

## 4.1.2 Living Environment

### (1) Demand Analysis

In 2040, Greater Yangon will need about 1,232,000 housing units due to its growing population. In the demand analysis for housing units in each township in Greater Yangon for 2040, East Dagon and Thanlyin will need about 200,000 units; Mingalardon will require 100,000 units; and Dala, Hlegu, Hmawbi, Htantabin and Twantay will need over 60,000 units. Table 4.1.15- 4.1.19 show the current and projected population and number of families in each township in the different areas in Yangon.

**Table 4.1.15: Population and Number of Families in Townships in the CBD Area**

Code	Township Name	Township Group	District	No. of Wards	Area (m2)	Current	Projected					
						2011	2018	2020	2025	2030	2035	2040
1	Latha	CBD	Yangon (West)	10	604,720	34,125	34,125	34,125	34,125	34,125	34,125	34,125
2	Lanmadaw	CBD	Yangon (West)	12	1,310,572	43,137	43,137	43,137	43,137	43,137	43,137	43,137
3	Pabedan	CBD	Yangon (West)	11	618,984	37,551	37,551	37,551	37,551	37,551	37,551	37,551
4	Kyauktada	CBD	Yangon (West)	9	701,876	34,797	34,797	34,797	34,797	34,797	34,797	34,797
5	Bothtaung	CBD	Yangon (East)	10	2,601,921	49,134	49,134	49,134	49,134	49,134	49,134	49,134
6	Pazundaung	CBD	Yangon (East)	9	1,067,498	53,648	54,182	54,353	54,822	55,354	55,959	56,647
							534	705	1,174	1,706	2,311	2,999
							107	141	235	341	462	600

Source: JICA Study Team

**Table 4.1.16: Population and Number of Families in Townships in the Inner Urban Ring Area**

Code	Township Name	Township Group	District	No. of Wards	Area (m2)	Current	Projected					
						2011	2018	2020	2025	2030	2035	2040
7	Ahlone	Inner Urban Ring	Yangon (West)	11	3,380,984	65,510	66,044	66,215	66,684	67,216	67,821	68,509
							534	705	1,174	1,706	2,311	2,999
							107	141	235	341	462	600
8	Kyee Myin Daing	Inner Urban Ring	Yangon (West)	22	4,570,110	115,841	121,718	123,600	128,751	134,607	141,265	148,835
							5,877	7,759	12,910	18,766	25,424	32,994
							1,175	1,552	2,582	3,753	5,085	6,599
9	Sanchaung	Inner Urban Ring	Yangon (West)	18	2,404,656	105,208	105,742	105,913	106,382	106,914	107,519	108,207
							534	705	1,174	1,706	2,311	2,999
							107	141	235	341	462	600
10	Dagon	Inner Urban Ring	Yangon (West)	5	4,894,633	24,492	28,766	30,135	33,881	38,140	42,982	48,488
							4,274	5,643	9,389	13,648	18,490	23,996
							855	1,129	1,878	2,730	3,698	4,799
11	Bahan	Inner Urban Ring	Yangon (West)	22	8,474,439	100,695	102,298	102,811	104,216	105,813	107,629	109,693
							1,603	2,116	3,521	5,118	6,934	8,998
							321	423	704	1,024	1,387	1,800
12	Tarmwe	Inner Urban Ring	Yangon (East)	20	4,985,869	191,114	192,182	192,525	193,461	194,526	195,737	197,113
							1,068	1,411	2,347	3,412	4,623	5,999
							214	282	469	682	925	1,200
13	Mingalar Taung Nyunt	Inner Urban Ring	Yangon (East)	20	4,943,032	155,767	157,370	157,883	159,288	160,885	162,701	164,765
							1,603	2,116	3,521	5,118	6,934	8,998
							321	423	704	1,024	1,387	1,800
14	Seikkan	Inner Urban Ring	Yangon (West)	3	1,174,225	2,241	2,241	2,241	2,241	2,241	2,241	2,241
							0	0	0	0	0	0
15	Dawbon	Inner Urban Ring	Yangon (East)	14	3,111,295	87,284	87,818	87,989	88,458	88,990	89,595	90,283
							534	705	1,174	1,706	2,311	2,999
							107	141	235	341	462	600

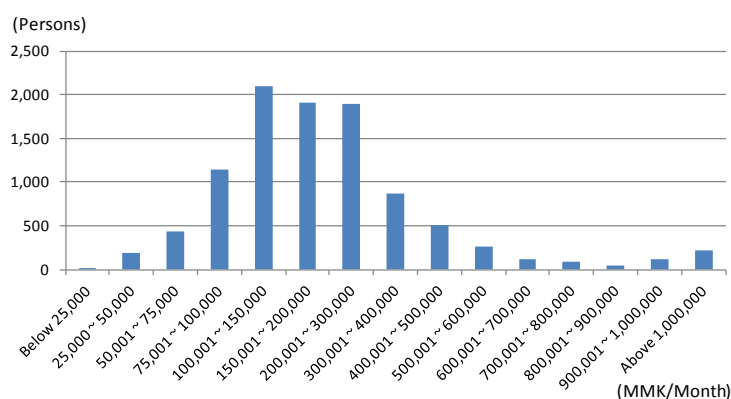
Source: JICA Study Team

**Table 4.1.17: Population and Number of Families in Townships in the Suburbs**

Code	Township Name	Township Group	District	No. of Wards	Area (m2)	Current	Projected					
						2011	2018	2020	2025	2030	2035	2040
16	Kamaryut	Outer Ring	Yangon (West)	10	6,472,493	87,881	90,552	91,408	93,749	96,411	99,437	102,878
							2,671	3,527	5,868	8,530	11,556	14,997
17	Hlaing	Outer Ring	Yangon (West)	16	9,820,283	151,014	153,151	153,835	155,708	157,838	160,259	163,012
							2,137	2,821	4,694	6,824	9,245	11,998
18	Yankin	Outer Ring	Yangon (East)	16	4,791,565	125,909	125,909	125,909	125,909	125,909	125,909	125,909
							0	0	0	0	0	0
19	Thingangyun	Outer Ring	Yangon (East)	39	13,120,302	231,621	233,758	234,442	236,315	238,445	240,866	243,619
							2,137	2,821	4,694	6,824	9,245	11,998
20	Mayangone	Northern Suburbs	Yangon (West)	10	25,834,479	205,403	216,622	220,215	230,049	241,229	253,940	268,392
							11,219	14,812	24,646	35,826	48,537	62,989
21	Insein	Northern Suburbs	Yangon (North)	21	31,397,616	311,200	322,953	326,718	337,019	348,732	362,048	377,188
							11,753	15,518	25,819	37,532	50,848	65,988
22	Mingalardon	Northern Suburbs	Yangon (North)	32	127,943,855	288,858	398,909	434,158	530,621	640,293	764,983	906,748
							110,051	145,300	241,763	351,435	476,125	617,890
23	North Okkalapa	Older Suburbs	Yangon (East)	19	27,755,247	333,484	349,511	354,644	368,692	384,664	402,823	423,468
							16,027	21,160	35,208	51,180	69,339	89,984
24	South Okkalapa	Older Suburbs	Yangon (East)	13	8,217,705	191,388	192,456	192,799	193,735	194,800	196,011	197,387
							1,068	1,411	2,347	3,412	4,623	5,999
25	Thaketa	Older Suburbs	Yangon (East)	19	13,448,713	253,284	258,092	259,632	263,846	268,638	274,086	280,279
							4,808	6,348	10,562	15,354	20,802	26,995
26	Dala	South of CBD	Yangon (South)	46	98,400,859	181,087	236,112	253,737	301,968	356,804	419,150	490,032
							55,025	72,650	120,881	175,717	238,063	308,945
27	Seikgyikhaungto	South of CBD	Yangon (South)	9	12,101,872	38,425	44,836	46,889	52,508	58,897	66,160	74,419
							6,411	8,464	14,083	20,472	27,735	35,994
28	Shwe Pyi Thar	New Suburbs	Yangon (North)	27	52,706,107	295,993	334,992	347,483	381,666	420,531	464,717	514,954
							38,999	51,490	85,673	124,538	168,724	218,961
29	Hlaing Tharyar	New Suburbs	Yangon (North)	29	77,614,147	488,768	533,109	547,311	586,177	630,366	680,605	737,724
							44,341	58,543	97,409	141,598	191,837	248,956
30	North Dagon	New Suburbs	Yangon (East)	27	24,177,408	221,200	232,953	236,718	247,019	258,732	272,048	287,188
							11,753	15,518	25,819	37,532	50,848	65,988
31	South Dagon	New Suburbs	Yangon (East)	39	37,506,127	370,403	402,457	412,724	440,819	472,763	509,080	550,371
							32,054	42,321	70,416	102,360	138,677	179,968
32	East Dagon	New Suburbs	Yangon (East)	60	170,871,278	145,505	330,348	389,553	551,573	735,779	945,210	1,183,320
							184,843	244,048	406,068	590,274	799,705	1,037,815
33	Dagon Seikkan	New Suburbs	Yangon (East)	48	42,035,707	120,161	169,844	185,758	229,306	278,818	335,111	399,111
							49,683	65,597	109,145	158,657	214,950	278,950
34	Kyauktan	Periphery Area	Yangon (South)	13	76,120,987	48,473	67,171	73,160	89,549	108,183	129,368	153,454
							18,698	24,687	41,076	59,710	80,895	104,981
35	Thanlyin	Periphery Area	Yangon (South)	36	254,846,226	181,959	371,076	431,650	597,416	785,881	1,000,154	1,243,770
							189,117	249,691	415,457	603,922	818,195	1,061,811
36	Hlegu	Periphery Area	Yangon (North)	14	101,003,839	50,793	136,804	164,353	239,744	325,458	422,910	533,707
							86,011	113,560	188,951	274,665	372,117	482,914
37	Hmawbi	Periphery Area	Yangon (North)	18	84,228,570	83,719	167,059	193,752	266,802	349,854	444,280	551,636
							83,340	110,033	183,083	266,135	360,561	467,917
38	Htantabin	Periphery Area	Yangon (North)	18	81,770,250	40,234	103,807	124,170	179,893	243,247	315,277	397,170
							63,573	83,936	139,659	203,013	275,043	356,936
39	Twantay	Periphery Area	Yangon (South)	10	107,864,054	24,936	79,427	96,881	144,644	198,947	260,687	330,882
							54,491	71,945	119,708	174,011	235,751	305,946
						10,898	14,389	23,942	34,802	47,150	61,189	

Source: JICA Study Team

Based on the result of the household income survey (HIS), the average income of Yangon citizens (or household) is about MMK 100,000-150,000. The distribution of income is shown in Figure 4.1.11.



Source: JICA Study Team

**Figure 4.1.11: Current Situation of Income Based on Household Income Survey**

The households earning income in Greater Yangon can be divided into five groups. Group I is the low-income households who earn about US\$5.5 per day. Groups II and III are middle-income households, and Groups IV and V are high-income households. Group I families may live in cheaper rental houses. Groups II and III live in average rental houses. Group IV and V families belong to the market of house buyers. Table 4.1.18 shows the details of the different income groups in Yangon.

**Table 4.1.18: Classification of Income (HIS)**

Group.	I	II	III	IV	V
Class	I	II		III	
Income (MMK/month)	≤100,000	100,001 - 150,000	150,001 - 200,000	200,001 - 300,000	≥300,001
(US\$/month)	≤166	166-174	174-232	232-348	≥348
Ratio	18%	21%	19%	19%	23%

Source: JICA Study Team

Group 1, whose monthly earnings are MMK 100,000 and below, fall under Class I. Groups II and II, whose monthly earnings range from MMK 100,000-150,000, are categorized as Class II. The relatively well-to-do households of Groups IV and V, whose monthly earnings are MMK 200,000 and above, fall under Class III.

**Table 4.1.19: Number of Families (Class I – III)**

Contents	Low Income Class-I	Middle Income Class-II	High Income Class-III	total
Number of families	221,685	492,632	517,264	1,231,581
Ratio	18%	40%	42%	100%

Source: JICA Study Team

Until 2040, the Government of Myanmar, YCDC, and private companies must construct about 1,232,000 new houses in Greater Yangon. About 222,000 units for Class I, 493,000 units for Class II, and 517,000 units for Class III families.

Table 4.1.20 shows the monthly expenditure of families in Yangon based on HIS. The average spending of families in Greater Yangon is MMK 216,199, which excludes the house rent.

**Table 4.1.20: Monthly Expenditure of Greater Yangon's Family**

	Education	Clothing	Food and Beverage Expenses	Healthcare	Telephone Call Charges	Internet Charges	Transportation (Gasoline, Parking, Public Transport Use)
Number of Answers	1,381	915	1,192	1,183	1,324	174	968
Maximum (MMK)	2,000,000	600,000	1,500,000	600,000	600,000	2,000,000	1,000,000
Minimum (MMK)	500	500	500	200	200	200	200
Average (MMK)	58,157	15,509	102,603	22,372	14,317	26,084	24,387

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

Source: JICA Study Team

(2) Development Policy

Sector Vision	<b>Realization of Living Environment that All Citizens can Enjoy Comfortable, Healthy and Modern Living</b>
Basic Policy	<ol style="list-style-type: none"> <li>1) Supply of houses to accommodate the population in 2040 (proactive housing implementation for low- and middle-income families)</li> <li>2) Arrangement of residential areas to facilitate public transport accessibility (around rail way station and bus terminal)</li> <li>3) Preventing the spread of urbanization of the residential area by a massive unused land within the built-up area</li> </ol>

The detailed explanations and background of each basic policy are as follows:

- 1) Supply of housing units to accommodate the increasing number of families by 2040 (proactive housing implementation for low- and middle-income groups)

There is a strong need to provide housing units to accommodate the rapidly growing population in Greater Yangon. The Ministry of Construction, which has been the main player in housing development, is now shifting its function to regulatory and policy making. Therefore, local governments such as YCDC must supply inexpensive and collective housing units. There is a need to provide houses for approximately one million households by 2040 in Greater Yangon. Therefore, there must be new residential areas in suburbs, old apartments in built-up areas must be rebuilt if necessary, and new residential areas must be built on unused lands in Greater Yangon.

The Department of Human Settlement and Housing Development (DHSHD) under the Ministry of Construction, YCDC, and private companies must act to become the principal of residential construction. In addition, there is a need to establishment a public organization that specializes in the development of new residential areas. Recently, as Greater Yangon has soaring land prices, and land development for public residential areas has become difficult, it is then necessary to use public or government lands for housing projects. Since the target shall be affordable housing for rent for low-income groups, this is a very highly anticipated public enterprise. For this reason, together with rental income, funds are need to operate the housing project for low-income groups.

For example, a private company may proceed to develop housing for high-income earners. Alternatively, it is necessary to incorporate measures such as rent to serve as budget for the development housing for low-income groups. There is a need to establish a system that can build numerous low-cost housing projects.

It will be considered as an effective method for re-development of slums by private sectors. In Greater Yangon some sites private sectors (the construction industry, real estate appraisers and money brokers) have re-developed.

- 2) Arrangement of residential areas to facilitate public transport accessibility (round the rail way station and bus terminal)

In order to promote the use of public transport, it is more convenient to construct high-rise residential buildings around the railway stations and bus terminals. The location of train stations and high-rise residential buildings that have been planned by DHSHD are appropriate.

To promote the use of public transportation, there is a residential development should be near public transport hubs. High-density residential areas are to be developed near railway stations, while medium- and low-density residential areas will be near bus terminals. In addition, to ensure the convenience of persons with disability and senior citizens, barrier-free urban infrastructures will be adopted.

- 3) For the informal settlers living in Greater Yangon, rental houses will be constructed to promote health and urban living

Many informal settlements exist in Greater Yangon. There have been many fire outbreaks around these areas and many buildings have been damaged (7,737 units: 1985-1989). As for the housing policy of Greater Yangon, all families must have the opportunity for healthy and civilized living environment. The government has prepared new houses for low-income families.

Low-income families must pay the rent that will be about 1/10 of their monthly incomes. Rental housing will be built as part of the infrastructure for these groups.

(2) Goals and Target Effect Indicators

For the purpose of evaluation of future living environment and to confirm the outcomes, the development goals and effect indicators as shown in Table 4.1.21 have been prepared.

**Table 4.1.21: Development Goals and Effect Indicators (Living Environment)**

Development Goal	Effect Indicators	
a) Housing	2012 (current situation)	1,114,000 units
	2025	+482,000 units
	2030	+700,000 units
	2035	+949,000 units
	2040	+1,232,000units

Source: JICA Study Team

(3) Strategy for Living Environment

- 1) Housing development through a variety of business methods:

- Pilot projects on housing development on the sites owned by the Government of Myanmar government and YCDC.
- Reconstruction of old apartments to high-rise residential buildings in CBD
- Residential construction using funds by the global market
- Absorption and activity development benefit for advanced acquisition of land and development of residential areas.
- Foundation of tax for new urban development and renewal

- 2) Expansion of preferential policies to encourage private companies to develop housing projects

- Promotion of measures to redevelop the old buildings in the CBD
- In Greater Yangon, the implementation of measures to mandate the construction of low-income housing with a certain percentage

- In the suburbs, development of a new city to facilitate the establishment of a union by landowners
  - Establishment of a new incentive system for private sector about slum re-development
- 3) Residential area development with railway infrastructure
- 1) *Development around railway stations*
- High-rise condominium will be built near the railway station
  - Offices and commercial buildings are built next to the station
- 2) *Promotion of prompt development through the government and association of rightful claims to land use right*
- Organize the association of land and floor right owners for the prompt development of new housing projects
  - Collect funds for development cooperation that is equivalent with the increase in price of land right
- (4) Proposed projects and implementation schedule

The outline of the living environment plan and schedule is described as follows:

1) Infrastructure Layout

The basic concept of Future land use plan in the suburban residential area is summarized as follows:

- Business, commercial, and high-rise apartments will surround the railway stations. Also, there will be a station frontage which will be connected to the arterial road. These will help form a dense urban area around the railway station.
- For residential areas that are required in the year 2040, three types of housing.

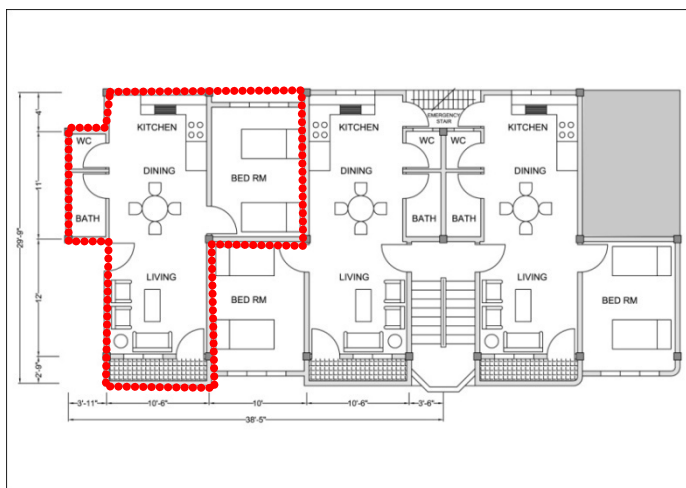
In 2040, Greater Yangon will need about 1,232,000 housing units because of the country's growing population. Table 4.1.22 shows the types of housing to be allotted for different income groups. Figure 4.1.12 and Figure 4.1.13 show the plans for the typical house to be allotted for different income groups.

**Table 4.1.22: Type of House (Class I-III)**

		Class-I	Class-II	Class-III
Area (in sq. ft.)		540 or 50 m <sup>2</sup>	720 or 67 m <sup>2</sup>	720 or 67 m <sup>2</sup>
Cost (MMK)		7,500,000	10,000,000	10,000,000
Unit Cost (MMK/m <sup>2</sup> )		149,000		
Ownership form		Rent	Rent	Sale
Urban Services	Electricity	o	o	o
	Piped Water Supply	o	o	o
	Sewage	o	o	o
	Sludge Removal from Septic Tank	o	o	o
	Parking	x	o	o

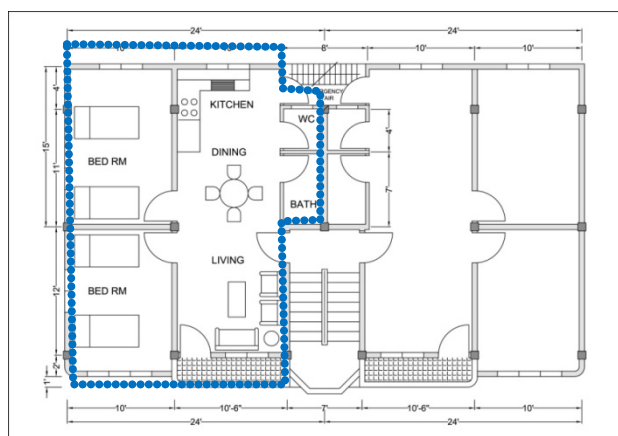
Note: o- Applicable; x-Not applicable  
Source: JICA Study Team

The costs of the units shown in Figure 4.1.12 and Figure 4.1.13 are MMK7,500,000 and MMK10,000,000, respectively. As an example, the amount of payment per month for Class-III groups is discussed. About MMK92,010 per month for ten years must be paid to the bank (condition of payment: equal monthly payment for 120 months with 2% interest rate). Since the selling price of a house is about three times the annual income of the householder in Greater Yangon, Class III groups will be required to pay MMK300,000 or more per month, aside from the MMK92,010 monthly payment.



Source: JICA Study Team

**Figure 4.1.12: Plan of House (Class I for Rent)**



Source: JICA Study Team

**Figure 4.1.13: Plan of House (Class II and Class III for Rent and Sale)**

**Table 4.1.23: Types of Owner for Class I – III**

(o: Applicable / x: Not applicable)

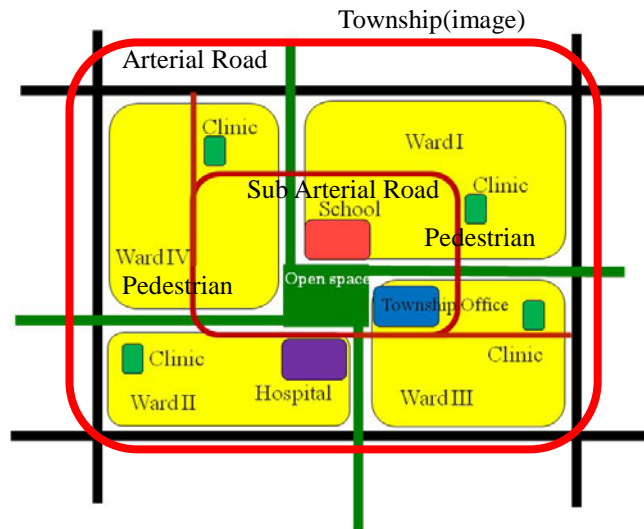
	Class-I	Class-II	Class-III
<b>Ownership form</b>	Rent lot	Rent lot	Selling lot
Setting the rent or mortgage payments	Under 1/10 of the monthly salary	At 1/10 of the monthly salary + maintenance cost (Consideration with business plan)	Payment option based on the fund management plan
Sublet or resale	x	x	o

Source: JICA Study Team



In the new residences, the establishment of educational and medical facilities is considered to attract tenants.

The layout of educational and medical institutions is arranged in accordance with the manual issued by Ministry of Construction. The case study (or basic concept) is summarized below, while the effective distance of each facility is shown in Figure 4.1.14.



Source: JICA Study Team

**Figure 4.1.14: Case Study for the Layout of Educational and Medical Institutions**

### 4.1.3 Social Services

(1) Development Policy

<b>Sector Vision</b>	<b>Provision of Equal and Inclusive Social Services for All Citizens</b>
<b>Basic Policy</b>	<ol style="list-style-type: none"> <li>1) Provision of mobility and accessibility for all</li> <li>2) Provision of equal opportunity of education for all</li> <li>3) Provision of equal opportunity of employment for all</li> <li>4) Provision of healthy and secure living environment for all</li> </ol>

Achievements of the goals, objectives, and visions of the Master Plan will bring benefits generated by economic growth and globalization. Those benefits should be shared with all the people in the community, which is an important factor in realizing all the processes in the inclusive development. The inclusive development should provide equal opportunity and accessibility for all persons and allow them fully to participate and contribute in the process of growth. It has a target for wider levels of social groups not only the groups with limited means of living, but also those classified in any income groups. Urban development in Yangon City should be achieved with good recognition and enough considerations on this issue, and realize strengthened socio-economic structures. The detailed explanations and background of each basic policy are given as below:

1) Provision of Mobility and Accessibility for All

Mobility and accessibility are the most important instruments that will create equal and inclusive society. Particularly for the persons with disabilities (PwDs), such as the handicapped, the aged, and persons who have difficulties to go out due to poor public transport mode or access to buildings. Such persons are losing their opportunities of traveling and accessing the society. In addition, poverty groups are also in the same situation with PwDs. Their mobility is currently limited to public transport modes, which offer cheaper price but relatively lower service level. Those situations should be improved together with improvement of infrastructure and institutions. However, improvement of public transport services should be provided by the Urban Transport Sector. In consideration of the Social Sector, assistance for PwDs and poor groups should be provided.

2) Provision of Opportunity of Education for All

Currently, the access to education is also limited particularly for low income groups and minorities.. There are nine townships where school enrollment ratio of five years old children is substantially lower than 100% according to data books of General Administrative Department, Ministry of Home Affairs in 2012. This number should be increased to 100%. In addition, comparing the school enrollment ratio of five years old children at the beginning of primary school and those of ten years old children at the beginning of middle school, it has decreased by 37%. This indicates that a large ratio of students is unable to continue education beyond the primary school. That is mainly caused by poverty, poor access mode to schools, and gap of number of schools, i.e. the ratio of middle school and primary school is about 1:6.6. Measures to reduce those students should be taken. The indicators to assess those changes can be taken by a school enrollment ratio of five years old children and a ratio of student eligible for university, which shows a percentage of students who pass the matriculation examination.

3) Provision of Equal Opportunity of Employment for All

The labor market and employment opportunities have many gaps concerning those classified as vulnerable groups such as gender, PwDs, poverty groups, and lower education levels, as well as newly graduates from universities. Many students who graduated in the university cannot find immediate employment, and remain dependent to their parents for several months or years. Those hidden demands of vulnerable groups and newly entries to labor market should be clarified and matched with appropriate jobs. Therefore, job matching services should be provided for them. In addition, appropriate vocational training programs for job seekers should be provided particularly for vulnerable groups. The participation of vulnerable groups to growth process of the city will contribute in realizing an inclusive development.

4) Provision of Healthy and Secure Living Environment for All

The quality of living environment depends on the health condition and connectivity to urban services. The health facilities by types are not equally distributed in the city currently. The gap of service level should be balanced by establishing necessary health facilities. However, those establishments should be achieved together with appropriate assignment of qualified health workers. On the other hand, even if urban services will be developed by the responsible sectors in the Master Plan, supports to poverty groups to access urban services are required.

(2) Goals and Target Effect Indicators

For the purpose of evaluation of improvements and to confirm its outcomes, the following development goals and effect indicators are prepared:

**Table 4.1.24: Development Goals and Effect Indicators (Social Service)**

Development Goal	Effect Indicators
a) Increase of accessibility to school	Average school enrollment ratio of five years old (98.6% → 100.0 %)
b) Decrease of retired students	Ratio of Middle School Students by Primary School Students (63% → 80%)
c) Improvement of quality of education	Students to teacher ratio in primary school (50.1 → 30)
d) Increase of accessibility to hospital	Number of hospitals per 1,000 population (0.44 → 0.50)

Source: JICA Study Team

(3) Strategy for Social Services

Formulation and implementation of a development strategy for social services will facilitate for sustainable economic growth and human development in the long term. In particular, development strategy for social services will accelerate steps towards establishing a society where income and employment opportunities expand rapidly, where children have universal access to quality education, where everyone has access to proper and affordable health care, where socially disadvantaged groups are fully integrated into the development process. Since the target of social services varies widely, the strategy for social services shall be provided by the target groups and cross-cutting issues.

1) Education

Education is the most important of the country development. Therefore, it should be upgraded not only infrastructures but also education system and school curriculum. Education in both schools and teachers should be provided equally in the city according to the expected population in the future. However, it is difficult to construct a public school in remote and

scarcely populated areas. In such case, establishment of branch school or operation of school bus should be considered. Besides the following a range of supports also should be provided to overcome barriers that may prevent poorer households from availing themselves of educational opportunities.

- Preparation of school allocation plan according to the estimated future population and number of students.
- Upgrading teacher quality with pre-service and in-service teacher training programs
- Improvement of infrastructures for educational institutions such as open more schools with modern teaching aids
- Expansion for provision of post-primary schools including middle schools and branch schools
- Operation of school bus service to commute from remote area
- Launching mobile school program in remote area & special program for over-age children
- Upgrading education standard to international level and alignment with the needs of technology driven labor market
- Close communication with the monastic schools and the government to have consistency with the government policy on education
- Develop regulations that lead to greater complementarities between private and public schools

## 2) Health

Indeed, health conditions may increase the risk of poverty through lost earnings and health expenditures. Thus, this sector requires a great deal of attention. Strengthening of health workforce, facilities, medical products/technology, and improving the quality of health workers are top priority to achieve a certain level of well-being and improve the quality of life. The following recommendations should be considered to enhance the health status of the community.

- Establish hospitals in proper size to improve health care coverage especially for grass roots level
- Establish appropriate and sustainable health financing scheme
- Training of health provider (in-service and on-the-job) and appropriate assignment of qualified health workers
- Launch program for promotion of public health, such as education and information about the spread of diseases, and tobacco control by mass media
- Improve access and availability of health care services, safe water supply and sanitary latrines
- Introduce health insurance system particularly for the urban poor community
- Community support system for elderly people to provide health care, social care and protection in their activities of daily life

### 3) Poverty Groups

Poverty level of Yangon City is better compared to the situation in the whole of Myanmar; however, there still exists many urban poor communities particularly in the peripheral area. Provision of a comprehensive and flexible supporting system together with education, employment, and health are required. In addition, improvement of urban services enhances upgrading of living conditions of the households particularly for poverty groups.

- Survey on the existing condition of poverty group and orphans regarding living condition, education, employment and health
- Provision of affordable housing for low income households
- Promotion of human development programs (literacy campaign, skill-enhanced trainings, vocational training, etc.)
- Supporting home-based income-generating activities such as home garden program
- Promotion of small enterprises and micro-enterprises (including street vendors) by encouraging financial organizations (public and private banks) to lend to them with low interest rate (Micro-finance program)
- Some forms of education-related assistance program such as scholarships program to enable children for their successful transition from primary to secondary school, and in-kind support
- School book loan program to alleviate difficulties that some students face in gaining access to required texts
- Support system for poverty groups to access the urban services

### 4) Labor Markets and Employment

Unemployment and lack of job opportunities are frequently cited as major challenges among urban poor communities. This would translate to poverty and poor living conditions in the households. Labor market, therefore, should be accessed equally by all people that are of labor age. However, currently existing gaps in labor market should be balanced by the following activities:

- Enhancement of vocational training which targets to special job seekers, i.e. who retired schools earlier, PwDs, poverty groups, females, etc.
- Provision of various employment opportunities through job matching system
- Revision of labor market regulations and legislations that discourage employment, employment protection rules such as minimum wage laws, hiring and firing regulations,
- Facilitating the flow of information on jobs
- Providing practical job training
- Gender focus development strategies to promote the welfare status of both women and men

5) PwDs

The current situation of PwDs is not generally grasped. Public transport modes and other public facilities are also not designed for PwDs as can be seen in below Figures and are therefore greatly inaccessible to PwDs. Based on accurate statistics, establishment of laws and regulations to obligate the considerations and special design for PwDs with barrier-free concept is required.



Source: JICA Study Team

**Figure 4.1.15: Current Access to Public Transportation**

In order to improve the situation for PwDs, the following recommendations should be raised for implementation within government organizations, international non-government organizations, and community based organizations.

