

Analysis of Municipal Solid Waste Management System of North Delhi Municipal Corporation

¹Hafsa Nazir, ²Syed Khursheed Ahmad, ³Ghanshyam

¹M.Tech Student, Department of Civil Engineering, School of Engineering and Technology, Al-Falah University, Faridabad, Haryana, India

²Professor, Department of Civil Engineering, School of Engineering and Technology, Al-Falah University, Faridabad, Haryana, India

³Lecturer (Selection Grade), Arya Bhat Institute of Technology, G.T Karnal Road, Delhi, India.

Corresponding Author: Hafsa Nazir

ABSTRACT

One of the most critical challenges facing modern metropolises' is the problem of effective and efficient Municipal Solid Waste Management (MSWM). Large populations, rapid industrialization, perpetual infrastructure building along with improper municipal facilities further exacerbate the situation. A dynamic MSWM system, in order to have the desired impact, needs to take into account these facets of MSWM and keep improving upon the provision of municipal facilities. This will have a positive impact on both the environment and aesthetics of the area. Despite its criticality and sensitivity, MSWM continues to remain a neglected area of urban development in India. The present study attempts to analyze the MSWM system of North Delhi Municipal Corporation (North DMC). The study extends its scope beyond the existing scenario and attempts to predict the future scenario of MSW management of North DMC. The study uses secondary data to make inferences supplementing the analysis with various statistical tools and appropriate graphical representation. The study observed that the North DMC is grossly over populated with densities being among highest in the world. This has an adverse impact on the overall MSWM as large population logically implies higher rates of MSW. Given this large quantity of MSW, the resources and facilities available for effective and efficient MSWM is significantly less than the facilities required. With regards to future, the study found that the solid waste generation is staggering and reveal the need for the authorities to take this problem seriously as they lag behind in providing adequate facilities for MSW management. The problem is further compounded by rampant urbanization and various problems associated with this process. Finally it can be said that there is an urgent need for North DMC to improve upon its provision of Municipal facilities so as to ensure an effective and efficient MSWM system not only for present but also for the future.

Keywords: Municipal Solid Waste, Management System, Urban Area, North DMC Delhi.

Date Of Submission: 30-06-2019

Date Of Acceptance: 19-07-2019

I. INTRODUCTION

The responsibility to collect MSW lies with the respective corporations and municipalities. In most of the areas MSW is collected through community bins which are placed at various locations. Improper placement of these community bins often leads to unauthorized open collection points. NGOs are playing an important role in mobilizing and organizing community effort to encourage house to house collection across different Metros in the country. A number of municipalities have roped in private contractors to help in secondary transportation of MSW to disposal sites. While as other local bodies have sought intervention from citizen groups and NGO's to oversee the collection of MSW from its source of generation and to further supervise its segregation. The sweeper uses the wheelbarrow to collect the

waste from the road side and to subsequently transport it to collection points, mostly dustbins (Colon and Fawcett, 2006; Lal and Reddy, 2005). From this MSW generated, most of it is collected and transported to various sites for disposal or for processing where as a portion of this MSW generated is not collected. This has a negative impact on the collection efficiency of municipalities and corporations. The collection efficiency is the quantity of MSW collected and transported from streets to disposal sites divided by the total quantity of MSW generated at the same time. A number of studies on this issue have shown that the MSW collection efficiency is a function of manpower availability and transport capacity. In India the average MSW collection efficiency stands at around 70 % (Nema, 2004; Gupta et al., 1998; Maudgal, 1995; Khan, 1994). A multitude of

vehicles are employed by municipalities across India for transporting MSW collected to various disposals and processing sites. In addition to using their own transportation municipalities in some areas outsource MSW collection to private contractors (Bhide and Shekdar, 1998; Reddy and Galab, 1998).

In light of this literature review, we can say there is a clear gap in the literature in so far as an in-depth analysis of collection and transportation of MSW in a particular area is concerned. Filling this gap is imperative so as to determine the actual situation on ground with regards to the standards of collection and transportation and existing realities. The main objective of this paper is, therefore, to analyze the MSW management in North DMC. In present study an attempt has been made to analyze the Municipal Solid Waste Management System (MSWMS) of North Delhi Municipal Corporation. The study has also been extended for prediction of solid waste and future scenario.

