

ANALYSIS ON SUSTAINABILITY IN MANDALAY CITY PLANNING

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Abstract

For human beings, good living environment, which both include built environment and natural environment, is very important. To create a good living environment, urban planning, rural planning, landscape architecture as well as building designs are crucial to be harmoniously planned and designed. Most of the countries seriously consider for planning their living environment to become sustainable cities. Developing countries are also trying to make a corrective action for the sustainable development of the countries. Mandalay city, Myanmar, as a city of a developing country, has the problems that need to improve for livable and sustainable environment. Mandalay city which is situated in the central part of Myanmar and it is a centre of transport and communication for all trades and commerce activities. After the policy of market-oriented economic system, the city has become one of the most developed economic centers for commerce. The city's rapidly increasing population leaves impacts on the living environment. Some developments and infrastructure have not met the present day needs of our society. In order to get a better living environment, we need to improve the situations in which we are operating Mandalay City's planning. In this paper, the trends towards sustainability of quality of life and living environment in Mandalay City have been considered. To indicate the requirement of quality of life and living environment, suitable set of indicators for Mandalay has been selected and evaluated. According to these indicators the requirements for sustainability of Mandalay city have been formulated to become a good living environment. As the country is moving towards a developed country, many sectors in urban planning of cities should be improved along with economic development to be one of the sustainable cities in the world.

Keywords: Sustainability, Indicators, Quality of Life, Living Environment, Urban Planning

1. Introduction

In 1857 AD, King Mindon built the palace, Mya Nann San Kyaw and fixing boundary mark started from the base of Mandalay hill, east-north of present rampart (Win Maung, 1999). Being a capital is called 'Mandalay' from that time forward. Mandalay as a near-perfect geometrical pattern, the road and streets cutting at right angles-physically. The city was divided by the cardinal points-the east, the west, the south, and the north. Mandalay city is second largest city in Myanmar. People from urban area faced with the problems such as traffic congestion. So it is very important to arrange the suitable community facilities and accessibilities. And then appropriate set of indicators for the city is selected. From this analysis, the finding for the selection set of indicators is chosen. And according to these indicators, the requirements for sustainability of Mandalay city have been formulated to become a good living environment.

2. Methodology

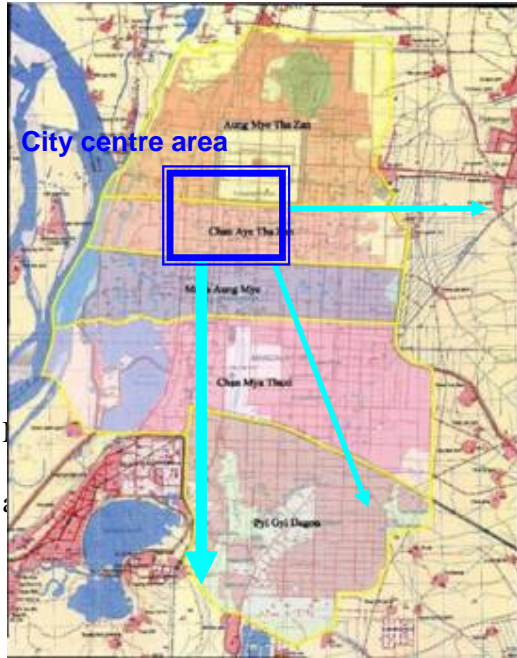
More than 50% of the world population lives in the cities. In urban area, the living condition due to their fast growth concentrated high amount of resources and produce such as high amount of wastes, the pollutants elements. The implementation of a sustainable strategy needs to the use of measurable policies and performance indicators. For the analysis of Mandalay city's sustainability;

Comparison between the other countries' indicators

Comparison between the UN indicators and the other countries indicators has been done (Shamsudin. K, 2006). In this analysis, the comparison method is used. And the criteria are used for indicators selection.

2.1 The Increase Development of Mandalay City

With the development of market-oriented economic system, the city has become one of the most developed economic centers for commerce.



Together with that, many changes and actions effecting in many sectors were occurred. They are as follows;

- Urban sprawl to east, south and south-east as shown in figure (1).

- Increased Population 210,000 from 1990 to 2005

- Solid Wastes Management

Problems of the city

- Traffic problems in

- Buses can only be carried

City centre area

- Other private transport vehicles

Figure (1) Urban sprawl of Mandalay city

2.2 Selection of Indicators for Mandalay City's Sustainability

There are many cities that focus on sustainability. Since the United Nations Conference on Environment and Development held in Riode Janeiro in 1992. Many developed and developing countries tried to improve their economic, social situation. And developed creations of new machines are made much pollution. There have many trends to choose indicators.