*(1) Creation of Physical & Social “Barrier Free Environment”*

- Survey on current condition of mobility and accessibility of the PwDs in public facilities and public transport modes
- Establishment of strong and significant policies and legislation regarding barrier-free public facilities and public transport modes
- Subsidy for the construction/renovation of school/hospital/other public facilities buildings and replacement of transport modes which applies to the regulations
- Fostering of social acceptability to PwDs and minorities through public campaign to help people understand their current situation, and provide necessary support
- Featuring articles on disability and the challenges PwDs encounter by mass media to raise awareness and educate the public about disabilities



Source: JICA Study Team

**Figure 4.1.16: Current Access to Religious Buildings**

*(2) Inclusive Education System*

- Special assistance for children with disabilities to study in public schools together with normal students
- Educational grants for children with disabilities

*(3) Health Promotion and Protection*

- Provision of basic medicine and supporting to access medical care services

- Financial aids for assistive devices

*(4) Livelihood Program*

- Income generation program
- Vocational trainings, Job coaching programs and employer advocacy campaigns
- Disability inclusive agriculture and fishery

*(5) Social Inclusion*

- Support to involve in traditional water festival and other social activities
- Implement disability-related sport activities and support them to participate
- Establish sign language-supported media and television program

6) Overall Social Services Activities

Social welfare services are being carried out not only by the government but also voluntarily by local and international social organizations. Their activities are covering the areas and the fields where the government cannot provide enough services. These activities and services provided to the target groups should be grasped by the government, and the information and necessities from both sides should be shared and organized efficiently. Moreover, the government should take all necessary steps to develop social welfare policies and programmes, build consensus about a national social welfare policy framework. Funding for social services usually comes from government, but when dealing with charities or NGO's, donations may be used. Wider services of cooperation should also be promoted, including the following:

- Enhancement of cooperation and information sharing with NGOs on social services
- Establishment of the center for social activities
- Strengthen coordination mechanism to manage technical assistance and donor support

#### 4.1.4 Urban Landscape and Heritages

The city is continuously changing. The current urban area is composed of numerous buildings which have been constructed in accordance with the social, economic, and cultural needs of time, and were woven in a multilayered texture in each area. Currently, in the context of economic growth, the city of Yangon is exposed to rapid changes caused by developments of private investments.

Rapid changes in the city resulted in the significant degradation of the urban environment and the fragmentation of the urban space. In order to regulate the changing speed, it would be efficient to form an urban landscape plan in each district, and to clearly define the areas to be conserve and to be developed. To conserve urban space does not mean letting the environment remain untouched. It is a method to regulate urbanization for a better quality of life.

In order to adapt a unique, diverse, and attractive urban space for the future generation, as described below, it is urgent to record the current state of the city as rich cultural resources, to establish guidelines that can be shared by various stakeholders, and to construct a process for implementation.

##### (1) Development Policy

<b>Sector Vision</b>	<b>Realization of Attractive Urban Landscape Worthy of International City through the Conservation and Utilization of Historic Buildings</b>
<b>Basic Policy</b>	<ol style="list-style-type: none"> <li>1) Recording of Historical and Cultural Heritage</li> <li>2) Establishment of Guidelines including Zoning Plan for Urban Regeneration Plan Utilizing Heritage Buildings</li> <li>3) Establishment of Management Plan for the Implementation of Conservation</li> <li>4) Cultivation of Human Resources of Experts for Heritage-related Construction</li> <li>5) Implementation of Heritage Buildings Renovation and Urban Landscape</li> </ol>

The detailed explanations and background of each basic policy are given as follows:

##### 1) Recording of Historical and Cultural Heritage

In order to entrust historical and cultural heritage to the future generation, the history and physical dimensions of the city must be recorded. Among tangible and intangible cultural heritages in this city are historic buildings and urban heritage zones as well as their surrounding environment.

As for tangible cultural property, there are some lists for the conservation of historical buildings. However, there are no on-going research and surveys on the cultural and historical values, except some prominent buildings. Therefore, it is urgent to expand the common database. These databases are expected to be utilized as basis for various planning such as policy development for the preservation of the historic buildings and urban landscape.

##### 2) Establishment of the Guidelines for Urban Regeneration Plan Utilizing Heritage Building

The city of Yangon consists of thousands of buildings and various stakeholders. In order to preserve historical buildings and to regenerate the unique urban landscape as a property of the city, it is urgent to develop guidelines to be shared among urban citizens. There is a need to



limit the disorderly development, while protecting the fundamental rights, such as property rights, and harmonizing them with the public interest to create a good urban environment..

For the preservation of the urban landscape, some guidelines in response to different scales are required: (1) the building rule for the conservation of historic building, (2) the district rule for the conservation of the urban landscape, and (3) the whole city rule for the conservation of the silhouette of the city that centers on the Shwe Dagon Pagoda.

By developing guidelines in accordance with the rule from one unit (the building) to the whole area (the city), it is expected to be maintain a unique image of the city with certain order.

3) Establishment of the Management Plan for the Implementation of Conservation

For the implementation of the conservation plan, there is a need to establish a mechanism to commence the projects through certain organizations.

Currently, the building application processes are being carried out by the Building Division of YCDC. However, this is intended to check whether the application drawings for new construction are set in line or not. Therefore, the division does not measure the historic or cultural value of buildings. To implement conservation, appropriate evaluations by expert, guidelines to determine whether the plan is suitable as a preservation plan, and mechanisms for licensing are needed to be established.

4) Cultivation of Human Resources of the Expert for Heritage Related Construction

For the implementation of the conservation plan, it is necessary to cooperate with a variety of experts. While there is a need of specialists such as urban planners, architects, and historians in the planning stage, it is also urgent to train construction technicians who specialize in conservation repairs of historic buildings in the construction stage.

Currently, these types of experts are scarce in Yangon City, therefore, repairs have not been carried out appropriately. For the implementation of the conservation plan, human resource development in each stage such as research, planning, construction, and maintenance is indispensable.

5) Implementation to Renovate Heritage Buildings and Urban Landscape

It might be effective to carry out pilot projects by government agencies, prior to the implementation of the development by the private sector. In particular, most of the state-owned buildings in the central part of the downtown, which have been mostly used as the former government offices, have not been used enough as urban facilities for citizens. It is desirable to conserve, renovate, and convert these buildings in order for them as new urban hubs.

(2) Goals and Target Effect Indicators

In order to realize an identical and attractive urban space, the development goals and effect indicators shown in Table 4.1.25 have been prepared.

**Table 4.1.25: Development Goals and Effect Indicators (Urban Landscape and Heritage)**

Development Goal	Effect Indicators
a) Registered Listed Heritage Building	189 (current) to 300 including privately-owned buildings
b) Urban Heritage Zones	0 (current) to 5 heritage zones
c) Conserved Visual Axes	0 (current) to 20 visual axes

Source: JICA Study Team

(3) Strategy for the Urban Landscape and Heritages

1) Construction of the Database of the Historic and Cultural Heritage

*1) Monuments, Historic Buildings, and Industrial Structures*

*a) Listed Buildings*

YCDC established a list of historical important buildings known as the “189 Listed Buildings” in 2001. As of 2001, the list consists of 188 buildings. Selected buildings in the list were built in the Yangon Region before 1930 and have distinctive architectural style such as British colonial architecture. Listed buildings are mainly publicly-owned buildings such as educational and religious buildings, and exclude private ones such as residences. After the publication of this list, one listed building was demolished. Therefore 188 buildings are nominated on the list now.

In addition, the Ministry of Culture established the Heritage Conservation Law in 1998 (then amended in 2009), which specifies 16 ancient pagodas in Yangon Region. These are recognized as cultural heritage sites, and significant pagodas such as Shwe Dagon Pagoda and Sule Pagoda are included in the list. Through the enforcement of this law, the compounds of each pagoda are strictly protected as heritage sites.

However, the database of such lists includes only the building names and their respective addresses. Further detailed information such as actual architectural drawings (plan, elevation, and section), collections of actual and old photos, and descriptions of historic values must be well arranged as a part of the historic and scientific approach. In line with these databases, the Association of Myanmar Architects (AMA) has already published a book entitled “30 Heritage Buildings of Yangon” in 2012, while the University of Cologne is planning to publish a guidebook in 2013 based on these listed buildings.

*b) Unlisted Buildings*

Apart from the *Listed Buildings*, the Yangon Heritage Trust (YHT) in collaboration with AMA is making another list of privately-own old buildings which exist for more than 50 years. In this list, the areas examined are four (4) townships in the central part of the downtown, namely the Latha, Pabedan, Kyaukdada, and Botahtaung townships. In this list, the types of the building such as public, private, educational, and industrial are marked on a map. Apart from this list, the YHT is also conducting a study to expand their target area to ten townships in total. Including Kamayut Township, which house a university, the 78% of the listed buildings will be established in this determined area.

c) *Other Buildings*

Aside from historic buildings in the urban area, some structures such as warehouses or factories in the industrial and port areas are also important elements for configuring the unique urban landscape of Yangon City. Especially at the Sule Pagoda wharf area along the Yangon River, there are some significant warehouses which are made of bricks. Also, there exist four single-storey structures of over 100 years and three two-story of over 60 years. In addition, there are hidden significant buildings within the military area. Therefore, an additional list for these industrial structures must be included in the database.

2) *Urban Area*

To understand the history of Yangon City, existing maps that were made in certain years must be collected. Through the information of maps, the routes of the actual urban condition can be understood. Also it will be efficient to superimpose all these data into a single digital information to compare the past and present conditions.

2) Formulate the Guideline for the Urban Landscape

1) *Guideline for Heritage Building*

In addition to the by-laws and the National Building Code (NBC) which is now being prepared and will be published during the year, guidelines for the heritage building have to be formulated. While the by-laws and NBC indicate the basic and minimum requirements for new construction, the guidelines are needed to give other requirements focused on building conservation.

For the guidelines of heritage buildings, the following items are examples to be considered:

- Prohibition items: Reconstruction, modification of exterior façade, installation of signboards, etc.
- Regulation
  - ✓ by Dimension: Building height, distance from the boundary, etc.
  - ✓ by Design: Façade design, Roof design, window design, etc.
  - ✓ by Material: Façade material, interior finishing material, etc.

2) *Guideline for Urban District*

To sustain this uniqueness of Yangon City, an orderly urban landscape has to be formed through clear definitions of the area between conservation and new development areas.

DHSHD and YCDC already proposed different definitions of conservation area as shown below. For the definition of the conservation area, not only from the point of view of having historic urban landscape such as preserving of building façades, but also property right of the building together with land-uses has to be well considered. In addition, all the determined lines should be precisely digitalized to GIS data.

a) *Definition by DHSHD, MOC in 2012*

In the Vision 2040 which was presented in the late 2011, DHSHD of MOC guided urban renewal zones mainly focus on the downtown area where there are block districts designed during the British colonial era as shown in Figure 4.1.17. The proposed map indicates two heritage conservation zones: one is the Sule Pagoda Environment Heritage Zone, where there

is a restriction of the building height; and another is the China Town Heritage Zone, where original street patterns and characters such as shop houses are to be preserved. Together with these zones, there are other areas considered within the Tourism Promotion Zone, Heritage Buildings (Listed Buildings), River Front Urban Development Zones, etc.



Source: DHSHD

**Figure 4.1.17: Proposal for Urban Renewal Zones in Yangon City by DHSHD**

*b) Definitions and Proposals by YCDC in 2012*

The heritage conservation zone, as defined by YCDC, consists of two townships, namely the Kyauktada Township and a part of Bothataung Township. The 232 ha area is surrounded by the Bogyoke Aungmye Road to the north, Theinphyu Road to the east, the Sule Pagoda Road to the west, and Strand Road to the south, as shown in the Figure 4.1.18.

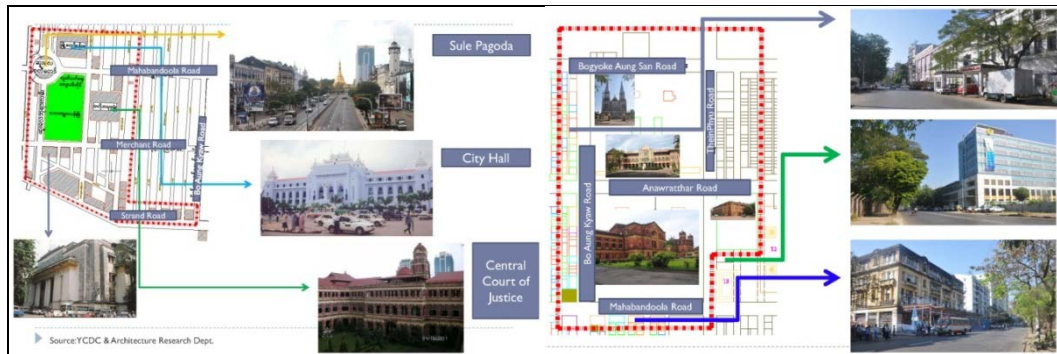
However, this is not yet indicated in the present laws and by-laws. Therefore, it does not function in order to conserve the area as a heritage zone.



Source: YCDC

**Figure 4.1.18: Heritage Conservation Area as Defined by YCDC**

Apart from this definition, Architectural Research Department of YCDC has another proposal for the heritage area. In this guideline, three areas are proposed for conservation in CBD. The first one is Kyauktada Township where former ministry buildings are concentrated. The second is in Botahtaung Township where the former Minister's Office and some other listed buildings are located as shown in Figure 4.1.19. These areas are defined covering the site of the listed buildings.



Source: YCDC

**Figure 4.1.19: Proposal for Heritage Conservation Area by YCDC**

In addition, YCDC proposed an area of Chinatown as a conservation area. This area does not have sufficient number of listed buildings, but as an identical urban landscape, the characteristic of this area has to be conserved for the future. Chinatown conservation area is located in Latha Township.



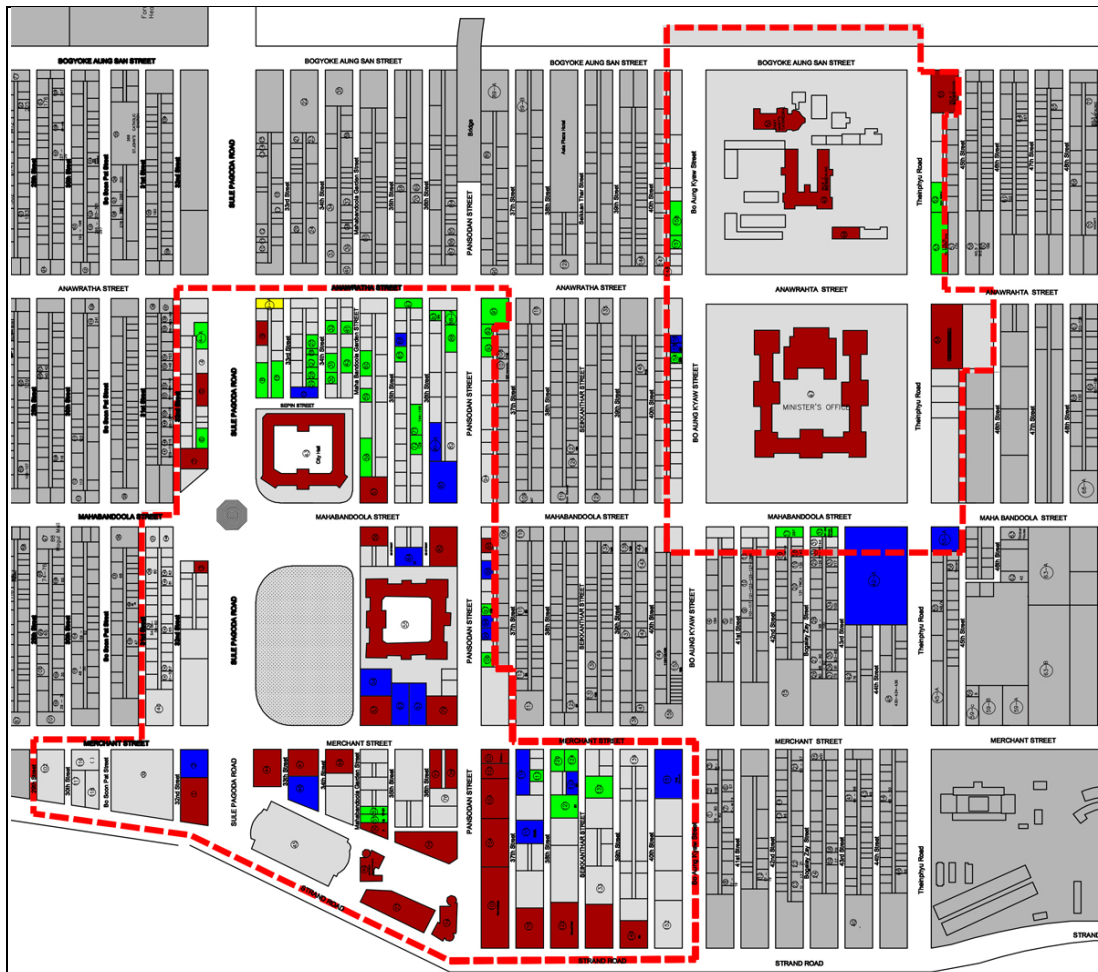
Source: YCDC

**Figure 4.1.20: Proposal for Chinatown Conservation Area by YCDC**

Based on the proposals described above, a certain definition of the historic conservation area and some other areas such as tourism promotion area, green conservation zone is needed by certain working groups, including MOC, DHSHD, YCDC, YHT, JICA Study Team and some other experts in order to address the issue regarding heritage.

*c) Definitions and Proposals by YHT in 2013*

Based on the location of the listed and unlisted building, YHT proposed his own definition of the conservation area. In order to keep the continuity of the historical building facades, it can be understood that the urban landscape along the main street are is respected. Most of the roadside buildings along the main streets are included in the conservation area.



Source: YHT

Note: Color in Red: listed buildings, Blue: public buildings, Green: unlisted buildings, Dark Grey: other buildings

**Figure 4.1.21: Proposal for Conservation Area by YHT**

### 3) Guideline for Cityscape

The UPD of YCDC started to study the two items related to the cityscape in large scale. One is the analysis of visual axes towards some symbolic landmark such as Shwe Dagon Pagoda and Sule Pagoda, and another is the analysis of the silhouette of the city that can be seen from certain viewpoint outside the city. In order to maintain the image of the city, these analyses are effective to form the concept of the cityscape.

#### a) Visual Axes

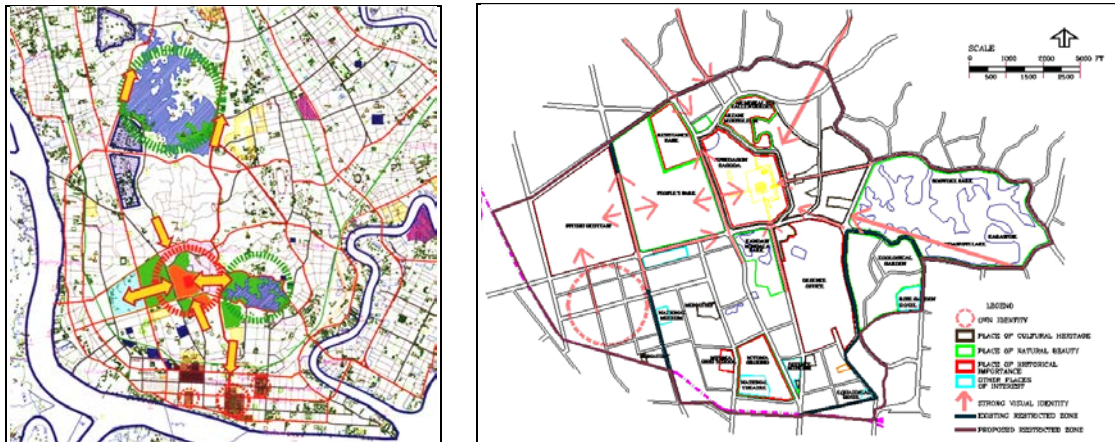
Yangon is a city that has a silhouette of the urban landscape represented by some ancient monuments such as Shwe Dagon Pagoda and Sule Pagoda. In a large part of the city, people can see either of these symbolic monuments through streets or parks. These vistas through certain visual axis are vital in keeping Yangon's significant urban landscape .

Unfortunately, due to the lack of restriction in building heights in Yangon City, some structures that obstruct important views of the monument are built in some areas. To clear the skyline as much as possible, analysis of the visual axis and definition of areas with height restrictions is needed.

Actually, in the area around Shwe Dagon Pagoda, there is a height restriction imposed by YCDC. However, in order to keep the visual axis towards the monument, this restriction alone

is not sufficient. Hence, aside from height restriction, view analysis from certain places is required.

The following Figure 4.1.22 indicates major important axes in Yangon city area (left) and around Shwe Dagon Pagoda (right).



Source: DHSHD

**Figure 4.1.22: Major Visual Axes in Yangon City Area and Around Shwe Dagon Pagoda**

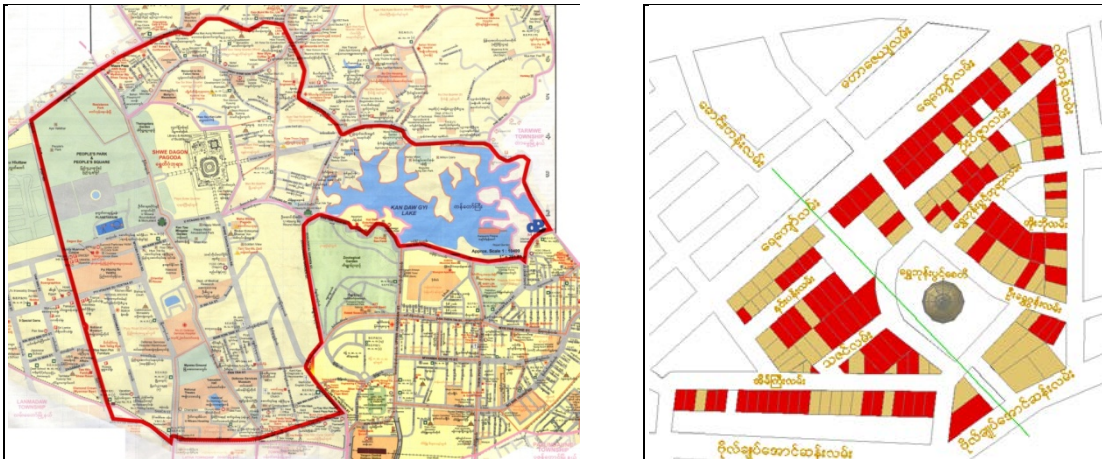
Also, DHSHD and YCDC pointed out the importance of visual axis in the urban area, as follows:

The views from four visual axes around the monument are important. These include U Wisara Road from the north, Gyar Tawya Street from the east, and Shuwedagon Pagoda Road from the south. From the west, there is a huge vacant axis through the People's Park and People's Square.

*b) Urban Silhouette*

In order to maintain an identical silhouette of the city, grasping the geographical features, urban structures, and the locations of the landmarks have to be well considered especially in relation to height.

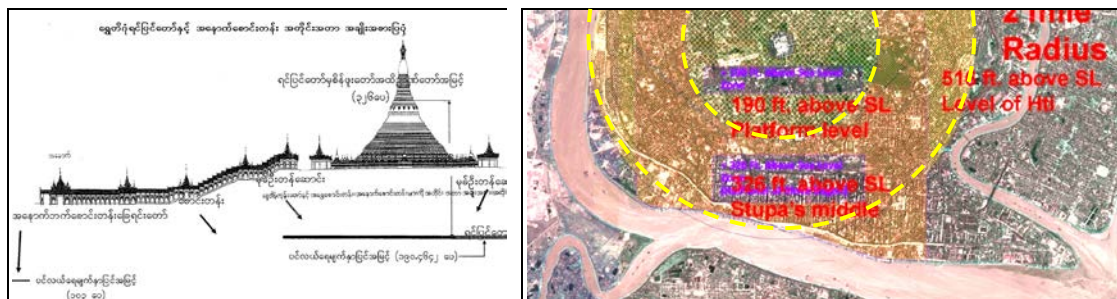
According to the regulation by YCDC, there are already two areas in Yangon City where restrictions on height limitations are imposed. One is the area around Shwe Dagon Pagoda, which limits maximum construction height to six stories as shown in Figure 4.1.15 (left). Another is the area around Shwe Phone Pwint Pagoda, which requires three stories as the maximum, as shown in Figure 4.1.15 (right).



(Left): Reserved Area around Shwe Dagon Pagoda, (Right): Reserved Area around Shwe Phone Pwint Pagoda  
Source: Yangon City Development Committee

**Figure 4.1.23: Defining Reserved Areas**

Based on the reserved area around Shwe Dagon Pagoda, the YCDC presented one additional proposal for the whole city area in January 2013 as shown in Figure 4.1.24. There are three definitions related to the height based on the scale of the Shwe Dagon Pagoda. One, is the height of the platform ground of the pagoda from sea level is 190 feet (58m), the height of the pagoda from the platform ground is 326 feet (99m), and the height of the top from sea level is 516 feet (157m), as shown in Figure 4.1.24. The zoning then centers on the pagoda, where the 190 feet (58m) height limit from the mean sea level covers the first 1 mile (1.6km) radius, then after the 326 feet (99m) limit covers up to the 1.5 mile (2.4km) radius, and finally the 516 feet (157m) limit covers up to the 2 mile (3.2km) radius. The area covered by the 326 feet (99m) limit continues toward the south area along the Yangon River in order to maintain the silhouette from the riverside.



Source: YCDC

**Figure 4.1.24: Elevation of Shwe Dagon Pagoda and Proposal for the Height Limit by YCDC**

In addition, YCDC collaboration with the JICA Study Team in studying 3D models of the city. Through the 3D models, various views from certain perspectives can be analyzed easily as shown in Figure 4.1.25. This model can be useful for the visual analysis not only for the whole city scale, but also for the district scale. Therefore the 3D model may as well be shared as part of the city database, which has been described in the first part of this section.





Source: JICA Study Team

**Figure 4.1.25: Rendered Image of the CBD Area**

3) Formulate the Management Plan of Conservation

1) *Assessment*

For the new construction and rehabilitation projects in the conservation area, the Heritage Impact Assessment (hereafter HIA) will be needed. Through HIA, some evaluations of the impact to the environment around the building site such as height, form, material, and color must be well considered through the objective data for the new projects.

2) *Mechanism of Approval*

For the realization of conservation works, it is urgent to construct a mechanism of approval by certain official agencies, such as governmental organizations, which are authorized to give official permission. Without this mechanism, the conservation plan cannot be realized.

Currently, the Engineering Department for buildings in YCDC gives permission for new construction based on the by-laws. For conservation works, which are not considered as new construction projects, an understandable mechanism for approval will be made considering the organization and its roles.

4) Cultivation of Human Resources and Promotion of the Heritage

1) *Training Workshops for Expert for the Cultural Heritage*

Over the past year, there were several international and professional workshops related to heritage conservation. The following are the major workshops:

a) *“Towards a Conservation Strategy for Yangon in the 21<sup>st</sup> Century” in January 2012*

For the theme of conservation of the heritage buildings in Yangon City, Dr. Thant Myint-U, the founder and chairman of YHT, organized the first conference related to heritage conservation in Yangon together with some international experts.

b) *“Forum for Urban Future in Southeast Asia Seminar” in December 2012.*

This seminar was organized by two organizations, namely the University of Cologne in Germany and the MOC in Myanmar. Most of the participants are from the Southeast Asian Region, such as Vietnam, Laos, Malaysia, and Singapore.

c) *“The Heritage Conservation Forum” in January 2013.*

YHT organized an internal meeting on heritage conservation plan with some experts residing in Yangon City.

All these intellectual workshops and forums have been successful in providing related knowledge in such a short time. At the same time, having conducive venues for discussion and

intercommunication is effective for participants from different countries and different professions. These workshops are expected to be held continuously toward the future.

2) *Training Workshop for the Management of Conservation Works*

For the implementation of conservation works, methodologies of management works for conservation have to be shared between related organizations and professional experts. Although there is insufficient structure to realize these, after the completion of the mechanism for the management, various types of workshops based on different themes will be useful to upgrade the level of human resources.

3) *Training Workshop for Conservation Construction Technicians*

To cultivate human resources for conservation works on site, conservation technicians must be well trained. The conservation of buildings will not be accomplished only by the planners but by the technicians working on site as well.

In the construction site of restoration projects, various types of works mainly involving interior and exterior finishing works will be needed. Necessary knowledge and techniques have to be taught by well-experienced national and overseas experts. Through these workshops, people can directly learn such techniques. The themes will vary depending on the material, technique, structure, etc. After the completion of the workshop, it will be useful to award certifications that can be effective for the future construction site. The growth of the conservation technicians will help maintain the historical buildings for the future generation.

#### 4.1.5 Public Parks and Greenery

##### (1) Development Policy

Sector Vision	<b>Creation of Green Amenity Spaces by Construction of Public Parks and Improvement of Greenery to Realize Comfortable and Healthy Urban Life and Urban Development with Less Environmental Impacts</b>
Basic Policy	<ol style="list-style-type: none"> <li>1) Improvement of Green and Water Network in Greater Yangon</li> <li>2) Construction of New Public Parks and Open spaces</li> <li>3) Renovation of Existing Public Parks to Meet the Citizen's Needs and Satisfactions</li> <li>4) Promotion of Comfortable Greenery in Urban Areas</li> </ol>

##### 1) Improvement of Green and Water Network in Greater Yangon

Improvement of green areas and water network shall realize more sustainable urban development with less environmental impacts than providing isolated green and water areas without a network. While green area is an essential factor for the water network, river water surface will also be very important. Thus it is highly recommended that the rivers flowing through the urban areas such as the Bago River and Nga Moe Yeik Creek are improved as elements of the natural environment with a trail alongside which the people can utilize to enjoy walking, jogging and running in good natural atmosphere. The Yangon River is an important landmark for Greater Yangon and some parts of its riverfront should be improved as comfortable open spaces, in unison with the natural environment in consideration of the city landscape.

Green areas should be conserved mainly on the low lying hills in the central area, so as to make the so-called “North-South Green Axis”. Hlawga Nature Protected Areas must play the most important role which is considered a keystone in greening Greater Yangon’s future, especially the wildlife habitat and water reservoir.

In parallel with the progress of urbanization, new and large-scale public parks should be created to sustain a good living environment. These large-scale public parks with water body are considered very important open spaces which will provide the required functions for mitigating disasters (for example, flood control) and conserving the existing environmental conditions.



Source: JICA Study Team

**Figure 4.1.26: Image of Network of Green and Water**

2) Construction of New Public Parks and Open spaces

In the whole YCDC, there are only 58 public parks with a total area of around 188 ha (470 acre). The calculated density is approximately 0.37 m<sup>2</sup> of park space per person. This number seems to be too small for the urban population. In the future of Greater Yangon, it is necessary to construct and maintain public parks and open spaces in both existing and new urban areas in order to contribute to establishing an effective network and distribution system of green spaces for sustainable urban development. Since there are no public parks at the nine townships in YCDC and six periphery townships, creation of such parks should be prioritized in those areas.

3) Renovation of Existing Public Parks to meet the Needs and Satisfactions of the Citizens

It is necessary to renovate and improve the existing public parks to be more attractive and useful spaces for the citizens. In order to meet the changing needs and satisfactions of the citizens, a question and/or user counting survey must be conducted in order to understand the current status and issues. Public parks are required to be improved and renovated as desired by citizens. Additionally, public parks must contribute to the sustainable development of urban areas and appropriate urban environment. This is better than the artificial spaces covered with concretes or asphalts.

4) Promotion of Comfortable Greenery in Urban Areas

Greenery in the urban areas are places for relaxation. In addition, large trees create shady spaces which serve as covering for people especially in sunny days. Thus, even in urbanized area, it is necessary to maintain and improve the greeneries. Not only for public lands but also for private lands, greenery should be promoted by means of offering administrative incentives and awards to development activities, promoting and disseminating information related to greenery, and guiding and supporting any endeavors for greenery.

(2) Goals and Target Effect Indicators

For the purpose of evaluation of future public parks and greenery and to confirm its outcomes, the following development goals and effect indicators are prepared:

**Table 4.1.26: Development Goals and Effect Indicators (Public Parks and Greenery)**

Development Goal	Effect Indicators
a) Total Area of Public Parks	188 ha (current) to 705 ha (2040)
b) Public Parks per Capita	0.37m <sup>2</sup> (current) to 0.76m <sup>2</sup> (2040)
c) No. of Townships with no Public Parks	15 townships (current) to 0 townships (2040)

Source: JICA Study Team

(3) Strategies of Public Parks and Greenery

1) Construction of New Public Parks in New Town Areas

(1) Standard and Guideline for Construction of New Public Parks

To realize comfortable living environment, it is necessary to stake out and construct new public parks appropriately in new town areas to be developed in the future. Under housing development activities both by public and private sectors, setting of standards and guidelines are recommended for construction of new public parks.

Public parks to be constructed in new town areas will be categorized into two types, namely, “District Park” and “Pocket Park”, which is according to size and functions. Those categories may contribute for efficient supply of public parks for the citizens. For making these two types of public parks, the accessibility for users (area for service) will be considered. It is so-called as “Service Distance for Use (SDU)”. Table 4.1.27 and Figure 4.1.27 shows the basic idea of attracting distance to use.

