50,000 scale data, the JICA Study Team created the 1:10,000 scale GIS data (Appendix 3.3). Figure 2.5.52 shows a part of the 1:10,000 scale GIS data overlaid on the purchased high-resolution GeoEye satellite ortho image. Thus, GIS data will be used as the base map for the study of transportation planning and other sectors.

For preparing the newly 1:10,000 scale GIS data, the feature categories and the GIS database definition tables were prepared after the discussions with JICA Study Team experts. The field verification, the feature extraction and the attribute editing was conducted following the GIS database table.



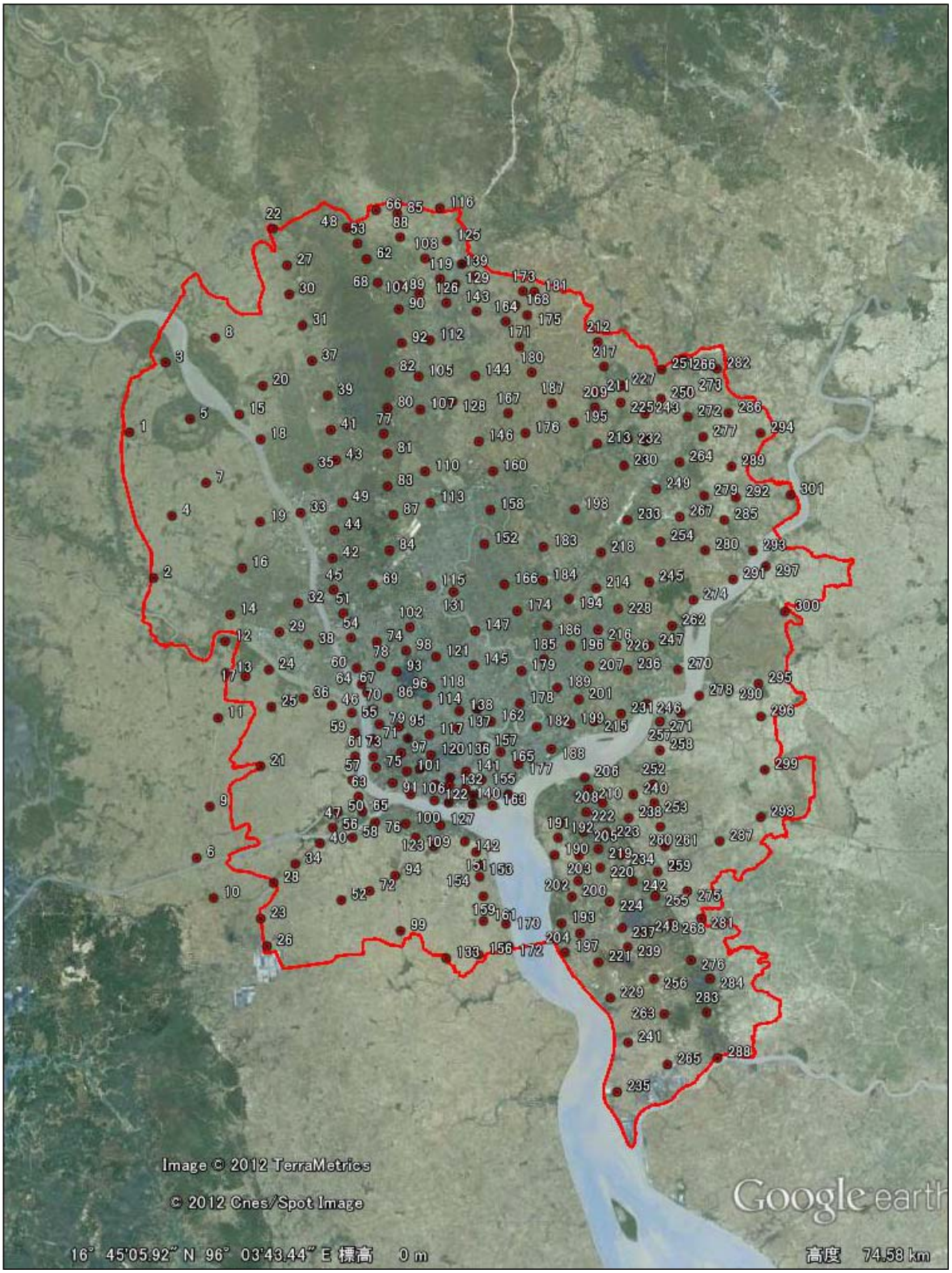
Source: JICA Study Team / Google earth

Figure 2.5.47: Area Covered for Updating Topographic Data and Creating GIS Data.