II. METHODOLOGY

2.1) Study Area

The area selected for the present study occupies a significant position in the National Capital Territory (NCT) with regard to its location and population (Map1). North Delhi Municipal Corporation (NDMC) came into existence after Municipal Corporation of Delhi (MCD) was trifurcated in 2012. North DMC serves a population of 68 lac citizens and lies between the latitude of 28°24'17" to 28°53'00" North and longitude of 76°50'24" to 77°20'37" East. The body is also responsible for monitoring, upgrading and developing civic amenities efficiently with a view to create a better tomorrow for citizens of Delhi. North DMC covers an area of 604.36 Sq.km. which is about 43% of total Delhi area. North DMC comprises of six zones- Rohini, Civil Lines, Karol Bagh, City, Sadar Paharganj and Narela. These zones are further sub-divided into 104 wards, 728 regularized colonies, 450 unauthorized colonies, 102 rural villages and 33 urban villages. There are 5 major hospitals and one medical college in North DMC. North DMC maintains the roads/streets upto 60 feet ROW alongwith drains located on these roads/streets. A road length of 10153 km (in 12 feet width) is under the jurisdiction of North DMC.



Map1

2.2 Data Collection

The present study is based mostly on secondary data. Secondary data has been collected from the government, semi-government and private publications. The data on Municipal Solid Waste (MSW) in the given context was collected mostly from Municipal Corporation of Delhi (MCD), Central Pollution Control Board (CPCB), North Delhi Municipal Corporation (NDMC). This includes data on MSWM system such as waste generated per day, resources available to collect and transport this waste such as community bins, containers, trucks, Dhalaos and refuse collectors/compactors.

However the study also used primary data collected in the form of in-depth interviews with the North DMC officials in order to distribute the population of North DMC into different categories. The need for this arose due to the lack of availability of data at such a micro level.

2.3 Data Analysis Procedure

The present study makes use of quantitative parameters. The unit of observation in this study is North DMC. The focus of this study is to analyze the MSWM System of North DMC. The primary and secondary data collected for this purpose has been organized, moderated, tabulated, analyzed and portrayed using suitable graphical representations and statistical tools. The data collected was used to estimate the gap between the available resources and what is actually required as per the existing waste generation. This enabled the study to estimate the shortage in the North DMC in

regards to the availability of required resources to provide effective and efficient Municipal services.

2.4 Prediction of future scenario

The study uses the 2018 as base year to estimate the 10 year design, 20 year design and 30 year design. In doing this the study attempts to predict the future scenario of MSW in North DMC. The study makes use of the geometric increase method to estimate the future population and subsequently calculate the MSW generation.

2.5 Comparative Analysis

The study uses the findings on future scenario of MSW in North DMC to do a comparative analysis. This analysis includes comparing the MSWM data for present with the data predicted for future. The study aims to provide some perspective with regards to the criticality of MSWM situation and how things are expected to shape up, in future.

III. RESULTS AND DISCUSSION

3.1) Present scenario of North DMC

North DMC jurisdiction, spread over 604.36 SQ KMs area, comprises of Six Zones-

Karol Bagh Zone (13 wards), City & SPZ (13 wards), Keshavpuram Zone (18 wards), Rohini Zone (26 wards), Civil Line Zone (18 wards) and Narela Zone (16 wards). North DMC has 104 wards with a population of around 68.00 lac. The average per capita MSW Generation is around 500-550 gm per day. The North DMC generates around 4000 MT of garbage per day. About 26400 nos. of safai karamcharies sweeps the roads, streets, lanes, by-lanes, footpath etc on daily basis under the overall supervision of sanitary superintendent/ASI/SI of the area. At present about 2000 MT of MSW generated is being dumped at SLF site, Bhalswa. The number of community bins in North DMC stand at around 1900 while as the number of containers stands at 292. Similarly the number of Dhalaos stands at 673. This waste is transported to disposal sites or for recycling using 500 trucks and 58 refuse collectors/compactors. For primary collection 370 Nos. of Auto Tippers with the capacity of 600 kg for door to door collection of MSW collects 1110 MT per day. In addition 2078 nos. of Cycle Rickshaws and 6150 nos. of wheel barrow collects about 1350 MT per day of MSW. 1400-1500 MT MSW comes directly from the Bulk Generators.

Table 1: zone wise detail of MSW collected, collection points, drains.