2.3 Criteria for Indicator Selection

Mandalay city is situated on the eastern bank of Ayeyarwaddy River and is a city with a large port. It was the capital city of the second last king of Myanmar. So it is the cultural heart-centre of Myanmar. It stands as a rich in historical memories, as the last capital before the British annexed the whole country. Mandalay is as a city rich in monuments relating to Buddhism.

Mandalay city is in hot and dry zone. Existing physical condition of the city and land use of the city and also the climatic effect on Mandalay are required to consider. Moreover the traditional aspect of the city, the environmental and social conditions of Mandalay city are also required to be considered for the selection of indicators.

The basic consideration for the selection of appropriate indicators is the fact that it is theoretically and practically impossible to describe any real situation completely.

A set of selected indicators can never claim to correctly describe a situation of several different situations but can be used for analysis. The following table (1) is shown the list of data provider of the analysis.

2.4 Data Provider

Sr No.	Data provider
1	Cleaning Department (M.C.D.C)
2	Water and Sanitation Department (M.C.D.C)
3	Road and Bridge Department (M.C.D.C)
4	Factories and Vehicles Department (M.C.D.C)
5	Building and Department (M.C.D.C)
6	Garden and Playground Department (M.C.D.C)

Table (1) List of Data Provider

3 The Selection Set of Indicators for Mandalay

The following indicators are chosen for Mandalay city towards sustainability.

According to the existing physical conditions of the city an appropriate set of indicators are chosen as the following table (2);

Serial No.	Indicators for Mandalay
1	Increased Population
2	Urbanized area
3	Solid Wastes per person per day
4	Total daily garbage collection
5	Solid wastes that are required to recycle
6	Availability and use of recycling facilities inside communities
7	Number of dustcart
8	Electricity consumption per person per day
9	Water usage per person per day
10	Air pollutants in urban areas
11	Area ratio of public facilities (Lee, Y.J, 2006)
12	Crime rate (Lee, Y.J, 2006)
13	Average number of students per classroom
14	Maintenance on Heritage Elements and Urban Beautification, Percentage of Attraction area
15	Percentage of public bus user (Shamsudin. K, 2006)
16	Percentage of single occupancy vehicles that enter the city centre during morning and evening peak hour
17	Number of paying car parks and motor-bikes on roads
18	Pedestrian Crossing Bridge (around Zegyo Daw)
19	Railway Crossing Bridge
20	Waste Water

Table (2) Set of Indicators

3.1 Sustainability of Mandalay According To the Indicators

3.1.1 Sustainable Population

According to the increased population indicator, Mandalay city has reached the total population over 870,000 in 2005. From 1990 to 2005, the population has increased about 210,000. And the growth rate of population is about 2.3 % (Swe Swe Aye, Ma, 1997). The rising of population as well as population density due to migrations from rural to urban area is one of the important activities. After market-oriented economic system, the workers from the surrounding regions are worked in the city around Zegyo Daw area as shown in figure (2-b). Most of the workers from the nearest regions are entered and left the city daily. According to sustainable population indicator, Mandalay city has the growth rate of 2.3 % in population. To these growth rate of population Mandalay city can be increased on year 2010 about 1.3 million. Total number of population in a city or town is proportionate with its carrying capacity of its infrastructure, social, facilities, economy and environment. It can be seen from the quality of life aspect. Adequate housing is required for increase in population and satisfies individual needs (safety, health without pollution). So planning areas can be arranged such as recreation area, housing estate.

According to the urbanized area indicator, the area between 72th st and 84th streets in the east-west direction and between 26th st and 35th streets as shown in figure (3) is the most congested area where the city's population is concentrated and many growth activities such as Educational buildings, Commercial buildings, Administrative buildings are situated on that area as shown in figure (4). To analyze the sustainability of Mandalay City from the above aspects, congestion at city center area, number of paying car parks and motor-bike on roads and single occupancy vehicles that enter morning peak hours are also necessary to analyze as shown in figure (2-a).

The use of Vehicles

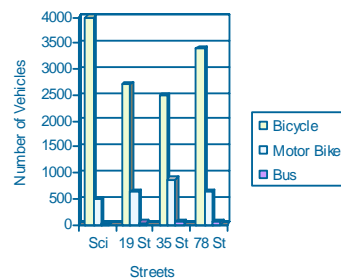


Figure (2-a) single occupancy vehicles that enter morning peak hours



Figure (2-b) Zegyo Daw Urbanized Area of the city



Figure (3) Location of Area of the city



Figure(4) the Urbanized Area of the city

Source: Field Survey 2005

3.1.2 Sustainable Infrastructure

According to water usage indicator, in present Mandalay, water can be supplied only seventy percentage of the total population. Water cannot be supplied all the households. As water supply in need is required to increase yearly due to the growth of population and development of the city.