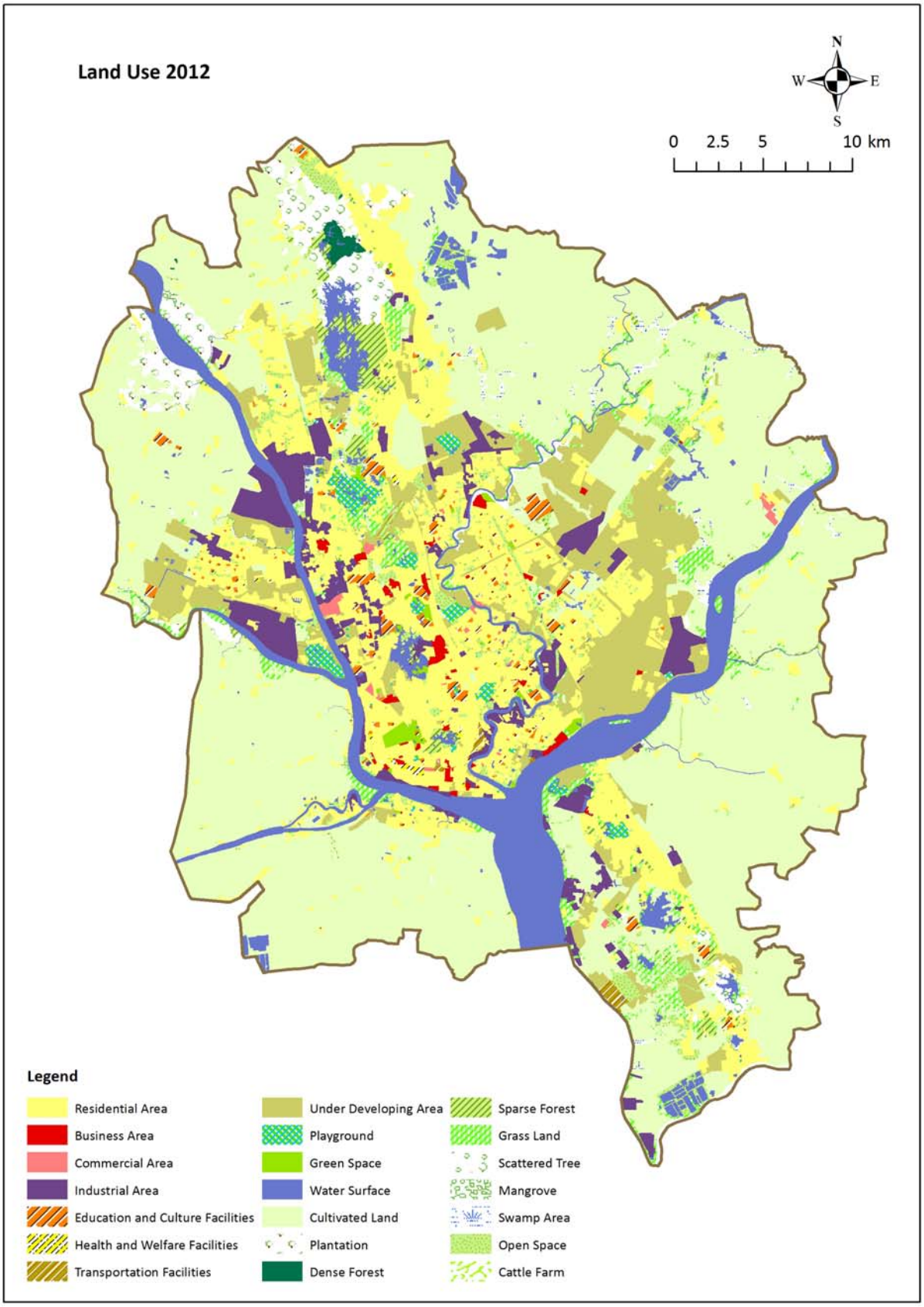
Source: JICA Study Team

Figure 2.5.48: Ortho Image Index Map.