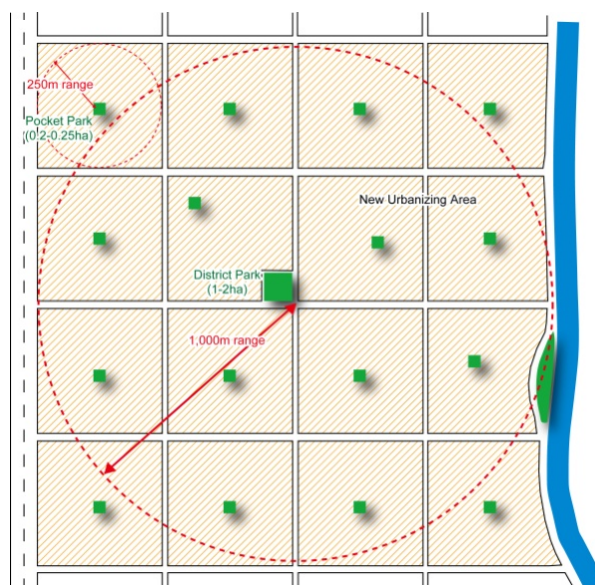
According to “Introduction to Planning Regulation” made by the Ministry of Construction, a children’s play space shall be provided for every 300-700 persons. This SDU follows this guideline as well.

Based on an idea of SDU, detailed standards and guideline for construction and management are required in Phase II of this study.

**Table 4.1.27: SDU of District Park and Pocket Park**

Type of Park	SDU			Standard Size
	Round Distance	Block Size to be Made	Estimation Time to Access the Park	
District Park	1,000m range	Square of 2km length	Within 20 min on foot	1-2ha
Pocket Park	250m range	Square of 500m length	Within 5 min on foot	0.2-0.25 ha

Source: JST



Source: JICA Study Team

Note: This figure does not mean to supply parks in grid pattern

**Figure 4.1.27: An Image of SDU of District Park and Pocket Park**

To make public parks efficient, it is necessary to minimize the expenses for labor and materials. The LGU must put up an affordable and sustainable management fee intended for maintaining the newly constructed public parks. Participatory approach in maintaining the parks must be established and formulated by the beneficiaries and the government. As public parks will play a role for enhancing community relationship, public parks should be managed by not only local government but also by the local communities.

The JICA Study Team proposed the methods for construction and management of public parks as shown in Table 4.1.28.

**Table 4.1.28: Methods for Construction and Management of District Parks and Pocket Parks**

Type of Park	Creation (Construction) Phase	Management Phase
District Park	<ul style="list-style-type: none"> <li>- YCDC which constructed many existing parks will be the main responsible organization to construct new district parks in cooperation with, or in supervision of the developers who intend to do development activity in new urbanized areas.</li> <li>- District parks should be constructed by using surplus spaces in cooperation with other infrastructure construction such as roads, public facilities, etc.</li> <li>- District parks should be constructed making good use of existing and remaining marsh, pond, forest, trees and the other natural materials as much as possible.</li> <li>- Surrounding road (sidewalk) of the park should be constructed in consideration to be used for running, jogging and walking.</li> </ul>	<ul style="list-style-type: none"> <li>- YCDC or Township</li> </ul>
Pocket Park	<ul style="list-style-type: none"> <li>- Organizations which intend to construct new urban development or infrastructures should also construct new pocket park by using surplus spaces without large expenses and labor.</li> <li>- Pocket parks should utilize existing large trees to provide good shade space for relaxation.</li> </ul>	<ul style="list-style-type: none"> <li>- YCDC or Township</li> <li>- Local communities</li> </ul>

Source: JICA Study Team

Based on the above concept, the area for public parks will increase by 705 ha; construction and development of new urban areas may reach a total of around 513 km<sup>2</sup> by 2040; and the total area of public parks will be approximately 893 ha together with the existing parks. The year 2040 population projection will be 11,730,000 in Greater Yangon, so that a density parameter of public park area per capita in 2040 will be 0.76 m<sup>2</sup> per person which is almost double of the current density.

**Table 4.1.29: Area Estimation of Public Parks for Year 2030**

Type of Park	Block Size which one park is constructed (A)	New Urbanizing Area (B)	Number of new public parks to be constructed (C=A/B)	Standard Size of one park (D)	Total area of new public parks (E=C*D)
District Parks	4km <sup>2</sup>	513km <sup>2</sup>	128	1 to 2ha	192ha
Pocket Parks	0.25km <sup>2</sup>	513km <sup>2</sup>	2,050	0.25 ha	513ha
Total Area					705ha

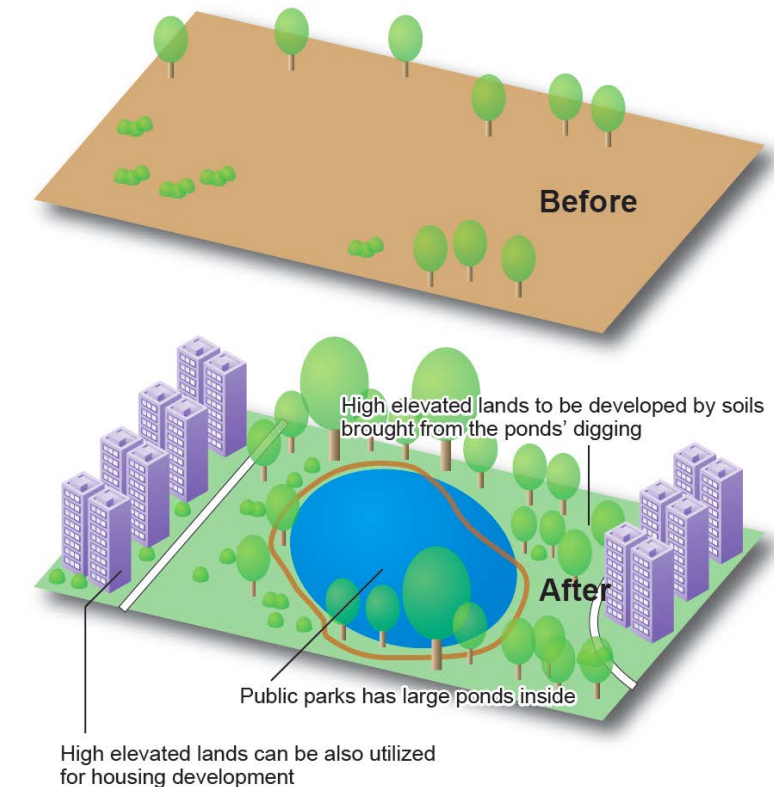
Source: JICA Study Team

(2) *Basic Idea on how to Construct New Public Parks*

Spaces for new public parks will be allocated mainly from lands not suitable for housing development, which are relatively low elevation and/or along the river banks. The public parks with ponds/marshes to be constructed at such lands will be expected to contribute to flood control and water purification function as well as offer amenities in urban areas. As Yangon

City and its citizens are dependent on rivers, it is recommended to construct new public parks along the river banks in order to provide attractive riverfront spaces as before.

To realize it, landfill and expenditure for construction may be the immediate issues. Regarding the landfill, it is proposed that public parks has large ponds inside and high elevated lands to be developed by soils brought from the ponds' digging or excavation. The high elevated lands can be also utilized for housing development, which will generate cost to implement construction of public parks.



Source: JICA Study Team

**Figure 4.1.28: Basic Idea of Construction of New Public Parks**

On the other hand, in the case of construction of small scale public parks from spaces left when implementing infrastructure development such as roads and railways, precise construction must be done in order to ensure the security and safety of the citizens. Furthermore it should be noted that maximizing use of existing and remaining natural elements such as marsh, pond, forest, trees and others at the site of public parks would be useful during construction.

## 2) Renovation of Existing Public Parks and Urbanized Areas with Green

### (1) Renovation of Existing Public Parks

Public parks are expected to satisfy four basic functions, namely (a) providing spaces for recreation, (b) improving landscape, (c) mitigating disasters (flood control etc.), and (d) conserving nature and improving environmental conditions. From the viewpoint of Myanmar's situation, it is recommended to emphasize the following additional functions when public parks are renovated or constructed:

*(a) Creation of Waterfront Spaces for Relaxing*

The people of Myanmar seem spend time along lakes and riverside areas for relaxation. In creating more attractive public parks, it is better to maximize and make use of ponds and rivers as much as possible at the time of renovation and construction of the public parks. It will also contribute to improving the scenery of urban spaces.

*(b) Creation of Shady Spaces Provided by Large Trees*

In Myanmar, where sunshine is dominant, large trees in public parks are very important as they provide shades. Maximizing the use of existing large trees and planting and raising trees such as *Samanea saman* in public parks as much as possible is recommended at the time of construction of the public parks. Providing grass on public parks, especially under large trees offer cooler spaces even in day time.

*(c) Creation of Walking and Jogging Path and Deck*

The people of Myanmar are fond of walking and jogging especially in the morning. Considering this, footpaths and decks in or around public parks must be considered.

*(d) Creation of Playground Spaces with a Variety of Playground Equipment for Children*

Along Kan Daw Gyi Lake, a place with playground equipment attracts a lot of children with their families. To provide such spaces for all children, construction of public parks with a variety of playground equipment for children is recommended.



Waterfront Spaces for Relaxing

Shady Spaces by Large Trees

Walking and Jogging Path and Deck

Playground with Equipment

Source: JICA Study Team

**Figure 4.1.29: Examples of Recommended Functions in Public Parks**

NIPPON KOEI CO., LTD., NJS CONSULTANTS CO., LTD.  
YACHIYO ENGINEERING CO., LTD., INTERNATIONAL DEVELOPMENT CENTER OF JAPAN,  
ASIA AIR SURVEY CO., LTD., and ALMEC CORPORATION



To provide public parks with special functions in addition to the above mentioned ordinary functions is also sometimes necessary from a comprehensive point of view in Greater Yangon. The special functions include zoological and botanical functions, environmental education, eco and adventure tourism, museum of art, and others. Making parks with some specific concepts can satisfy citizens' specific demands and may create new trends. Some ideas are proposed as follows;

- Hlawga Natural Protected Area shall be open to limited citizen's use of eco and adventure tourism with guides for environmental education and tourism destination.
- One of the existing public golf courses shall be renovated as a new public park with a museum of art which provides beautiful and relaxing atmosphere.



Source: JICA Study Team

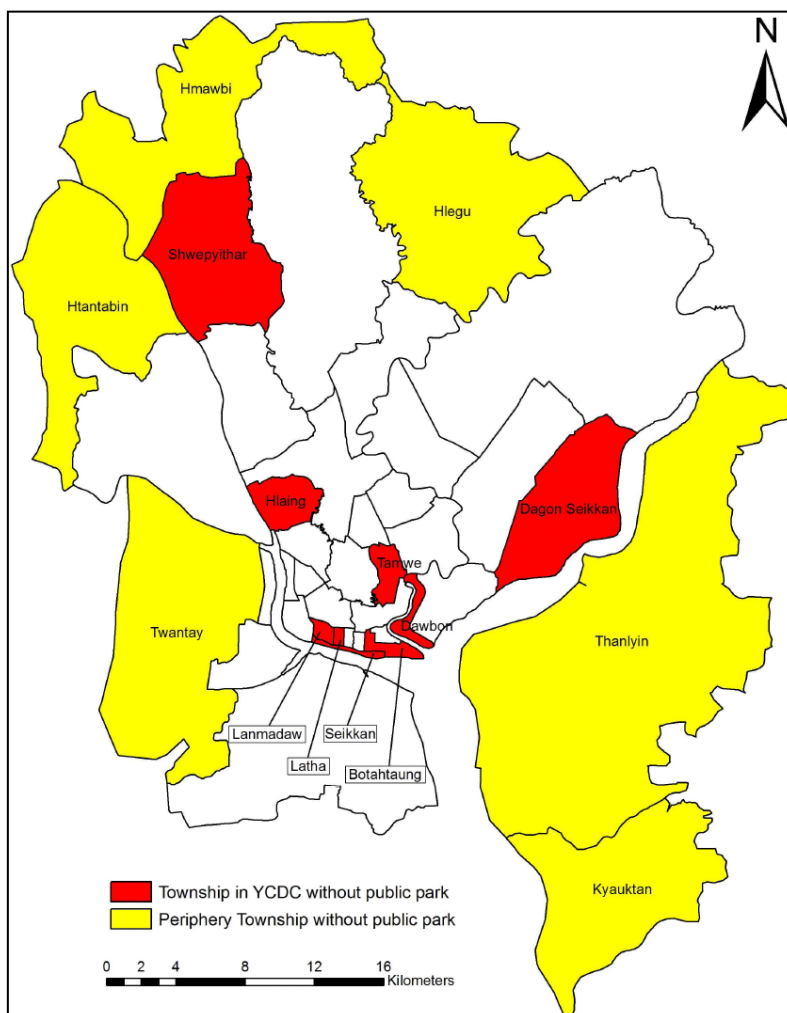
**Figure 4.1.30: Japan's Examples of Special Purpose Parks**

(2) *Supplying Public Parks for all Townships*

In Yangon City, there are nine townships which have no public parks, namely: Latha, Lanmadaw, Botahtaung, Tarmwe, Seikkan, Dawbon, Hlaing, Shwe Pyi Thar, and Dagon Seikkan as shown in Figure 4.1.31. There are also six periphery townships which are likely to have no public parks. As the distribution of existing public parks lacks spatial balance, it is necessary to prioritize construction of new public parks in those townships as well as that in new urban areas. Although sourcing of spaces to be allocated to new public parks would be difficult in urbanized areas, some ideas are proposed by the JICA Study Team as follows;

- In Latha, Lanmadaw, Botahtaung Townships in CBD, it is recommended to find and create spaces for public parks or relevant open spaces in the case of transferring public facility from CBD to outwards or redeveloping commercial and business building.
- In Seikkan Township along the Yangon River, it is recommended to find and create spaces for public parks or relevant open spaces in the case of transferring port functions from Yangon Port to Thilawa Area Port.
- In Dawbon Township along the Pazyndaung Creek, it is recommended to create green footpath along the creek side.
- In Tarmwe Township which has high-dense housing facilities, it is recommended to find and create spaces for public parks or relevant open spaces in the case of redeveloping commercial and business building.

- In Hlaing Township which has a lot of industrial zones even in inner urban, it is recommended to find and create spaces for public parks or relevant open spaces in the case of transferring existing industrial zones to outwards
- In Shwe Phy Thar, Dagon Seikkan and six periphery townships which will be developed as new urbanizing areas in the future, new public parks might be constructed at the time of development of new towns.



Source: JICA Study Team

**Figure 4.1.31: Township without Public Parks**

3) Promotion of Greenery in Urban Areas

(1) Required Green Space Coverage

Suitable green spaces coverage ratio (green spaces/ total development area) should be adopted when large-scale buildings are constructed or re-constructed. The JICA Study Team proposed that administrative instruments for development activities are undertaken under the building application/permission procedure by the Engineering Department (Building) of YCDC in two categories according to the sizes of development activities as follows:

*(a) Development Size: More than 20 ha*

In case of urban development projects of more than 20 ha (200,000 sqm), the development activity must follow the requirement for maintaining the proposed green spaces coverage ratio in the development site.

*(b) Development Size: More than 1,000sqm*

In case of development activity which has the size of more than 1,000 sqm, an administrative instrument will be strongly recommended by those who are in charge of building permit, targeting the party interested in conducting development activity to provide for the proposed green spaces coverage ratios.

**Table 4.1.30: Proposed Administrative Instrument and Green Space Coverage Ratio**

Size of Development Site	Green Spaces Coverage Ratio
20ha -	<b>Ratio: 30%</b>
1,000sqm - 20ha	Ratio: 10%

Source: JICA Study Team

*(2) Recommendation of Greenery in Private Lands*

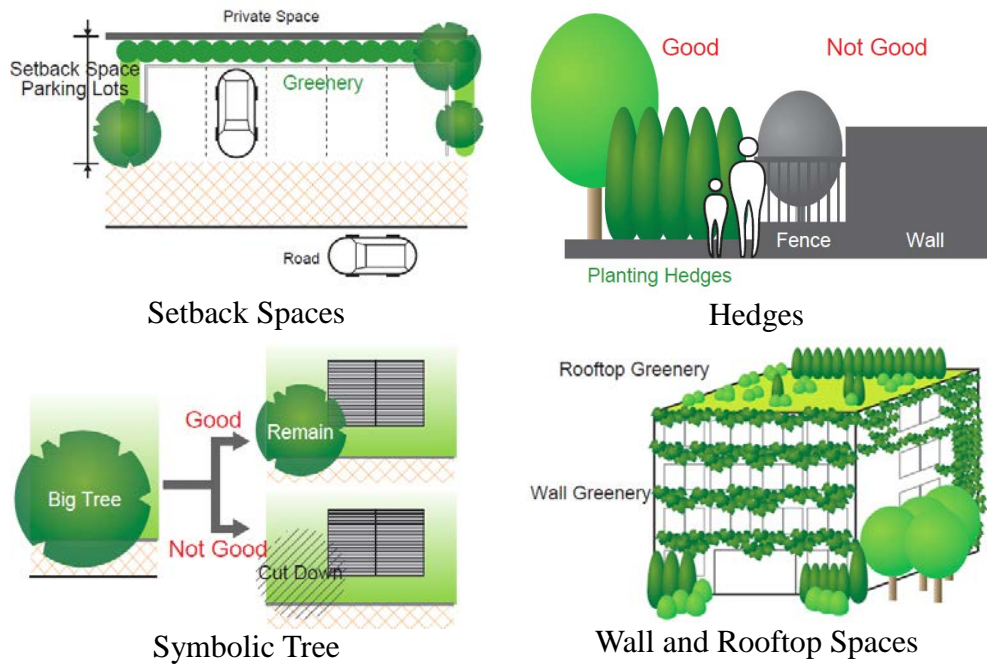
To improve private spaces with rich greenery, mainly two major strategies should be adopted. One of which is promoting and disseminating information related to greenery, and the other is constructing a system for recommendation, guidance and support for greenery. The proposals are as follows:

*(a) Information and dissemination*

- Making and distributing “Greenery guideline for private properties” (see Figure 4.1.32)
- Holding public seminars and making a qualification system to register the persons who can support greenery activities in practice
- Selecting 100 symbolic trees, or so-called “Yangon 100 Trees”

*(b) System for recommendation, guidance and supporting*

- Making a consulting panel supported by professional advisers for greenery
- Supporting for improving greenery of regional level both in expenses and in practice
- Subsidizing and supporting hedges, containers and planters for individual houses both in terms of expenses and practice
- Constructing a system of recommendation and guidance for greenery in large-scale development in cooperation with those who are seeking building permit



Source: JICA Study Team

**Figure 4.1.32: Examples of Greenery Guideline for Private Properties**

## **4.2 Land Use Plan**

### **4.2.1 Necessity of a Land Use Plan**

As there has been no modern Town Planning Law (or any of its sort) enacted in Myanmar, there is no clear framework to formulate a land use plan in Yangon City and also in Myanmar. As the Greater Yangon shall accommodate a large number of population, which will double by 2040 from its present level, a land use plan is necessary to define and regulate the direction and configuration of the future urbanization.

The land use plan can contribute favorably to the creation of a good living environment, provision of convenient life for all its citizens, promotion of sustainable development with efficient management, minimizing expensive infrastructures, and mitigation of negative impacts on the environment. It should also be noted that the actual changes in land use should be controlled in reference to the land use plan formulated through the broad stakeholder participation and good governance.

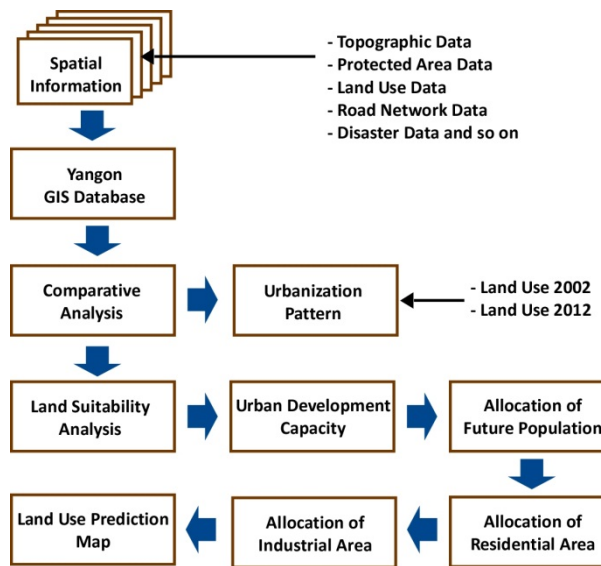
In the Interim Report II, land evaluation was carried out to identify land capacity for urban development in the future. Based on the land evaluation, a map showing future land use has been formulated through discussions among stakeholders, as presented in the Draft Final Report.

### **4.2.2 Land Evaluation**

Land evaluation aims at identifying the anticipated capacity of available land for urban development in the Greater Yangon. Assessment of the potential of land for urbanization could contribute to a rational future population allocation. In this study, land suitability evaluation by means of Geographic Information System (GIS) was conducted. Accordingly, the size of suitable land for urbanization in each township is calculated based on this evaluation. The result proves that the land use plan is conducive to serve as foundation for the future land use plan.

Major steps for land evaluation and future population allocation are as follows. The methodology is briefly illustrated in Figure 4.2.1.

- Establish a GIS database
- Carry out comparative analysis based upon the land use data in years 2002 and 2012 in order to understand an urbanization pattern in YCDC (refer to Section 2.2.4, Chapter 2)
- Conduct a land suitability analysis under the current condition based upon the GIS database with grid cells and scoring systems.
- Calculate the capacity of suitable land by township with a view on future population
- Allocate future population by township (refer to Section 3.2, Chapter 3)



Source: JICA Study Team

**Figure 4.2.1: Methodology on Land Evaluation**

(1) GIS Database

Wide ranges of data and information have been collected from government agencies and relevant organizations during this study. In addition, a variety of data has been developed by means of satellite imageries and site surveys by the JICA Study Team. These collected data and information are compiled and integrated in the numerical and/or the geographical data format in order to carry out several types of analysis, and utilized as fundamental data for preparing future land use plan.

GIS Database, which has been developed by the JICA Study Team, consists of two types of data depending on the scale; one is 1:50,000 and the other is 1:10,000. Basically the 1:50,000 scale data was developed from satellite imageries and the database has already been completed. Meanwhile the 1:10,000 scale data was developed based on satellite imageries supplemented by interviews and site surveys. This process is still on-going.

GIS database includes the following information:

1:50,000 scale

- Township boundary
- Village Point
- Contour
- Flood Prone Areas
- Conservation and protected areas
- Rivers and other water bodies
- Road networks
- Railway networks and stations
- Public Facilities
- Large-scale Buildings
- Detailed Land use (2002 and 2012)

1:10,000 scale

- Township boundary
  - Contour
  - Land use
  - Buildings
  - Road networks
  - Railway networks
  - Transport facilities
  - Public facilities
  - Rivers and other water bodies
- (suppose to be completed in February2013)

(2) Land Suitability Evaluation for Urban Development

A land suitability evaluation aims at identifying the appropriate land for urbanization in the future by means of GIS Database explained above. In general, urbanization tends to be affected by natural conditions, land use, location and current status of infrastructure. To take into account these aspects,

land suitability evaluation was carried out in terms of three broad categories: natural condition, accessibility, and existing land use.

Natural Condition

- Slope Area
- Conservation Area (Wildlife Area)
- Large-sized Green Area (>50ha)
- Water Surface Area (Rivers and Lakes)
- Flood Prone Areas

Accessibility

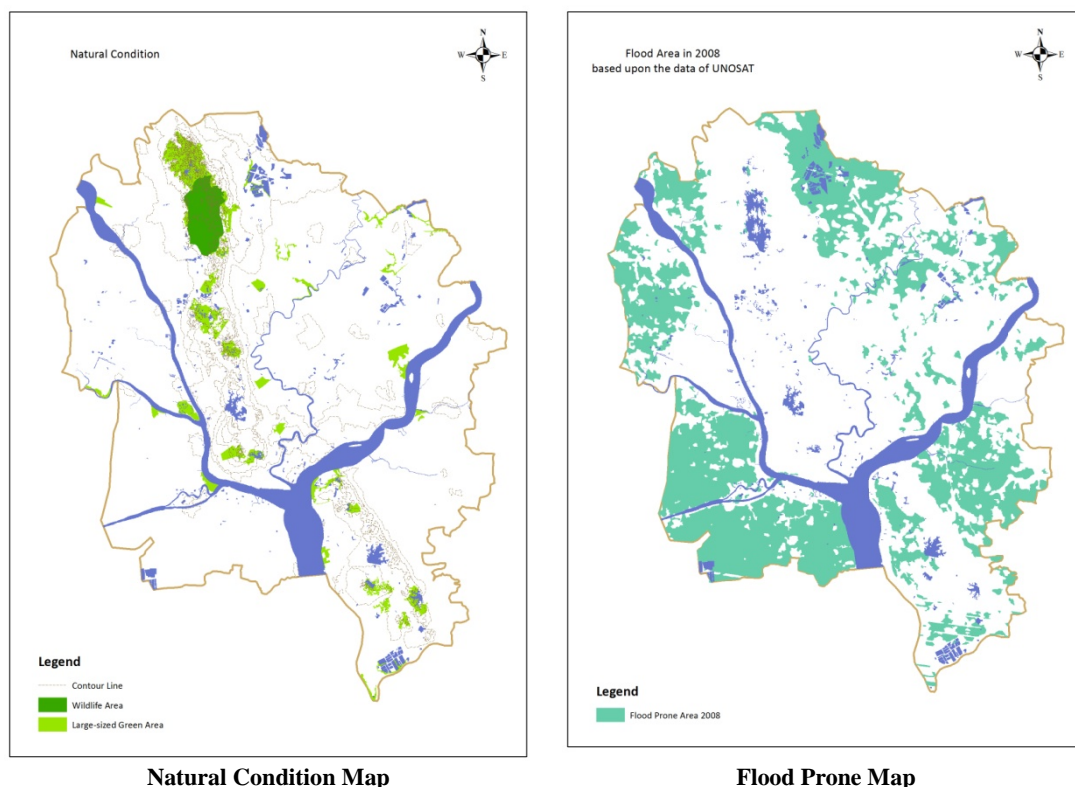
- Road Networks
- Railway Networks
- Proximity to Urban Center
- Proximity to Existing Built-up Areas

Land Use

- Under Developing Area
- Agricultural Areas

1) Natural Condition

The natural conditions of the Greater Yangon are illustrated in Figure 4.2.2. YCDC lies on a relatively flat plain where there are no major conservation areas except Hlawga Wildlife Area as explained in previous chapters. In terms of urban development, the natural condition shows the area where development should be avoided such as steep slope sections, conservation sites, water surface area and flood prone locations. Besides, large-sized green area including a forest, swamp and mangrove forest are considered to be a non-prioritized from the view point of urban development since they have potential to become urban green area.



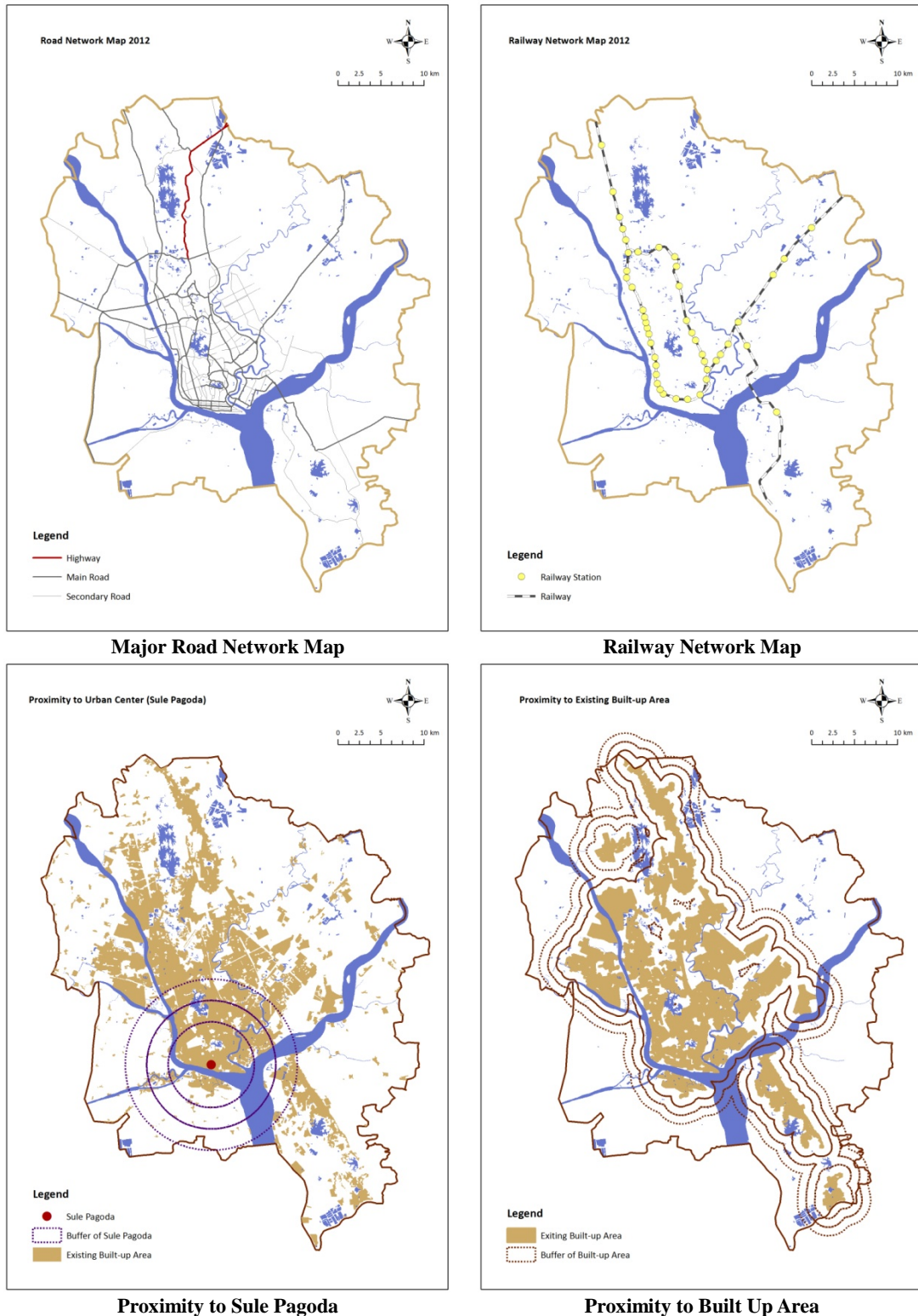
Source: GIS database (1:50,000) developed by JICA Study Team with a basis of 2012 Satellite Image Analysis and 2008 UNOSAT flood analysis

**Figure 4.2.2: Natural Condition in the Planning Area**

2) Accessibility

The transportation networks including roads and railways, and spatial proximity to urbanization areas are illustrated in Figure 4.2.3. The transportation network tends to cause a strong impact toward the direction of urbanization. In addition, the proximity to the urban

centers and existing urbanization areas are also important factors that contribute positively to urbanization. Those centers are already developed areas which can provide jobs and educational opportunities, and support social activities of the populace.