To get sufficient water for Mandalay city, the new project of water supply system should be established to increase yearly. In order to accommodate, the future extension program for installation of city's water supply. The taxes should increase for future extension of water supply. The availability of adequate, good and clean water is one of the requirements.

Dug artesian wells and pumps are being installed for the use of two-third of the population as shown in figure (5). This situation has lead to self hand pumps and tube wells. Mandalay citizen are required getting more and enough good and clean water. The demand of the water is sufficient by own tube wells.

Mandalay City Development Committee has dug artesian wells and hand pumps which are being installed for the use of two-third of the population. Measurement on nature of the earth, analysis of water sample will be conducted to choose the suitable method of purification. The study is made to enable Mandalay citizen getting more and enough good and clean water.

Water supply, electricity etc...supplies that is efficient and adequate to ensure the health and well being of local residents. But the data for electricity consumption indicator is not available.

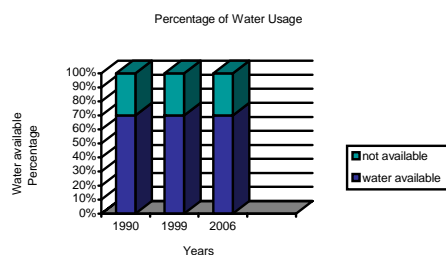


Figure (5) The percentage of water supply in the city

According to solid wastes per person per day, total daily garbage collection, and solid wastes that are required to recycle indicators, there has 0.35 g per person per day in the city. In Mandalay City, the solid waste management is carried out by Mandalay City Development Committee. The cleansing department is mainly responsible in solid waste management. The generation of solid wastes by the households and industries is one of the environmental impacts of modern civilization and of today's high standard of living. The amount of solid waste is increasing due to the generous use and disposal of almost all matter of everyday use. In Mandalay, at present there are two method of collection system. There has not enough collection of wastes which cause private collectors for each quarter. The increasing solid wastes are required to recycle. Moreover, recycling facilities are also required for the city sustainability. The prime reasons for controlled collection and disposal of refuse are hygienic and aesthetics ones. Mandalay City Development Committee strongly give the priority for solid waste management and draw long-term as well as short-term plans regarding the solid waste management with respect to the promotion of human welfare from a hygienic and aesthetic

point of view. The suitable solid wastes management systems are also considered in order to accommodate the city's population. Due to improvement in living standards of the people, more wastes products are produced and they should be collected with a more suitable system.

3.1.3 Sustainable Transportation

According to percentage of public bus user indicator, only 30% of the populations are using public buses because buses can only be carried around Zegyo Daw (city centre area). So well organized traffic operation is required from city centre area to other zones.

Most of the people in Mandalay city are used private transport vehicles such as motor-bikes and bicycles. As people from surrounding townships are working at city centre area and these workers always use private transport vehicles such as bicycles, motor-cycles as shown in figure (6). Because buses can only be carried around city centre area and the workers cannot use public transport. The time of their working off is later than 5:30 PM, at that time public transport buses are not available.

And according to percentage of single occupancy vehicles that enter the city centre during morning and evening peak hour indicator, there has many private vehicles such as bicycles, motor-bikes which enter to the city in the morning and leave from the city in the evening as shown in figure (7). Most of the workers from the surrounding regions work in the city especially construction sites.



Figure (6) Vehicles that are entered to the city centre during morning peak hour



Figure (7) single occupancy vehicles

So many single occupancy vehicles that are entered to the city centre during morning are as shown in figure (7). And they turn to their townships during evening. Most of the workers are from the following townships such as Pathein Gyi, Amarapura, and Myit Nge. Most of the routes of 19th street and Science street are used by the workers from Pathein Gyi Township. The route of 78th street is used by the workers from Myit Nge. And the workers from Amarapura used especially 84th street. Most of the workers use bicycles so many traffic congestions occur along those streets. Then according to number of paying car parks and motor-bikes on roads Indicator, the highest number of paying car and motor-bike parks on road can be seen along 84th street between 25th street and 30th street around Zegyo Daw as shown in figure (8-a) & (8-b). Parking area around Zegyo Daw area are about 50 numbers. Due to car and motor-bike parks on road, the city centre areas have traffic congestion particularly at Zegyo Daw environments as shown in figure (9).



