Sustainable Segregation, Processing and Landfill Reduction Strategies of Solid Waste Management in Metropolitan Regions of Maharashtra

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Abstract: ***Solid waste is increasing with increase in urbanisation, income and changing consumption pattern across the world. India is not exception to increase in urbanisation phenomenon. Municipal Corporation of Greater Mumbai in Mumbai Metropolitan Region contribute maximum solid waste. It is followed by Pune, Nasik and Nagpur Municipal corporation in Metropolitan Region. The contribution of biodegradable, inert is higher in solid waste of Municipal Corporations. Municipal corporations do not collect complete solid waste and process it. They transport to landfill sites which create more health hazards for people. Population and industry, health care and educational institutions will continually increase and generate more solid waste. Therefore, state government must provide long term policy and right direction to collect, segregate solid waste at ward level and process whole solid waste. Government must launch behavioural and communication change model through mass media. Municipal Corporations must invest in technology to collect complete solid waste, human resource, scientific processing of solid waste. Such efforts will help to clean urban Maharashtra, improve health of people and contribute economic growth of state.***

Keywords: ***Health, Electricity, Sustainability***

INTRODUCTION

With rapid population growth and urbanization, the global annual waste generation is expected to increase to 3.40 billion tonnes by the year 2050, while improper waste disposal poses a potential threat of growing concern (Omotayo, A.O. 2024). The world's population growth, increasing urbanization and rising standards of living are some of the factors influencing waste generation (Ali, N. E. et.al 2020). The demand for goods is currently higher than it has ever been before. This has resulted in the production of more waste than ever before. The problem of waste management is not new for humans, but the complexity of the issue has increased more in present days (Awasthi P. et.al 2023) Solid waste management issues are now the front burner challenges of the 21st century, more especially in developing countries (Muhammad S. and Marzuki A. 2024). Urban households are depending upon markets to satisfy daily needs. Households buy milk packets, biscuits, soaps and detergents. They regularly go to market and buy vegetable, garments, sweets and grains. Now a days supermarkets, agricultural produce market packs all commodities in plastic and papers and provide to customers. The rich households' orders food from food supply chain apps. There are number of beverage and hotel units deliver packed food at any place in city. Households buy online items and throw the packets in dust bins. Rich households continuously order fast food, water bottles, cakes, gifts from shops. Maximum solid waste is generated in such process by rich households. The solid waste generation rate varies in different socioeconomic groups due to many environmental and social factors (Khan et.al 2016). Most of the times, it is difficult to observe and study the generation of solid waste generation in cities.

There is trade-off between income and time spent for food preparation of families in cities. Many people in Metropolitan region travel to work at morning. They eat breakfast at hotels and restaurants in suburbs. Most of the time, they prefer packed snacks for breakfast. Some street vendors provide quick service as packed breakfast in paper and plastic bags. At lunch, they order food from hotels and restaurants. Many patients visit hospitals, they get admitted in city hospitals where maximum tablets and injections are given to patients to get cure fast. At discharge, tablets and injections and other prescriptions are always given. Medical stores within or outside hospitals provide all kinds of medicines. It creates maximum solid waste as packets of medicines, covers of tablets and syrups

etc. All medicines packed in plastic bags, papers etc. Finally, it goes to dustbin as solid waste in city. In educational institutions, children's, youths carry books, notebooks, pens, papers, cardboards. They do number of activities such as drawing, projects, practices of science subjects etc. Such activities create maximum solid waste in schools and colleges. Children carry food in tiffin at school. They order number of food items from canteen, buy biscuits, chocolates, cold drinks from canteen. While eating food, they generate more solid waste. The birthdays are celebrated by children in educational institutions. The working staff in educational institutions also generate solid waste related to work, food and other activities. Markets generate maximum solid waste during packing material and delivery of the products. Plastic bags and papers are the basic need of workers working in this occupation. Households generate the solid waste after its delivery from wholesale or retail shops. Registered shops and commercial establishments provide all commodities in packed form to their customers. Commercial units are growing fast in all cities of Maharashtra state.