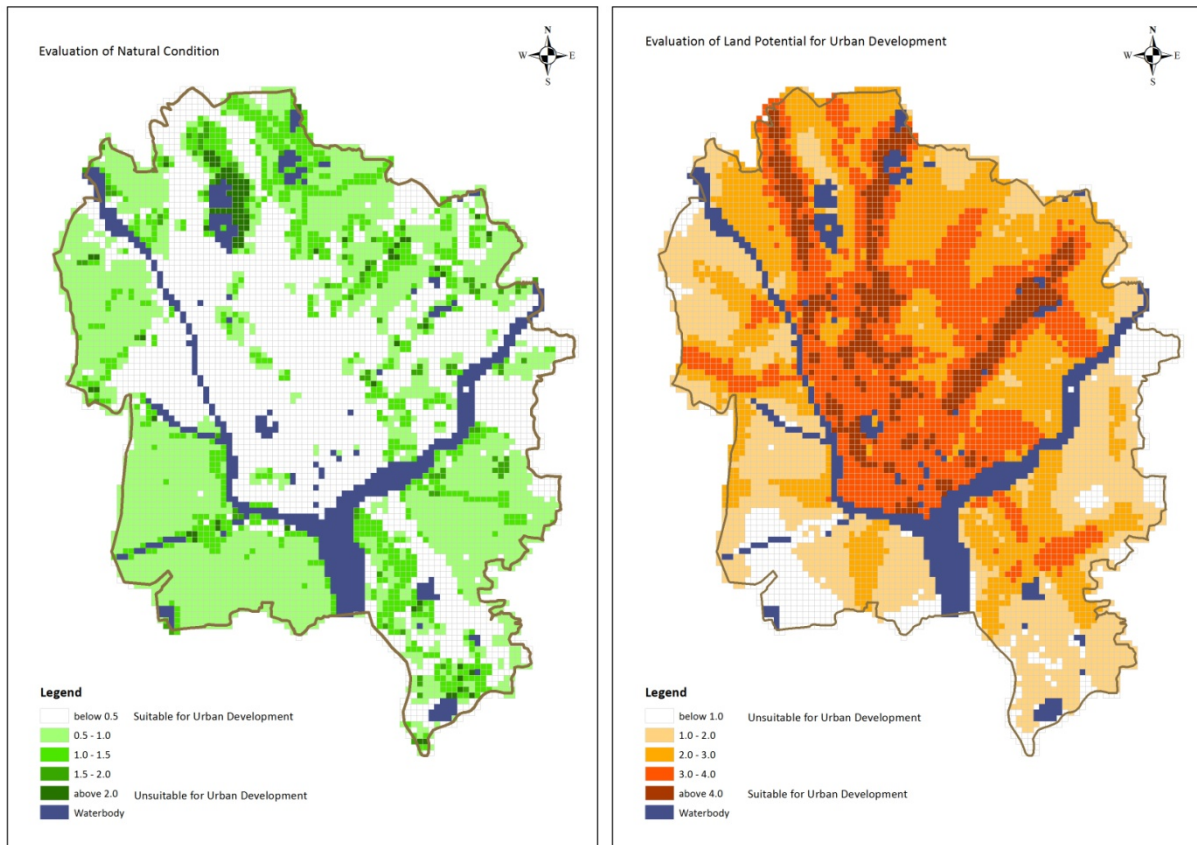


Source: GIS database (1:50,000) developed by JICA Study Team with a basis of 2012 Satellite Image Analysis

**Figure 4.2.3: Accessibility of the Planning Area**







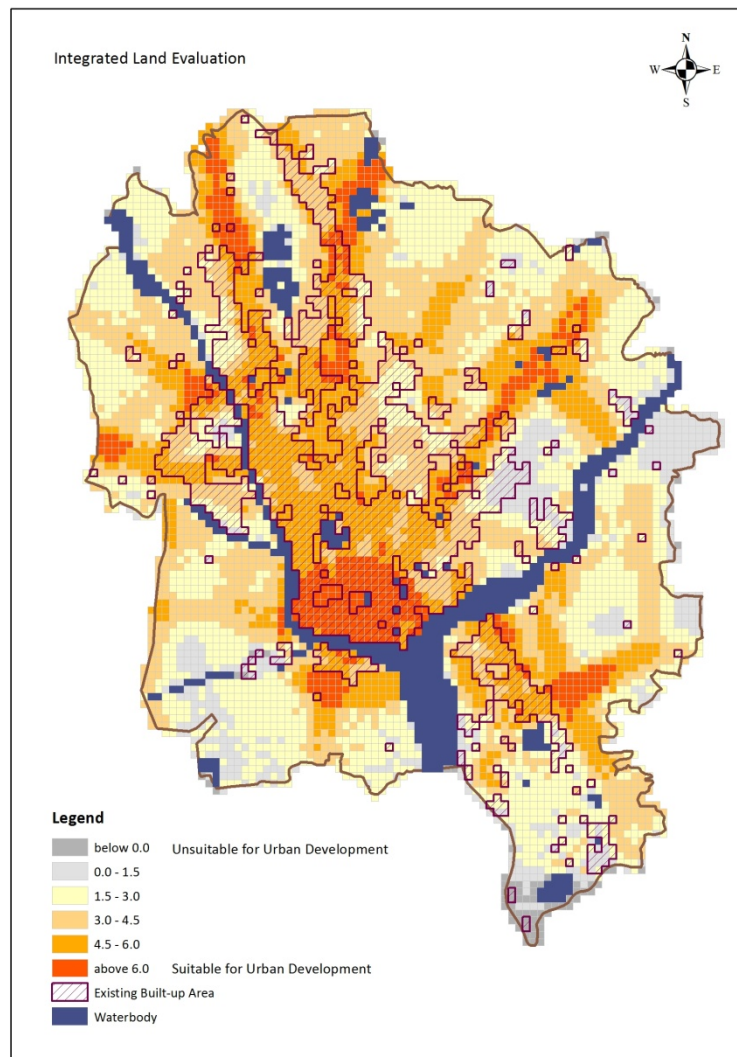
**Natural Condition**

**Accessibility and Land Use**

Source: GIS database (1:50,000) developed by JICA Study Team with a basis of 2012 Satellite Image Analysis

**Figure 4.2.5: Land Suitability Evaluation**

Figure 4.2.6 illustrates the result of the land suitability evaluation from integrated viewpoints combining the three thematic evaluations. Dark and strong orange colors indicate the area, which has large potential for urban development. Existing built-up area is mostly included in this area. Gray color represents the unsuitable area for urbanization and thus, are not prioritized for economic activities.

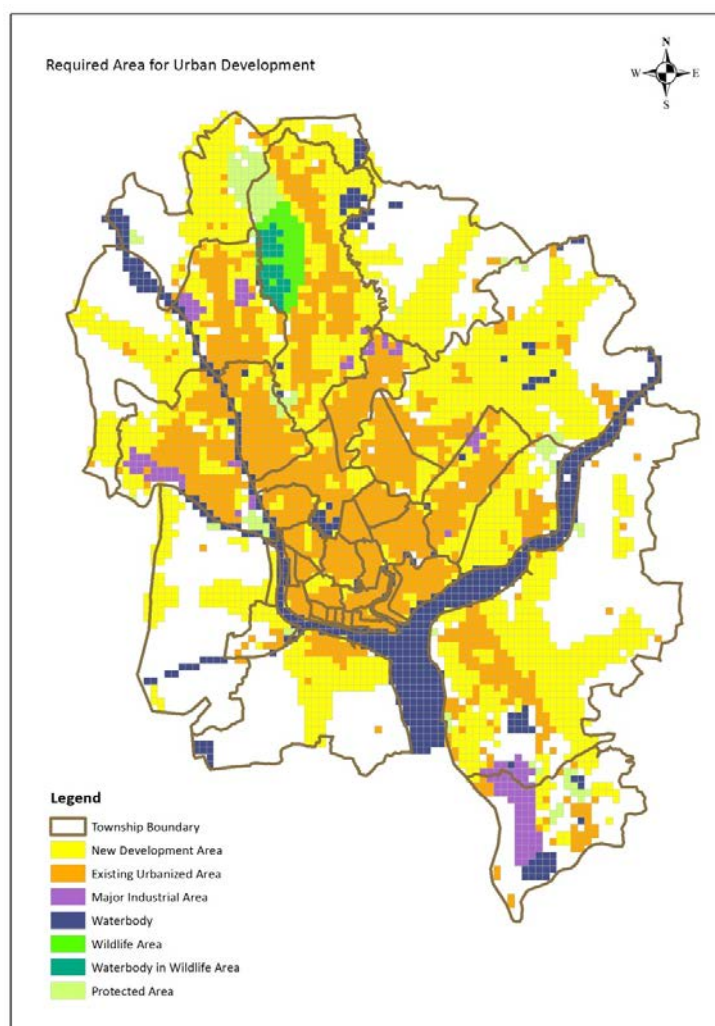


Source: GIS database (1:50,000) developed by JICA Study Team with a basis of 2012 Satellite Image Analysis

**Figure 4.2.6: Integrated Land Suitability Evaluation**

Based on the result of land suitability evaluation, the high potential areas for urban development were identified in the Planning Area. These areas shall mostly accommodate the increasing projected population of around 6.2 million. By 2040, roughly 51,300 ha of additional land development areas will be needed to accommodate the anticipated population based on a 120 person/ha population density. Applying the required development size to the density, approximately 2,053 of 500 m grid columns shall be selected. Based on the results of the evaluation and the required number of mesh grid columns, new development area is identified as shown in Figure 4.2.7.

Based on said figure, the size of new development area by township boundary is further calculated and summarized in Table 4.2.1. The newly development area consists mainly of two types of land use: one is under developing area and the other is agricultural area. According to the table, most of the townships in CBD have no rooms for new development, while Thanlyin and East Dagon townships have large potential for urbanization in the future.



Source: GIS database (1:50,000) developed by JICA Study Team with a basis of 2012 Satellite Image Analysis

**Figure 4.2.7: New Development Area**

**Table 4.2.1: New Development Area by Township**

New Code	Township Name	Township Group	New Development Area (m <sup>2</sup> )		
			Under Developing Area	Agricultural Area	Total
1	Latha	CBD			0
2	Lanmadaw	CBD			0
3	Pabedan	CBD			0
4	Kyauktada	CBD			0
5	Botahtaung	CBD			0
6	Pazundaung	CBD		250,000	250,000
7	Ahlonge	Inner Urban Ring		250,000	250,000
8	Kyee Myin Daing	Inner Urban Ring		2,750,000	2,750,000
9	Sanchaung	Inner Urban Ring		250,000	250,000
10	Dagon	Inner Urban Ring		2,000,000	2,000,000
11	Bahan	Inner Urban Ring		750,000	750,000
12	Tarmwe	Inner Urban Ring		500,000	500,000
13	Mingalar Taung Nyunt	Inner Urban Ring		750,000	750,000
14	Seikkan	Inner Urban Ring			0
15	Dawbon	Inner Urban Ring		250,000	250,000
16	Kamaryut	Outer Ring	1,250,000		1,250,000

New Code	Township Name	Township Group	New Development Area (m <sup>2</sup> )		
			Under Developing Area	Agricultural Area	Total
17	Hlaing	Outer Ring	750,000	250,000	1,000,000
18	Yankin	Outer Ring			0
19	Thingangyun	Outer Ring		1,000,000	1,000,000
20	Mayangone	Northern Suburbs	750,000	4,500,000	5,250,000
21	Insein	Northern Suburbs	750,000	4,750,000	5,500,000
22	Mingalardon	Northern Suburbs	11,750,000	39,750,000	51,500,000
23	North Okkalapa	Older Suburbs	4,500,000	3,000,000	7,500,000
24	South Okkalapa	Older Suburbs		500,000	500,000
25	Thaketa	Older Suburbs	1,500,000	750,000	2,250,000
26	Dala	South of CBD	1,250,000	24,500,000	25,750,000
27	Seikgyikhanaungto	South of CBD	250,000	2,750,000	3,000,000
28	Shwe Pyi Thar	New Suburbs	9,750,000	8,500,000	18,250,000
29	Hlaing Tharyar	New Suburbs	11,000,000	9,750,000	20,750,000
30	North Dagon	New Suburbs	2,750,000	2,750,000	5,500,000
31	South Dagon	New Suburbs	12,500,000	2,500,000	15,000,000
32	East Dagon	New Suburbs	40,250,000	46,250,000	86,500,000
33	Dagon Seikkan	New Suburbs	23,250,000		23,250,000
34	Kyauktan	Periphery Area	4,500,000	4,250,000	8,750,000
35	Thanlyin	Periphery Area	11,500,000	77,000,000	88,500,000
36	Hlegu	Periphery Area	5,000,000	35,250,000	40,250,000
37	Hmawbi	Periphery Area		39,000,000	39,000,000
38	Htantabin	Periphery Area	250,000	29,500,000	29,750,000
39	Twantay	Periphery Area		25,500,000	25,500,000
Total			143,500,000	369,750,000	513,250,000

Source: JICA Study Team

### 4.2.3 Future Land Use

Future land use of middle-term (2025) and long-term (2040) was envisaged and formulated on the basis of land suitability analyses as explained above. These maps of future land use takes into account the land suitability and the existing land use, and presume that a series of development projects in progress and future in the Planning Area including the Thilawa Special Economic Zone development project will be implemented. On top of these, the required urban functions namely “Sub-center with Green Isle System” defined in Chapter 3 are reflected. Therefore, such urban functions including secondary CBD and sub-centers, new town core, agriculture and green area are allocated coordinating with future transportation network including road and railway development.

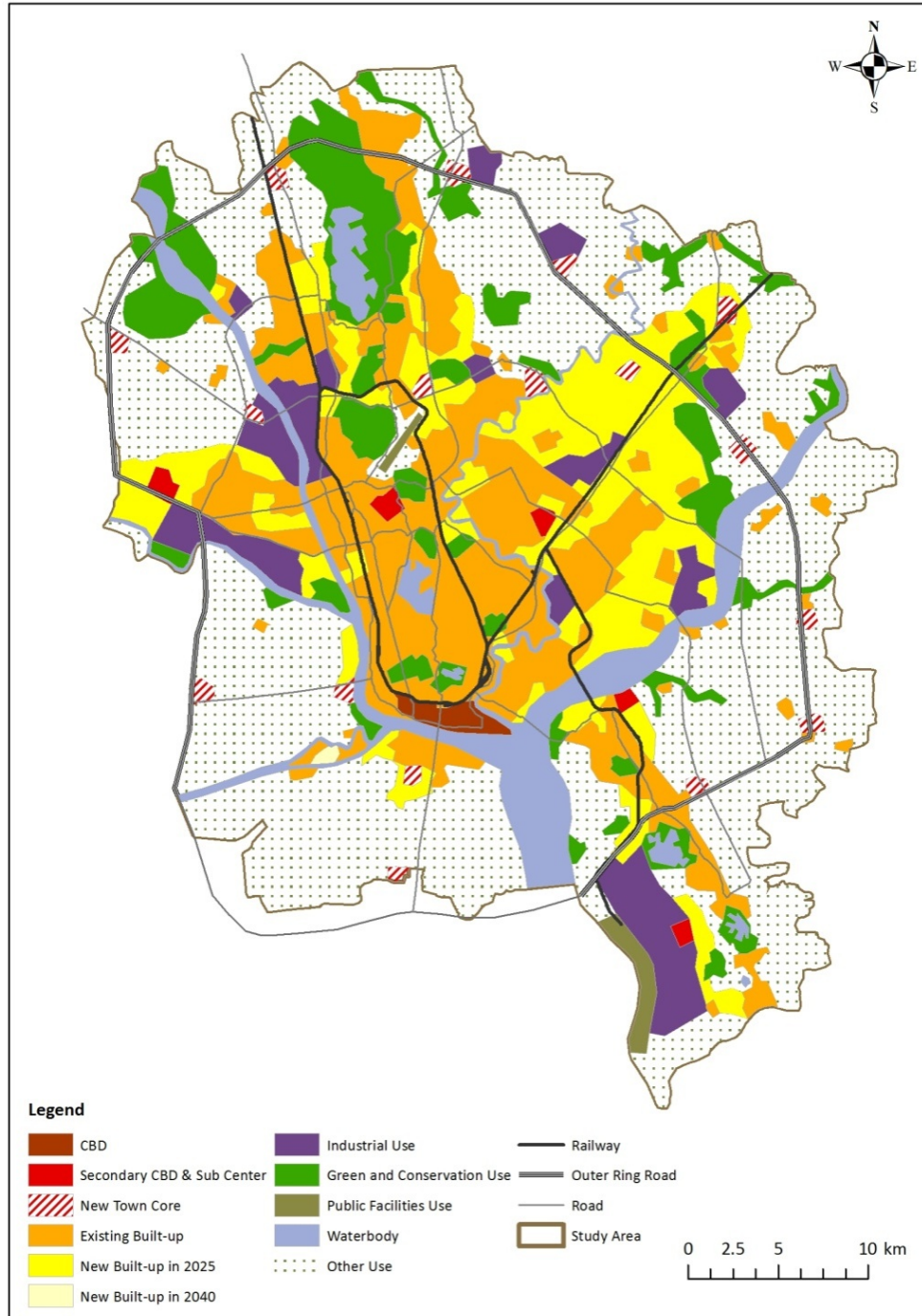
Future land use maps for years 2025 and 2040 are illustrated in Figures 4.2.8 and 4.2.9, respectively. These figures were developed from 1:50,000 scale maps. The categories are defined as follows:

**Table 4.2.2: Definition of Land Use Category**

Land Use Category	Definition
CBD:	Existing CBD area
Secondary CBD and Sub-centers:	1 secondary CBD and 4 sub-centers
New Town Core:	17 new town cores
Existing Built-up:	Built-up area in 2012 including residential, commercial, small scale industrial and public facilities areas
Existing Built-up in 2025:	Built-up area in 2025 including residential, commercial, small scale industrial and public facilities areas
Existing Built-up in 2040:	Built-up area in 2040 including residential, commercial, small scale industrial and public facilities areas
Industrial use:	Large size industrial area
Green and Conservation use:	Large size green area (larger than 10 ha) with types of forest, swamp, glass land, and open space, and Hlawga wildlife area

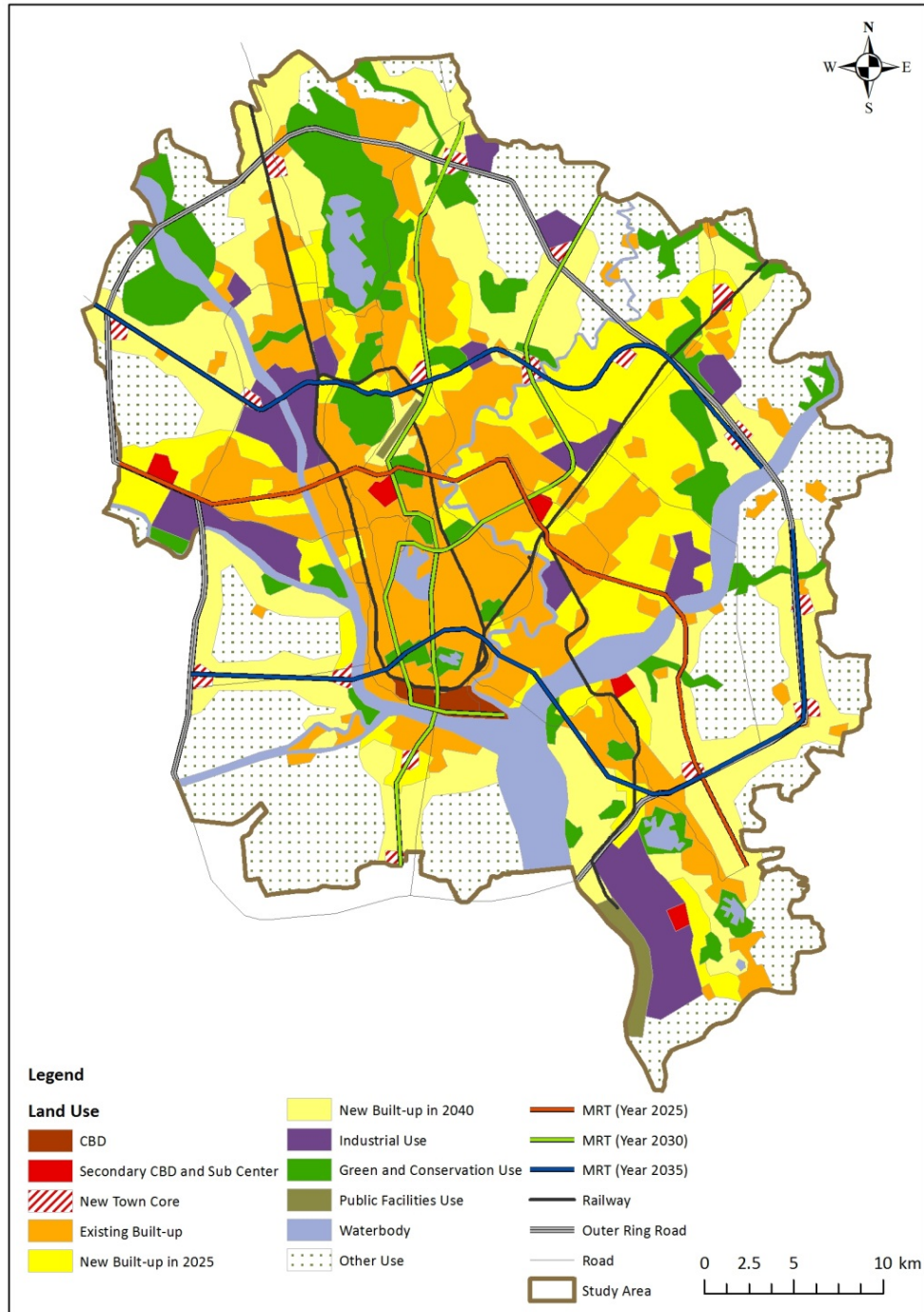
Land Use Category	Definition
Public Facility use:	Yangon International Airport and planned river port
Water body:	River, lake and ponds
Others:	Agricultural area and others

The forecast on future land use will contribute to proper urban development allocation in the Planning Area, and will lead to formulation of a detailed land use zoning plan.



Source: JICA Study Team

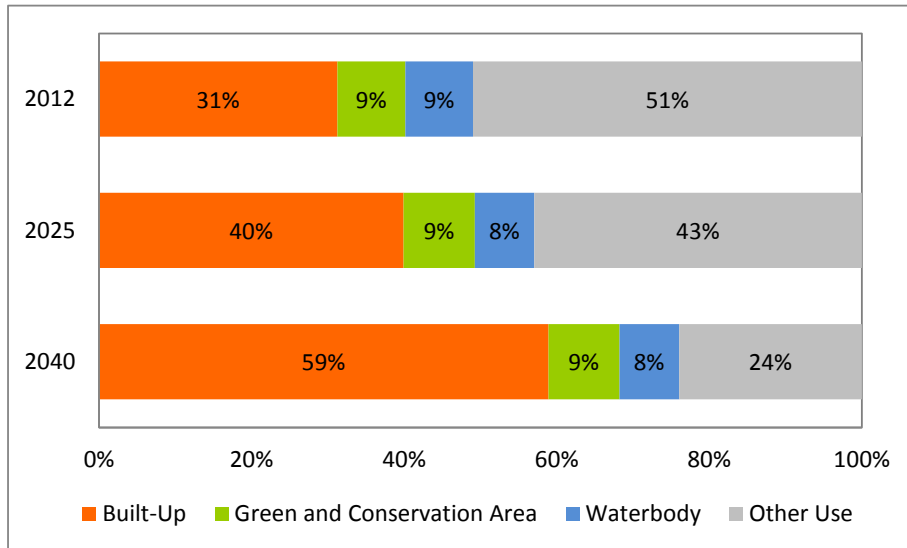
**Figure 4.2.8: Future Land Use Map in 2025**



Source: JICA Study Team

**Figure 4.2.9: Future Land Use Map in 2040**

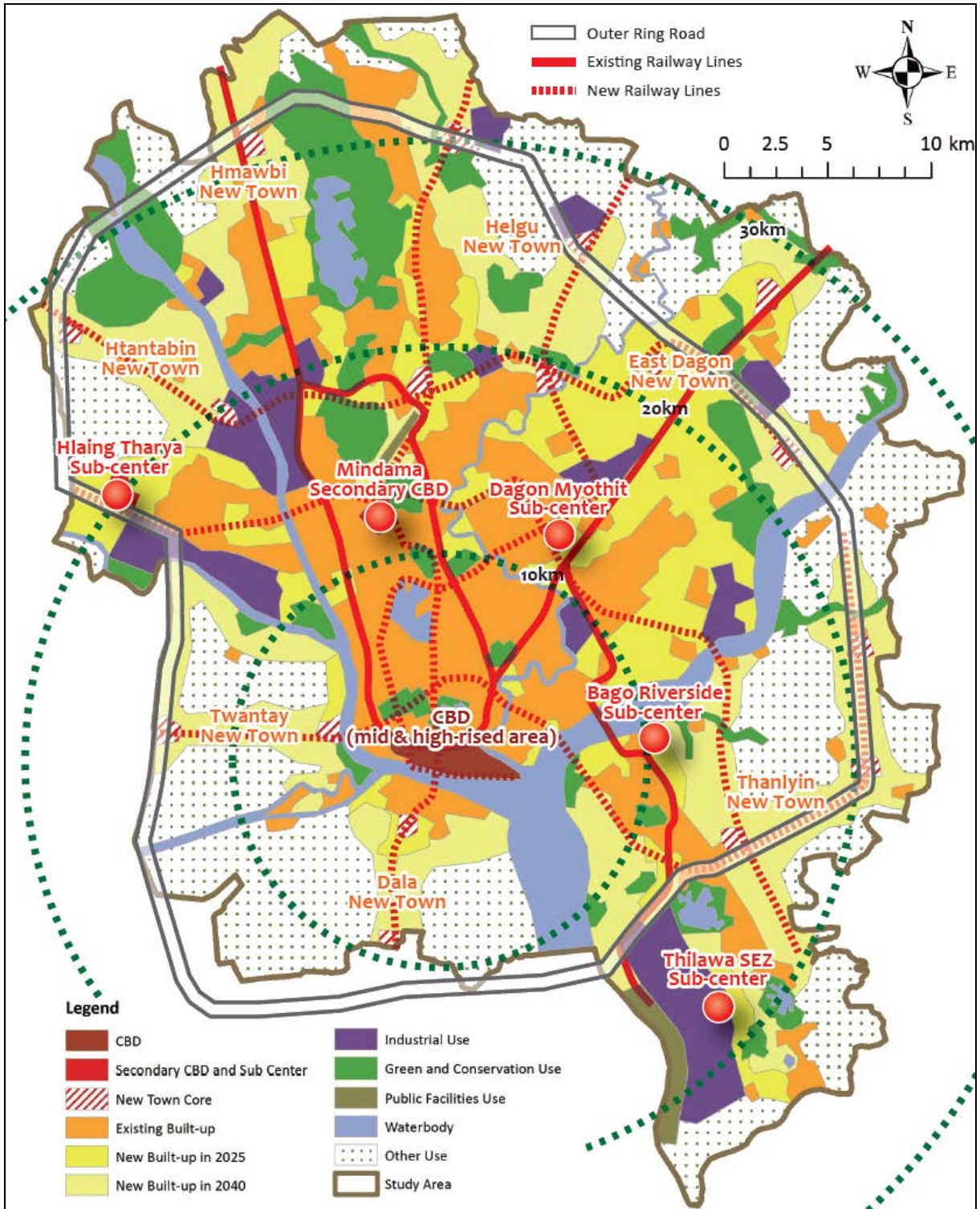
The proportion of general land use in the Planning Area is expected to change as shown in the following chart. Built-up areas include residential, commercial, industrial and public facilities. Meanwhile, there are other uses which are not included like the agricultural areas and others. According to the chart, the built-up areas in 2040 would double in size of the existing land use allocation, while the green areas will keep its current size.



Source: JICA Study Team

**Figure 4.2.10: Dynamics of General Land Use in 2012, 2025 and 2040.**





Source: JICA Study Team

**Figure 4.2.11: Future Urban Structure and Land Use of Greater Yangon**

#### 4.2.4 Outline of Proposed Land Use Zoning Scheme

##### (1) Basic Framework for Land Use Regulation System

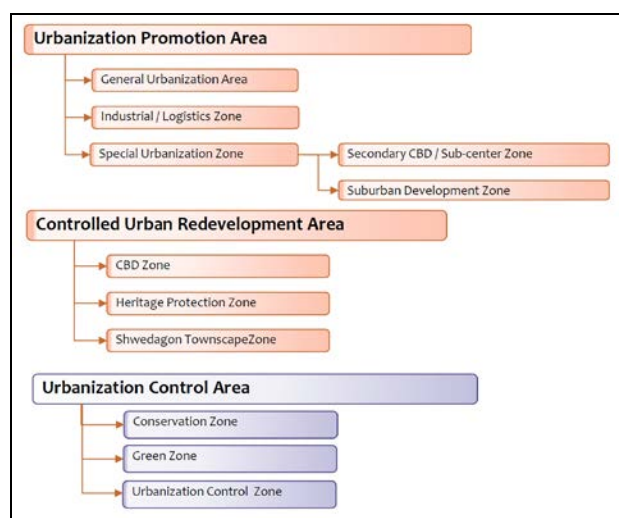
Since there is no Town Planning Law yet in Myanmar, the proposed Land Use Regulation System shall be authorized within the framework of YCDC falling under YCDC regulations and a by-laws. The Land Use Regulation System, after being thoroughly contemplated within the framework of YCDC or possibly in Yangon Region Government with the local assembly, shall be posted in public places to formally disseminate its effectivity and implementation. It must be noted that deeper and more extensive examination and discussion with relevant organizations are necessary. JICA Study Team proposes an idea of land use zoning scheme as follows:

The instrument for the land use regulation shall be the building application/permission procedure now undertaken by the Engineering Department (Building) of YCDC. As the present land use regulation is based on the building height control relative to the width of the frontage road (normally, up to two times of the width), this basic system shall be adopted for the continuity of regulation. Floor area ratio (FAR) is tentatively not to be considered in the general urbanization area to avoid complexity. Control of land use shall be made only for new construction or expansion of large scale factories exceeding a certain threshold size (say, 1000 m<sup>2</sup> of floor area) shall not be allowed in general urbanization area. Specific contents of the land use regulation will be discussed further with YCDC, and will also be presented under the Phase 2 of this study.

##### (2) Proposed Idea of Land Use Zoning Scheme

In order to prepare for the formulation of a comprehensive land use zoning plan, the whole areas of the Greater Yangon will be classified into three types of zones, namely “Urbanization Promotion Area”, “Controlled Urban Redevelopment Area” and “Urbanization Control Area” as shown in Figure 4.2.12 and Table 4.2.3. Brief description of these areas is as follows:

- “Urbanization Promotion Area” where urbanization shall be promoted with appropriate urban infrastructure and public service
- “Controlled Urban Redevelopment Area” where urban development and redevelopment shall be carefully monitored in light of preserving the urban townscape of Yangon
- “Urbanization Control Area” where urbanization shall take a back seat to the Urbanization Promotion Area, and supplying urban infrastructure and public service will not be prioritized.



Source: JICA Study Team

**Figure 4.2.12: Proposed Idea on Land Use Zoning**

**Table 4.2.3: Proposed Idea on Land Use Zoning Scheme**

Land Use Zone		Definition	Intention	Remarks
Urbanization Promotion Area	General Urbanization Zone	Zone for basically the urbanized area and urbanizing area	Guiding planned urbanization in harmony with the urban environment.	
	Industrial & Logistics Zone	Zone for industrial facilities such as large scale factories, plants and garages, and logistics facilities, such as truck terminals and inland container depots.	Guiding the location of industrial / logistics facilities away from the city center, and accumulate in special zones.	
	Secondary CBD & Sub-center Zone	Zone for promoting urbanization to create a secondary CBD or Sub-Center to ease the load to the concentration to the existing CBD.	Providing incentives for intensive urban development with high-rise buildings for offices, commercial, hotels, residential and others.	Requirement of Planning: A comprehensive development plan covering the entire area must be submitted at the time of application.
	Suburban Development Zone	Zone for promoting large scale planned residential development in the suburban areas.	Providing housings for all income groups to cater for the increasing population of Greater Yangon in good environment.	
Controlled Urban Redevelopment Area	CBD Zone	Zone for basically the same as the general urbanization area, but require special attention when a proposed development may affect heritage buildings.	Guiding planned urbanization in harmony with the urban environment, and minimize affects on heritages.	Heritage Impact Assessment: When a proposed development may affect designated heritage buildings and/or townscape, a heritage impact assessment report must be submitted in advance at the time of application.
	Heritage Conservation Zone	Zone to be conserved as the identity of Yangon where a number of heritage buildings are located.	Controlling the demolition and rebuilding of designated heritage buildings and conserving the overall atmosphere of the zone.	
	Shwe Dagon Townscape Zone	Zone surrounding the Shwe Dagon Pagoda.	Protecting the townscape of Shwe Dagon Pagoda which is the symbol of Yangon.	
Urbanization Control Area	Conservation Zone	Zone to be conserved due to the importance of the greenery and water environment.	Any form of urban development shall be prohibited, except for some minimal development for the recreational use of the zone.	
	Green Zone	Zone to be conserved or preserved in harmony with the greenery and water environment.	Development must take into consideration the preservation of the greenery and water environment.	
	Urbanization Control Zone	Zone where urbanization is not prioritized.		

Source: JICA Study Team



# ***CHAPTER 5***

***Urban Infrastructure Development Strategy***

***< Part-II: The Master Plan >***



Figure 5.1.1 summarizes not only the concept of Public Transport but also the concept of Road Network, Railway and Port and Logistic since these transportation sectors are closely interrelated, which are discussed in Sections 5.2 (Road Network), 5.3 (Railway), and 5.4 (Port and Logistic).

### **5.1.1 Macro Traffic Demand Analysis for Land Transport Sector**

This section discusses a macro traffic demand analysis for the urban development strategies in Yangon. Due to the lack of traffic data and information, the analysis has been made based on secondary data as well as in reference with the data obtained in other transport studies in other countries. Although reliability of the analysis may be limited, the macro analysis will provide valuable information to contemplate on the urban development strategies. In addition, the detailed traffic demand analysis of the transport sectors will be conducted by the sector master plan which was undertaken by JICA in December 2012.

In general, there are mainly two traffic flows: people and goods. Different lifestyles and different productive activities create various types of travel patterns. Since it is not easy to analyze the goods' flow without detailed data of production, this study will focus on the passengers' flow and the car demands by applying the passengers' flow analysis.