Zone(Before Delimitation of wards)	Waste Generation (weekly average) MT/day	No. of Dustbins/Dhalaos/Collection points	No. of auto tippet	No. of Drains less than 4 ft. width/depth	Length of Drains less than 4ft. width/depth in meters	No. of Drains more than 4ft. width/Depth	Urinal blocks	Waterless urinal blocks
City-S.P. Zone	900	107	39	35	8905	15	489	32
Karol Bagh	700	103	39	78	40993	30	239	72
Kesavpuram Zone	700	107	72	172	101644	37	246	55
Narela	400	161	46	110	137347	41	83	12
Rohini	750	129	103	238	103417	54	244	67
Civil Lines	550	66	71	244	112115	16	123	100
Total	4000	673	370	877	504421 say 505 km	193	1424	338

Source: North DMC report 2018

3.2) Design of MSWM System for North DMC

The North DMC, owing to its sheer size, has been divided into six zones. This area (North DMC) is home to around 6.8 million inhabitants. The population includes a host of different categories viz. residential, commercial, institutional, offices, hospitals. The residential population was estimated to be approximately 76.4

percent; commercial population at around 17.64 percent; institutional population at around 4.4 percent; offices and hospitals at 1.47 and 0.5 percent respectively. The category wise waste generation was calculated and thus it was found that the total waste generated in North DMC is around 4000MT per day.

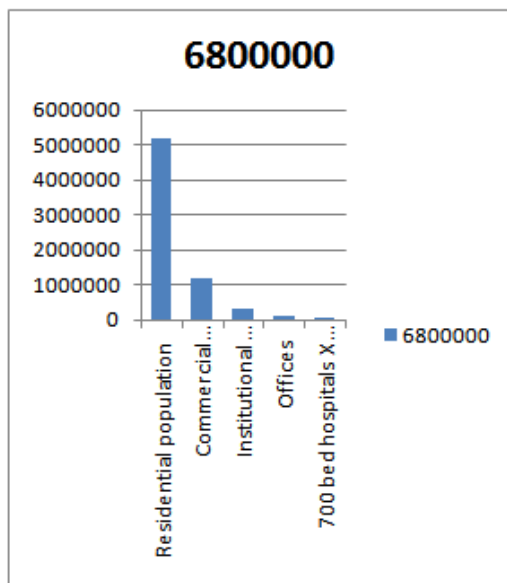


Figure1: Category wise population distribution

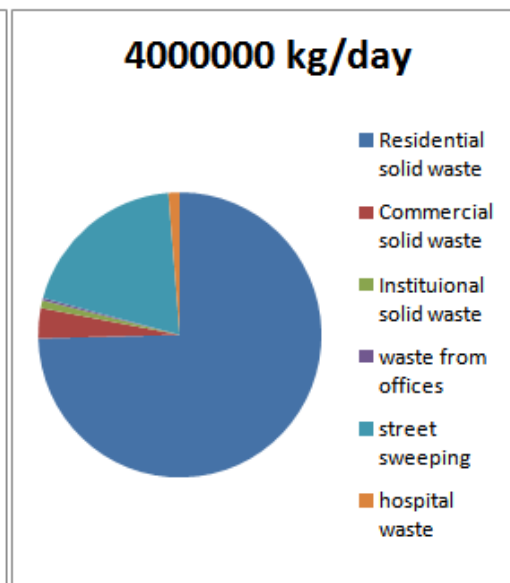


Figure2: Category wise waste generation

With the help of the data i.e. category wise population and total waste generation, the design for MSW system for North DMC was estimated which showed that the available quantity of resources for MSWM are much less than the required number. The total MSW generated in the area stands at a whopping 4000 MT/day leading to gross mismanagement of MSW generated in North DMC. This mismanagement is mostly down to the lack of availability of adequate resources for the North DMC to effectively and efficiently manage the MSW generated in the area under its jurisdiction. Take for example the case of MSW collection and transportation facilities at North DMC's disposal; community bins-the number of bins required is 7273 whereas the bins available are

only 1900, representing a shortage of almost four times. The rest of the collection and transportation facilities also present a similar picture-a grim one at that. The number of trucks available is 72 less than what is required; the number of refuse collector/compactors available are ten times less than the required number; the number of containers(stationary or hault) available are 9 times less than the required number. The only bright spot in this is the number of available Dhalaos which are more than required. The need of the hour is that the authorities take the problem of MSW very seriously as the present scenario shows that these agencies lag behind in providing adequate municipal facilities for MSW management in the area under their jurisdiction.