In all cities of Maharashtra, the solid Waste problem is associated with a constant migration from surrounding rural communities, uncontrolled sprawl dominated by illegal settlements, extensive slums. Both financially and physically, a city finds it difficult to provide facilities for waste collection, especially with regard to the urban poor. The urban poor are often left to contend with waste disposal on their own. Support given to the urban poor in slums and squatter settlements has serious deficiencies adversely affecting their health and generally the urban environment itself. Thus, the management of solid waste is an issue of vital importance to urban sustainability. Slums and squatter settlements are characterized by a gross deficiency of basic services (Gowda.et.al. 2013). The studies have found that the solid waste management practices such as storage and disposal practices in the slums are unsatisfactory, and separation and composting is minimally practiced. Slum residents' practices, concerns, and attitudes indicated lack of sufficient knowledge about good waste practices, their responsibilities, and consequences of poor waste management (Mukama, Trasias et.al 2016). The poor people do not much knowledge about the segregation of solid waste. The solid waste is not collected daily, and it is often thrown at water bodies and burned.

People in region regularly visit theatres, gardens and recreation centres. They go to see cinema, drama, visit parks, beaches, forts, museums. They eat food at restaurants, café and generate maximum solid waste. They order food, water bottles, toys for children etc. Many people regularly visit at beaches, parks, malls in city and generate maximum solid waste. At households' level and community level, the waste is not segregated. Due to lack of knowledge and behavioural factors, the highly educated and less educated people behave same way and throw solid waste without segregation at streets. Papers and plastic material, glass required different kind of collection, segregation and treatment. Biodegradable solid waste need landfills. But in corporation, due to lack of segregation whole solid waste collected by waste pickers and put in solid waste carrying vehicles. It further transported to landfill sites of municipal corporation. Municipal Corporation of Greater Mumbai carry maximum solid waste to Deonar and Kanjurmarg, Mulund dumping ground. In Pune and Thane district, municipal corporation have reserved dumping grounds. The vehicles carry unsegregated solid waste to landfill grounds. Due to rise in population and number of units such as hospitals, schools, hotels, shops and commercial establishments, theatres and industrial units are rising fast. The solid waste generation will continuously rise in metropolitan regions of Maharashtra.

Therefore, Municipal Corporations need to adopt scientific approach in collection of solid waste at word level. They must segregate and process entire solid waste. It will reduce the expenditure of landfill and management of dumping grounds. The first part of the research paper deals with data and methodology. Second part explains solid waste generation by each municipal corporation in region that is Mumbai, Pune, Nasik and Nagpur Metropolitan Region. The third part of the research paper is future generation of solid waste in Municipal Corporation of Metropolitan Region. The last part of research paper explains policy implication and conclusion to reduce, collect, segregate and process of solid waste in all Metropolitan Region of Maharashtra.

Data:

We have collected population data of corporation from census 2001 and 2011. The solid waste generated, collected and processed in each municipal corporation is collected from city

development report. The city development reports of Mumbai, Pune, Navi Mumbai, Bhiwandi Nizampur, Mira Bhayandar, Kalyan Dombivli Municipal Corporation is referred. The environment status report of Mumbai, Thane, Nasik and Nagpur is also referred. We estimated solid waste for each municipal corporation from Metropolitan Regions of Maharashtra.

Economic model:

We have developed economic model for solid waste generation in metropolitan region in Maharashtra. The factors responsible for solid waste generation is also taken into consideration.

$$\sum_{n=1}^{t} MR_{SW} = sw(M, P, Na, Nk) \quad (1)$$

Solid waste in Metropolitan Region of Maharashtra comprises as solid waste in Mumbai, Pune, Nagpur and Nasik region.

$$\sum_{n=1}^{t} MMR_{sw} = MC(M, T) \quad (2)$$

Solid waste in Mumbai Metropolitan Region is categorised as solid waste in municipal corporations of Mumbai and Thane district.