First, traffic demands for the whole Yangon Region were estimated. Based on these analyzed results of the whole city, traffic flows among the townships were then analyzed.

#### **(1) Current Traffic Demand**

Current traffic demand is estimated based on the following information obtained from relevant ministries and agencies such as Ministry of Construction, Ministry of Rail Transportation and Myanmar Railway, etc. (Refer to Figure 2.3.3).

- (i) The bus passengers are about 4.4 million per day in 2008. The modal share of bus is 84%.
- (ii) The passengers of circular railway are 130,000 per day. The modal share of circular railway is about 3%.
- (iii) The modal share of private cars, including taxis, is 11%.
- (iv) There were 233,000 vehicles registered in 2009 (37.5 vehicles per 1000 population), which included 143,000 passenger cars (25 passenger cars per 1000 population).

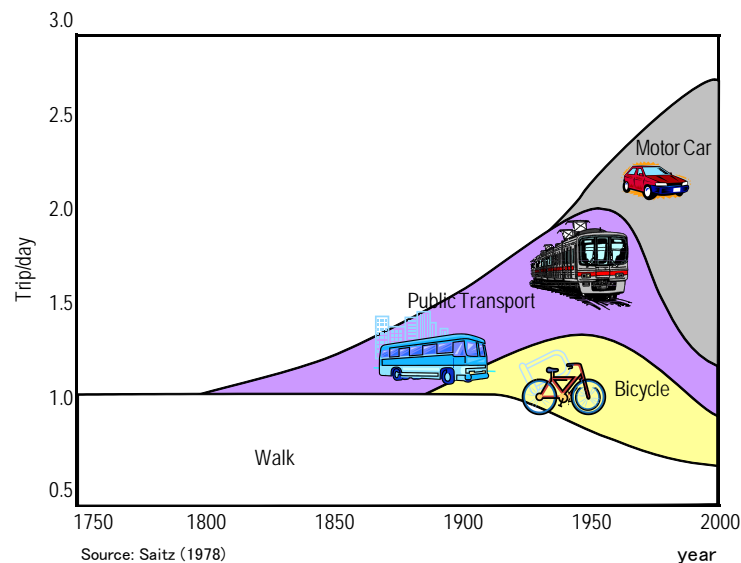
By using above mentioned data, the current traffic demands and modal share are estimated as shown in Table 5.1.1. Current trip rate (person trip per day) in Yangon Region is not more than 1.0. Figure 5.1.2 shows the historical change of number of trips among the transport modes; average trip rate was around 1.1 trips per day before the era of motorization when people traveled only to go to work and the travel distance was very short (Saitz 1978). After the increase in motorization rate, the number of trips and travel distances has increased drastically with alternative modes of transportation such as cars, buses, train, and bicycle. In the major cities of Asia at present, such as Hanoi, Manila, Bangkok, and Jakarta, the reported average trip rates range from 2.5 to 3.0 trips per day. In comparison, the current trip rate (excluding 'Walk' trip) in Yangon is lower than those in other cities in Asia mainly due to (1) lower car ownership ratio, (2) prohibition of motorcycle and bicycle in the urban area, and (3) less urban economic activities. Detail calculation is shown in Appendix 4.

**Table 5.1.1: Estimation of the Current Traffic Demands**

Year	Population (thousand)	Use Traffic Mode (trip/person)	Total Trip (1000)	Vehicle Use and Modal Share							
				Ownership (veh/1000 population)	Vehicles (veh)	Use Rate	Trip Average (trip/day)	Occupancy	Total Vehicle Trip (1000)	Vehicle Use Person Trips (thousand)	Modal Share of Vehicle
2008	5,500	0.96	5,280	25	137,500	0.7	3.0	2.0	289	578	11%
2009	5,740	1.00	5,740	25	142,869	0.7	3.0	2.0	300	600	10%
2011	6,214	1.00	6,214	25	157,156	0.7	3.0	2.0	330	660	11%

Year	Total No. of Trips ('000)	Modal Share (%)						Person Trip ('000)				
		No.	Rail	Bus	Car	others	Total	Rail	Bus	Car	others	Total
2008	5,280		2.5%	84.0%	11%	2.5%	100%	132	4,435	581	132	5,280
2011	6,214	Now	2.1%	84.0%	11%	2.9%	100%	130	5,220	684	180	6,214

Source: JICA Study Team



**Figure 5.1.2: Historical Change of the Number of Trips among the Transport Modes**

## (2) Vehicle Ownership and Modal Share

With the rapid increase in motorization among the large cities in the developing countries of Asia, the transport-related issues such as traffic congestion, traffic accidents and air pollution that confront these cities have become more serious. Traffic problems affect not only the pedestrians and users of non-motorized vehicles but as well as passengers and operators of road-based public transport modes. Various traffic management means have been introduced in some countries to address these urban transportation issues. For example, TDM (Transportation Demand Management) measures such as the priority policy for the public transportation and control of the usage of private mode of vehicles have been introduced in some countries of South East Asia region.

Table 5.1.2 shows the vehicle ownership in other Asian countries. As compared with the vehicle ownership of 127 vehicles per 1000 population in Thailand and 240 in Malaysia, 25 of the same unit in Yangon (only passenger cars) is still very low. However, with the projected increase in the average annual income level of Yangon in the future, vehicle ownership is also expected to reach a high level which may lead to serious traffic congestions such as those being experienced in Bangkok, Jakarta and Manila.

**Table 5.1.2: Vehicle Ownership by Per-capita Income**

Country	Year	Per-capita USD 1000	Ownership per 1000 pop
Thailand	2002	6.2	127
Malaysia	2002	8.1	240
Indonesia	2002	2.9	29
Korea	2002	15.1	293
Japan	2002	23.9	599

Source: OECD

Due to the recent government deregulation policy on the importation of vehicles, the motor vehicles in Yangon are increasing rapidly and it is expected that the number will continue to increase along with high level of economic growth. Table 5.1.3 shows passenger car traffic demand according to the changes of motorization level and also shows alternative modal shares based on the car traffic demand. Total number of trips in Yangon in 2040 is estimated at 11.7 million trips with the current trip rate.

If the ownership is 50 passenger car unit (pcu)/1000 population, the modal share of cars will be 24%. If the ownership is 100 pcu/1000 population, the modal share will be around 50%. In order to control the modal share to less than 60%, vehicle ownership should be around 200 pcu/1000 population. However, in case vehicle ownership reaches this level for daily commuting, the road infrastructure might not be able to meet with this demand unless new roads will be constructed with massive land acquisition and resettlement where, eventually, people will already be faced with serious traffic congestion in the city.

Therefore, the modal share of the passenger car (private mode of transport) should be limited to lower than 30%, i.e. vehicle ownership needs to be around 50-70 pcu/1000 population. However, with the present economic development which brings about an improvement in the life style of people in Myanmar, it will be difficult to control the surge in level of motorization. Thus, improvement and modernization of public transport network system, introduction of strategic TDM system in addition to the current traffic control and management on vehicle import control, and limitation of two-wheel vehicle usage is very critical.

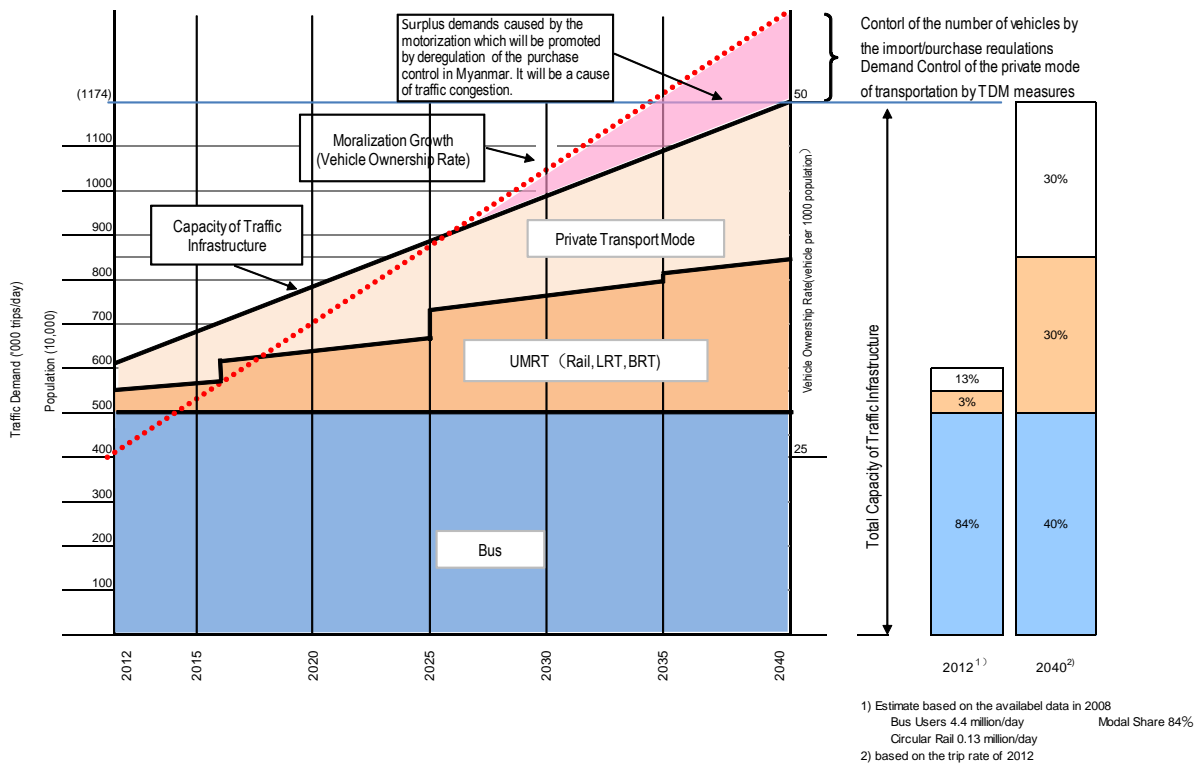
Figure 5.1.3 illustrates the traffic demand projections. Estimated modal share of bus transport is decreased as estimated number of bus passengers is set to be the same as the current level. Instead of bus transport, urban railway system is assumed to play a significant role in public transport system in Yangon. On the other hand, increase in level of motorization is expected with the expansion of transport infrastructure capacity; thus, accordingly, the use of private modes of transport (such as private cars) should be controlled as discussed.

**Table 5.1.3: Estimation of Traffic Demanded in 2040**

Year	Population (thousand)	Trip Rate (using Transport Modes) (trip/perso)	Total No. of Trips (1000)	No. of Trips and Modal Share of Passenger Car								Remarks
				Owernship (veh/1000 population)	Passenger Car (veh)	Utilization Rate	Average No. of Trips (trip/dav)	Occupancy	Passenger Car Trips (1000)	Total Trips Passenger Car (thousand)	Modal Share of Passenger Car	
2040年	11,730	1.00	11,730	25	296,765	0.8	3.0	2.0	712	1,424	12%	
				50	586,500	0.8	3.0	2.0	1,408	2,815	24%	
				100	1,173,000	0.8	3.0	2.0	2,815	5,630	48%	
				130	1,524,900	0.8	3.0	2.0	3,660	7,320	62%	
				200	2,346,000	0.5	3.0	2.0	3,519	7,038	60%	
				300	3,519,000	0.34	3.0	2.0	3,519	7,038	60%	
Year	Total No. of Trips (thousand)	Modal Share (%)					Person Trip (thousand)					Remarks
	No.	Rail	Bus	Car	Others	Total	Rail	Bus	Car	Others	Total	
2040	11,730	(1)	38.0%	50.0%	12%	0.0%	100%	4,457	5,865	1,408	0	11,730
		(2)	30.0%	46.0%	24%	0.0%	100%	3,519	5,396	2,815	0	11,730
		(3)	22.0%	30.0%	48%	0.0%	100%	2,581	3,519	5,630	0	11,730
		(4)	20.0%	20.0%	60%	0.0%	100%	2,346	2,346	7,038	0	11,730
		(5)	20.0%	20.0%	60%	0.0%	100%	2,346	2,346	7,038	0	11,730
		30.0%	40.0%	30%	0.0%	100%	3,519	4,692	3,519	0	11,730	

Source: JICA Study Team





Source: JICA Study Team

Figure 5.1.3: Ownership Ratio and Traffic Demand

### (3) Macro Analysis of Cross-Sectional Traffic Demands

By using the number of total trips estimated above, the OD (origin and destination) traffic volume was estimated with the population framework examined in the urban development strategy of this study. The OD traffic volume is distributed to a simple network, and the characteristics of the cross sectional traffic demands have been examined. The base of the traffic network for the cross sectional demand analysis is shown in Figure 5.1.4. Thirty three (33) townships in Yangon City and six townships around the city are put together into 9 zones and the traffic demands among the zones were estimated. The estimated distribution of population (11.7million) is shown in Table 5.1.4. It shows that zone No.5 has the biggest population with 2.0 million, followed by zone No.3 with 1.9 million, and zone No.7 with 1.4 million.

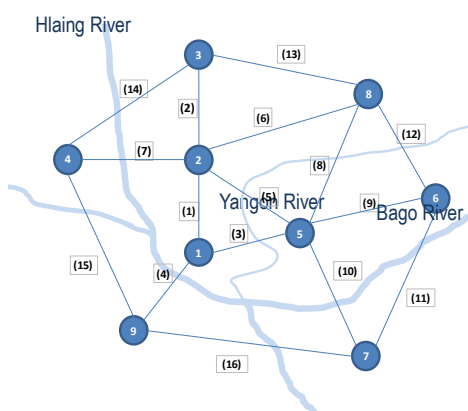


Table 5.1.4: Estimated Population (2040)

Zone No.	Township	Population (2040)
1	Latha, Lanmadaw, Pabedan, Kyauktada, Botataung, Pazundaung, Seikkan, Ahlone, Dagon, Kyeemyindaing, Sanchaung, Kamayut, Bahan, Mingalataungunt, Tamwe, Yakin	1,332
2	Hlaing, Mayangon, Insen	808
3	Mingaladon Shwepyitha, Hmawbi	1,974
4	Hlaringthayar, Htantabin	1,135
5	Dawbon, Thaketa, Thingangyun, South Okkalapa, North Dagon, South Dagon, Dagon Seikkan	2,048
6	East Dagon	895
7	Thanlyin, Kyauktan	1,397
8	North Okkalapa, Helgu	1,183
9	Dala, Seikkyee Khanaunglo, Twantay	957
	Total	11,730

Figure 5.1.4: Simple Network and Zones for Estimation of Cross-Sectional Traffic Demand

In order to estimate the OD traffic demand, the following two points are considered.

- (i) There are two types of zonal OD traffic, one is intra-zonal traffic and the other is inter-zonal. In this analysis, the intra-zonal OD is assumed to be 50% in the existing urban area (comparative size of zone is smaller than others) and 70-80% in the new urban development areas (zone sizes are larger) in the suburban area.
- (ii) In order to calculate the modal share of the OD traffic demand, the vehicle ownership ratio is placed at 50-100 pcu/1000 population. Remaining traffic demands are assigned to the public transport system including rail and bus. In the suburban areas, usage of motorcycle is also taken into consideration.

In this macro traffic demand analysis, as the capacity of traffic network is not considered, the estimated traffic volume will be potential or “desired” traffic demands among the zones based on the assumed traffic model indicators and socio-economic framework. Thus, in the first place, transport infrastructures may be examined to meet the demands, but in case the total investment for the infrastructure is not justified, this will be considered in the urban development strategies including socioeconomic framework and land use as well.

The cross sectional demands calculated are shown in Table 5.1.5.

- (i) Current traffic demands are mainly concentrated in two corridors connecting the existing urban center (CBD): the north-south corridor and corridor between CBD and Eastern Districts (South Okkalapa, Dagon). Traffic demand distribution in 2040 will drastically increase based on projected urban expansion, particularly in corridors linking the sub-urban centers. Traffic demands passing the Yangon River, Bago River and Hlaing River will also increase significantly.
- (ii) On the main corridor from CBD to North (Zone No.1, 2 and 3), the demands of Northern link will significantly increase due to the new CBD development in Mayangone (Zone No.2) and a projected increase of population in the northern townships. The corridor No.2 will have over 2 million trips and the number of passengers on the public transportation will be over 18 million people. These numbers are extremely large from the view point of the current situation. In order to provide sufficient capacity of transport infrastructure, two to three UMRT (Urban Mass Rapid Transit) lines will be required. To disperse CBD functions from the zone to other zones is also one of the measures to alleviate traffic demand concentration.
- (iii) From the CBD to Dagon (East) township, due to rapid increase in population, corridor No.3 will have 1.8 million trips. Public transportation, railway system in particular, will need major improvements to handle the huge traffic demand. Moreover, since the newly developed residential townships such as Dagon North, Dagon South and Dagon East are included in this zone No.5, it is essential to provide efficient feeder network system from the railway stations in order to ease the traffic congestion on corridor No.3 as well as to provide better accessibility from the residential area to the CBD.
- (iv) Traffic demand crossing the Hlaing River is estimated to be around 3 million trips per day. The reason for this large traffic demand is that the corridor is connected with the sub-centers, Hlaingtharya-Mindama-Dagon Myothit. Furthermore, two large urban areas, Hlaingtharya and Htantabin townships in Zone No.4 with population 1.1 million and Mingaladon, Shwepyitha and Hmawbi townships in the Zone No.3 with 2 million population, are located side by side crossing the Hling River generating the traffic demand connecting the two areas. It will not be easy to handle such huge volume of traffic demand which will require three railway lines at least and four to five road bridges. Therefore, urban development strategies for the regions will have to be re-examined.

- (v) In the opposite side of the CBD crossing the Yangon River, Dala Township also has a plan to have about 1.0 million population. It is expected that most of its population will be commuting to CBD area by crossing the river. Furthermore, connecting trips to Hlaing township and Thanlyin township will also be increased.
- (vi) To the opposite side of the Bago River, Thanlyin and Thilawa townships, the traffic demand will be increased 4 times of the current demand. It is estimated that 1.6 million trips per day will cross the river in line with the future urban economic corridor developments from Hlaingthayar, Mindama, Dagon Myothit and to Thanlyin and Thilawa. Some huge investments will be required to construct new river crossing infrastructure to provide smooth traffic flows for both passenger and goods.

**Table 5.1.5: Results of Macro Analyses for Cross-Sectional Traffic Demands**

	Existing (2011)	Future (2040)							
		Motorization Rate 50 cars per 1000 population			Motorization Rate 100 cars per 1000 population				
No. Trips (person trip)									
Public (bus, rail) (passenger)									
Car (pcu/day)									
Link No.	Trips (‘000 Person)	Public1) (‘000 Passenger)	Vehicle1) (‘000 Pcu)	Trips (‘000 Person)	Public1) (‘000 Passenger)	Vehicle1) (‘000 Pcu)	Trips (‘000 Person)	Public1) (‘000 Passenger)	Vehicle1) (‘000 Pcu)
(1)	652	596	113	1,073	1,368	192	1,703	1,047	320
(2)	661	612	107	2,114	1,801	192	2,114	1,514	306
(3)	1,028	937	183	1,829	1,438	239	1,829	1,058	390
(4)	(30)2)	(30)2)	0	922	798	67	922	677	113
(7)	419	385	71	1,715	1,427	144	1,715	1,161	250
(9)	367	336	65	1,100	900	105	1,099	713	179
(13)	271	259	33	673	528	94	727	445	151
(14)	679	631	128	2,892	2,461	218	2,892	2,069	374
(10)+(11)	412	383	64	1,609	1,394	142	1,609	1,202	197

Source: JICA Study Team

Note: 1) Public transport includes rail and bus (vehicle: cars and buses for passengers only, not including trucks, M/C, and other transport vehicles)

2) Number of passengers on the ferry transport

(4) Road Traffic Demand

Next issue of the macro traffic demand analysis is the demand for road network development for the trunk road network including main roads, highways and secondary roads. The vehicular traffic demand in terms of vehicle-km will be obtained roughly from distributing the OD traffic volume on the simplified traffic network. There is at present a total of 603 km of trunk roads network which is obtained from the JICA digital map 2012. Result of the analysis is shown in Table 5.1.6.

**Table 5.1.6: Existing and Future Road Development Levels in Yangon**

Motorization Rate (per 1000 population)	Vehicle-km (thousand pcu-km)	Existing Road Length (km)	Existing Road Capacity (thousand pcu-km)	Level of Traffic Congestion	Necessary Road Length to Meet Future Traffic Demand (km)
Now	25	16,800	24,000	0.70	-
Future (2040)	50	35,300		1.45	880
	100	55,300		2.30	1,380

Source: JICA Study Team

If an average number of lanes on the existing roads are assumed as 4 lanes and the capacity of one lane is 40,000 pcu-km per day, a total existing road capacity will be estimated as 24 million pcu-km. While the existing passenger vehicle demand is approximately 16.8 million pcu-km which is obtained from the macro traffic assignment, the traffic congestion ratio on the existing roads was estimated to be around 0.7. In 2040, passenger car traffic demand would be 35.3 million pcu-km and 55.3 million pcu-km for motorization rate 50 and 100 passenger car per 1000 population respectively. If the future demands are assigned on the existing road network, the congestion level will be 1.45 and 2.30, which will induce more serious traffic congestions. In order to provide a sufficient road network in future, at least 880 km or 1,380 km of trunk roads network will be required.

Next, based on the cross sectional traffic demands, a necessary number of lanes on the major corridors have also been analyzed. The demand estimated before is just for the passenger car and excludes that for truck and other vehicles for goods transport. Therefore, in order to calculate the necessary number of lanes, the demands are increased by 30% to allow for goods transport demand. Results of the analysis on the necessary number of lanes in future urban development strategies are shown in Table 5.1.7. In the current situation, the number of car lanes in most of the cross sections is supplying the demand except for the Hlaing River section. In the future, most of the sections will require more car lanes which will be 1.5 to more than 2.0 times of the existing number of car lanes.

For example, the traffic demands crossing the Bago River (link No. (10)+(11)) will need at least 20 car lanes in the future, which will be equivalent to two bridges with 6 car lanes and two bridges with 4 car lanes. At present, there are a total of 6 lanes including one bridge with 2 lanes and the newly constructed bridge with 4 lanes, thus additional 14 lanes will be needed in the future. However, it might be difficult to justify the construction of another 14 car lanes bridges. Therefore possible solution would be to construct two new bridges providing additional 10 lanes and remaining demand should be transferred to railway or integrated into the intra-zonal traffic through the enhancement of independent urban economic activities in the areas.

**Table 5.1.7: Necessary Car Lanes Calculated from the Cross-Sectional Traffic Demands**

Link No.	Traffic Demand ('000 pcu/day)			Current Car Lanes	Necessary Car Lanes		
	Now	2040			Now	2040	
	Motorization Rate				Motorization Rate		
	MR25	MR50	MR100		MR25	MR50	MR100
(1)	147	250	416	24	16 (0.7)	25(1.1)	42(1.8)
(2)	139	250	398	16	14 (0.9)	25(1.6)	40(2.5)
(3)	220	311	507	24	24 (1.0)	32(1.3)	51(2.2)
(4)	0	87	147	0	0	9(-)	15(-)
(7)	85	187	325	6	9(1.5)	19(3.24)	33(5.5)
(9)	78	136	232	6	8(1.3)	14(2.3)	24(4.0)
(13)	40	122	197	4	4(1.0)	13(3.3)	20(5.0)
(14)	43	96	162	4	5(1.2)	10(2.5)	17(4.3)
(10)+(11)	82	185	256	8	8 (1.0)	19(2.5)	26(3.4)

Source: JICA Study Team

#### (5) Feedback to the Urban Development Strategy

As discussed above, the development of a mega city with 10 million population will need a large amount of investment for the transport infrastructures to cope with huge amount of traffic demands. It is apparent that transport system has to play a significant role in the urban development in Yangon. Therefore it is necessary to further develop an integrated transport network so as to maximize the efficiency of the huge investment.

Urban areas in Yangon are separated by rivers and channels, thus huge investment will be required to cross the rivers. Single core urban structure will generate huge amount of inter-zonal traffic demand and require huge infrastructure development, while multi cores urban structure will be able to encourage intra-zonal activities and reduce the inter-zonal traffic demand. Even so, the UMRT system for inter-zonal traffic particularly for passengers will be indispensable as a main framework of the transport network system connecting the urban cores with each other. It is thus recommended to promote urban development along the proposed UMRT lines, so that the effectiveness of the huge investment would be higher.

#### 5.1.2 Development Policy

Sector Vision	<b>Realization of An Environment-friendly, Comfortable and Convenient Transport System (High Mobility and Reliable Transportation System Led by Modernized Urban Railway, and Contribution to Promote Planned New Urban Development)</b>
Basic Policy	<ol style="list-style-type: none"> <li>1) Development of A Functional Road Network as Urban Backbones (incl. Logistic Routes)</li> <li>2) Increase People's Mobility through the Effective Public Transport System led by the Urban Mass Rapid Transit (UMRT)</li> <li>3) Realization of a Safe, Environment-friendly and Comfortable Transport System</li> <li>4) Development of Appropriate Traffic Demand Management Systems</li> <li>5) Organizations/Institutions and Capacity Building for Creating and Maintaining A Comprehensive Transport System in the Greater Yangon</li> </ol>

Compared to other major cities in South East Asian countries, traffic demand in Yangon is not so high at present and the traffic accidents caused by motor cycles which are dominant in other Asian cities are also not very many, partly because there is the government regulation on the vehicle import and the restriction for the use of motorcycle.

As mentioned in the previous section, people's mobility in Yangon is low. Bus serves as the prime mode of transport for their personal mobility, in particular, to and from places of work. However, bus system is beleaguered with perennial problems and services provided are often regarded as inadequate. This results in people preferring to live near their places of work, particularly in old and narrow houses around the CBD area.

Recently, the foreign investments in Myanmar are growing rapidly in parallel with the relaxation of economic sanctions. New industrial zones and the urban development projects will be constructed around the urban area of Yangon Region. The current population of 6 million is projected to increase up to 11.7 million in 2040. Ownership and use of the motor vehicles will expectedly expand along with increasing urban size, population, economic activities and incomes.

There are some major cities which have more than 10 million population such as Bangkok, Manila and Jakarta. Those cities have the common urban transport problems such as serious traffic congestion and accompanying air pollution, traffic accidents, among others. The shortage of available parking spaces in the urban centers is also a serious problem in those cities. Although the respective city governments attempt to promote the use of public transportation by way of controlling or regulating the private mobility, these may not automatically result in a fast modal shift from the private to public modes due to the convenience of using private cars which provide for "door-to-door" transfer of passengers. Consequently, some of the countries give a high priority to develop urban mass transit system.

In the urban area of Yangon, urban development projects will be started in the near future. Lessons learned from other cities will be useful to formulate the strategy for integration of urban transport and urban planning. In this study, with the promotion of the existing traffic regulation, the following five planning ideas are proposed with the basic underlying theme of "Realization of an Environment-friendly, Comfortable and Convenient Transport System."

- (i) Development of Functional Road Network as Urban Backbones (incl. Logistic Routes)
- (ii) Increase People's Mobility through the Effective Public Transport System led by the Urban Mass Rapid Transit (UMRT)
- (iii) Realization of a Safe, Environment-friendly and Comfortable Transportation System
- (iv) Development of Appropriate Traffic Demand Management Systems
- (v) Organizations/Institutions and Capacity Building for Creating and Maintaining the Comprehensive Transportation System in the Greater Yangon

1) Development of Functional Road Network as Urban Backbones

The existing road network of the Greater Yangon is characterized as a combination of both a radial road system (CBD to suburbs) and a grid road system in CBD. However, existing road network pattern will not function to promote or to support the future urban development for the year 2040.

The future road network configuration and its size shall be determined by the future urban structure and land-use plan. The requirements in widening of existing roads and directions/ locations/ size of new roads and bridges also depend on the future traffic movement patterns which will be generated from/ attracted to the new residential/ commercial and industrial areas. The results of preliminary traffic demand forecast showed that quite large traffic demands will emerge not only on north-south direction but also on east-west direction in the future when the planned urban structure is realized. The existing road network cannot handle such large magnitude of traffic demands which will be generated from more than 10 million population. Therefore, formation of a high capacity road network sufficient to accommodate future traffic demands is essential to support and to guide the targeted future urban development.

2) Increase in People's Mobility through the Effective Public Transport System led by the Urban Mass Rapid Transit (UMRT)

According to preliminary results of the Household Interview Survey (HIS) for this Study, about 34% of respondents replied that the main cause of current traffic congestion is the increasing usage of automobiles, followed by lack of roads (26%). At the same time, almost all respondents (99%) agreed with the necessity for expansion of public transport services. The types of public transport desired are Bus Rapid Transit (BRT, 38%), Urban Railway (elevated or underground, 23%), and Ordinary buses (28%). The existing Circular Railway is supported by only 7.6% of respondents if the present service level is not improved. Also, regarding the current bus services, about 50% of people feel uncomfortable due to the very crowded situation onboard. These results indicate that many people await high quality (comfortable), high capacity (no-congestion in buses), and high speed public transport.

3) Realization of a Safe, Environment-friendly and Comfortable Transportation System

Improvements and expansion of road network are necessary not only to handle the future increasing traffic demand, but also to ensure safety, comfort, and better environment (minimize pollution and noise). Traffic accidents in CBD and on the main roads in other townships are urgent issues to be addressed. Well-managed and modernized railway systems including UMRT and LRT will provide a safe, comfortable and environment-friendly transport services.

4) Development of Appropriate Traffic Demand Management System

Traffic Demand Management (TDM) is one of effective measures for the urban transport sector. The basic idea of TDM will be discussed further in 5.1.4 of this chapter.

5) Organizational/ Institutions and Capacity Building for Creating and Maintaining the Comprehensive Transportation System in the Greater Yangon

Organizational and institutional framework (laws/regulations) is another important component in the implementation and maintenance of the urban road network and other transport infrastructure. The urban transport system consists of all related transport modes and facilities such as roads, railways, ports, inland water, private cars, buses, trucks and ferry services which are now operated and managed by different organizations/agencies. However, in order to implement a comprehensive transport system, coordination, cooperation and connectivity between each organization are very important. Therefore, an alternative idea of new organizations and institutional framework shall be considered together with capacity development.

### 5.1.3 Development Goals and Target Effective Indicator

Table 5.1.8 shows the indicators of the development goals of the transportation sector that corresponds to the underlying theme of “Realization of an Environment-friendly, Comfortable and Convenient Transport System (High Mobility and Reliable Transportation System led by Modernized Urban Railway, and Contribution to Promote Planned New Urban Development).”

**Table 5.1.8: Development Goals and Effect Indicators (Urban Transport)**

Development Goal	Effect Indicators
a) Increase in mobility	Average speed in peak hours (10 km/hr → 25 km/hr)
b) Traffic safety	Accident rate/ 10,000 vehicles (Bus : 749 → 75) (Total: 96 → 10)
c) Transport modal share	Rail Transport: 30%
d) Vehicle ownership	50 passenger cars per 1000 population (or to control the use of private modes of transport equivalent to the vehicle ownership rate)

Source: JICA Study Team

### 5.1.4 Preliminary Development Plan

#### (1) Preliminary Development Plan

In accordance with the basic concept, the strategies to achieve the target goal is formulated. The target area is divided into three subject areas to discuss the development planning ideas as 1) central area, 2) existing urban area, and 3) new urban area. Furthermore, the strategy on the 4) logistics for the promotion of the industrialization which will be the base of the economic growth is also examined.

#### 1) Central Area

Regarding the development of the transport system in the central area, the following five (5) main strategies are proposed:

- i) Effective use of the existing infrastructure
- ii) Harmonization with the historical buildings
- iii) Promotion of the waterfront development
- iv) Management of the traffic demand and traffic flows
- v) Intra-zonal public transport system in the CBD centered on Yangon Central Railway Station

As there are a number of historical buildings in the CBD area, existing infrastructure needs to be used efficiently rather than the construction of the new infrastructures. On the other hand, to make the CBD area more attractive, the promotion of urban redevelopment is needed. Public transportation system which circulates in the CBD area originating and ending at Yangon Central railway station can help to increase the mobility in the CBD area. The management of the traffic flow is also necessary. In order to control the traffic demands in CBD area, the traffic flow can be monitored and managed by the traffic operation center. Additionally, implementation of a comprehensive parking policy and construction of public parking space are also necessary in this area since lack of available parking spaces will create problems in near future.



2) Existing Urban Area

For the existing urban area around northern part of CBD such as Hlaing and Okkalapa township, the following four (4) main strategies are proposed in order to support the corridor development from the Hlaingthayar to Mindama, Dagon Myothit, Thanlyin and Thilawa.