Figure (8-a) Motor-bike Park on road Park on road road

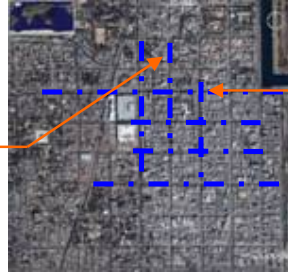


Figure (8-b) Parking areas around Zegyo Daw



Figure(9) Motor-bike Park on road

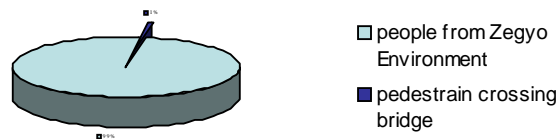


Figure (10) Percentage of use of pedestrian Crossing Bridge

The pedestrian Crossing Bridge (around Zegyo Daw 27th street) indicator, traffic way around CBD areas are one way, two ways etc. Pedestrian crossing Bridge on 27th street is insufficient crossing and formed traffic congestion around Zegyo Daw environment. Pedestrian crossing Bridge (27th street) divided that street at the middle of the lane. And there are three to five people per hour who use this bridge (Fig. 12).



Figure (11) Not suitable



Figure (12) Pedestrian crossing Bridge



Figure (13) Bridge

According to railway crossing bridge indicator, the bridges on 35th street and 42nd street between 78th street and 80th street as shown in figure (13) are railway crossing bridge. The sharp crossing bridges are not suitable for bicycle as well as motor-bikes. Many crossing places along railway are informally occurred and dangerous for the people as shown in figure (11).

3.1.4 Sustainable Urban Design and Public Facilities

To analyze the sustainability of Mandalay city from this aspect, the indicators maintenance and heritage elements and beautification and percentage of attraction areas in Mandalay has been analyzed. Thus Greater Mandalay has rich historical and cultural background compared with the other cities in Myanmar as shown in figure (14). There are many historical buildings and sites to visit and attractive spots to see in Mandalay as shown in figure

(15). There are many heritage pagodas and other interesting places in Mandalay. Historical sites required conservation to be attraction areas of the city.



Figure (14) Beautification of Mandalay hill

Figure (15) Historical Design on MahaMyat Muni Image

Availability of adequate public and recreational facilities by the authorities need to be aligned with population growth. The land is planned with the respective area of the carrying capacity. There are many heritage elements and sites and attractive spots to visit in Mandalay city. The expenditures of heritage elements and the public facilities are essential to increase. The expenditures on heritage urban design are required to increase yearly. Providing the sustainable public facilities such as open spaces, recreation areas, sports and leisure can fulfill the functional and aesthetic requirements for the people.

3.1.5 Sustainable Environment

Sustainable Environment concept is mainly base on the balance between development and environment. To analyze the sustainability of Mandalay City from the above aspects, the indicators air pollution in urban areas, number of dustcarts, dumping sites, and waste water are necessary to be analyzed. There were used many single occupancy vehicles especially bicycles in the last decade of 2000 as shown in figure (16).

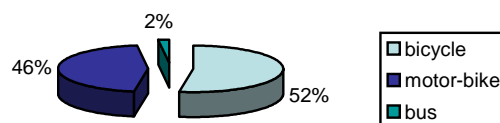


Figure (16) Percentage of Vehicles use

There is air pollution particularly at city centre areas. Many public and private cars cause air pollution to its surroundings. Later 2000, numbers of motor-bikes entering city centre area increased 1500 numbers per hour yearly. It can be seen that the use of motor-bike causes more pollution. These factors are considered to control air pollution such as the use of motor-bikes, the time of traveling, and the increased usage of mass transportation.

According to dumping sites indicators, two dumping sites are being used in Mandalay city as shown in figure (18). At dumping site, the whole area is filled with the solid wastes. After solid wastes are filled up to the ground level, the excavated soil is covered in that area as shown in figure (19).

The areas are Land area near Kandawgyi Lake and Land area near Panyandaw creek (Annual Magazine, 2003).

For solid wastes, the refuses from the city are required to divide the types and to collect for each type. Then each type is combined and that are required to recycle. This is one of the systems of solid wastes management. For dumping sites, it is required to landfill the wastes and the landfill methods should use for the city. For wastes transportation, more suitable collection trucks should use and maintenance cost is required as an important things as shown in figure (17).