$$\sum_{n=1}^{t} T_{sw} = Mc(T, KD, NM, UN, MB, BN, P, VV) \quad (3)$$

Total solid waste in Thane district comprises as municipal corporation as Thane, Kalyan Dombivli, Navi Mumbai, Ulhasnagar, Mira Bhaynder and Bhiwandi Nizampur Panvel, Vasai Virar Municipal Corporation.

$$\sum_{n=1}^{t} PMR_{sw} = (P, PCMC) \quad (4)$$

Solid waste in Pune Metropolitan Region comprises as solid waste in Pune and Pune Pimpri Chinchwad Municipal Corporation.

$$\sum_{n=1}^{t} SW_{M} = f(P, H, H, S, M, RSC, PF, S, CHT, FH, IE, RC) \quad (5)$$

Solid waste in Mumbai city comprises as population, hotels, hospitals, schools, markets, registered shops and commercial establishments, permitted factories, slums, cinema houses and theatres, fire hydrants, industrial estate, recreation centres.

$$\sum_{n=1}^{t} Sw_{TD} = MC_{sw}(P, I, S, H, R, T, PS, SC, C, PGI, H) \quad (6)$$

Solid waste in Municipal Corporations of Thane district comprises as population, industry, shops, hotels, restaurants, theatres, primary schools, secondary schools, colleges, Post graduate institutions, health care institutions.

$$\sum_{n=1}^{t} TSW_{PMC} = sw(P, I, SCU, T, H, HO, EI, P) \quad (7)$$

Total solid waste in Pune Municipal Corporation comprises as solid waste from population, Industry, Shops and Commercial Units, Theatures, Hospitals, Hotels, Educational Institutions and Parks.

$$\sum_{n=1}^{t} TSW_{PCMC} = sw(P, I, HO, S, Ht, TH, EI, P) \quad (8)$$

Total solid waste in Pimpri Chinchwad Municipal Corporation comprises as solid waste in Population, Industry, Hospitals, Shops, Hotels, Theatures, Educational institutions and Parks.

$$\sum_{n=1}^{t} TSW_{NaMC} = sw(P, PS, SS, C, I, HCI, Ho, CE) \quad (9)$$

Solid waste in Nasik Municipal Corporation consists of solid waste from population, primary schools, secondary schools, colleges, industry, health care institutions, hotels, commercial establishments and Gardens.

$$\sum_{n=1}^{t} TSW_{NgMC} = sw(P, I, PS, SS, C, HC, HO, CE, PP) \quad (10)$$

The solid waste in Nagpur Municipal Corporation comprises as solid waste from Population, Industry, Primary schools, Secondary schools, Colleges, Health care, Hotels, Commercial estates, Park and playgrounds.

About Metropolitan Region in Maharashtra:

Mumbai Metropolitan Region is in Kokan division of Maharashtra, Western India. The region has 6328 square kilometres with population of more than 26 million. It is most populous metropolitan region in World. It has boundary in parts of Thane, Raigad and Palghar district. The Mumbai Metropolitan Region has nine Municipal Corporations and eight Municipal Councils. It has also rural area with number of villages. Each Municipal Corporation and Municipal Council has its own revenue resources and expenditure pattern. They regularly receive grant and aid from central and state government to develop infrastructure and provide basic amenities to its population. Mumbai Metropolitan Regional Development Authority (MMRDA) is in charge to prepare development plans and develop infrastructure facilities of this region. It focuses on

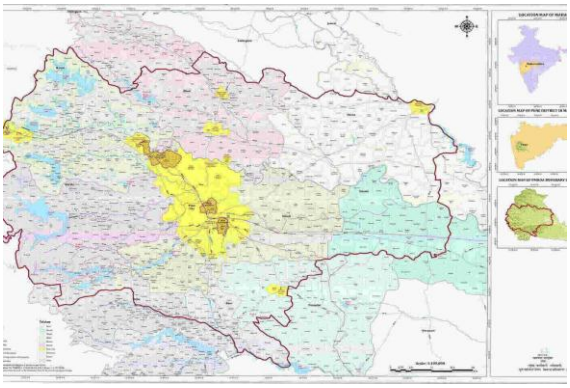
town planning, transportation, housing and economic development of region.