- i) Improvement of the road network (East-West main road and North-South main road, construction of bridges)
- ii) Construction of the over-bridges on the existing railway crossing
- iii) Upgrading of the circular railway and construction of East-West railway
- iv) Restructure of the existing bus network and construction of new urban transit system (UMRT, LRT and BRT, etc)

Since the urbanization in this area has started, the function of new transport system as a developing corridor needs to be improved more. Especially the development project for the East-West main road and railway which will provide effective connection between proposed new urban centers are important. Furthermore, the circular railway which will enhance the accessibility to CBD area also needs to be utilized strategically.

The macro analysis in the previous section reveals that the traffic volume will concentrate in this area. Therefore, it is necessary to construct the over-bridges to promote the smooth traffic flow. It is also important to ensure the accessibility among the satellite towns by restructuring of existing bus routes and introducing of new transport system. The traffic volume crossing Hlaing River and Bago River will be increased and therefore, the new bridges need to be constructed.

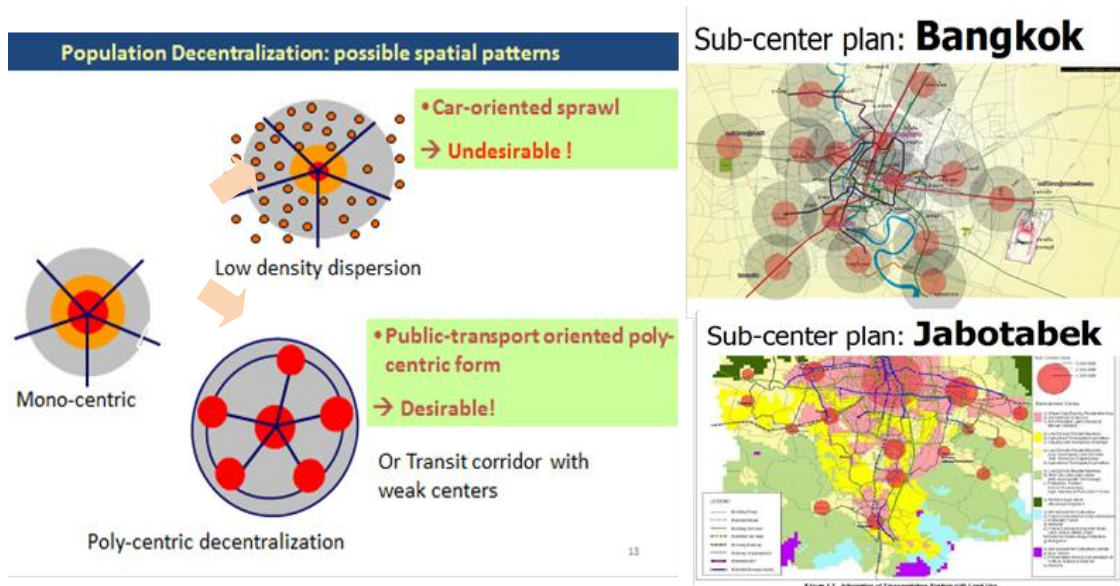
3) New Urban Area

For the new urban development area, the following 5 strategies are proposed.

- i) Promotion of TOD (Transit Oriented Development) focusing on UMRT
- ii) Protection of the environment of residential area and construction of the circular main road network
- iii) Diversification of the traffic situation, including the bicycle use
- iv) Development of TDM (Transport Demand Management)
- v) Preservation of existing nature and improvement of living environment

It is essential to promote the TOD policy for the new urban development area to optimize the effectiveness and efficiency of the public transportation system. Meanwhile, the outer ring road is also needed to construct the road network covering the satellite towns efficiently. More importantly, it is also vital to encourage bicycle usage which is the most environment-friendly mode of transportation in order to maintain the green environment since this area has much more green environment compared to the CBD area.

TOD refers to residential and commercial centers designed to maximize access by transit and non-motorized transportation, and with other features to encourage transit ridership. A typical TOD has a rail or bus station at its center, surrounded by relatively high-density development, with progressively lower-density spreading outwards 0.5-2.0km, which represents pedestrian scale distances.



Source: Urban Transport Policy in Asia Megacities (Dr. Shigeru MORICHI)

**Figure 5.1.5: Concept of the Transit Oriented Development (TOD)**

Another important transport policy in Yangon is Transport Demand Management (TDM). TDM is the application of strategies and policies to reduce travel demand (specifically that of single-occupancy private vehicles), or to redistribute this demand in space or in time. The term TDM has its origins in the United States in the 1970s and 1980s. The concepts of TDM borrowed from mainstream transport planning in Europe, which is sometimes referred to as Mobility Management in Europe. Many cities outside the United States and Europe have also consistently taken a demand management approach to transport and land use planning, notably Curitiba, Brazil, Portland, Oregon and Vancouver, Canada and also in Asian megacities, such as Singapore, Bangkok, Manila, among others. Table 5.1.9 classifies a number of TDM measures aimed at influencing people travel behavior. As discussed before, existing transport related policies in Yangon such as controlling number of vehicle registration and prohibition of motorcycle in the urban areas are among the TDM measures. However, because of the expected huge amount of traffic demand and urbanization, more strategic and comprehensive TDM measures will be significant in Yangon.

**Table 5.1.9: TDM Measures**

Type	Measures
Economic Measures	<ul style="list-style-type: none"> <li>● Fuel tax, road user charge</li> <li>● Parking charge</li> <li>● Subsidizing public transport, etc.</li> </ul>
Land Use	<ul style="list-style-type: none"> <li>● Land use and transportation strategies such as car-free developments, and finding the right location for the new developments</li> <li>● Park and ride facilities, etc.</li> </ul>
Information for Travelers	<ul style="list-style-type: none"> <li>● Travel information before a trip is undertaken</li> <li>● Car sharing, etc.</li> </ul>
Alternative Communication Methods for Travel	<ul style="list-style-type: none"> <li>● Tele-working</li> <li>● E-shopping, etc.</li> </ul>
Administrative Measures	<ul style="list-style-type: none"> <li>● Parking controls</li> <li>● Pedestrianized zones</li> <li>● Alternative working patterns, etc.</li> </ul>

Source : JICA Study Team

4) Logistics

The strategies on the logistics to promote industrialization are as follows.

- i) Replacement of port to the suburban area
- ii) Strengthening of the port function (extension of the scale and optimization)
- iii) Capacity for container ship
- iv) Strengthening of inland water transport system
- v) Strengthening of sea line safeness

Industrialization is essential for Myanmar's economic growth and it will be the prime mover for urbanization. In order to promote industrialization, the replacement of port and capacity development is necessary. Medium- and small-sized port facilities and the other industrial facilities are currently utilizing along the Hlaing River, Yangon River and Bogo River. However, for the future, the port facilities need to be modernized and connected with railways and main roads. In addition, it is also necessary to select the place for industrial park to efficiently transfer the investment from overseas. By promotion of the redevelopment of the existing port facilities and industrial areas, water front will become the new urban spaces. IWT will also contribute to mitigate the traffic congestion.

(2) Proposed Infrastructure

The basic principles of development for the transport sectors are shown in Table 5.1.10.

**Table 5.1.10: Basic Principle for Time-wise Development for Transport Sectors**

	Period	Basic Strategy	Public Transport System	Road/ Logistic Network	Traffic Demand Management and related Facilities	Institutions, Organizations, Human Development
Basic Policies by Each Period	Short Term (2018)	<ul style="list-style-type: none"> <li>Promotion of Symptomatic treatments for urgent measures</li> <li>Arrangement of organizations and systems for Medium and Long term development</li> <li>Human development (A rapid economic development may proceed together with foreign direct investment under the insufficient infrastructure condition. Symptomatic treatments are necessary for urgent projects. At the same time, a large scale project like the Thilawa industrial zone will take place in this short period)</li> </ul>	<ul style="list-style-type: none"> <li>Modernization of Circular Railway (Improvement and electrification)</li> <li>Restructure/ Re-network of bus routes (including improvement of access to Circular Railway)</li> <li>Improvement of bus services in towns/communities (Zone bus system, etc.)</li> <li>Development of bus-interchange system and facilities</li> <li>Restructure of bus routes by introducing BRT</li> </ul>	<ul style="list-style-type: none"> <li>Construction of flyovers at intersections (CBD &amp; Main roads)</li> <li>Improvement of Bottleneck Point such as old/narrow bridge</li> <li>Strengthening of road maintenance and management</li> <li>Construction of traffic safety facilities including medians on main roads</li> <li>Improvement of bus stop facilities</li> <li>Expansion and construction of port</li> <li>Renovation of shipyards</li> <li>Containerization of inland water transportation</li> <li>Replacement of old vessels</li> <li>Rehabilitation of embankment</li> </ul>	<ul style="list-style-type: none"> <li>Policy of Traffic Demand Management (control of car ownership, restriction of car usage and parking control)</li> <li>Improvement of traffic signal operation system</li> <li>Road Information system (cooperation with private sector)</li> <li>Education for traffic safety and safety driving</li> <li>Reinforcement of control of traffic offences/violation</li> </ul>	<ul style="list-style-type: none"> <li>Establishment/enactment of Yangon Urban Transportation Facility Law</li> <li>Establishment of Bureau of Urban Transport Planning, and capacity development</li> <li>Strengthening of organization for roads &amp; bridges maintenance and management</li> <li>Survey on institutional operation system</li> <li>Survey on institutional framework for BOT and PPP</li> <li>Strengthening of organization for approach channel maintenance and management</li> <li>Improvement of navigation safety</li> </ul>
	Medium Term (2025)	<ul style="list-style-type: none"> <li>Development of infrastructure to promote Medium/ Long Term Urban Development Concept</li> <li>Expansion of public transport network to development centers in suburbs</li> <li>Modernization of transport system in existing urban area (Comprehensive transportation system is required with combinations of railways, new public transport, and TDM policies as urbanization will be expanded and economic activities will be accelerated in existing urban area)</li> </ul>	<ul style="list-style-type: none"> <li>Construction of urban railways, new public transport system (existing urban area)</li> <li>Construction of intermodal terminals (promotion of urban development accompanied with public transport system)</li> <li>Construction of circular LRT in CBD</li> </ul>	<ul style="list-style-type: none"> <li>Construction of 2nd Main Rd.No.3</li> <li>Construction of Outer Ring Road</li> <li>Improvement of Main Rd.No.2</li> <li>Construction of East - West Road (Hlaing-Dagon)</li> </ul>	<ul style="list-style-type: none"> <li>Traffic Demand Management policy (Charging fees)</li> <li>Expansion of traffic control system</li> <li>Construction of intermodal facilities</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of vehicle related tax system, Institutional framework for Traffic Demand Management</li> <li>Establishment of institutional framework for public transport subsidizing</li> <li>Establishment of Traffic Impact Assessment Law</li> <li>Organizations for urban railway operation and management</li> <li>Organization for public bus operation and management (PTA controlling both railways and bus systems)</li> <li>Establishment of Toll Road Development Authority</li> <li>Traffic control center</li> <li>Establishment of ITS Myanmar</li> <li>Digitalization of vehicle registration and licenses</li> <li>Review of ship related Taxation system</li> <li>Establishment of Directorate of river ship operation and management</li> </ul>
	Long Term (2035)	<ul style="list-style-type: none"> <li>Development of infrastructure to promote long term urban development concept</li> <li>Expansion of public transport network to new urban area in suburbs</li> <li>Construction of wide area trunk road network</li> <li>Integration with nationwide transport system (Establishment of functional transport system for realization of the urban development concept for 10 million population city)</li> </ul>	<ul style="list-style-type: none"> <li>Construction 2nd Circular Railway</li> <li>Construction of urban railway, new public transport system (New Urban Area)</li> <li>Construction of intermodal terminals (Urban development accompanied with public transport system)</li> </ul>	<ul style="list-style-type: none"> <li>Construction of Outer Ring Road</li> <li>Construction of East - West Road (Hlaing-Mingalardon)</li> <li>Construction of deep sea port (offshore development)</li> </ul>	<ul style="list-style-type: none"> <li>Construction of intermodal facilities</li> </ul>	

Table 5.1.11 shows the result of examination of the projects corresponding to the above strategies. Since the railway, road, port and logistics are shown in the other sections of this report, mainly the bus transportation and traffic demand are examined in this section.

The estimated costs are for the investment to achieve the target of urban development. It should be noted that these are the reference for the urban development and not estimated based on the detailed plan. The investment cost for traffic system environment excluding the big scale construction, such as railway and bridges, is around US\$ 750 million.

**Table 5.1.11: Investment Cost for Projects on Traffic System (Excluding Railway, Road, Port and Logistics)**

Program/ Project	Contents	Investment Cost (million US\$)	Remarks
<b>a. Road-Related Public Transport System Improvement Program</b>			
Restructuring of passenger bus network	- Restructuring of passenger bus network - Introduction of functional network system including bus zones - Re-organization of bus operation companies	3.0	
Modernization of the passenger bus services	- Renewal of bus fleets - Provision of information to the passengers and introduction of smart card - Operation management by GPS and traffic safety management	50.0	
Prioritization of passenger bus transportation	- Introduction of bus lane - Introduction of bus-priority traffic light	15.0	3 lanes
Development of bus interchanges	- Connecting point of major bus routes - Construction of facility for transfer passengers	20.0	10 points
Development of bus terminals	- Construction of bus terminals for each urban area	20.0	4 points
BRT system development	- Introduction of BRT system in the north-south urban development corridor	200.0	2 lanes
Development of public transportation system in the CBD	- Circular bus or LRT in the CBD - Traffic restriction of private vehicles	100.0	1 lane
<b>b. Mitigation of Traffic Congestion and Traffic Safety Development Program</b>			
Traffic congestion mitigation project	- Improvement of existing traffic bottlenecks - Installation of traffic signal and improvement of intersection geometry	20.0	10 bottle necks
Intersection Grade-separation Project	- The intersections of main roads with traffic congestion	150.0	10 points
Modernization of traffic control and management system	- Introduction of Area Traffic Control System, provision of information about traffic conditions	50.0	Urban center
Improvement of traffic safety facility	- Provision of the center barrier on the main roads - Construction of pedestrian bridges - Traffic enforcement, installation of traffic lights	20.0	Main road
Improvement of areas for pedestrian in the CBD	- Enforcement of the street vendors, barrier-free pedestrian facilities - Development of pedestrian mall (shopping arcade)	5.0	
Traffic safety education and propaganda	- Traffic safety education and propaganda - Capacity development of traffic safety committee	3.0	
Enhancement of traffic enforcement	- Provision of enforcement equipment incl. camera - Reform the laws and regulation on road traffic - Simplification of traffic violation ticket	20.0	
Development of traffic accident database and traffic safety audit system	- Development of database for traffic accident - Development of Traffic Safety Audit system	5.0	
<b>c. TDM and Parking Policy Development Program</b>			
Computerization of vehicle and license registration	- Computerization of vehicle registration and driving license	5.0	
Transport demand control in the CBD	- Pricing and registration control, etc. - Control of motorcycle use	20.0	

Program/ Project	Contents	Investment Cost (million US\$)	Remarks
Development of public parking and guidance system in CBD	- Effective use of government vacant lands - Construction of multi-story parking area - Parking information system and enforcement	30.0	
Reform of law and regulation on traffic management and TDM	- Traffic impact assessment - Garage Law, compulsory parking facilities - Laws and regulation on traffic management	1.0	
<b>d. Development Program for Human Resources and Organizations</b>			
Yangon Urban Traffic Planning Unit	- Planning and monitoring of urban transport system - Updating of urban transportation database	5.0	
Public Transport Authority (PTA)	- Management of public transportation system - Policy development for public transport system	5.0	
Traffic Control and Information Center	- Operation of traffic control center - Provision of traffic information	3.0	
	Total	75.0	

Source: JICA Study Team

### (3) Implementation Schedule

The implementation schedule for urban transport sector projects (excluding railway, road network and ports/inland water transport) is shown in the table below. The basic preconditions to establish the implementation schedule are as follows:

- (i) It is assumed that urgent projects will be completed within 2-3 years from the commencement of the feasibility study. Short term project will be defined as the projects implemented by 2018 and Mid-term projects will be the projects which will be started after 2018.
- (ii) Most of the projects discussed in this section will be categorized into the software components in contrast with hardware components such as road, railway and port infrastructure development projects. In addition, most of the projects will be essential to mitigate current traffic problems or indispensable components for the future transport issues which shall be developed in advance such as TDM policies, Parking policy, human resource development, etc. Therefore, those projects should be implemented in the earlier period before expansion of motorization.
- (iii) Only Traffic Control and Information Centre will be implemented in the later stage because the advanced computerized system will require not only huge investment cost but also operation and maintenance cost yearly. At the present limited fund resources, it will be difficult to operate this system.
- (iv) The proposed projects are inter-related with each other. For example, the bus network restructure project shall be in coordination with the bus terminal and interchange developments. Moreover, in order to develop effective network system, the role of Public Transport Authority (PTA) may be significant. Traffic Demand Management will affect parking policies and traffic management system as well. Therefore, more detailed examination based on reliable transport data will be required.

**Table 5.1.12: Implementation Schedule (Urban Transport)**

Implementation Schedule		Status	Implementation Schedule													
No.	Project Name		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2040
1	Restructuring of passenger bus network	Short-term		█	█	█	█	█	█	█	█	█	█	█	█	
2	Modernization of the passenger bus services	Short term		█	█	█	█	█	█	█	█	█	█	█	█	
3	Prioritization of passenger bus transportation	Short term		█	█	█	█	█	█	█	█	█	█	█	█	
4	Development of bus interchanges	Short term		█	█	█	█	█	█	█	█	█	█	█	█	
5	Development of bus terminals	Short term		█	█	█	█	█	█	█	█	█	█	█	█	
6	BRT system development	Short-Mid		█	█	█	█	█	█	█	█	█	█	█	█	
7	Development of public transportation system in the CBD	Short term		█	█	█	█	█	█	█	█	█	█	█	█	
8	Traffic congestion mitigation project	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	
9	Intersection Grade-separation Project	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	
10	Modernization of traffic control and management system	Mid term					█	█	█	█	█	█	█	█	█	
11	Improvement of traffic safety facility	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	
12	Improvement of pedestrian environment in the CBD	Short term		█	█	█	█	█	█	█	█	█	█	█	█	
13	Traffic safety education and propaganda	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	
14	Enhancement of traffic enforcement	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	
15	Development of traffic accident database and traffic safety audit system	Short term		█	█	█	█	█	█	█	█	█	█	█	█	
16	Computerization of vehicle and license registration	Short term		█	█	█	█	█	█	█	█	█	█	█	█	
17	Transport demand control in the CBD	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	
18	Development of public parking and guidance system in CBD	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	
19	Reform of law and regulation on traffic management and TDM measure	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	
20	Yangon Urban Traffic Planning Unit	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	
21	Public Transport Authority (PTA)	Short term		█	█	█	█	█	█	█	█	█	█	█	█	
22	Traffic Control and Information Center	Mid term					█	█	█	█	█	█	█	█	█	

< Legend >

█ : Feasibility Study

█ : Detailed Design, Tender Preparation, Tendering

█ : Construction/Institutional Development/Capacity Deve.

█ : Commencement of Operation

Source: JICA Study Team

(4) Priority Projects

Most of the proposed projects discussed above will be categorized into “Urgent” or “Short Term”, except for Traffic Control and information Centre project. Project components and rough estimate investment cost are shown in Table 5.1.11.

## 5.2 Road Network

The proposed infrastructure development concept for the transport sector (urban transport, road network, railway, port and logistic) is summarized in Figure 5.1.1 of this chapter. Appendix 1.1 (three sheets of A3 size) is an enlarged figure of Figure 5.1.1.

### 5.2.1 Demand Analysis

The preliminary traffic demand forecast (Macro Traffic Demand Analysis), presented in Section 5.1: Urban Transport, revealed that high road traffic demands will be generated from more than 10 million population in 2040. This is expected even if the UMRT share (railway, LRT, BRT) for total passenger traffic is increased from the current 3% to 30% in 2040. The demand-supply gaps are checked on eight selected cross sections (screen lines: Figure 5.2.1), comparing the current number of car lanes and future requirement of additional lanes as shown in Table 5.2.1.

**Table 5.2.1: Future Lane Requirement at Main Cross Section**

Cross Section No.	Current No. of lanes	Lane requirement in 2040 (*)	Shortage of No. of lanes in 2040
L(1) : north – south : Inner Urban Area	24	26	2
L(2) : north – south : Suburbs	16	26	10
L(3) : northeast : Pazundaung Creek	24	32	8
L(9) : northeast : Along Main Rd.No.2	6	14	8
L(10+11) : west – east : Bago River	8	20	12
L(7+14) : west – east : Hlaing River	10	30	20
L(4) : CBD - Dala	0 (Car ferry)	10	10
L(13) : west – east : Along future Outer Ring Road	4	14	10

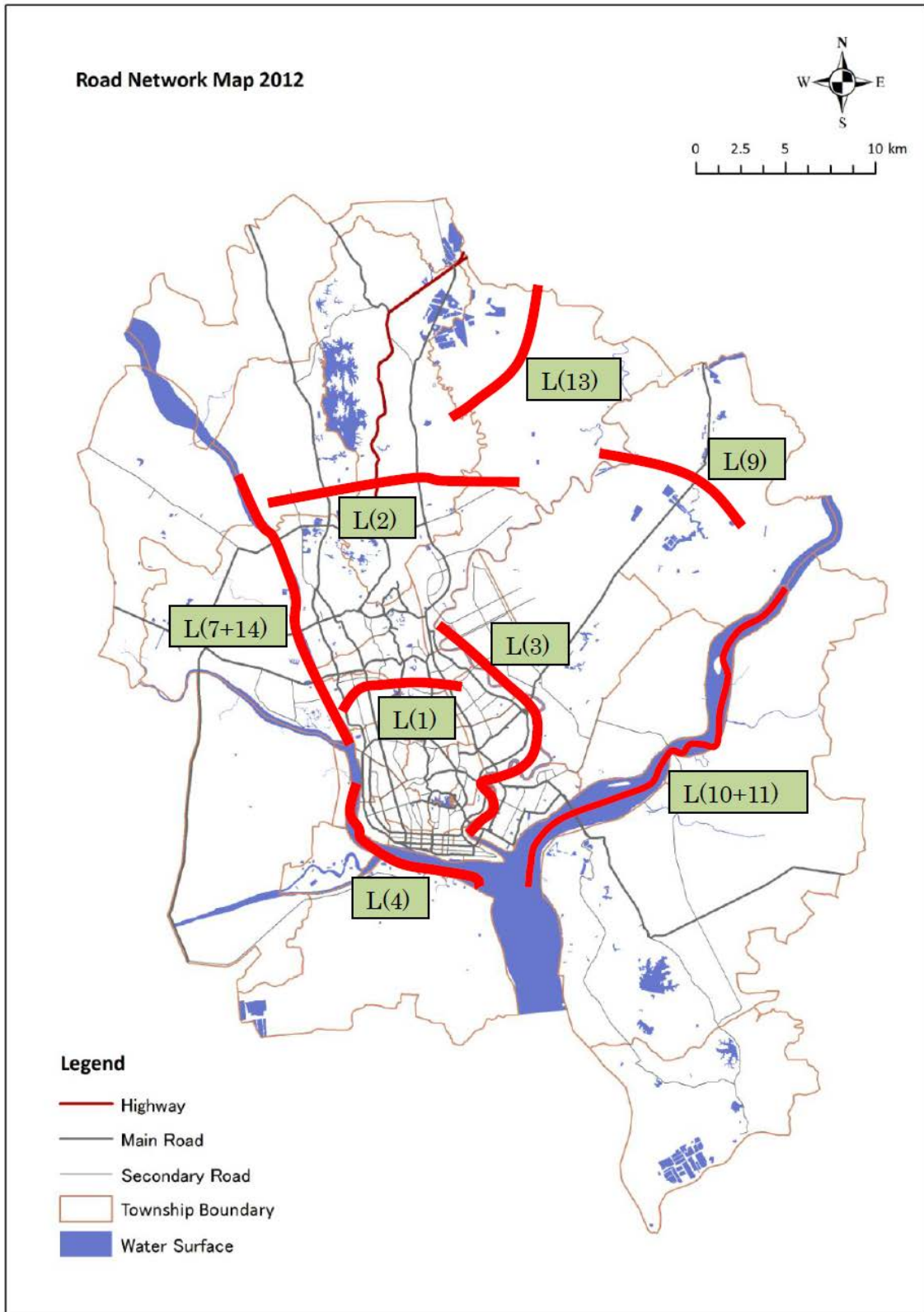
Source: JICA Study Team

Note: (\*): Motorization Rate = 50/1000 population

Although the above results are based on the preliminary forecasts and more detailed analyses should be carried out, these results can provide some insight information on the necessary expansion of future road networks when the proposed urban development vision and urban structure plan are realized in 2040. It is forecasted that future road traffic demands will exceed the current road capacity for every direction.

Special attention should be given to river crossing bottlenecks. The traffic demand of the Hlaing River and Bago River crossings will require additional 20 lanes and 12 lanes, respectively by 2040. The formation of future road network should be done in reference to the results above and in conformity with proposed future urban structures.





Source: JICA Study Team

Note: Numbers in parentheses indicate route numbers shown in the macro traffic demand analysis.

**Figure 5.2.1: Cross Sections for Checking Demand-Supply Gaps**

## **5.2.2 Development Policy**

### **(1) Necessity for a Comprehensive Development Policy**

The review of the current conditions of the road sector and public transport illustrates various problems which affect local residents and their daily socio-economic activities. Traffic congestion in most of the sections and intersections of main roads are getting worse during peak hours due to higher traffic demand which is beyond the present capacity and concentration of traffic to the CBD via the limited north-south main roads (bottleneck points). The existing circular railway does not function as a mass transit due to its old facilities and inefficient operation system. The bus transport services are the dominant transport mode, particularly for people who do not own cars. However, public passenger buses are already very much congested and uncomfortable. Also, an increase in the number of buses will result in further congestion of roads. Traffic conditions in the CBD are also facing problems such as insufficient public parking space, unsystematic signal operation, and higher traffic accident rate by buses. No comprehensive traffic demand management (TDM) is taken at present.

If these situations are left as it is, more severe conditions described below will take place in the near future:

- (i) Urbanization will be accelerated along the north-south main roads which will consequently increase the trip length and volume of traffic to/from CBD. It will cause the spread of congestion in almost all road sections not only in the peak hours but almost all day long. As a result, accessibility to/from CBD will be significantly reduced.
- (ii) Decrease in accessibility to/from CBD and reduced public mobility will weaken and stagnate the socio-economic activities and urban functions of Greater Yangon. Under these conditions, urban environment will be aggravated. Sustainable regional and national economic development will also be difficult to achieve.
- (iii) The Greater Yangon has been given the position to become an international hub city as a center of Myanmar. However, without improving the current conditions of the transport sector, the international competitiveness of Greater Yangon will weaken. As a result, foreign direct investments (FDIs) may be adversely affected.

Under this situation, it is not effective to tackle only the road sector alone. In order to address or overcome this problem, a comprehensive transport development policy is required. It aims to combine all possible measures covering not only the road sector but also public transport and port/logistic sector together with the creation of a strong institutional and regulatory framework.

### **(2) Sector Vision and Basic Policy for Medium and Long Term**

The following planning ideas and basic policies were derived based on the review of current conditions of existing transportation infrastructures, preliminary traffic demand forecast and the development vision of future urban structures for Greater Yangon (Structure Plan) as explained in Chapter 3. In addition, results of the Social Survey were also referred.

These basic policies were prepared for short (until 2018), medium (until 2025) and long term (up to 2035/2040) periods to keep consistency with the future urban development plan.

On the other hand, the short term policies to solve the issues/problems that are currently occurring were prepared separately as urgent and symptomatic treatments.

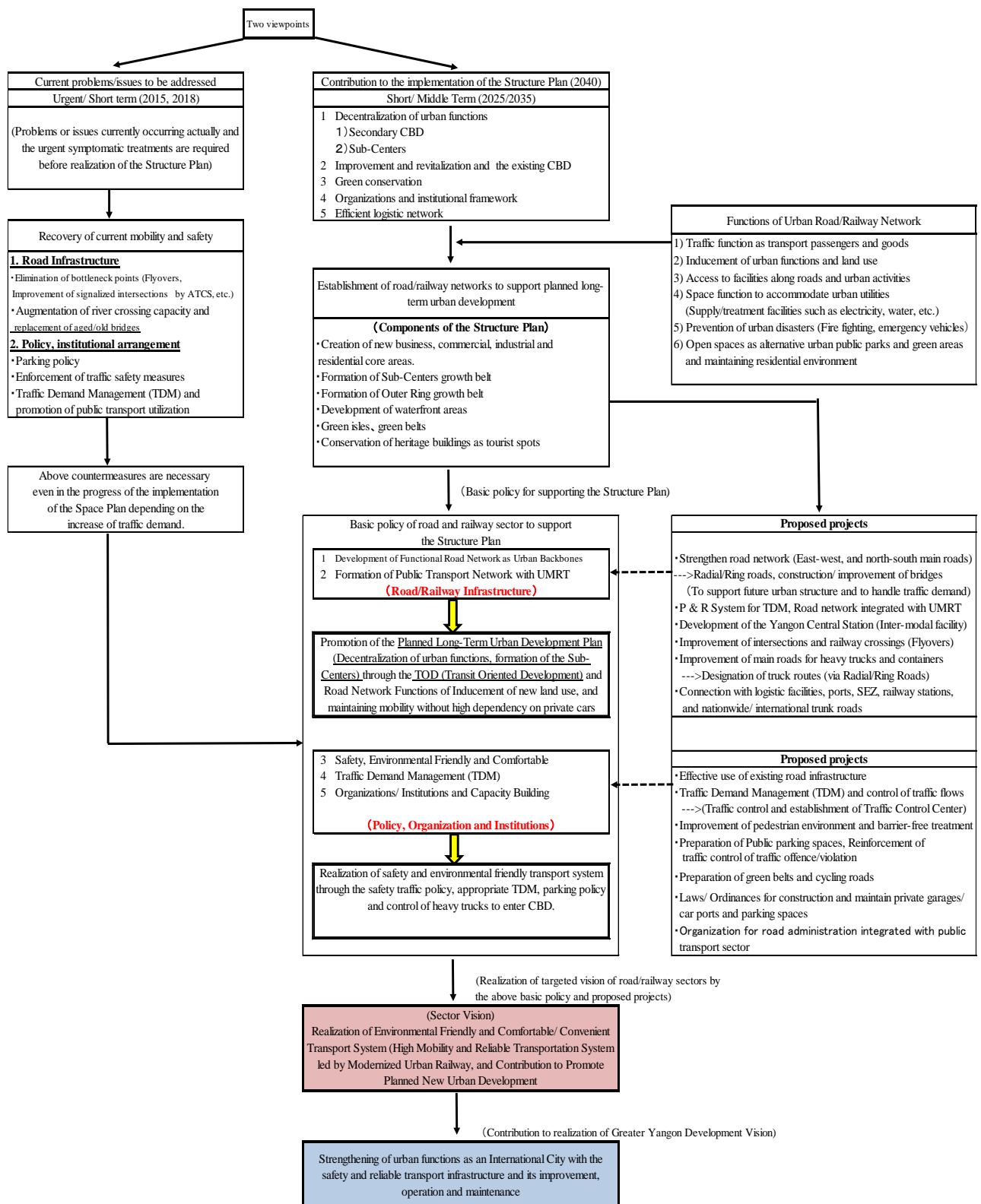
<b>Sector Vision</b>	<b>Realization of An Environment-friendly, Comfortable and Convenient Transport System (High Mobility and Reliable Transportation System Led by Modernized Urban Railway, and Contribution to Promote Planned New Urban Development)</b>
<b>Basic Policy</b>	<ol style="list-style-type: none"> <li>1) Development of A Functional Road Network as Urban Backbones (incl. Logistic Routes)</li> <li>2) Increase People’s Mobility through the Effective Public Transport System led by the Urban Mass Rapid Transit (UMRT)</li> <li>3) Realization of a Safe, Environment-friendly and Comfortable Transport System</li> <li>4) Development of Appropriate Traffic Demand Management Systems</li> <li>5) Organizations/Institutions and Capacity Building for Creating and Maintaining A Comprehensive Transport System in the Greater Yangon</li> </ol>

The linkage between above “Sector Vision” and “Basic Policy” with the “Structure Plan” is shown below together with the various functions of urban road network.

There are two points of view as presented in the figure below for establishment of the sector vision: 1) Current problems/ issues and countermeasures, and 2) Structure Plan (which proposes the decentralization of urban functions and changes in urban structure up to the final target year 2040). The sector vision of road (railway) sector is formulated so as to support and promote the this Structure Plan. The former 1) is related to the problems/ issues currently occurring such as traffic congestion, on-road parking, traffic accidents, and superannuated bridges, and urgent/ immediate effective countermeasures are required before the implementation of the Structure Plan.

