

MANAGEMENT OF SOLID WASTES OF AIR TRANSPORT: A CASE STUDY ON JESSORE AIRPORT, KHULNA CITY REGION, BANGLADESH

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ABSTRACT

Solid Waste Management System (SWMS) is a key feature for a city's aesthetic view and image. SWMS in transportation sector is an important part for city planning. Khulna is one of the important regions of Bangladesh from economic, administrative and tourism point of view. Jessore Airport (JA) is the only one domestic airport situated in Khulna division. Proper SWMS is very crucial for the JA. The management system of solid waste is comprised of its collection, transportation and disposal. Semi structured interviews are conducted with related stakeholders like Airport Engineer, Manager, Staff and Passengers to collect data on SWMS in JA. Among the 385 passengers of Aeroplanes connected with JA, 5% (20 persons) are interviewed. Overall two types of solid waste are generated from JA namely flight wastes and non-flight wastes. Total 16 people are involved in SWM in JA including Aeroplanes. After collection of wastes, they dump the wastes into Reinforce Cement Concrete (RCC) built dustbin adjacent to the JA. Their total work is very systematic and well planned. Around 63kg solid wastes are generated from the total JA area daily. About 66% wastes are generated in six aeroplanes and remaining 34% are generated in the civil aviation area. Among the surveyed passengers 55% passengers described the service and present conditions of SWMS in JA as well, 30% described it as better and 10% described as moderate. There are scopes of improving SWM system of air transportation sector through development of effective coordination among concerned stakeholders and also initiative of Public and Private Partnership (PPP).

Keywords: Solid Waste Management System (SWMS), Airway Transport, Jessore Airport.

1. INTRODUCTION

Solid Wastes (SWs) generation and its impact is an emerging issue for public health aspects in the developing countries. Solid waste generation is lower in the developing county than the developed county in relation to per capita income owing to less purchasing and consumption rate (Cairncross et al, 1993). Khulna City generated 380 metric tons of solid wastes in 1998 and by the year 2020 it would be around 922 metric tons (Roy, 2011). The city covers an area of 45.65 square kilometres with a population of near about 1.5 million. About 520 metric tons of municipal solid wastes are generated per day in Khulna City (Roy et al., 2013). The amount of wastes generated in urban areas depends upon a number of factors like food habit, standard of living, degree of commercial and industrial activity etc. Solid Wastes generated in all the sectors of Bangladesh is increasing day by day with the increase of population. A major amount of solid wastes are also generated in transportation sector. But, wastes of transportation sector could not draw attention of concerned stakeholders in separate manner. Air links create regional accessibility and social inclusion and improves the business location of the area. Finally, it possibly stimulates tourism and leads to increase employment. The nearest airport from Khulna City is at Jessore. Jessore Airport (JA) located 71 km north of Khulna City Centre, is the only airport in the region. It is a domestic airport which lies at 23°11'01"N 89°09'39"E coordinates and length of the runway of the airport is 8000ft (2438m) and surface pattern is asphalt (Wikipedia, 2015). This airport is used both for military and public purpose. Proper management of solid wastes generated in airport is important for ensuring better health of the passengers both from national and international level, staff and people connected with air transportation system. The objectives of this study are:

- To find out the amount and category of generated solid wastes in different areas of Jessore Airport.
- To find out the existing Solid Waste Management System (SWMS) with the problems and limitations of concerned stakeholders and
- To provide some recommendations for better SWMS of Jessore Airport.

2. METHODOLOGY

The study is conducted in 2015 following both the qualitative and quantitative research method. Primary and secondary data i.e. name, location, history of JA; existing SWMS of JA are collected from the survey of passengers as users; from the office documents of JA and also from secondary documents. Among the total 385 passengers of four airline services, 5% (20 persons including 5 women) passengers were selected randomly as survey respondents. Interviews with officers of Civil Aviation Authority are conducted through checklist. Photographs are taken from different areas of JA. Collected data from JA is analyzed and presented through texts, tables, graphs and maps. ArcGIS 10 is used for preparation of maps.

3. AMOUNT OF SOLID WASTE GENERATED IN JESSORE AIRPORT

4.1. Total Average Amount of Solid Wastes Generated from Civil Aviation and E/M Section in JA

There are two big metal dustbins placed at the corner of main services area which is surrounded by public terminals, ticketing, food service areas. Metal dustbins are cleaned up after 2/3 days interval. Almost in each and every office room there has a plastic bin. Waste collectors collect all the wastes from the plastic bins every day. Remaining solid wastes are collected during dry sweeping, washing, mopping, watering and toilet cleaning.

