

# A Geographical Study on Solid Waste Disposal Management in Pyawbwe

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## *Abstract*

Waste generation is increasing in Pyawbwe year by year because of increasing population, developing technologies and expanding economy. Physical factors describing the study area, both now and projected for the future, size, growth patterns, population, influence the economics of the proposed solid waste management systems. Solid wastes are collected under bell ringing system and communal dump collection system and are disposed at final landfilled waste disposal site located at Ingyin Kone cemetery. By using the Pearson's Product Movement Correlation Method, it is found that the correlation between the generation of solid from households and the collection of Municipal Department of Pyawbwe, there is high degree of positive correlation. Solid waste generation is depending upon the number of Tank Carriers and garbage trucks and it is also significantly related with households in Pyawbwe. These results indicate that it is necessary for the management of household solid wastes in Pyawbwe to take prior.

**Key words:** waste generation, communal dump collection system, Tank Carriers

## **Introduction**

**Solid-waste management**, the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease—that is, diseases spread by rodents and insects. The tasks of solid-waste management present complex technical challenges. The most basic management will be educating and improving the public awareness about the hazardous nature of solid waste. Therefore, it is necessary for local people participate more in solid waste disposal management.

## **Study Area**

Pyawbwe Town is located in Yamethin District, Mandalay Region. It has an area of 563 acres (or) 0.88 square miles. It comprises nine wards. Its east – west length is about 2 miles and from north to south is 3 miles wide. According to Koppen's classification of climate, Pyawbwe Town has enjoyed Tropical Steppe Climate (BSh). According to the records of General Administrative department, Pyawbwe has the total population of 31,496 persons in 2019. The Population situation is an important factor in the solid waste disposal management.

## **Aim and Objectives**

The major aim of this paper is to analyze reducing and eliminating adverse impacts of waste materials on human health and the environment to support economic development and superior quality of life. The objectives of this study are as follow:

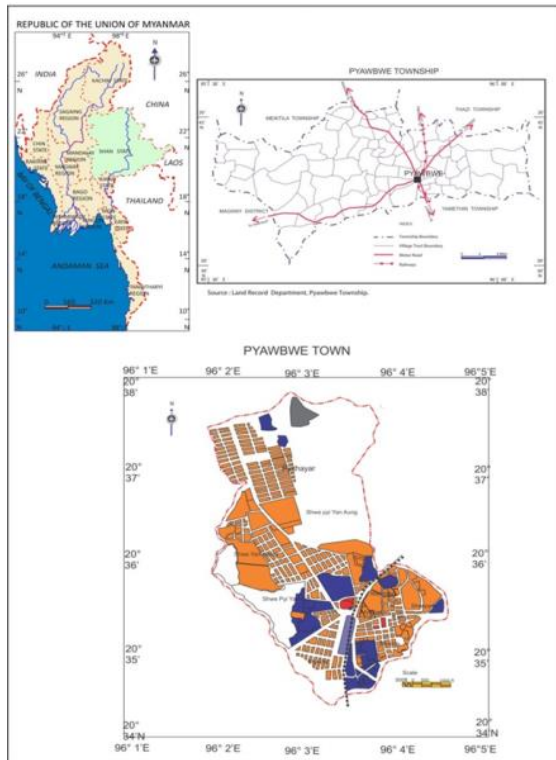
- To examine the efficiency and effectiveness of solid waste storage, collection, transportation and disposal,
- To reduce the volume of solid waste stream through the implementation of waste reduction and recycling programs,
- To provide necessary data and suggestions for solid waste disposal management in Pyawbwe.

## **Source of Data and Methodology**

Firstly, primary data are collected by field observation and personal interviews. Sampling methods can be used to observe the amount of waste generation. SWOT analysis will examine the Strengths, Weakness, Opportunities, and Threats on the solid waste disposal management. After that, secondary data are collected from respective offices, such as Municipal Department of Pyawbwe, General Administration Department, Immigration and National Registration Department, Land Records Department. Correlation between waste generation and other variables is analyzed by the application of Pearson's Product Movement Correlation Method. Data analysis and mapping are also carried out by means of Computer-aided technologies and GIS methods.

## **Types and Sources of Solid Waste in Pyawbwe**

Solid waste is also known as municipal solid waste because its management is usually taken by the municipal department of the respective urban area. Moreover, the problem of municipal solid waste is a consequence of urbanization. If the municipal department is responsible for management of a type of solid waste (collection and disposing), this waste can be considered as municipal solid waste (MSW). (Source: Developing ISWM Plan, Vol. 1: 2009, P-10)



**Figure 1 : Location Map of Pyawbwe**  
Source: UTM Map - 2096\_10,  
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In Pyawbwe, almost all types of solid wastes are under the responsibility of Municipal Department. In terms of the systems of collection and disposing, up to 2011, they have been grouped into: Solid Wastes of residential area, municipal services (including waste collection in Markets), industrial, and health care services and governmental institutions (including monasteries, schools). Some of them are not collected by the municipal.