On the other hand, latter 2) is the Structure Plan formulated based on the Development Vision for the whole Greater Yangon which consists of 4 pillars (International Hub City, Comfortable City, Well-Managed Infrastructure City, and Good Governance City). The Structure Plan proposes more concrete components such as decentralization of urban functions to the Secondary CBD and Sub-Centers, construction of New Towns, and Re-allocation of industrial sector, which will largely change the existing urban structure. The Basic Policy of the road/ railway sector was prepared setting the Structure Plan as a pre-condition and intended to support/ promote the realization of the Structure Plan effectively and appropriately (such as Radial/Ring Roads for the Sub-Center Growth Belt and the Outer Ring Growth Belt. Etc.). Furthermore, preliminary demand forecast (macroscopic demand analysis) was also based on the future population distribution by the Structure Plan. Therefore, direct supporting and promoting the realization of the Structure Plan by the road/ railway sector will also result in the contribution to the realization of the Development Vision of the Greater Yangon.

It is noted that the some urgent countermeasures proposed in the analysis of current problems/ issues are not only for the urgent and short term, but also applicable to the middle and long-term plans in the Structure Plan and may be implemented continuously (traffic safety policy, area traffic control system, etc.)



Source: JICA Study Team

**Figure 5.2.2: Linkage between Structure Plan and Road/ Railway Sector Vision**



3) Pursuit of a Safe, Environment Friendly and Comfortable Transportation System

The road sector also need to take necessary measures such as setting of median parts at the center of main roads for MRT/LRT, provision of pedestrian crossing bridges (overpass), installation of exclusive pedestrian signals, improvement of sidewalks, and establishment of bus bays for safety boarding/alighting. In addition to such physical measures, enhancement of traffic control and diffusion of traffic safety education should also be incorporated.

4) Development of Appropriate Traffic Demand Management Systems

When widening of existing roads and new road construction are difficult in CBD and at already urbanized areas, it is necessary to control the excessive demand coming into designated areas/roads so as to reduce traffic accidents, to keep the traffic flow smooth , and to maintain the urban environment in good condition. Traffic demand management (TDM) is an effective measure in areas such as CBD where the augmentation of road capacity by widening and new road construction is difficult. The basic idea of TDM is to use existing road facilities as much as possible by controlling the demand side.

TDM is also applied more extensively in new cities and new towns by the integration of different forms of public transport to reduce the usage of private cars.

Strict TDM measures are not taken at present in Greater Yangon. Therefore, various menus for TDM will be prepared considering its applicability in the area, taking into account future urban development plans.

5) Organizational/Institutions and Capacity Building for Creating and Maintaining a Comprehensive Transportation System in the Greater Yangon

Organizational and institutional framework (laws/ regulations) is another important base to implement and maintain urban road network and other transport infrastructure. The urban transport system consists of all related transport modes and facilities such as roads, railways, ports, inland water, private cars, buses, trucks and ferry services. These facilities/vehicles are currently operated and managed by different organizations/agencies. Coordination, cooperation and connectivity between each organization are very important in order to fulfill its function as a comprehensive transport system in total. Therefore, an alternative idea of new organizations and institutional framework shall be considered together with capacity development.

### 5.2.3 Development Goals and Target Effect Indicators

For the purpose of evaluation of future road network development and to confirm its outcomes, the following development goals and effect indicators are prepared as shown in Table 5.2.2:

**Table 5.2.2: Development Goals and Indicators (Road Network)**

Development Goal	Indicators
a) Increased mobility: through elimination of current traffic congestion and to promote future urban development plan, maintaining the urban functions	Average speed during peak hours (10 km/hour → 25 km/hour)
b) Traffic safety: Basic condition for environmental friendly and comfortable transport system	Accident rate/10,000 vehicles (Bus : 749 → 300): about half of 2011 (Total: 96 → 50) : about half of 2011

Source: JICA Study Team

It is noted that the effect indicators are limited to items that can actually be counted based on traffic surveys or statistical data in the future.

### 5.2.4 Preliminary Development Plan

#### (1) Preliminary Development Plan

The countermeasures obtained from the analysis on the current problems/ issues are treated as urgent (or short-term) projects. Other projects up to 2018 (short-term), 2025 (middle-term), and 2035/2040 (long-term) are treated as projects to support/promote the Structure Plan (Sub-Center with Green isles). The projects raised in the current problems/ issues are listed as blow:

- Augmentation of river crossing capacity and replacement of aged/ old bridges
- Elimination of bottleneck points (Flyovers, improvement of signalized intersections by ATCS. etc.)
- Parking policy, Enforcement of traffic safety measures., traffic demand management (TDM) and promotion of public transport utilization.

The preliminary development plan for the road sector is formulated by classifying into passenger movements and logistic, dividing the Greater Yangon area into three types of areas as shown in Table 5.2.3 below. The characteristics of each area have been considered in order to adopt the most appropriate plans to realize the basic policies and goals discussed above.

**Table 5.2.3: Basic Development Strategy by Classified Area**

Type of Traffic	Passengers Transport by Road Network			Logistic/Freight Transport
Target Period	(Medium and Long Term Strategy)			Medium and Long
Area	Central Area	Existing Urban Area	New Urban Area	Logistics
Basic Development Strategy	1) Effective use of existing road infrastructure (including improvement of signal operation at main intersections, such as ATCS) 2) Traffic Demand Management(TDM) and control of traffic flows including parking policy. 3) Development of the Yangon Central Station as an intermodal facility. 4) Traffic safety measures, Improvement of pedestrian environment and barrier-free treatments	1) Strengthen road network (East-west, and north-south main roads and bridges). Replacement of aged/ old bridges 2) Improvement of intersections and railway crossings (Elimination of bottleneck points by grade separation). 3) Traffic Demand Management (TDM) and control of traffic flows	1) Road network integrated with UMRT. 2) Construction of trunk radial and ring roads network, and preservation of environment in residential zones. 3) Preparation of cycling roads in new towns. 4) Promotion of P&R System for a TDM policy and by TDM	1) Preparation and designation of trunk routes for heavy goods vehicles and container trailers (via main radial/ring roads). 2) Connection with logistic facilities, ports, SEZ, railway stations and nationwide/ international trunk roads.

Source: JICA Study Team

(2) Candidate/ Applicable Projects

Based on the above basic development strategy, the following candidate road projects by each area are raised with their purpose and expected effects shown in Table 5.2.4 below:

**Table 5.2.4: Candidate Road Projects (Central Area)**

Area	Central Area	
	Project	Purpose and Effect of the Project
Road Infrastructure Projects (Hard Components)	<ol style="list-style-type: none"> <li>1) Development of the Yangon Central Station as an intermodal facility.</li> <li>2) Improvement of main intersections</li> <li>3) Construction of flyovers at selected intersections.</li> <li>4) Preparation of public parking spaces.</li> </ol>	<ol style="list-style-type: none"> <li>1) Promotion of the use of public transport by smooth transfer from/to railway to/from buses.</li> <li>2) &amp; 3) Reduction of traffic congestion at intersections (to reduce long stopping and waiting)</li> <li>4) To increase road capacity and traffic safety.</li> </ol>
Traffic Control/TDM and Other Policies. (Soft Components)	<ol style="list-style-type: none"> <li>1) Area pricing system</li> <li>2) Parking restriction/prohibition</li> <li>3) Introduction of traffic control system</li> <li>4) Preparation of walking space (improvement of sidewalks for pedestrians) and safety measures (pedestrian signals and pedestrian overpass)</li> <li>5) Reinforcement of control for traffic offenses/violations</li> <li>6) Education of traffic rules and traffic safety.</li> </ol>	<ol style="list-style-type: none"> <li>1) Restriction of vehicles to enter CBD and reduce congestion.</li> <li>2) To increase road capacity and traffic safety.</li> <li>3) Realization of smooth traffic flows by providing information of traffic jams, traffic conditions and by controlling signals (ATCS, etc).</li> <li>4) To reduce accidents of pedestrians.</li> <li>5) &amp; 6) To reduce traffic accidents..</li> </ol>
Preparation of Institutional Framework/ Regulations	<ol style="list-style-type: none"> <li>1) Laws/ordinances for construction and maintenance of private garages/carports and parking spaces.</li> <li>2) Preparation of laws related to road users taxes, vehicle registration taxes</li> <li>3) Laws for traffic impact assessments</li> <li>4) Laws related to BOT and PPP.</li> </ol>	<ol style="list-style-type: none"> <li>1) To ensure preparation of garages and parking spaces by car owners.</li> <li>2) To control increase motorization at the stages of owning and using cars. To reserve financial resource.</li> <li>3) To evaluate the effects of policies on traffic flows and accidents.</li> <li>4) To promote participation of the private sector to road investment.</li> </ol>

Source: JICA Study Team

**Table 5.2.5: Candidate Road Projects (Existing Urban Area)**

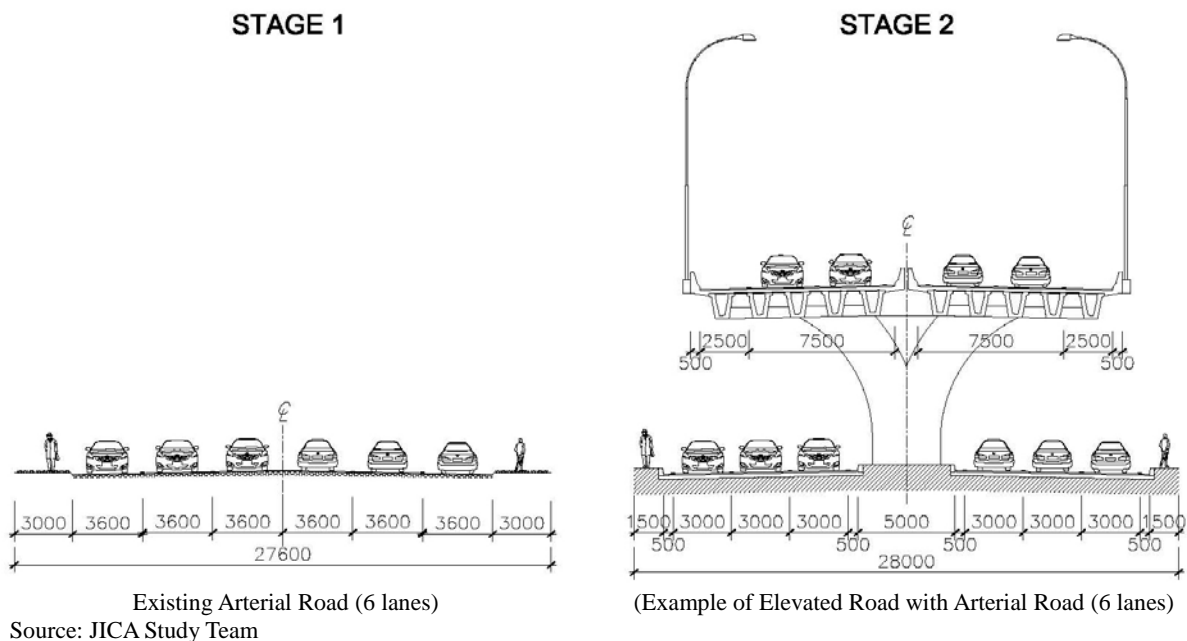
Area	Existing Urban Area	
	Project	Purpose and Effect of the Project
Road Infrastructure Projects (Hard Components)	<ol style="list-style-type: none"> <li>1) Improvement of Main Road No.2 (partly widening)</li> <li>2) Construction of Outer Ring Road (ordinary road section)</li> <li>3) Construction of Inner Ring Road (ordinary road)</li> <li>4) Serve pedestrian crossing facilities (overpass/ crossing bridges) and safety measures (pedestrian signals, guardrails )</li> <li>5) Improvement of Main Road No.4 (Bayint Rd.).</li> <li>6) Construction of second Main Road No.3 (North-South).</li> <li>7) Construction of East-West Road (Hlaing-Dagon section)</li> <li>8) Construction of East-West Road (Hlaing-Mingalardon section)</li> <li>9) Construction of new bridges over the Bago River, Hlaing River and Pazundaung/Nga Moe Yeik Creek.</li> <li>10) Elevated Inner Ring Road (toll road) as an alternative (refer to Figure 5.2.3)</li> </ol>	<ol style="list-style-type: none"> <li>1) &amp; 2) To expand north-south capacity for future traffic demand of trucks from the Thilawa SEZ by providing detour routes to avoid entering the central area.</li> <li>3) To support circular movements in existing urban area.</li> <li>4) To keep the safety of pedestrians crossings at main roads of heavy traffic.</li> <li>5) To strengthen the existing Main Road No. 4 for heavy trucks.</li> <li>6) To expand north-south capacity for future traffic demand</li> <li>7) 8) To expand east-west capacity for future traffic demand.</li> <li>9) To handle future river crossing traffic demand.</li> <li>10) To expand the capacity of the Inner Ring Road</li> </ol>



Area	Existing Urban Area	
	Project	Purpose and Effect of the Project
Traffic Control/TDM and Other Policies. (Soft Components)	<ol style="list-style-type: none"> <li>1) Preparation and reinforcement of laws related to garages and parking lots.</li> <li>2) Passing restriction of large vehicles and motorcycles.</li> <li>3) Expansion of the traffic control system.</li> <li>4) Road traffic information system</li> <li>5) Modernization of reinforcement to traffic offenses/violation</li> <li>6) Education for public transport priority and traffic safety.</li> </ol>	<ol style="list-style-type: none"> <li>1) To ensure preparation of garages, carports and parking spaces by car owners.</li> <li>2) Preserve the environment in urban and residential areas as well as protect congestion due to motorcycles.</li> <li>3) &amp; 4) Realization of smooth traffic flow by providing information of traffic jams, traffic conditions and control signals.</li> <li>5) To reduce traffic offenses by effective use of modern ITS equipment such as CCTV.</li> <li>6) To reduce traffic accidents and promotion of the use of public transport instead of private cars.</li> </ol>
Preparation of Laws/ Institutional Framework/ Regulations	<ol style="list-style-type: none"> <li>1) Laws/ordinances for construction and maintenance of private garages and parking spaces.</li> <li>2) Preparation of laws related to road users taxes, vehicle registration taxes</li> <li>3) Laws for traffic impact assessments</li> <li>4) Laws related to BOT and PPP.</li> </ol>	<ol style="list-style-type: none"> <li>1) To ensure the preparation of garages and parking spaces by car owners.</li> <li>2) To control the increase of motorization at the stages of owning and using cars to save on financial resource.</li> <li>3) To evaluate the effects of policies on traffic flows and accidents.</li> <li>4) To promote the participation of the private sector in road investments.</li> </ol>

Source: JICA Study Team

In order to expand the capacity of the arterial inner ring road as an alternative, an elevated viaduct structure might be considered. The road will be operated as a toll road in the case of a BOT or PPP project. The road shall be connected with the proposed Outer Ring Road via radial toll roads.



**Figure 5.2.4: Example of Elevated Inner Road Alternative**

**Table 5.2.6: Candidate Road Projects (New Urban Area)**

Area	New Towns, New Development Areas	
	Project	Purposes and Effects of Project
Road Infrastructure Projects (Hard Components)	<ol style="list-style-type: none"> <li>1) Construction of Outer Ring Road (Ordinary road sections/toll expressway sections)</li> <li>2) Construction of greenbelt roads for pedestrians and bicycles with traffic safety measures)</li> </ol>	<ol style="list-style-type: none"> <li>1) To guide new locations for industrial zones along the ORR, and provide alternative routes through traffic in the east-west, north-south movements.</li> <li>-To provide heavy trucks that come from industrial zones and at Thilawa industrial zone (SEZ) with detour routes to prevent entering the central city and residential areas.</li> <li>-To form a strong road network for safety measures in case of city disasters (such as earthquake) by providing alternative routes for evacuation of residents and emergency vehicles.</li> <li>2) To make easy access to natural/agricultural resources and promote better city environment.</li> </ol>
Traffic Control/TDM and Other Policies. (Soft Components)	<ol style="list-style-type: none"> <li>1) Preparation of road traffic information system (ITS)</li> <li>2) Preparation of park and ride (P&amp;R) facilities (parking spaces for transfer to railway, UMRT in new towns)</li> <li>3) Promotion of road construction by participation of private sectors</li> </ol>	<ol style="list-style-type: none"> <li>1) For the effective operation toll expressways and to provide toll for road users and information regarding traffic conditions (ORR)</li> <li>2) To reduce car usage and promote the diversion of drivers to public transport.</li> </ol>
Preparation of Laws/ Institutional Framework/ Regulations	<ol style="list-style-type: none"> <li>1) Laws/ordinances for construction and maintenance of private garages and parking spaces.</li> <li>2) Preparation of laws related to road users taxes, vehicle registration taxes</li> <li>3) Laws for traffic impact assessments</li> <li>4) Laws related to BOT and PPP.</li> </ol>	<ol style="list-style-type: none"> <li>1) To ensure the preparation of garages and parking spaces by car owners.</li> <li>2) To control the increase of motorization at the stages of owning and using of cars to save on financial resource.</li> <li>3) To evaluate the effects of policies on traffic flows and accidents.</li> <li>4) To promote the participation of private sectors in road investment.</li> </ol>

Source: JICA Study Team

**Table 5.2.7: Candidate Road Projects (Logistics)**

Area	Logistic, Freight Traffic	
	Project	Purposes and Effects of Project
Road Infrastructure Projects (Hard Components)	<ol style="list-style-type: none"> <li>1) Construction of truck terminals/logistic facilities at appropriate locations along the ORR and around interchanges.</li> <li>2) Construction of trunk roads for heavy trucks.</li> </ol>	<ol style="list-style-type: none"> <li>1) To provide heavy trucks that come from industrial zones and at Thilawa industrial zone (SEZ) with detour routes to prevent entering the central city and residential areas.</li> <li>2) Connection with logistic facilities, ports, SEZ, railway stations and nationwide/international trunk roads.</li> </ol>
Traffic Control/TDM and Other Policies. (Soft Components)	<ol style="list-style-type: none"> <li>1) Restriction of passing heavy vehicles.</li> <li>2) Restriction of over loading.</li> <li>3) Operation and Management System for Trucks</li> <li>4) Establishment of Safety Measures for Truck Operations.</li> </ol>	<ol style="list-style-type: none"> <li>1) To keep better environment and avoid traffic mix that will cause slow speed by heavy trucks.</li> <li>2) To minimize damages of trunk road.</li> <li>3) Rationalization of transportation of goods by trucks to reduce the number trips.</li> <li>4) Promote safety driving by regular maintenance of vehicles and the scheduling of drivers in safety education.</li> </ol>
Preparation of Laws/ Institutional Framework/ Regulations	<ol style="list-style-type: none"> <li>1) Laws/ordinances for designation of heavy vehicles routes.</li> <li>2) Preparation of laws related to road users taxes, vehicle registration taxes</li> <li>3) Laws for traffic impact assessment</li> <li>4) Laws related to BOT and PPP.</li> </ol>	<ol style="list-style-type: none"> <li>1) To ensure heavy vehicles could pass through designated routes, maintain the environment and avoid traffic accidents.</li> <li>2) To control the increase of motorization at the stages of owning and using of cars to save on financial resource.</li> <li>3) To evaluate the effects of policies on traffic flows and accidents.</li> <li>4) To promote the participation of private sector in road investment.</li> </ol>

Source: JICA Study Team

(3) Organizations Responsible for Planning and Implementation of the Road Sector

At present, the construction of roads and bridges and maintenance works in the Greater Yangon are being carried out by YCDC and MOC. The traffic police is responsible for traffic control (such as signal operation, one-way system, and regulation of traffic offences/violations). It is recommended to establish a new organization or committee for the planning and implementation of road projects as well as coordination with the urban public transport sector. Further discussions are necessary for this matter.

(4) Traffic Control in the Greater Yangon

1) Traffic Control

In general, the purpose of traffic control are:

- i) To ensure road traffic safety;
- ii) To maintain smooth traffic flow; and
- iii) To prevent negative impacts caused by road traffic.

In order to fulfill the above purposes, various procedures for traffic control are adopted in many countries such as: (i) Speed control; (ii) On-road parking restriction/prohibition; (iii) One-way systems in CBD; (iv) Zone traffic control; and (v) Installation of signals at main intersections, etc.

The procedures of traffic control currently applied in the Greater Yangon are the restriction of on-road parking in designated road sections, one-way system, and signalization at major intersections. However, each control measure is not functioning well, except for the one-way system.

● Restriction of On-Road Parking In and Around CBD

On-road parking in CBD is restricted at the designated zones by order of YCDC. However, actual situations show that a lot of vehicles are still parked in some zones deemed restricted due to the shortage of off-road parking facilities. Parking charges cost at about 200 Kyats/hour which is collected by YCDC. The influences of on-road parking are as follows:

- i) Direct causes of traffic congestion due to the reduction of one or two lanes; and
- ii) Increase in the possibility of traffic accidents.

Roads where parking is prohibited are identified. These are marked on curbstones of sidewalks with red and white stripes (parking prohibition) or yellow and black (prohibition of both parking and stopping vehicles). In addition to these markings, it is also recommended to install traffic sign boards for parking prohibition at roadsides so as to easily find the designated places.



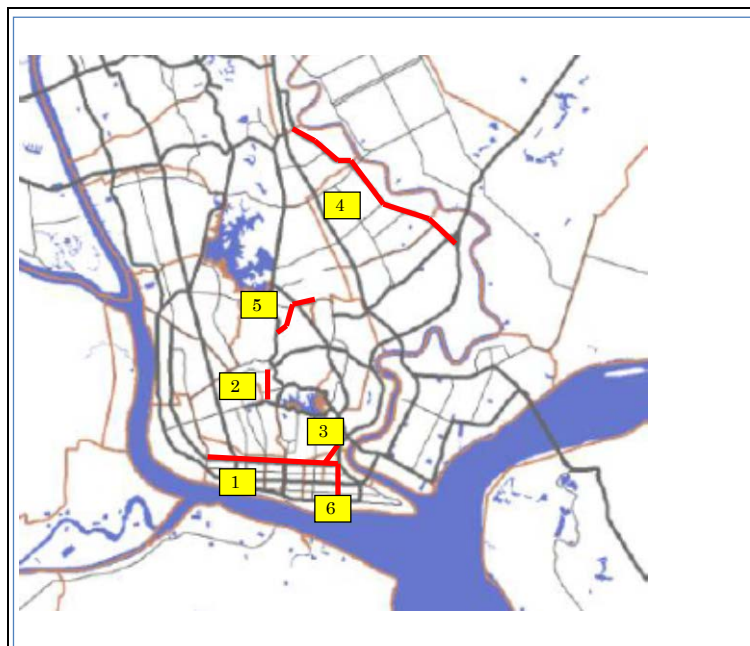
Source: JICA Study Team

**Figure 5.2.5: Markings for Parking Prohibition at Curbstones**

YCDC recognizes the necessity for the enforcement of parking restrictions. However, as there is little open space available for public parking facilities, strict measures on compulsory removal of parking vehicles are difficult to devise. Parking fees are collected by YCDC as one of the control measures.

On the other hand, YCDC has plans to prepare public parking spaces at six selected roads as shown in Figure 5.2.6.

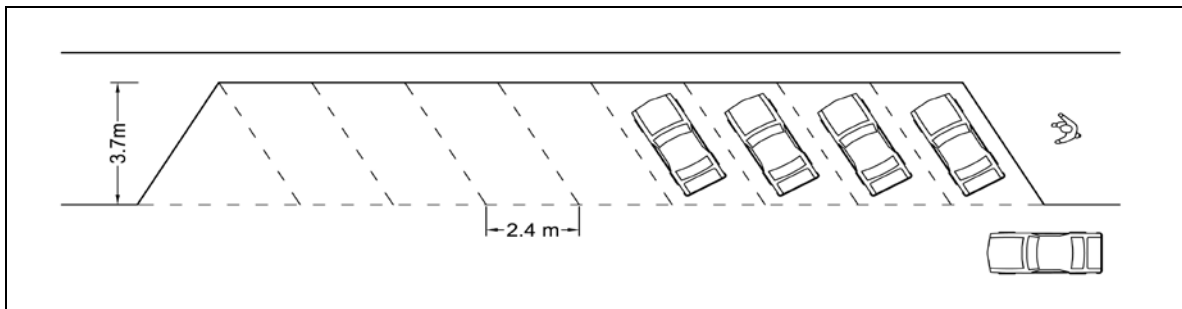
- |                            |                            |
|----------------------------|----------------------------|
| 1. Bogyoke Aung San Road   | 4. Thanthumar Road         |
| 2. Yae Tar Shae Old Street | 5. Sayar San Road          |
| 3. Yaekyaw Street          | 6. Botaht Aung Pagoda Road |



Source: YCDC

**Figure 5.2.6: New Parking Spaces Proposed by YCDC**

It is noted that these proposed new parking spaces are still on-road parking facilities which will be implemented by utilizing part of sidewalks for parking space and removing vendor shops on sidewalks. It is reported that the parking space for one car will be 8 ft x 12 ft (2.4 m x 3.7 m). This means that about 400 cars can park per kilometer (Figure 5.2.7).



Source: JICA Study Team based on the information from YCDC

**Figure 5.2.7: Layout of Roadside Parking Space by YCDC**

In addition to the above new parking space plan, the following policies are recommended:

- i) Enforcement of on-street parking prohibition in selected main roads where traffic volume is high and for avoidance of traffic accidents.
- ii) Adjustments/raising of parking charges to encourage public transport usage (with explanations that collected revenues are to be used for the preparation of other public parking spaces and improvement of public transport, etc.)

#### ● Traffic Signal Operation in CBD

The road network in the Yangon CBD is designed as a grid type with major east-west one-way roads and interconnecting north-south streets. There are 46 traffic signals located at short intervals, thus, causing frequent stops and additional delays to traffic. Due to numerous traffic signal junctions and lack of signal coordination, long queues are often observed even in off-peak hours.

The introduction of an advanced traffic control system based on the Area Traffic Control System (ATCS) is recommended for effective signal operation. It is reported that Yangon City has partly introduced ITS (Intelligent Transport Systems), such as CCTV monitoring, although there is no traffic control center yet. It is recommended to adopt ATCS at first and then ITS technology and to apply it for effective signal operation in CBD and in wide areas.



Long queues and long waiting time before an intersection signal even during off-peak hours (Sule Pagoda Road)

Source: JICA Study Team

**Figure 5.2.8: Congestion at an Intersection**

● Traffic Safety Policy

Based on the analysis on current traffic conditions in the Greater Yangon regarding traffic safety, the following measures are recommended:

- i) Construction of medians along major roads to improve operational speed and safety.
- ii) Improvement of sidewalks which are barrier-free for pedestrians. Prohibition of vendor shops on the improved sidewalks. The sidewalks can be used as space for placing urban utilities such as OFCs (optic fiber cables), etc.
- iii) Installation of pedestrian traffic signals at main intersections (at present there are very few pedestrian signals installed).
- iv) Construction of pedestrian crossing bridges to segregate vehicles and pedestrians.
- v) Provision of adequate bus lay-bys in CBD and along major roads to avoid congestion and to keep the safety of passengers.
- vi) Education of the pedestrian priority rule.



Source: JICA Study Team

**Figure 5.2.9: Pedestrian Environment**

(5) Traffic Demand Management (TDM)

1) Background and Purposes of TDM

It is widely recognized that good road facilities are basic pre-conditions to support daily activities in cities and to promote sustainable economic development. However, in the stage where the rapid growth of motorization is higher than the progress of development of road facilities, gaps between demand (traffic volume) and supply (road capacity) cause various problems such as traffic congestion, traffic accidents and environmental pollution.

On the other hand, the expansion and widening of road facilities to meet the increasing traffic demand, particularly in densely populated cities, is very difficult due to problems of land acquisition and resettlement of residents which may impose a huge financial burden.

Under these situations, measures of traffic control to realize smooth traffic flows and to prevent traffic accidents have been adopted in various countries and cities by effectively utilizing existing road facilities as much as possible. Although traffic control may affect the use of private cars to some extent, it does not have a clear incentive to reduce the use of

private cars. As already explained above, the expansion and widening of roads in densely populated cities are actually difficult (supply side condition). Alternative methods to balance road demand and supply should be considered by restricting/controlling the use of private cars (restriction of demand). TDM is the policy aimed mainly at controlling the demand side, both directly and indirectly. It is also necessary to ensure public consensus among citizens and to prepare alternative transport modes before executing TDM since the impacts of adopting TDM on society are significant.

The basic concept of TDM is based on the fact that road development in a given urban space is limited. Excessive traffic demand beyond the road capacity will cause various traffic problems and severe environmental pollution. The purpose of TDM is to realize the optimum level of car usage by controlling each stage of owning, registration, and usage of vehicles so as to recover the balance between the demand and supply.

## 2) Procedures and Methods for TDM

In order to restrict car usage, the following TDM procedures which are tried and similar to TDM in some countries are being considered:

- (i) Control of car owning: Raising import duties, taxes and vehicle registration fees;
- (ii) Control of car usage: Adjustment of fuel taxes, parking restriction;
- (iii) Road pricing (congestion tax) for specific road sections;
- (iv) Cordon pricing to restrict entering designated areas;
- (v) Area licensing system (ALS): Purchase permission cards to use cars inside designated areas; and
- (vi) Improvement and prioritization of public transport: To promote diversion from private cars to railways and buses by applying the following procedures for example.
  - Improvement of access to/from railway stations (parking facilities for P&R)
  - Establishment of bus priority lanes/ bus exclusive lanes during peak hours.
  - Introduction of transit malls in CBD or in subcenters with no-car zones.

These TDM methods have been applied or tried effectively in some European countries, as well as in North America, Hong Kong, Singapore and Japan. Of the above TDM procedures (iii) road pricing, (iv) cordon pricing and (v) area licensing system will require the establishment of toll gates at all entry points to CBD, installation of electric equipment for identifying vehicles, and development of operation systems. In addition to these technical issues, social and regulatory/institutional issues shall be raised to be solved before introducing and executing TDM (such as justification of levying entering fees on general roads).

As an example in area pricing, a kind of cordon pricing system was applied in Singapore in 1975 for morning peak hours (7:30-10:15). Levying charges on vehicles entering CBD (except for buses) are applied during that time. A total of 29 gates were constructed at all entry points to CBD and passing vehicles are checked by traffic police. Results of this system were reported that private car use was reduced by 50%, share of bus passengers increased by 10% and average speed increased by 20%.

If the same system is to be applied to CBD in the Greater Yangon, at least 15 checkpoints will be necessary to set up toll collection gates as shown in Figure 5.2.10. It may be possible to target a smaller area instead of the whole CBD.

It must be noted that a thorough feasibility study should be carried out, taking into consideration the technical, operational possibility and social impacts before applying such cordon pricing system.

At the same time, public transport prioritization policy should be considered together with combinations of other TDM procedures so as to promote effective shift from private cars to railways and buses.



Source: JICA Study Team

**Figure 5.2.10: Example of Checkpoints for Area Pricing System for CBD**

#### (6) Infrastructure Layout

The proposed short-term, middle-term, and long-term conceptual infrastructure layout plans for the main road network development are shown below. These infrastructure layout plans are established in consideration of the following points.

- (i) To fit with the concept and layout of the urban function for each target year;
- (ii) To match with the results of the macro demand forecast (required number of lanes);
- (iii) To give priority to improving and upgrading of the existing road network; and
- (iv) To give priority to areas with high population density as well as priority to on-going development project such as Thilawa SEZ.

These layouts are prepared based on the macro demand analysis conducted in this study. The detailed layout should be reviewed and finalized in the sector master plan which commenced in January 2013.

##### 1) Short-term Conceptual Infrastructure Layout Plan (Target Year: 2018)

Thilawa SEZ will be open in 2015 and heavy traffic to and from the SEZ will pass through the city. Therefore, it is proposed that the construction of the widening of Road No.2 and the improvement of Road No.7 (part of Outer Ring Road) as a diversion route of the above mentioned logistic related traffic be initiated.

Road No.2 will also enhance the urbanization of the Dagon Myothit area which was proposed as one of the subcenters (S/C) in this study as well as the development of housing and industrial area along Road No.7.

##### 2) Middle-term Conceptual Infrastructure Layout Plan (Target Year: 2025)

During this period, urban development such as high rise S/C proposed in this study (Dagon Myothit S/C, Hlaing Tharya S/C, Bago Riverside S/C) will be completed.



The east-west corridors to access these S/C are proposed to be constructed with the Outer Ring Road network (Sections 1, 2 and 3).

3) Long-term Conceptual Infrastructure Layout Plan (Target Year: 2035/2040)

Not only the above-mentioned S/C but also other new town cores (mid-rise areas) including the Twantay area and Dala area will be completed together with new industrial areas along the proposed Outer Ring Road. The Outer Ring Road network is proposed to be completed by this term.