Table 1: Amount of solid wastes generated in Jessore Airport

Location of Wastes Generation	Average Solid Wastes Generation (Kg/Day)
Services Areas, Public terminals, Ticketing, Food Service Areas	9
Security Gates, Offices Areas, Maintenance Areas, Airport Grounds Handling and Airfield Ramps etc. areas	12
Total	21

Source: Field Survey, May 2015.

4.2. Amount of Solid Wastes Generated from the Aeroplanes of Jessore Airport

Amount of wastes generation depends mainly on passenger capacity of each aeroplane. US-Bangla Airlines and United Airlines provide two types of aeroplanes on the basis of passenger capacity.

Table 2: Amount of solid wastes generated from the aeroplanes of Jessore Airport

Name of the Airlines	Passengers Capacity with Aircrew			Solid Waste Generation (Sacks/Day)			Average Amount of Wastes Generation Per Flight (Kg/Day)			Average Amount of Wastes Generation (Kg/Day)
	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small	All
US-Bangla	80	58	45	2	1	1	10	8	6	17
Novoair	-	-	49	-	-	1	-	-	7	7
United Airways	68	-	41	2	-	1	9	-	6	7.5
Biman Bangladesh Airlines	80	-	-	2	-	-	10	-	-	10
Total										41.5

Source: Field Survey, May 2015.

As US-Bangla Airlines service provides three categories of airlines services, daily 17 kg solid wastes are generated from here. United Airlines provides two types of aeroplanes. Daily only average 7.5 kg solid wastes are generated, as United Airlines provides an aeroplane per day.

4.2.1. US-Bangla

Daily one large size must and one small or medium size of aeroplane lands in and takes off from the Jessore Airport.

Average solid wastes generation per day (in kg) is,

= Waste generated from large size aeroplane + Average waste generated from medium and small size aeroplane.

$$= 10 + \{(8 + 6) / 2\}$$

$$= 17$$

4.2.2. Novoair

Daily an aeroplane lands in and takes off from the Jessore Airport. Daily average solid waste generated from this aeroplane is 7 kg.

4.2.3. United Airways

Though there is no fixed rule about aeroplane size but two aeroplane land in and takes off from the Jessore Airport in a day.

Average solid waste generation per day (in kg) is,

= {(Average wastes generated from two large size aeroplane) + (Average wastes generated from one large and one small size aeroplane) + (Average wastes generated from two small size aeroplane)} / 3

$$= [\{(9 + 9) / 2\} + \{(9 + 6) / 2\} + \{(6 + 6) / 2\}] / 3$$

$$= 7.5$$

4.2.4. Biman Bangladesh Airlines

Daily an aeroplane lands in and takes off from the Jessore Airport. Passengers Capacity with aircrew of this aeroplane is 80 persons. Daily average solid waste generated from this aeroplane is 10 kg.

4.2.5. Total Average Solid Wastes Generation from Four Airlines Per Day (in kg)

Total average solid wastes generation from four airlines per day is 49 kg.

4.3. Total Daily Average Amount of Solid Waste Generated from JA

Total average amount of solid waste generated from JA is the sum of total average solid wastes generation from four airlines and from total Civil Aviation areas.

Total average amount of solid waste,

$$= (21 + 41.5) \text{ kg}$$

$$= 62.5 \text{ kg}$$

4.4. Location Wise Solid Waste Generation Intensity

Ready-made food wastes like paper, polythene packets and fruit peels, wooden sticks of ice-cream and various steel & plastics bottles are generated daily in civil aviation area.

Table 3: Percentage of Total Average Amount of Solid Waste Generated from JA

Source	Total Amount of Solid Waste (Kg/Day)	Percentage of Total Average Amount of Solid Waste Generation in JA
Total Civil Aviation Area	21	33.6%
Six Aeroplanes of Four Airlines	41.5	66.4%
Total	62.5	100%

Source: Field Survey, May 2015.

Table 3 shows that daily around 66.4% wastes are generated from six aeroplanes and remaining 33.6% wastes are generated in total Civil Aviation area.

5. AREA OF WASTE GENERATION AND RESPONSIBLE AUTHORITY OF SWMS

5.1. Responsible Authority of SWM in Jessore Airport

Civil Aviation Authority (CAA) is responsible for managing the solid wastes generated from the total Civil Aviation areas excluding aeroplanes. The Civil Aviation area includes areas namely public terminals, ticketing, security gates, food service areas, offices & services areas, maintenance areas, airport grounds handling, airfield ramps etc. areas. It also includes E/M section, which is being developed within the Jessore Airport area for providing high-quality technical services for building airport infrastructure.