Pune Metropolitan Region comprises as Pune Municipal Corporation, Pimpri Chinchwad Municipal Corporation and 3 cantonment boards. Pune Metropolitan Region spread over 7256.46km^2. As per 2011 census, population of PMRDA was 7541946. PMRDA contribute 80 percent of GDP to Pune district and 9.2 per cent GDP to Maharashtra. Pune Metropolitan Region is spread over Rajgurunagar, Shiror, Bhor, Purander , Velhe, Daund, Haveli, Mulshi, Maval tehsil in Pune district.

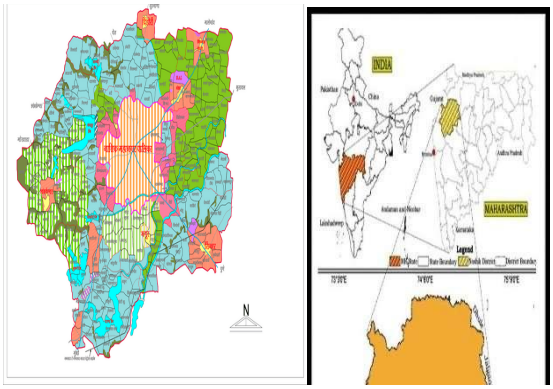
Nasik Metropolitan Regional Development Authority (NMRDA) was established on 21st March 2017. NMRDA has area about 2649.14 sq.km. It includes 275 villages from talukas such as Nasik, Niphad, Sinnar, Dindori, Trimbakeshwar, Igatpuri. NMRDA has been set up as a self-financing body by the Urban Development Department of the Government of Maharashtra. NMRDA has aim to words channelizing growth of Nasik region in a strategic and orderly manner. NMRDA covers a substantial portion of Nasik district, and it is comprising approximately 18 percent of total area with major focus on green field development.

Mumbai Metropolitan Region

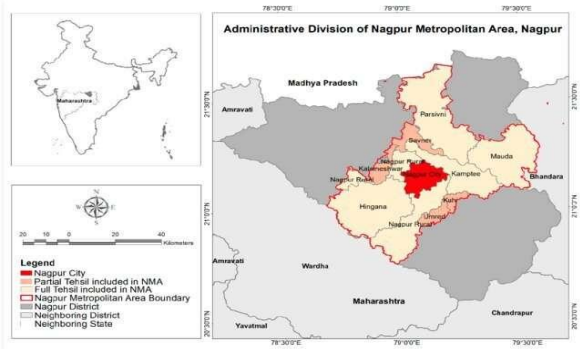
Pune Metropolitan Region



Nasik Metropolitan Region



Nagpur Metropolitan Region



Nagpur Municipal Corporation:

Nagpur is third largest city after Mumbai and Pune in Maharashtra. Since last few years, urban agglomeration has expanded beyond the city's Municipal boundaries. To achieve the balanced development, Nagpur Metropolitan Region is established. It was established on 23rd July 1999. Nagpur Metropolitan Region comprises as 721 villages and 9 tehsils of Nagpur district. It is spread on area of 3567km^2. Alternatively, it covers 36 per cent of Nagpur district. Nagpur Metropolitan Region promote economic growth of region with the motive of protection of natural resources, farmlands, industrial and tourism development. It also committed to provide better quality of life to people of region.

About solid waste in Metropolitan Region:

Solid waste may be defined as all discarded solid materials resulting from households, industrial, healthcare, constructional, agricultural, commercial, and institutional sources. Solid waste generated in a city town is often referred to as municipal solid waste (Andama C.A et.al.2024). It is also defined alternatively as follows. Solid garbage is the unwanted, harmful, and wasted substance arising from day-to-day civic events. Management of the

solid wastes can be described as the methodology of managing solid waste generation, storage, collection, transport, treatment and disposal (Choudhary, Shweta (2019). We have estimated solid waste generation in Municipal Corporation from Metropolitan Region in Maharashtra.