Table 2: Available and required quantity of facilities

Equipment	Available quantity	Required quantity
Community bins	1900	7273
Containers (stationary or hault)	292	2667
Trucks	500	572
Dhalaos	673	534
Refusecollector/compactor	58	572

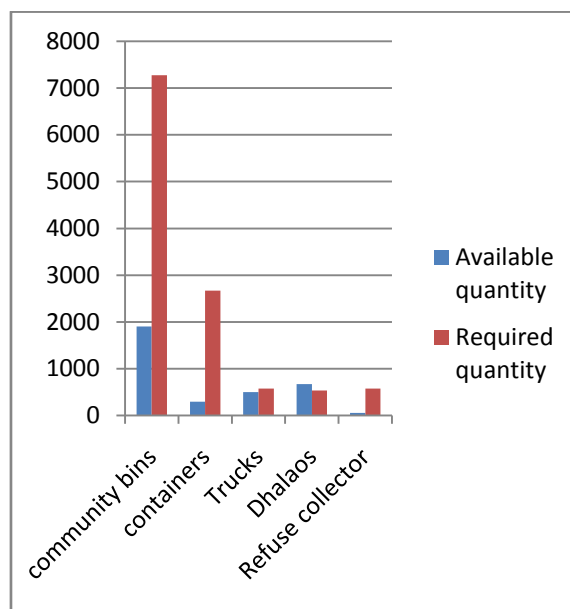


Figure 3: Available and required quantity of facilities

3.3) Population, waste generation and design: Projections for the future.

The study estimated future population for the years 2028,2038,2048,2058 using geometric increase method with 2018 as base year. From the estimated future population, the MSW generations for these years was also estimated. The estimates

are quite staggering and show a rapid increase in the quantity of MSW generated. This increased quantity of MSW generation implies that the North DMC has to keep pace with these numbers in so far as the provision of municipal facilities is concerned.

Table 3: Future projection of population and waste generation .

Year	Population	Future waste generation	
		Kg/day	MT/day
2018	6800000	4000000	4000
2028	7928800	4360840	4361
2038	9244981	5084739.55	5085
2048	10779648	5928806.40	5929
2058	12569069	6912987.95	6913

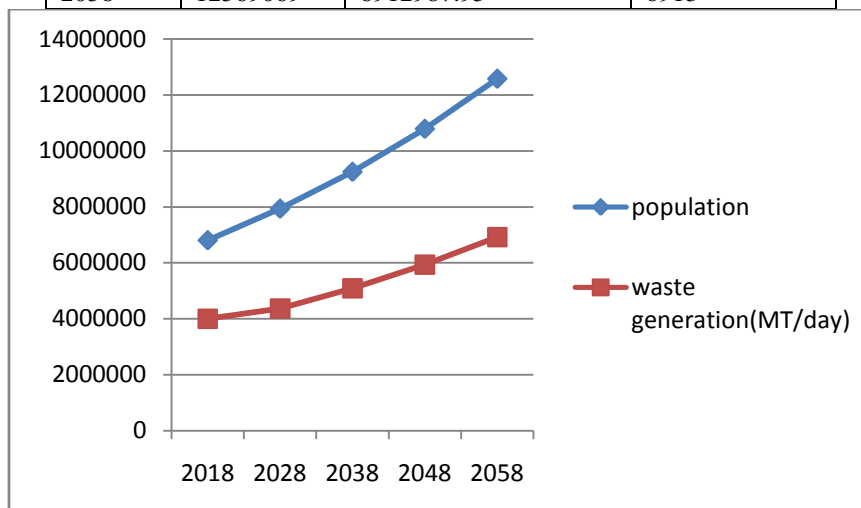


Figure 4: Future projection of population and waste generation

On the basis of these estimations, the study also calculated 10 year design, 20 year design and 30 year design for the MSWM system for North DMC. The design for the years 2028, 2038, 2048, reveals the following: the number of community bins required are 7929, 9245, 10780 respectively ;

the number of containers required are 2907, 3390, 3953 respectively ; the number of trucks required are 623, 729, 847 respectively ; the number of Dhalaos required are 436 , 508, 593 respectively ; and the number of refuse collector/compactor required are 623 , 726 , 847 respectively.

Table 4: Design for 10 year, 20 year, and 30 year.

Equipments	Year		
	2028	2038	2048
Community bins	7929	9245	10780
Containers	2907	3390	3953
Trucks	623	726	847
Dhalaos	436	508	593
Refuse collectors/compactors	623	726	847

Should the present trend of lackadaisical approach of the authorities continue in coming times as well, the future of MSW management appears to be very bleak. This problem is further aggravated by the high growth rate of population, rampant industrialization, infrastructure development and the continuous improper disposal of domestic residential wastes. Finally it can be said that there is an urgent need to improve the provision of municipal facilities in North DMC to ensure effectiveness and efficiency of MSWM system both in the present as well as in the future.