Total four airlines are providing services in Jessore Airport. US-Bangla Airlines, United Airlines, Novoair, Biman Bangladesh Airlines have regular flights between Jessore and Dhaka. SWM system of Airlines section means the management systems of solid waste generated into the aeroplanes. Every day total six aeroplanes land in and take off from the Jessore Airport. Authorities of the four airlines are responsible for managing the solid wastes generated from the aeroplanes.

5.2. Manpower Involved and Their responsibilities in SWM in Jessore Airport

5.2.1. Manpower involved in Civil Aviation Area and E/M Section in Jessore Airport

There are four persons, who are directly employed by CAA for Solid Waste Management in Civil Aviation area including E/M section of Jessore Airport. They all are men and permanent workers. They collect wastes from the total civil aviation area and dump the wastes into the RCC (Reinforce Cement Concrete) built dustbin adjacent to the airport and in a small open dumping site at the backside of Jessore Airport. Responsibilities of the manpower involved in SWM include dry sweeping, washing, mopping, watering and toilet cleaning. Their total work is very systematic and well planned.

5.2.2. Manpower involved in the Airlines connected with Jessore Airport

Total number of manpower involved in waste collection, sweeping, cleaning related work in each airlines are given below:

Table 4: Manpower involved in the Airlines connected with Jessore Airport

Name of the Airline Services	Waste Collectors
US-Bangla	3
Novoair	2
United Airways	3
Biman Bangladesh Airlines	4

Source: Field Survey, May 2015.

The four airline services appointed the waste collectors. Us-Bangla has 3, Novoair has 2, United Airways has 3 and Biman Bangladesh Airlines has 4 waste collectors. Among them there is no involvement of any woman. They work in two shifts in a day. Their main responsibilities are to do dry sweeping, washing, mopping, watering and toilet cleaning of the aeroplanes and waste collection through sacks from planes and finally dump the collected wastes into the RCC dustbin located adjacent to the airport.

5.3. Solid Wastes Management System in Jessore Airport

Waste collectors do dry sweeping, washing, mopping, watering and toilet cleaning. There is a charter of duties for the sweepers or cleaners under Civil Aviation Authority to clean different areas of Airport. They collect wastes through various baskets from the public Terminals, Ticketing, Security Gates, Food Service Areas, Offices & Services Areas, Maintenance Areas, Airport Grounds, Airfield Ramps etc. areas. Finally collected mixed solid wastes are dumped to the RCC dustbin located adjacent to the airport. Their work of collection of wastes is divided into two shifts- morning and evening, when the airoplanes land and take off. After various construction or maintenance work of machine, if any construction material or instruments remains, those are supposed to collect for further uses. Only a small amount of things remain in E/M section as wastes. The wastes include wire, polythene etc. These are also dumped into the RCC dustbins.

After landing the aeroplanes, waste collectors clean the aeroplanes within half an hour provided by individual airline authority. They collect wastes from aeroplanes through sacks and carry those wastes to the final disposal center.

Before disposing of the plastic water bottles, both plastic and aluminum bottles of various cold drinks are separated by workers for selling. Some paper wastes are taken for household use as fuel by the workers. In this process there is no involvement of CAA. The value of a sack of plastic bottles is 100BDT. It takes almost one month to fill up a sack with bottles. After filling up that RCC dustbin with wastes, the wastes are burnt by the workers.

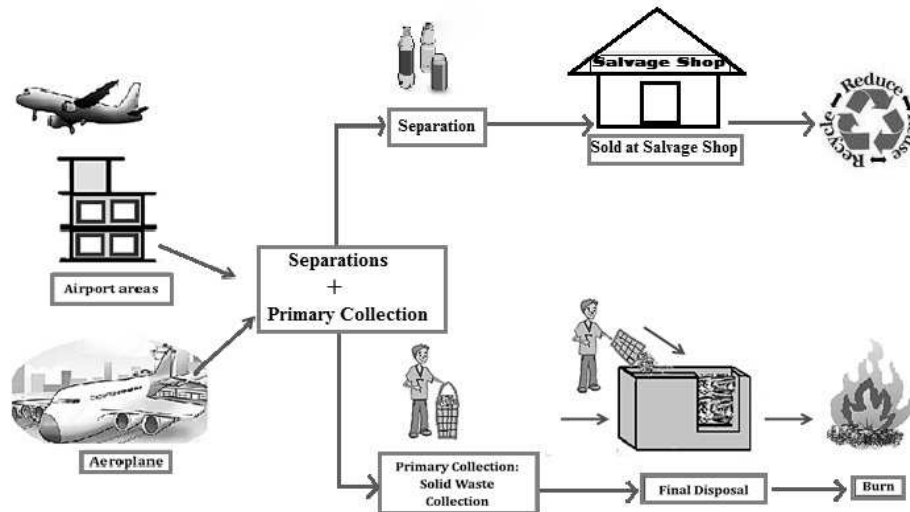


Figure 1: Solid Waste Management System in Jessore Airport

6. LOCATION WISE CATEGORY OF WASTES GENERATED IN JESSORE AIRPORT

6.1. Categories of Wastes in Civil Aviation Areas

Ready-made food wastes like paper, polythene packets and fruit peels, wooden sticks of ice-cream and various steel and plastics bottles are generated daily in civil aviation area. Mainly in Public Terminals, Ticketing, Security Gates, Food Service Areas, wastes are generated heavily because of passengers gathering.