Residential solid waste is also known as household waste or domestic waste. Solid waste from household in the study area are stored in various types of containers such as large carton (cardboard box), bamboo basket, plastic basket, plastic bag, plastic bin and sometimes, food waste. In the study area, the households have different family member, educational status, income level, distance from communal dump site and from the regular routes of garbage collection. In collecting the amount of solid waste generation from residential area, only a group of 90 households in 9 wards have been taken sample and measured.

Commercial solid waste can be defined as any waste generated as the result of carrying out a business. It comes from stores, restaurants, tea shops, markets, hotels, offices, services stations, auto repair shop, etc. Commercial solid waste consists of paper, cardboard, plastic, food waste, tins, cans, vegetable peels, glass metal special waste, etc. Solid waste from commercial activities in the study area is stored in various types of containers such as bamboo basket, plastic bag, plastic baskets, metal or plastic can/ tin, plastic or iron baskets. Solid waste generated from these groups is very different in amount and

composition. Among them food shops, restaurants, tea shops and large food shops (selling rice and curry) generate larger amount and more complicated waste. In the market sector, amount of solid waste from markets can be quantified by vehicle survey.

Hazardous wastes refer to waste that may, or tend to, cause adverse effects on the ecosystem and human being. In Pyawbwe, hazardous solid waste and household hazardous waste are mostly found. According to field observation and questionnaire, the total amount of hazardous solid waste is about 0.2 ton.

Apart from solid wastes (residential, commercial, hazardous, and infectious), other wastes are also found. In the study area, other wastes include institutional waste (schools, offices, and monasteries), street sweeping, construction and demolition waste. According to questionnaire and field observation, the total amount of other waste in the study area is estimated at about 14.85 tons.

## Solid Waste Disposal Management in Pyawbwe

Current solid waste disposal of the study area includes only five functional elements: Solid waste generation, Storage, Collection and Transportation of solid waste and Disposal.

### (i) Solid Waste Generation

In the study area, the measurement at the point of generation and the vehicles survey are used to quantify the amount of solid waste generation. In this measurement, solid waste from households, commercial activities (various kinds of shops), health care facilities and solid waste collector truck from various sources were quantified. Solid waste from sampled household, various kinds of shops and health care facilities in residential wards were collected and quantified. The major waste generators analyzed by this method include individual person, household, food shop, and clinic. This method help to provide an estimate of waste quantities to be scaled up from the single generator to a larger level.

### (ii) Vehicle Survey

In Pyawbwe, vehicle survey can be carried out for municipal service sector in Markets along the regular collecting route of garbage trucks and commercial sectors of downtown area. This survey can be made based on the number and kind of garbage trucks used in daily collection and frequency of waste collection by a truck in a day.

In 2019 the study area had 8 garbage trucks used in solid waste collection. The garbage trucks are shown in Plate (1). The estimation by these garbage trucks indicates that the total amount of solid waste that arrives at final dump site amounted to 1.65 tons) daily. However, the actual difference will be larger than this figure because some commercial activities or shops disposed of their solid waste to the final dump site by their private haulers and some residents refused their waste indiscriminately along the road sides and into the drains.



Plate1: The Garbage Trucks of Different Sizes in Pyawbwe

Source: Development Committee Pyawbwe

**( iii ) Community Waste Storage**

In Pyawbwe, Tank Carriers (TC) and wheeled plastic bins (also called Plastic Tote) can be used in some parts of downtown area, in Markets and in front of some large restaurants. These wastes are collected by sweeping and piled up at the concrete bunker near the market. This point can be regarded as secondary storage point. The open dumpsites along the roads and community waste storage facilities (Tank Carriers) are the secondary storage Facilities throughout the study area. The communal dumps in downtown areas cover smaller area and are collected and cleaned by the municipal department every morning or evening.

**Collection and Transportation of Solid Waste**

In Pyawbwe, solid waste collection system coincides with the solid waste transportation. In the collection system, the garbage trucks in the bell ringing system can collect the solid waste along the major routes passing through the residential wards. Moreover, some garbage trucks are very small in size, very old in age, incapable of full loading and have mechanical problem. The solid waste collected throughout the study area is directly transported to the final dump site.