4) Long-term Conceptual Infrastructure Layout Plan (Additional Consideration)

The capacity of the inner arterial ring road (Strand Road-Kyee Myin Daing Road-Bayint Naung Road-Khayae/Myo Pat Road-Thanthumar Road-Pazundaung Road) might be insufficient for future traffic demand. The elevated Inner Ring Road will be considered for construction, connecting it with the Outer Ring Road via radial toll roads as shown in Figures 5.2.11-5.2.15.

It is noted that the road network layout drawings in the above-mentioned layouts are conceptual plans to show the necessity of developing these corridors. Detailed route alignments will be studied and reviewed in the following sector master plan study based on the detailed traffic demand analysis.

Regarding the relationship between the development of the Thilawa SEZ and future road network, the results of the macro traffic demand analysis show that the existing bridge capacity crossing over the Bago River will be significantly short in the future. Under this situation, investment incentives of investors to SEZ will be affected. Therefore, proper roles and functions of SEZ will not be realized.

In addition, the smooth connection with the nationwide trunk road network is difficult. Therefore, additional bridges and approach roads infrastructure facilities for SEZ are essential. The future road network shown in the figures below were prepared taking into consideration the development of SEZ as one of the key factors.

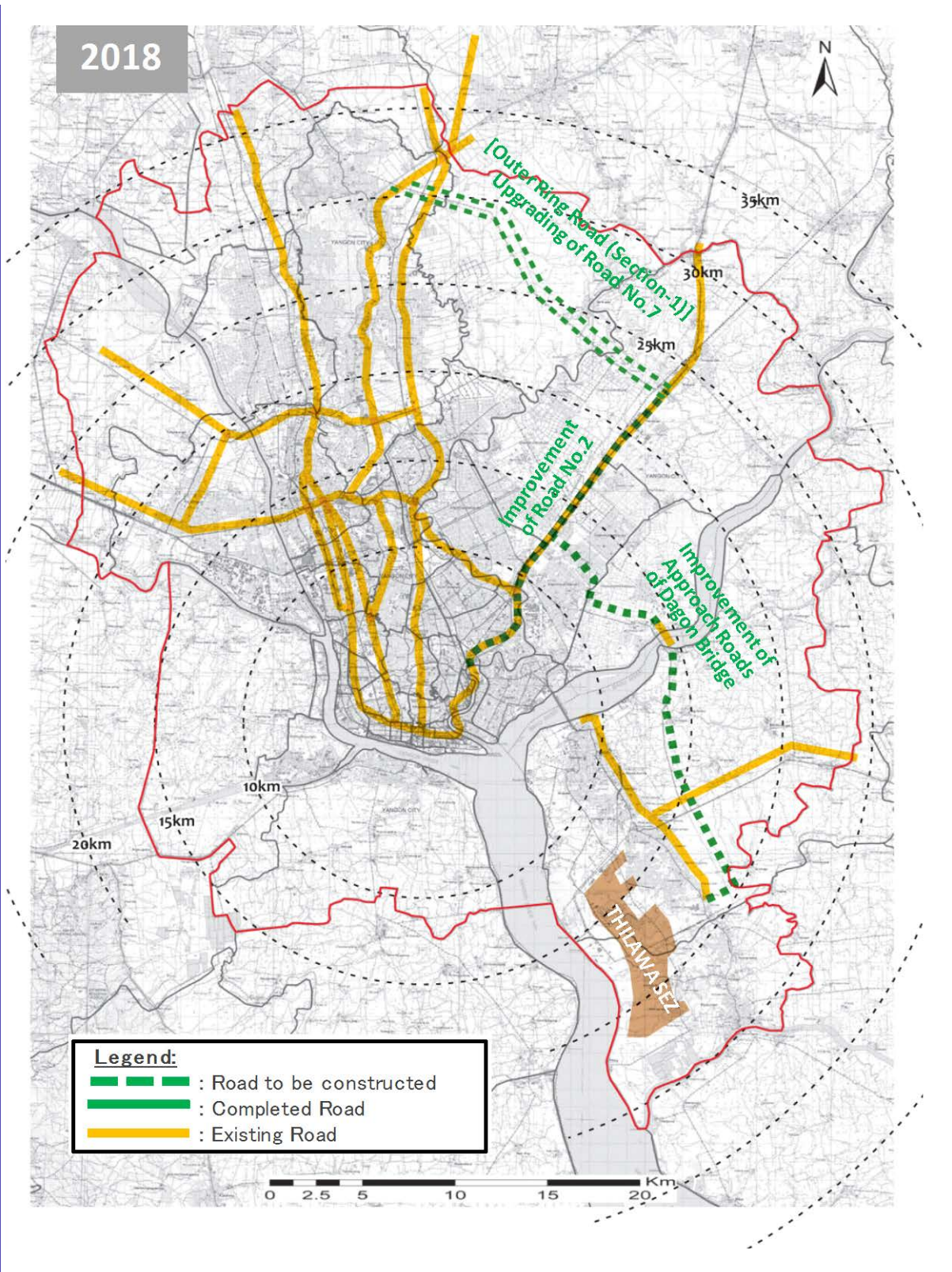
The urgent required projects have been proposed to ease or solve issues that are currently occurring. Urgent countermeasures are necessary (symptomatic treatments) considering the following criteria.

1) Prompt Implementation: Several projects should be implemented urgently. Projects without or less land acquisition have been proposed.

- a) Improvement of signalized intersection: Less or no land acquisition is expected;
- b) Construction of flyovers/Underpasses: Less land acquisition is expected; and
- c) Reconstruction of old bridge(s): Upper stream of the Thaketa Bridge is recommended.

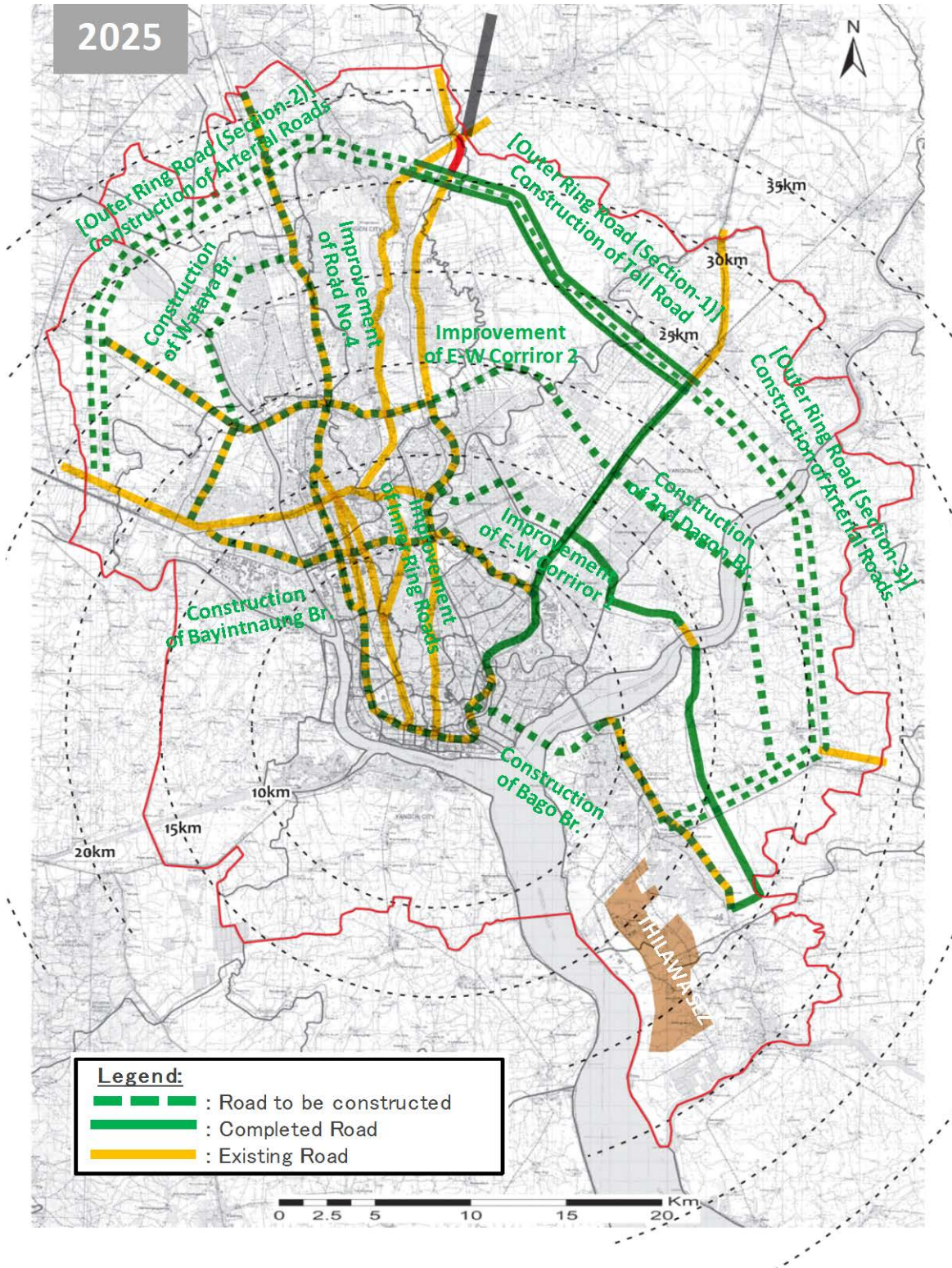
2) Basic Human Needs (BHN): The projects shall enhance the following objectives.

- a) Improvement of signalized intersection: To reduce commuting time, to reduce air pollution, to enhance pedestrian (social vulnerable) safety;
- b) Construction of flyovers/underpasses: To reduce commuting time, to reduce air pollution, to enhance pedestrian (social vulnerable) safety; and
- c) Reconstruction of old bridge(s): To reduce commuting time, to eliminate possible danger by destruction of old bridge, to enhance pedestrian (social vulnerable) safety, to enhance social and economic activity in the project area which will contribute to the improvement of gender equity.



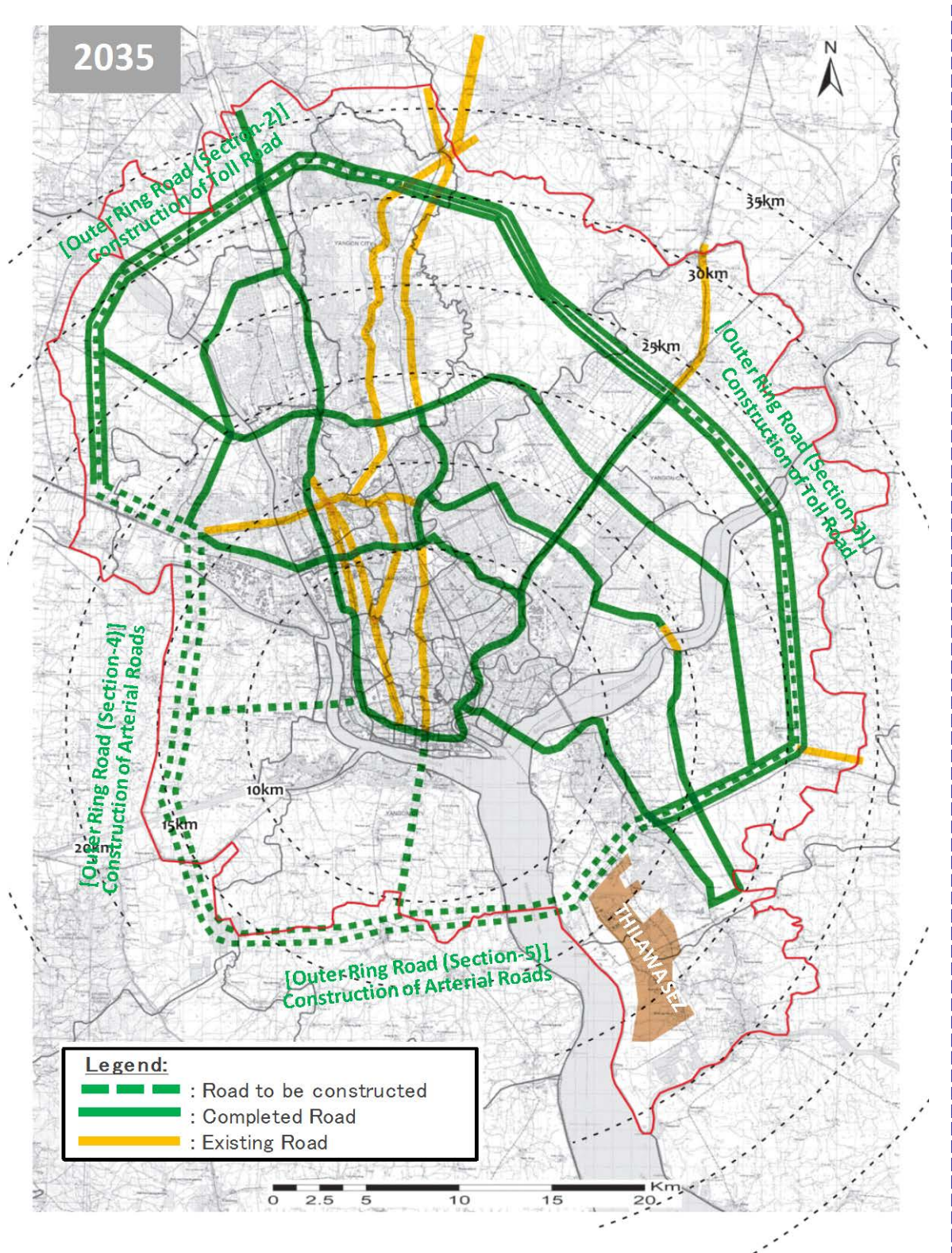
Source: JICA Study Team

**Figure 5.2.11: Short-term Conceptual Infrastructure Layout Plan (Target Year: 2018)**



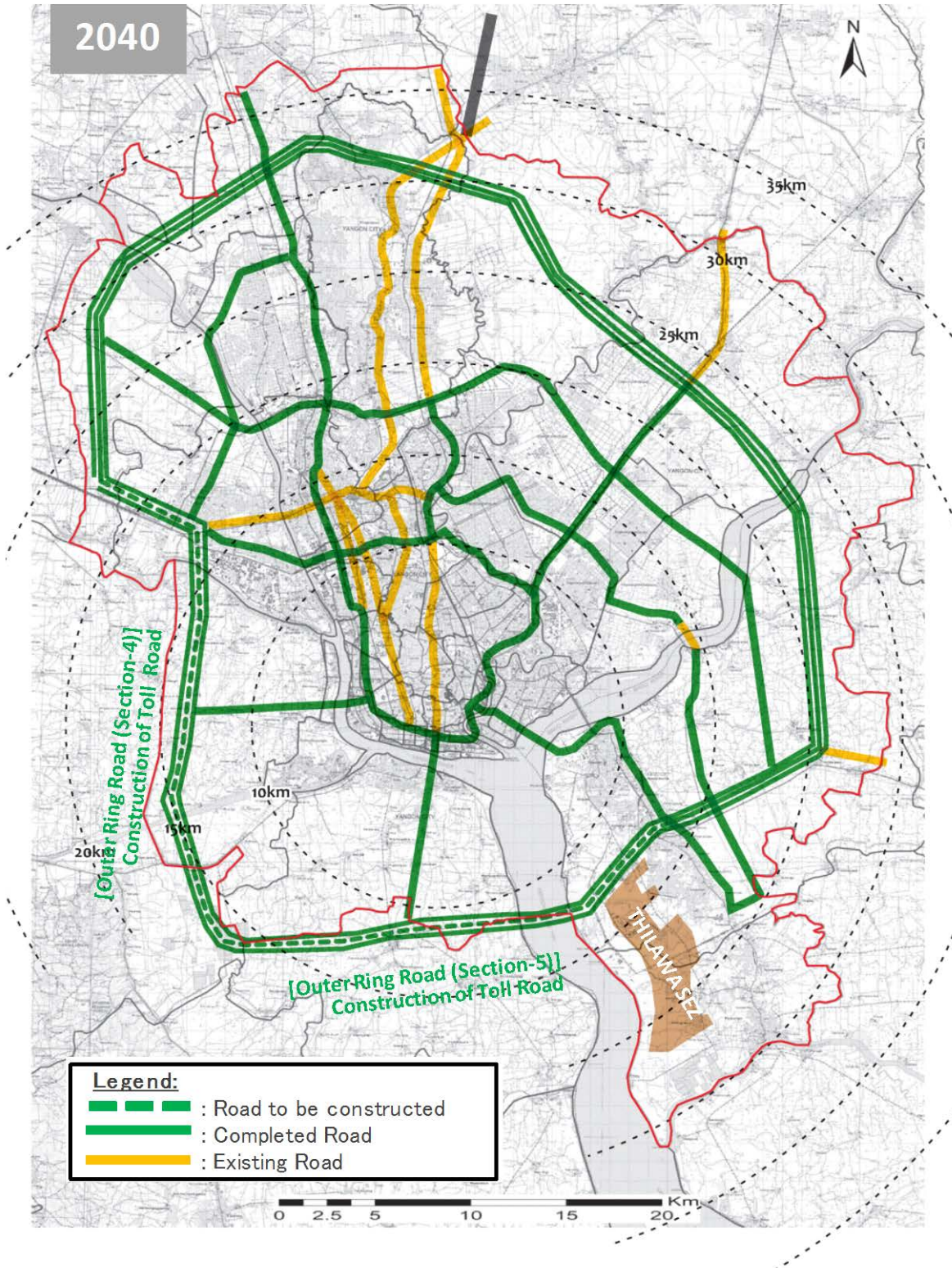
Source: JICA Study Team

**Figure 5.2.12: Mid-term Conceptual Infrastructure Layout Plan (Target Year: 2025)**



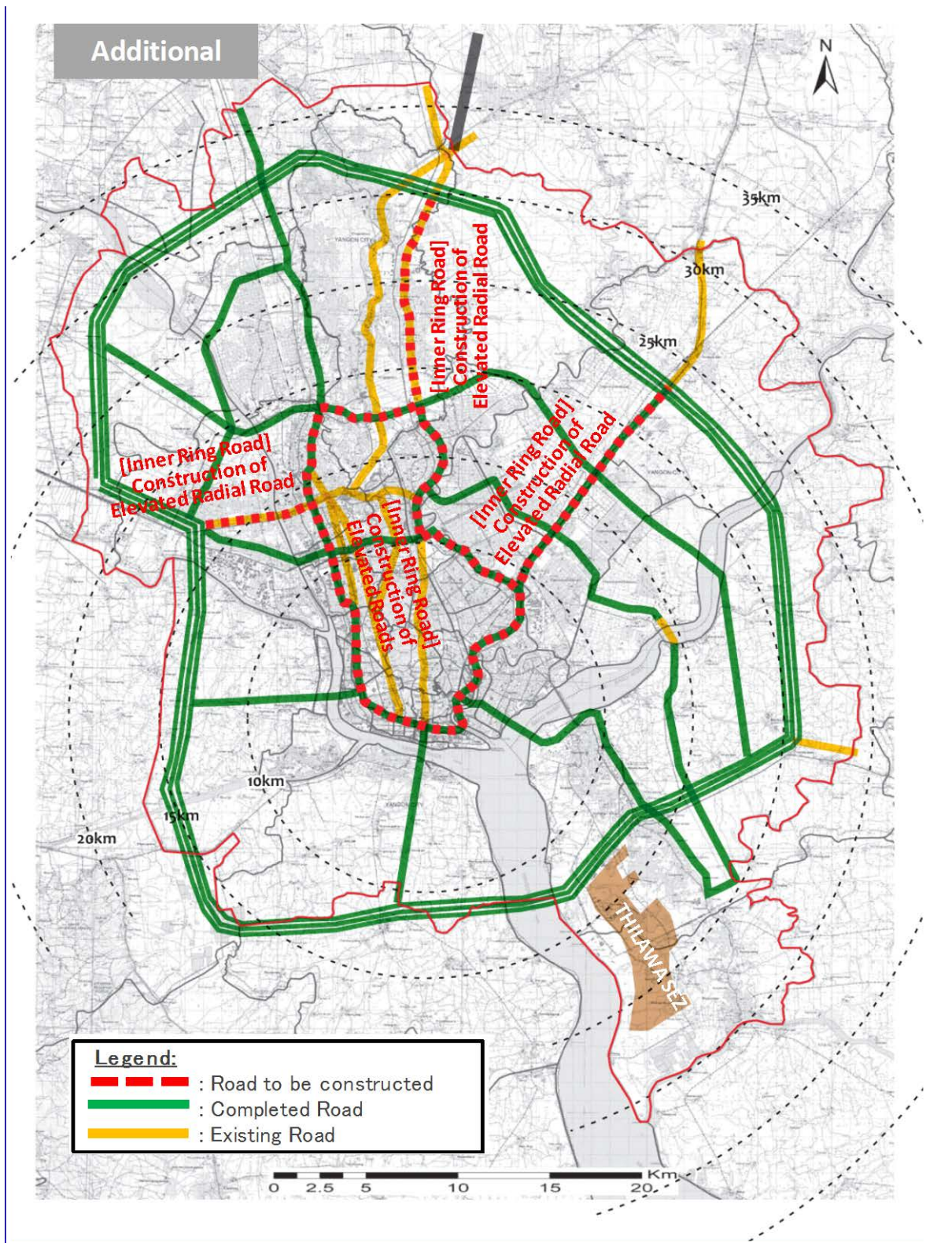
Source: JICA Study Team

**Figure 5.2.13: Long-term Conceptual Infrastructure Layout Plan (Target Year: 2035)**



Source: JICA Study Team

**Figure 5.2.14: Long-term Conceptual Infrastructure Layout Plan (Target Year: 2040)**



Source: JICA Study Team  
**Figure 5.2.15: Long-term Conceptual Infrastructure Layout Plan (Additional Consideration)**

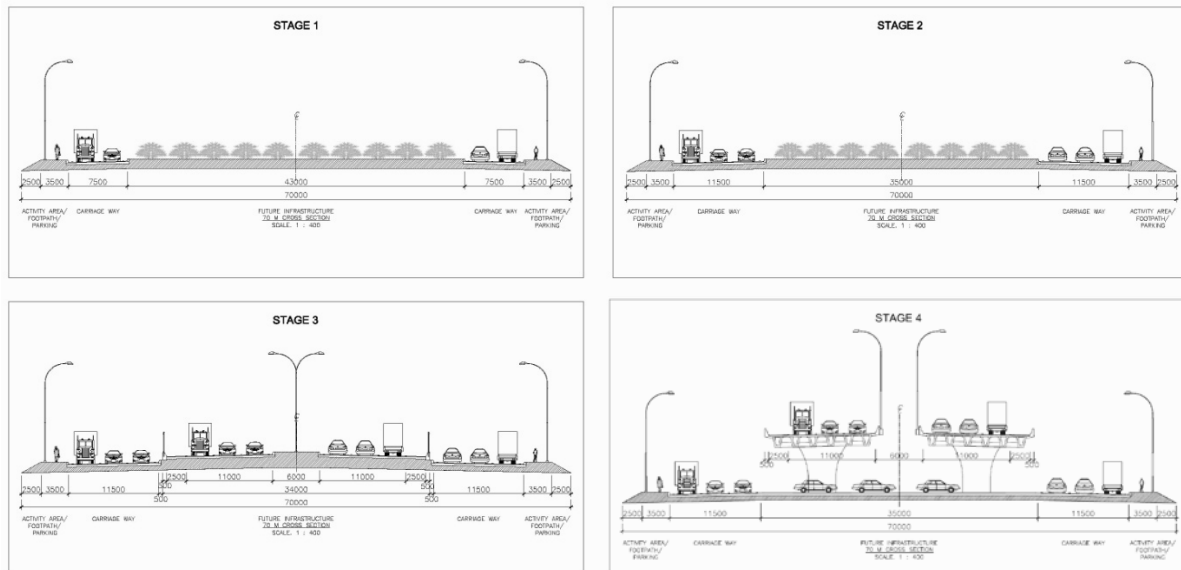
**Table 5.2.8: List of Proposed Projects**

Category	Project Name	Remarks
Urgent	Improvement of Signalized Intersections	Emergency measure to improve road traffic congestion
	Construction of Flyovers/Underpasses for Bottleneck Intersections	
	Reconstruction of Old Bridge(s) such as Thaketa Bridge	Emergency measure to ease future bottleneck points and to improve traffic congestion
Short-term (Target year: 2018)	Improvement of Approach Roads of Dagon Bridge	Widening or new alignment of the Dagon Bridge approach
	Improvement of Road No.2	Between Pazundaung Creek to Road No.7 Length:.20 km
	[Outer Ring Road (Section-1)] Upgrading of Road No.7	Between Road No.2 to Road No.1 Length:.26 km
Middle-term (Target year: 2025)	Improvement of Signalized Intersections (Phase 2,3)	Emergency measure to improve road traffic congestion
	Improvement of East-West Corridor 1	Road No.5 to Thanthumar Road
	Construction of New Bayntnaung Bridge	Length:.600 m with 6 lanes
	Improvement of East-West Corridor 2	Hlay Thin Atwin Wun Rd - Road No.2
	Construction of Wataya Bridge	Length:.1200 m with 4 lanes
	Construction of 2nd Dagon Bridge	Length:.2400 m with 4 lanes
	Construction of Bago Bridge (2 <sup>nd</sup> Thanlyn Bridge)	Length:.2800 m with 4 lanes
	Improvement of Road No.4 and Inner Ring Roads	Widening to 6 lanes
	[Outer Ring Road (Section-2)] Construction of Arterial Roads	Length:.32 km with 6 lanes
	[Outer Ring Road (Section-3)] Construction of Arterial Roads	Length:.40 km with 6 lanes
	[Outer Ring Road (Section-1)] Construction of Toll Road	Length:.26 km with 6 lanes
Long-term (Target year: by 2035/2040)	[Outer Ring Road (Section-2)] Construction of Toll Road	Length:.32 km with 6 lanes
	[Outer Ring Road (Section-3)] Construction of Toll Road	Length:.40 km with 6 lanes
	[Outer Ring Road (Section-4&5)] Construction of Arterial Roads	Length:.50 km with 6 lanes
	[Outer Ring Road (Section-4&5)] Construction of Toll Road	Length:.50 km with 6 lanes
Long-term (Add. Consideration)	[Inner Ring Road] Construction of Elevated Roads and Radial Roads	Length:.50 km (Inner Ring) Length:.35 km (Radials) Elevated Toll

Source: JICA Study Team

The Outer Ring Road is proposed for construction in phases presented in Figure 5.2.16.

The concept of this method is to secure land for the Outer Ring Road (Toll Road Section) in the future. This shall be done by constructing the outer edge of the arterial roads as soon as possible. If squatters and or speculative land owners have settled along the proposed alignment, the project shall face serious difficulties in land acquisition.



Source: JICA Study Team

**Figure 5.2.16: Example of Phased Construction for Outer Ring Road**

### (7) Implementation Schedule

The basic principles for three terms of development are shown in Table 4.1.10 of Section 4.1: Urban Transport. Following the discussed principles and necessary time for designing, tendering and constructions, the implementation schedule for road network is illustrated in Table 5.2.9.

The basic preconditions to establish the implementation schedule are listed below.

- (i) It is assumed that urgent projects will be completed by the end of 2018. Regarding other projects, it is assumed that: a) Basic Design (B/D) or Detailed Design (D/D) shall commence one year after the F/S due to selection of design consultants; b) Nine months shall be considered for the tendering period of contractors.
- (ii) Short and middle term projects give high priority to enhancing the road network for existing developed areas and the on-going industrial development such as Thilawa SEZ. On the other hand, long term projects give high priority to assuring access, connecting it with new town cores and new industrial zones.
- (iii) The implementation schedule should be harmonized with the above-mentioned infrastructure layout plans of each target year.
- (iv) The implementation schedule of large size projects such as the Outer Ring Road with huge project costs should not overlap to the utmost in order to reduce the financial burden of the Myanmar government.

The numerical/ quantitative criteria for the decision of priority projects are not adopted for the implementation schedule. However, high priority is given to the projects identified as urgent projects in the analysis on the current problems/ issues to be addressed and urgently implemented such as countermeasures to mitigate traffic congestion and replacement of aged/old bridges. Also, as the Thilawa SEZ is to be opened in 2015, bridges and access roads related to the SEZ are given high priority to be implemented in short-term. Implementation schedule of other projects are decided so as to keep consistency of progress of the Structure Plan.



Table 5.2.9: Implementation Schedule (Road Network)

No.	Project Name	Status	Implementation Schedule (FY)																											
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	Improvement of Signalized Intersections (Phase 1)	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
2	Construction of Flyovers/Underpasses for Bottleneck Intersections	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
3	Re-construction of Old Bridge(s) such as Thaketa Bridge	Urgent	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
4	Improvement of Signalized Intersections (Phase 2, 3)	Short to Middle-term			█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
5	Improvement of Approach Roads of Dagon Bridge	Short-term		█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
6	Improvement of Road No.2	Short to Middle-term	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
7	[Outer Ring Road (Section-1)] Upgrading of Road No.7	Short to Middle-term			█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
8	Improvement of East-West Corridor 1 (Road No.5 - Thanthumar Road)	Middle-term		█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
9	Construction of New Bayntnaung Bridge	Middle-term			█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
10	Improvement of East-West Corridor 2 (Hay Thin Atwin Wun Rd - Road No.2)	Middle-term		█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
11	Construction of Wataya Bridge	Middle-term			█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
12	Construction of 2nd Dagon Bridge	Middle-term			█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
13	Construction of Bago Bridge (2nd Thanlyn Bridge)	Middle-term	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
14	Improvement of Road No.4 and Inner Ring Roads	Middle-term		█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
15	[Outer Ring Road (Section-2)] Construction of Arterial Roads	Middle-term							█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
16	[Outer Ring Road (Section-3)] Construction of Arterial Roads	Middle-term																												
17	[Outer Ring Road (Section-1)] Construction of Toll Road	Middle-term																												
18	[Outer Ring Road (Section-2)] Construction of Toll Road	Long-term																												
19	[Outer Ring Road (Section-3)] Construction of Toll Road	Long-term																												
20	[Outer Ring Road (Section-4&5)] Construction of Arterial Roads	Long-term																												
21	[Outer Ring Road (Section-4&5)] Construction of Toll Road	Long-term																												
22	[Inner Ring Road] Construction of Elevated Roads and Radial Roads	Long-term																												

Source: JICA Study Team

(8) Symptomatic Treatments for Short-Term Projects that are to be Urgently Implemented

In order to draw up development policies for the road sector (including public transport), the following aspects are taken into consideration:

- (i) Development of policies to solve issues/problems currently occurring and urgent countermeasures are necessary (symptomatic treatments); and
- (ii) Development of policies to support and promote the development of future urban structure (such as creation of new S/C and new urban cores) which will drastically change traffic movement patterns and volume in future.

Although the changing present urban structure and construction of new S/C and new towns are fundamental measures to accommodate the increasing population, to disperse huge traffic demand will take a long time period. Therefore, these two aspects of development policies will be treated as phasing procedure for short-term, middle-term, long-term plans and the urgent projects in short-term.

Listed are the following road projects to which urgent symptomatic treatments are necessary in short-term.

- 1) Countermeasures to mitigate traffic congestion in CBD
  - i) On-road parking prohibition;
  - ii) Modernization of traffic signal operation system;
  - iii) Optimization of intersection configuration;
  - iv) Improvement of sidewalks;
  - v) Control of motorcycles and non-motorized vehicles to enter CBD and other designated areas;
  - vi) Road information services to drivers (about congestion, accidents, etc.);
  - vii) Construction of the Outer Ring Road (ordinary road section of the main road No.7 to bypass the through traffic and to provide alternative routes); and
  - viii) Maintain the current one-way system in CBD and improve it when necessary.
- 2) Countermeasures for traffic congestion on trunk/main roads
  - i) Improvement of trunk road network (widening, etc.);
  - ii) Construction of flyovers at congested intersections;
  - iii) Modernization of traffic signal control; and
  - iv) Construction of off-road bus terminals and bus lay-bys to avoid congestion.
- 3) Reinforcement of road maintenance and management
  - i) Improvement of road drainage system;
  - ii) Preparation of road asset management and inspection system;
  - iii) Procurement and maintenance of equipment and machine for road maintenance; and
  - iv) Securing of stable funds for road maintenance.
- 4) Road Traffic Safety
  - i) Construction of pedestrian crossing bridges at main roads;
  - ii) Construction of medians along major roads to improve operational speed and safety;
  - iii) Improvement of road facilities such as lightning, guardrails, and markings;
  - iv) Reinforcement of control on traffic offenses/violations;
  - v) Improvement of sidewalks including barrier-free treatments; and
  - vi) Education of traffic safety.

(9) Priority Projects

The priority projects are shown in the project sheets in Chapter 6.3.