6.2. Categories of Wastes in E/M Section

Unused wire, polythene, paper etc. are the main wastes generated in this section. Small amount of dust is also generated here due to the maintenance and construction works.

6.3. Categories of Wastes in Aeroplanes

Mainly readymade food wastes, plastic and aluminum bottles both for water and cold drink, plastics packets especially chocolates and chips etc. wastes are generated in the aeroplanes. One time (Temporary) Coffee-Cup and small water bottles are generated daily per trip in a fixed numbers.

7. USER SATISFACTION LEVEL ON SOLID WASTE MANAGEMENT IN JESSORE AIRPORT

Among 385 passengers 5% (20 persons including 5 women) passengers were selected randomly as survey respondents. Among the total 5% passengers of aeroplane, 25% (5 persons) is from US-bangla, 25% (5 persons) is from US-Novoir, and 25% (5 persons) is from United Airways, 25% (5 persons) is from Biman Bangladesh Airlines Passengers. Passenger satisfaction level was calculated by ranking method. Passengers Satisfaction Level is given below-

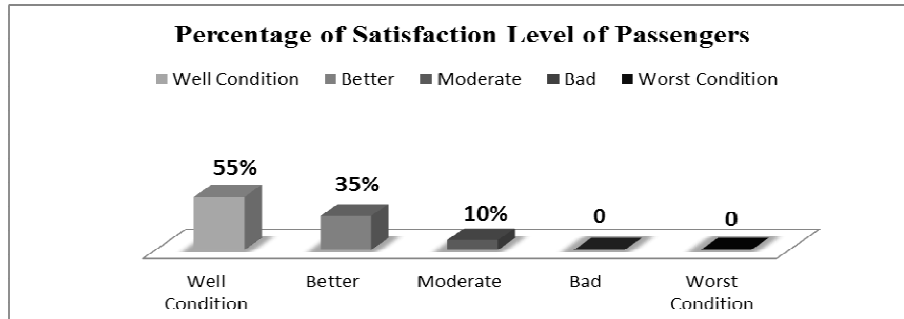


Figure 2: Passengers Satisfaction Level on SWM of Jessore Airport

The figure 2 shows that 55% of total passengers described the service and present condition of SWM systems in JA as well, 30% described it as better and 10% described the condition as moderate.

8. PROBLEMS OF SOLID WASTE MANAGEMENT SYSTEM OF JESSORE AIRPORT

The main problem of solid wastes management in Jessore Airport is that there is no specific waste separation mechanisms towards resource recovery through reduce, recycle and reuse.

9. RECOMMENDATIONS FOR IMPROVEMENT OF SWMS OF JESSORE AIRPORT

The recommendations for further improvement of solid waste management system of Jessore Airport are:

- Keeping recyclables separate from the wastes generated in the aeroplanes can greatly assist the ground crews in recycling of the wastes. Resource recovery from solid wastes in the form of reduce, reuse and recycling can be introduced.
- Public awareness about solid waste management system and services can be raised. Steps can be taken to explore the scientific ways for the management of plastic wastes. A guideline for infrastructural development for waste management including collection and disposal technique, supervision and monitoring of waste management activities of Jessore Airport can be developed.
- There should have provision of waste bins outside the restricted area or beside the parking lot of Jessore Airport.
- The Airport authority should introduce the signage system on management of its solid wastes. There should be instructions on using the bins or baskets for all classes of people. Steps can also be taken to strictly follow the instructions.

10. CONCLUSIONS

From the passenger satisfaction level point of view Solid Waste Management System in Jessore Airport is at satisfactory level. Jessore Airport maintains the international standards in solid waste management system. The main problem of solid wastes management in Jessore Airport is that there is no specific waste separation mechanism towards resource recovery through reduce, recycle and reuse. So, separation system is needed or other existing system need to be improved. An overall international SWM guideline or SWM plan for Jessore Airport specifying its different areas or parts of wastes generation in terms of spatial settings can be formulated. There is also an option to develop strong and effective linkage, coordination and cooperation among concerned stakeholders towards better SWMS of Jessore Airport as this airport can achieve the status of international level airport.

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