Table 1 Solid waste generated in Metropolitan Region in Maharashtra (2025)

Number	Metropolitan Region	Municipal Corporation	Solid waste (MT)	Percent
1	Mumbai	Mumbai	10568.07	39.09
		Thane	1512.34	5.59
		Kalyan Dombivali	1522.23	5.63
		Ulhasnagar	835.10	3.09
		Navi Mumbai	1581.56	5.85
		Mira-Bhayandar	1039.31	3.84
		Bhiwandi Nizampur	891.01	3.30
		Panvel	512.12	1.89
		Vasai Virar	1106.26	4.09
2	Pune	Pune	3472.66	12.84
		Pimpri Chinchwad	1075.38	3.98
3	Nasik	Nasik	1308.27	4.84
4	Nagpur	Nagpur	1611.45	5.96
		Total	27035.75	100.00

Source: Calculated from secondary data

We have calculated the 10568.07 MT solid waste in Brihan Mumbai Municipal Corporation in 2025. It is 39.09 percent of solid waste as compared to all Municipal Corporations in Metropolitan Region. The density of population is very high in this corporation. The number of other units are also higher. They create maximum solid waste in corporation. In Thane Municipal Corporation, the solid wate in current year is calculated as 1512.34MT. The Kalyan Dombivli Municipal Corporation would have 1522.23 MT solid waste in 2025. In both corporation, population density is very high. Ulhasnagar Municipal Corporation of Thane district could have 835.10MT solid waste in current year. It is contributing only 3.09 percent of solid waste in metropolitan regions of state. The Navi Mumbai, which is a planned city, now it could have 1581.56 MT solid waste in current period. Now more people prefer to stay in Navi Mumbai due to its planned nature of city and new international airport. The Mira Bhayandar could have 1039.31MT solid waste in region. Pune Municipal Corporation is largest corporation in Pune Metropolitan Region. It could have 3472.66 MT solid waste in 2025. Pimpri Chinchwad Municipal Corporation have 1075.38MT solid waste. Number of industries and population growth is higher in this corporation. It contributes to maximum solid waste. The Nasik Municipal Corporation may have 1308.27MT solid waste. Nasik Metropolitan Region is developing very fast. The Nagpur Municipal Corporation could have 1611.45MT solid waste in 2025. We have calculated as 27035.75MT solid waste from 13 Municipal Corporations in Maharashtra. Brihan Mumbai contribute maximum solid waste in Maharashtra. Therefore, it is important to study the various units and their contribution in solid waste of city.

Table 2 Solid waste as per components in Mumbai Municipal Corporation (2025)

Items	Solid waste	Percent
Population	5877.32	55.61
Hotels	74.86	0.71
Hospitals	118.18	1.12
Schools	182.18	1.72
Markets	21.66	0.20
Registered shops and commercial	1695.8	16.05
Permitted factories	332.33	3.14
Slums	1992.26	18.85
Cinema house	52.13	0.49

and theatres		
Fire hydrants	117.04	1.11
Industrial estate	85.38	0.81
Recreation centres	18.93	0.18
Total	10568.07	100.00