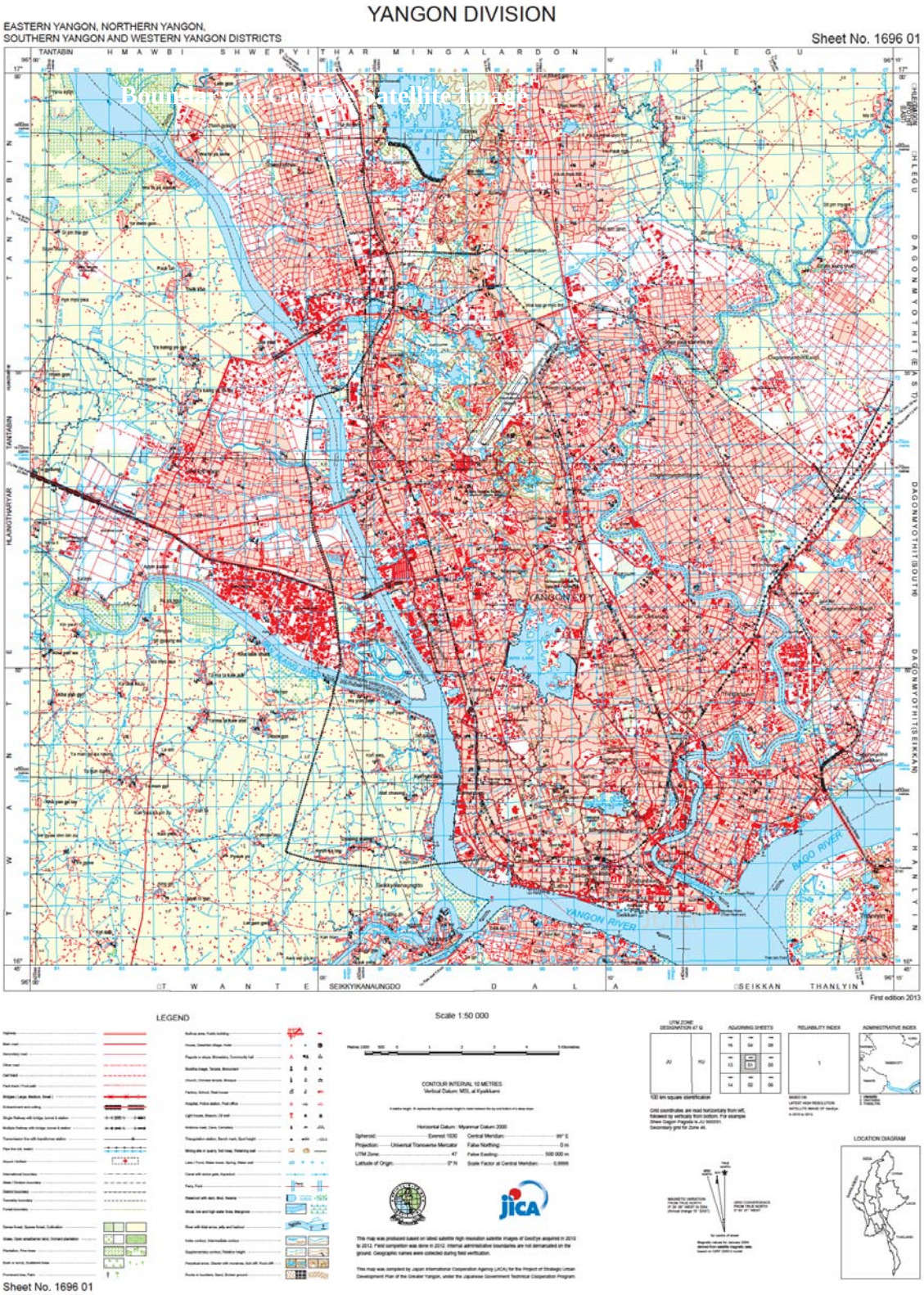
Source: JICA Study Team / Google earth

Figure 2.5.49: Distribution of Real Time Kinematic GPS Leveling Survey.