**Street Sweeping**

Another municipal services are street sweeping and collecting along Yangon- Mandalay Highway, and some Road. There are seven groups of workers for street- sweeping and litter- picking. Group (1) is composed of 15 labours, group (2) 17 labours, group (3) 10 labours, group (4) 13 labours, group (5) 10 labours, group (6) 8 labours and group (7) 5 labours. Their tasks by group are shown in Table (4.3). Refuses, sand and dust come out from the task are collected into Polythene Bag (Penan Bag) and got into the garbage truck. In this service, waste collectors use Polythene Bags, and plastic bins and a garbage truck to collect and transport the collected waste.

**Analysis on Solid Waste Disposal Management**

Urbanization is one of the critical results of economic growth and complex urban growth is

creating major challenges with regard to managing municipal services like solid waste disposal. There is a need for a sustainable waste management which offer solutions to issues of social, economic and environmental aspects. Therefore, it is necessary to analyze waste disposal management in Pyawbwe to predict the future trend of solid waste generation.

**Table 1: Social Factors and Disposed Solid Waste in Pyawbwe (2019)**

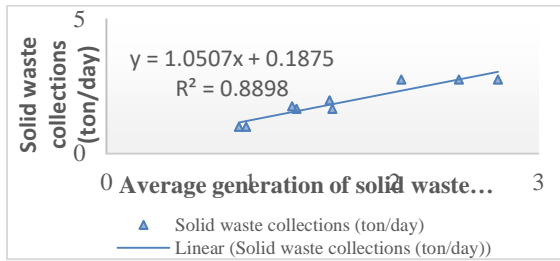
No	Ward	Total Population	Area Sq -mile	Population Density perSq(mile)	households
1	Shanpwe	5602	0.13	43092	1033
2	Myinbet	2734	0.07	39057	722
3	Myoma	2002	0.05	40040	463
4	Mandalay Tan	3203	0.02	160150	458
5	Myothit	4217	0.1	42170	980
6	Shwepiyanaung	1889	0.14	13492	652
7	Shwepiyannaing	3238	0.11	29436	1126
8	Shwepiyatlan	5049	0.02	72128	729
9	Pyithayar	2675	0.19	14078	854
	Total	31496	0.88	453643	7017

Source: Immigration and National Registration Department

**Table 2: Disposed solid waste and solid waste collection in Pyawbwe (2019)**

No.	Ward	Average generation of solid waste (ton/capita/day) (based on Population data)	Solid waste collections (ton/day) (based on collection of garbage truck)
1	Shanpwe	2.72	2.75
2	Myinbet	1.32	1.66
3	Myoma	0.97	0.99
4	Mandalay Tan	1.55	1.98
5	Myothit	2.05	2.75
6	Shwepiyanaung	0.92	0.99
7	Shwepiyannaing	1.57	1.66
8	Shwepiyatlan	2.45	2.75
9	Pyithayar	1.29	1.75

Source: Municipal Department of Pyawbwe



**Figure 2. The Correlation between generation of solid waste and solid waste collection in Pyawbwe (2019)**

Source: Based on Table (2)

In analyzing the correlation between the generation of solid from households and the collection of Municipal Department of Pyawbwe, the correlation coefficient value ( $r = +0.93$ ) show that there is high degree of positive correlation at 1 percent significance level. It means that, cleaning department of Pyawbwe can collect completely over the solid waste disposed from the households of the whole town. That is why it can be said that the management on the solid waste disposal of Pyawbwe is very effective and reliable for local people.

**SWOT Analysis on Solid Waste Disposal Management**

Bringing all people together on the waste disposal management is a major challenge in the human society but the benefit of a clean environment is a common goal. SWOT analysis serves as a strategy planning tool that can be used to help together in making informed decision and it identifies Strengths, Weakness, Opportunities and Threats.

**Table (3) SWOT Analysis on Waste Disposal Management**

<b>Strengths</b>	<b>opportunities</b>
<ul style="list-style-type: none"> <li>- Regular waste collection</li> <li>- Establishment of private waste collecting centers</li> <li>- Self-awareness for clean environment</li> <li>- Good transportation</li> <li>- Education camping on SWDM</li> </ul>	<ul style="list-style-type: none"> <li>- Enhance waste disposal management</li> <li>- Public services</li> <li>- Growth in local community and Organization, NGOs</li> <li>- Improve the environmental awareness</li> <li>- Obtaining external supports from government and private associations</li> <li>- Introducing for waste segregation</li> </ul>
<b>Weakness</b>	<b>Threats</b>
<ul style="list-style-type: none"> <li>- Insufficient Tanks, Carriers (TC)</li> <li>- Lack of financial support</li> <li>- Need to participate in SWDM</li> <li>- Lack of safe and modernized garbage trucks</li> </ul>	<ul style="list-style-type: none"> <li>- Large number of open dumps</li> <li>- Adverse effects on human health and environment</li> <li>- Public's awareness, perception and attitude</li> <li>- Collection of fair charges</li> <li>- Increasing population and economic growth may increase consumption and waste</li> </ul>