Source: As per table 1

In Mumbai city, population contribute 5877.32 MT solid waste in 2025. Due to continuous rise in population, the solid waste generation is increasing. Hotels could be generating 74.86MT (0.71 percent) solid waste. Hotel and beverage industry is continuously growing in city. Many people are working in this industry. Mumbai city provides best health care facilities. Many well-known hospitals are in city. Hospitals may be generating 118.18MT (1.12 percent) of solid waste. Many students and youths of region go to various schools and colleges in Mumbai city. Schools could be generating 182.18MT (1.72 percent) solid waste in 2025. Markets in Mumbai city could be generating 21.66 MT (0.20 percent) solid waste in 2025 year. There are wholesale and retail markets are in different parts of city. Registered shops and commercial shops also generating (1695.8MT) solid waste in (16.05 per cent) Mumbai city. The permitted factories in city may have contributed 1695.8 MT solid waste in city which is 16.05 per cent. Due to limited and expensive housing facilities, many people prefer to live in slums in city. The slums could have 1992.26 MT solid waste (18.85 per cent) in 2025 year. Fire hydrants could be contributing 117.04 MT solid waste (1.11 per cent). Recreation centres may be contributing 18.93 MT (0.18 percent) of solid waste in city. Total 10568.07 MT solid waste is calculated from city in 2025.The main component of solid waste generated at home is largely food debris that has the potential to be composted and plastics. (Fadhullah, W. et.al 2022). But is dumped at dumping ground without segregation.

Table 3: Solid waste as per the Municipal Corporations in Thane district (2025) (M.T)

Category	TMC	KDMC	ULHAS	NMMC	Mira Bhayandar	Bhiwandi-Nizampur	PMC	VVMC
Population	1063.87 (70.35)	928.75 (61.01)	326.85 (39.14)	974.43 (61.61)	606.54 (58.36)	506.27 (56.82)	255.25 (49.85)	616.55 (55.73)
Industry	183.53 (12.14)	249.48 (16.39)	232.19 (27.80)	243.61 (15.40)	151.64 (14.59)	126.57 (14.21)	70.08 (13.69)	160.01 (14.46)
Shops	22.33 (1.48)	16.33 (1.07)	15.12 (1.81)	20.18 (1.28)	29.81 (2.87)	20.63 (2.32)	36.40 (7.11)	53.63 (4.85)
Hotels	42.75 (2.83)	74.63 (4.90)	92.38 (11.06)	89.93 (5.69)	68.05 (6.55)	75.2 (8.44)	50.74 (9.91)	69.45 (6.28)
Restaurants	18.89 (1.25)	99.08 (6.51)	93.5 (11.20)	85.92 (5.43)	71.68 (6.90)	59.58 (6.69)	24.20 (4.73)	35.7 (3.23)
Theatres	26.8 (1.77)	19.8 (1.30)	22.11 (2.65)	12.1 (0.77)	43.12 (4.15)	28.73 (3.22)	3.13 (0.61)	28.35 (2.56)
Primary school	26.71 (1.77)	22.64 (1.49)	10.1 (1.21)	29.93 (1.89)	15.03 (1.45)	12.62 (1.42)	10.38 (2.03)	11.12 (1.01)
Secondary school	24.41 (1.61)	21.41 (1.41)	9.55 (1.14)	28.3 (1.79)	14.21 (1.37)	11.93 (1.34)	4.75 (0.93)	10.09 (0.99)
College	3.27 (0.22)	2.17 (0.14)	0.97 (0.12)	2.87 (0.18)	0.86 (0.08)	1.21 (0.14)	6.91 (1.35)	9.18 (0.83)
Post Graduate Institutions	1.09 (0.07)	1.69 (0.11)	2.03 (0.24)	3 (0.19)	1.58 (0.15)	1.29 (0.14)	3.36 (0.66)	10.20 (0.92)
Health care	98.69 (6.53)	86.25 (5.67)	30.3 (3.63)	91.29 (5.77)	36.79 (3.54)	46.97 (5.27)	40.92 (7.99)	101.18 (9.15)
Total	1512.34 (100)	1522.23 (100)	835.1 (100)	1581.56 (100)	1039.31 (100)	891 (100)	512.12 (100)	1106.26 (100)