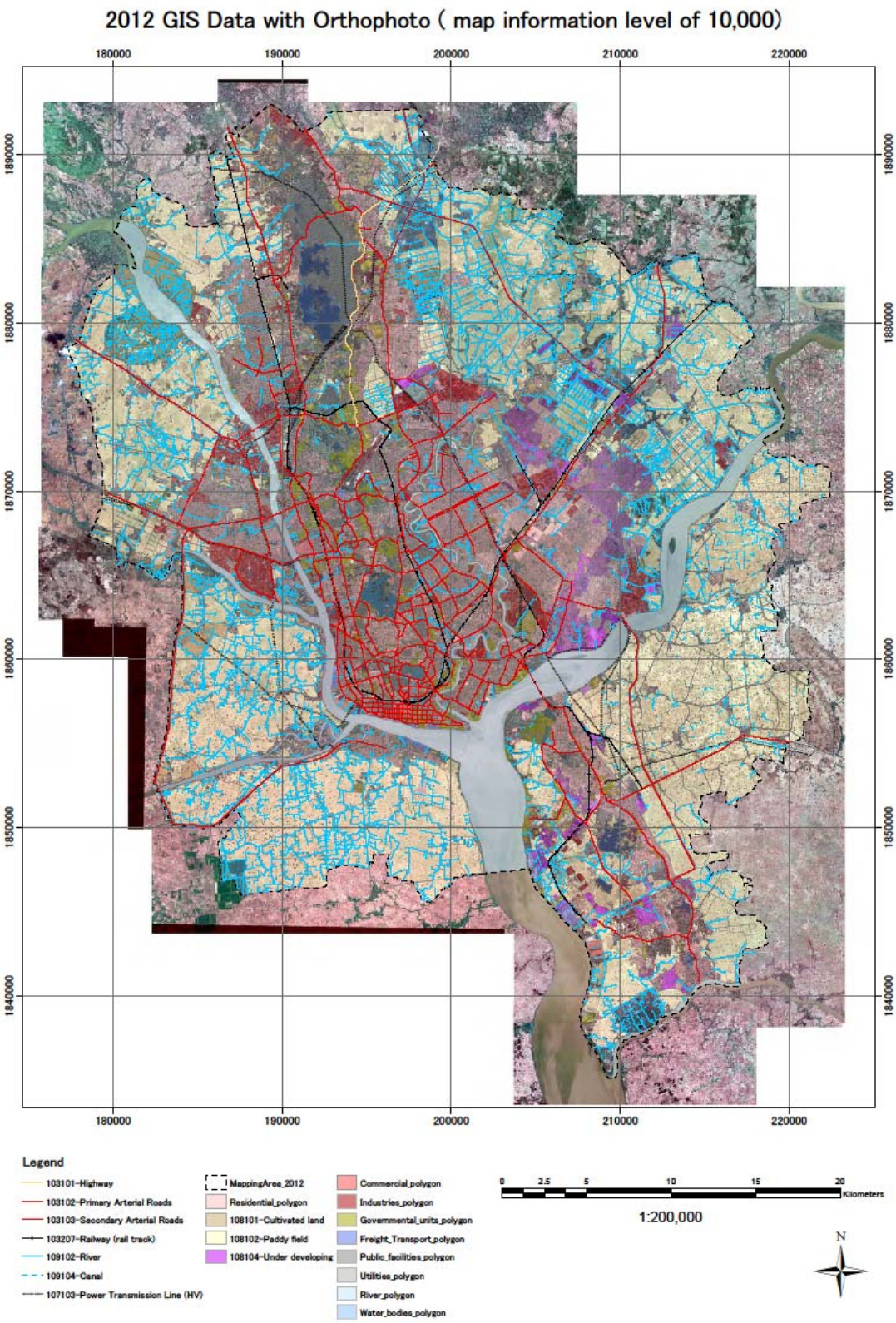
Source: JICA Study Team

Figure 2.5.50: 1:50,000 Updated Land Use Map based on GeoEye Satellite Image Acquired in 2012.



Source: JICA Study Team

Figure 2.5.51: 1:50,000 Updated Topographic Map based on GeoEye Satellite Image Acquired in 2012.



Source: JICA Study Team

Figure 2.5.52: A part of 1:10,000 GIS Data with the GeoEye Satellite Ortho Image