Source; Field survey and Interview (2019)

The management of solid waste disposal is practiced in Pyawbwe. Average generation of solid waste is about 14.84 kg per capita per day, which is based on the generation of residential solid waste. It is therefore proposed to develop community based solid waste disposal management for systematic collection and disposal of solid waste. This would involve placing of waste Tank Carriers with segregated bins for recyclable and non-recyclable wastes. It is information gaps that cause the problem. It implies that information campaigns are appropriate. It can be concluded that without information and perception, attitude of individual to reduce waste, the individual will not act or perform waste reduction programs.



**Plate (2) Final Dump Site at Pyawbwe**

Source: Field Survey



**Plate(3) Solid Waste Collection System in Pyawbwe (2019)**

Source: Field Survey

**Results and Discussion**

Pyawbwe has also waste disposing problems like other town and cities activities create waste, and the ways that waste is handled, stored, collected and disposed can affect the environment and the public health. The daily activities of the local people generates waste in Pyawbwe. Generation wastein 2019, the total solid waste generation is about 14.84 tons per day and includes household, commercial, market, infectious and hazardous waste.

Although the greater number of population can generate the larger amount of solid waste, the waste



can scatter over the wider area and collection problem can arise. Moreover, the large number of communal dumps or Tank Carriers (TC) can be found only in the ward of large population. In Pyawbwe, there were 12 garbage trucks that serve in solid waste collection. Among them, 8 garbage trucks were used in regular collection routes, of which 4 vehicles were very old and mechanically and physically deteriorated. Hand cart collection method is also found in Pyawbwe. This practicing and collecting method is run by a person who wanted to earn the extra money privately. According to field survey, it can be estimated that the number of hand cart collectors were 35 persons in 2019. A collector can collect the amount of solid waste ranging at least about 24 kg to 65 kg. About 26% of use plastic or polythene bags (called Penan Bag) and about 10% of households use two or more kinds of containers. Only 7% of households mostly restaurants, food shops, large stores use plastic bin with cover.

The preference of secondary storage facilities by the residents of wards in Pyawbwe was also surveyed. By this survey, even in the wards of downtown area where there is regular collection of waste by the garbage trucks, some households have still preferred a kind of communal dumping. According to the respondent, only 18% of the people segregated recyclable materials before waste is disposed and 82% non-segregated. "Three Rs", Reduce, Reuse, and Recycle, are possible for everybody to practice. However, the survey shows that about 45.6% know the 3R and 54.4% don't know them.

In Pyawbwe, solid waste problems are threatened to the people of the township. Waste disposition depends upon total population, household and location of the disposal site. Waste generation from residential source is the largest in all sources. Based on socio-economic conditions of the residents, the waste generation rate will be higher and higher.

Being Located in Mandalay Region, Pyawbwe has become renown various attractions. Therefore, Pyawbwe need keeping clean and pleasant surroundings. If we have more sufficient Tanks, Carriers, more financial support, the study area will be more cleaning area.

### Conclusion

Population is growing at annual growth of 3.7 percent. With increasing population, the amount of solid waste generation is more and more increasing. Due to the landfilled collection system, the township has suffered ground water pollution and soil pollution. In a waste stream, solid waste can cause short term and long term adverse effects for the environment and human health. The most basic management will be the

educating and improving the public awareness about the hazardous nature of solid waste.

Therefore, it can be suggested that-

- Educating should be done until people can accept the concept of solid waste at least to Reduce, Reuse and Recycle (3Rs)
- Compactor trucks or modernized safe garbage trucks should be used.
- There should be legislation of laws and regulations for infectious solid waste (including hazardous waste)

We are all part of the solid waste problem, but we can also be part of the solution. Therefore, we need to seek solution to the problem together. If all these measures are taken, Pyawbwe will become a more clean and pleasant township and systematically.

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### မြန်မာကျမ်းကိုးစာရင်း

ပျော်ဘွယ်မြို့နယ် အုပ်ချုပ်ရေးမှူးရုံး (၂၀၁၉)။ ကျေးရွာအုပ်စု အလိုက် ဒေသဆိုင်ရာအချက်အလက်များ၊ ပျော်ဘွယ်မြို့။

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