The prime reasons for controlled collection and disposal of refuse are hygienic and aesthetics ones. Mandalay City Development Committee strongly give the priority for solid waste management and draw long-term as well as short-term plans regarding the solid waste management with respect to the promotion of human welfare from a hygienic and aesthetic point of view.



Figure (17) Collection Truck Figure (18) Dumping site Figure (19) Dumping site

Present Mandalay has the requirements with the new development conditions. In which the operational situations are required to monitor for the present needs of the city. Moreover, the development that meets the needs of the present without compromising the ability of future generations will meet their own needs.



Figure (20) Not Suitable Drainage along Road Figure (21) Waste Water on Road

According to waste water indicator as shown in figure (20) & (21), most of the places along 12th street, 35th street, 30th street, 41st street, 42nd street, 66th street have floods during rainy season. The drainage system and suitable waste water treatment system are required to fulfill the sustainability of the city's environment. The present needs of the city for sustainable developments are balanced between environmental, social, and economic conditions. Through the activities the existing conditions of Mandalay city is recommended as follows. The present population is required a commodious

urban environment and communities where has healthy, cultured and opportunities with its carrying capacity of social, economic and infrastructure.

A good quality of life and living environment, decentralization and systematic development for the city centre area is required. To fulfill these requirements, the secondary centre area for Mandalay city is required for future. The expansions of present Mandalay city boundaries are mainly southward. So as the other boundaries are limited by geographical conditions. The areas towards southern expansion are the availability of land area to be developed. So the secondary centre of Mandalay city is promoted to southern with a commodious urban environment as shown in figure (22).

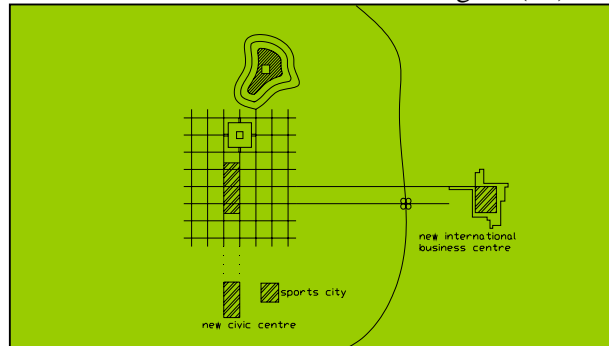


Figure (22) The structural Development concept in 1996 (CHEYODA plan, 1996)

4 Conclusions

The local authority Mandalay City Development Committee (M.C.D.C) is encouraged to assign duty to the branches of departments in M.C.D.C to analyze sustainable development of Mandalay City. In order to do this, the first step is to lay down the set of sustainable indicators in Mandalay city context.

By working all the departments in M.C.D.C in harmonious condition, Mandalay city will be one of the sustainable cities of Myanmar. After analyzing the selected set of indicators in Mandalay city, the operational existing conditions of the city is clearly seen. It can be clearly seen that the Mandalay city's planning which is required to fulfill the basic needs, such as arranging to get public facilities, the basic needs of infrastructure, and all people needs of a good living environment as well as the quality of life that all people will enjoy. Therefore, the approach to the sustainability of the present Mandalay city and also the future generation of the city needs. The city requires proper planning so that a corrective action can be done.

So the secondary centre of Mandalay city promotes southern urban environment. It is required to make the new structure development concept according to the present development conditions of the city. The traffic ways around city centre are required to smooth traffic and decentralization of the city centre area. The group in which to make corrective action to the city conditions is the first requirement. From which separate group are required to analyze the real situations. From which, the set of indicators for Mandalay city's sustainability can be seen clearly. Moreover, the concept of sustainability for Mandalay city has found and Mandalay city will be one of the sustainable cities of Myanmar.

5 References

- [1]CHEYODA plan, 1996, the structural Development concept, *Development Study of Mandalay and the region*.
- [2]Lee, Y.J, Sustainable Development Indicators for Taipei, Taiwan
Proceeding of 12th Annual International Sustainable Development Research Conference, Hong Kong 8-10 November, 2006.
- [3]Research Mandalay City Development Council, Annual Magazine, 2003.
- [4]Shamsudin. K, *MALAYSIAN URBAN INDICATORS NETWORK (MURNInet)*
Proceeding of 12th Annual International Sustainable Development Research Conference, Hong Kong 8-10 November, 2006.
- [5]Swe Swe Aye, Ma, 1997. *Growth Centers in Mandalay Region*. M.Arch thesis report. Yangon Technological University.
- [6]Win Maung, U (Tanpawaddy), 1999. *Mandalay Yatanarpone Golden City Paper*.