IV. CONCLUSIONS

It was observed that the area is grossly over populated with population density among the highest in the world. This factors in rather adversely on the overall MSW management as large population logically implies higher rates of MSW generation. Given this large quantity of MSW generated, the number of collection and transportation facilities required is far higher than the available facilities.

A case in point would be the existing scenario of total MSW generated in the area that stands at a whopping 4000 MT/day leading to gross mismanagement of MSW generated in North DMC. This mismanagement is mostly down to the lack of availability of adequate resources for the North DMC to effectively and efficiently manage the MSW generated in the area under its jurisdiction. MSW collection and transportation facilities available at North DMC's disposal are: community bins-the number of bins required is 7273 whereas the bins available are only 1900, representing a gap of almost four times. The rest of the collection and transportation facilities also present a similar picture-a grim one at that. The number of trucks available is 72 less than what is required; the number of refuse collector/compactors

available are ten times less than the required number; the number of containers(stationary or haul) available are 9 times less than the required number. The only bright spot in this is the number of available Dhalaos which are more than required. The need of the hour is that the authorities take the problem of MSW very seriously as the present scenario shows that these agencies lag behind in providing adequate municipal facilities for MSW management in the area under their jurisdiction.

The paper estimated future population for the year 2028, 2038, 2048, 2058 using geometric mean method with 2018 as base year. From the estimated future population, the MSW generations for these years was also estimated. The estimates are quite staggering and show a rapid increase in the quantity of MSW generated. This increased quantity of MSW generation implies that the North DMC has to keep pace with these numbers in so far as the provision of municipal facilities is concerned. On the basis of these estimations, the study also designed the MSW management system for the future. The design for the years 2028, 2038, 2048, reveals the following: the number of community bins required are 7929, 9245, 10780 respectively ; the number of containers required are 2907, 3390, 3953 respectively ; the number of trucks required are 623, 729, 847 respectively ; the number of Dhalaos required are 436 , 508, 593 respectively ; and the number of refuse collector/compactor required are 623 , 726 , 847 respectively.

REFERENCES

- [1]. Census of India, 2001. Published by Directorate of Census operations, New Delhi.
- [2]. Central Pollution Control Board (CPCB), 2003. Reports no. 21 and 22 on Collection, Storage, Transportation and Disposal of Municipal Solid Waste in Delhi. Ministry of

- Environmental and Forests, New Delhi, India.
- [3]. CPCB, 2004. Management of Municipal Solid Waste. Ministry of Environment and Forests, New Delhi, India.
- [4]. CPCB, 2004. Report no. 23, 24 and 25 on Collection, Storage, Transportation and Disposal of Municipal Solid Waste in Delhi. Ministry of Environmental and Forests, New Delhi, India.
- [5]. CPCB, 2005. Report no. 26 on Collection, Storage, Transportation and Disposal of Municipal Solid Waste in Delhi. Ministry of Environmental and Forests, New Delhi, India.
- [6]. Peavy H. S., Rawe D. R. and Tchobanoglous G., 1985. Environmental Engineering. McGraw-Hill Book Company, Singapore.
- [7]. Ministry of Environment and Forests (MoEF), 2000. The Gazette of India. Municipal Solid Waste (Management and Handling) Rules, New Delhi, India.
- [8]. Municipal Corporation Of Delhi (MCD), 2005. Unpublished Data, MCD, Delhi, India.
- [9]. Municipal Corporation Of Delhi (MCD), 2006. Unpublished Data, MCD, Delhi, India.
- [10]. National Environmental Engineering Research Institute (NEERI), 1996. NEERI Report Strategy on Solid Waste Management in India.
- [11]. New Delhi Municipal Council (NDMC), 2005. Unpublished Data, NDMC, New Delhi, India.
- [12]. New Delhi Municipal Council (NDMC), 2006. Unpublished Data, NDMC, New Delhi, India.
- [13]. Peavy H. S., Rawe D. R. and Tchobanoglous G., 1985. Environmental Engineering. McGraw-Hill Book Company, Singapore.
- [14]. Tata Energy Research Institute (TERI), 2003. New Delhi, India. Available at: <http://www.teri.res.in/teriin/camp/delhi.htm>.

Hafsa Nazir " Analysis of Municipal Solid Waste Management System of North Delhi Municipal Corporation" International Journal of Engineering Research and Applications (IJERA), Vol. 09, No.07, 2019, pp. 57-63