Source: As per table 1

Above table shows that Thane Municipal Corporation could have 1063.87MT (70.35 percent) from population. Density of population in Thane is higher as compared to another Municipal corporation in district. Thane is proximity to Mumbai city and many people prefer to stay in Thane city. In Kalyan Dombivli Municipal Corporation, the industry could be contributing 249.48 MT (16.39 percent) of solid waste in 2025. Kalyan Dombivli Municipal corporation has Maharashtra Industrial Development Corporation. Many small industries are in it. The shops could have 29.81 MT solid waste (2.87 percent) in 2025 for Mira Bhayandar. Hotels may be contributing 92.38MT (11.06 percent) of solid waste in Ulhasnagar Municipal Corporation. Number of hotel units contribute to solid waste generation. The restaurants in Kalyan Dombivli Municipal Corporation may have 99.08MT (6.51 percent) in 2025. Theatures in Mira Bhayandar could be contributing 43.12 MT (4.15 percent) solid waste in region. Primary schools in Navi Mumbai could be contributing 29.93 MT solid waste in current period. Secondary schools could have 28.3 MT (1.79 percent) in Navi Mumbai Municipal Corporation. The colleges in Thane Municipal Corporation could have 3.27 MT (0.22 percent) solid waste in 2025. In Thane Municipal Corporation could have 98.69MT solid waste (6.53 per cent) from health care facilities. In Thane city, many public and private health care facilities available for people. For quality purpose, people from Dombivali, Kalyan visit Thane for health care. Total 1581.56 MT solid waste contribution calculated from Navi Mumbai Municipal Corporation in 2025. It is higher as compared to other municipal corporations in Thane district. We have estimated 1106.26MT solid waste from Vasai Virar Municipal Corporation in 2025. It is fastest growing municipal corporation in terms of population and other units. Therefore the solid waste per year will also rise in near future.

Table 4 Composition of solid waste in Pune and Pimpri Chinchwad Municipal Corporation (2025) (MT)

Category	Solid waste	Percent	Components	Solid waste	Percent
Population	2633.45	75.83	Population	851.46	79.18
Industry	592.44	17.06	Industry	115.93	10.78
Shops and commercial units	124.03	3.57	Hospitals	63.03	5.86
Theatres	23.7	0.68	Shops	12.67	1.18
Hospitals	11.48	0.33	Hotels	7.44	0.69
Hotels	63.23	1.82	Theatres	3.5	0.33
educational institutions	11.5	0.33	Educational institutions	21.35	1.99
Parks	12.8	0.37	Parks	4.3	0.4
Total	3472.66	100	Total	1075.38	100

Source: As per table 1

Pune city is growing very fast in terms of population. In Pune Municipal Corporation, the population could be contributed 2633.45(75.83 percent) of solid waste. It is highest generation of solid waste as compared to units and corporation. The number of industries is also more in Pune Municipal corporation. Industry in Pune could have 592.44 (17.06 per cent of solid waste in 2025. Hospitals could be contributing 63.03 (5.86 per cent) to solid waste in Pimpri Chinchwad Municipal Corporation. Hotels in Pune could be contributing 63.23 MT (1.82 per cent) of solid waste in 2025.The number of hotels and people visiting to hotels is higher in Pune city. Educational institutions in Pimpri Chinchwad Municipal Corporation could have 21.35MT (1.99 per cent) of solid waste. Parks in Pune could be contributing 12.80MT (0.37 per cent) solid waste in current period. Solid waste generation will continuously increase in Pune city in future.

Table 5 Composition of solid waste in Nasik and Nagpur Municipal Corporation (MT) 2025

Category	Solid waste	Percent	Category	Solid waste	Percent

Population	448.73	34.30	Population	1065.93	66.15
Primary schools	19.41	1.48	Industry	157.15	9.75
Secondary schools	15.79	1.21	Primary schools	25.20	1.56
Colleges	24.62	1.88	secondary schools	17.30	1.07
Industry	478.17	36.55	Colleges	10.10	0.63
Health care institutions	109.05	8.34	health care	112.86	7.00
Hotels	26.63	2.04	Hotels	88.11	5.47
Commercial establishment	102.23	7.81	commercial estate	81.76	5.07
Playground and garden	83.64	6.39	park and playground	53.04	3.29
Total	1308.27	100.00	Total	1611.45	100.00

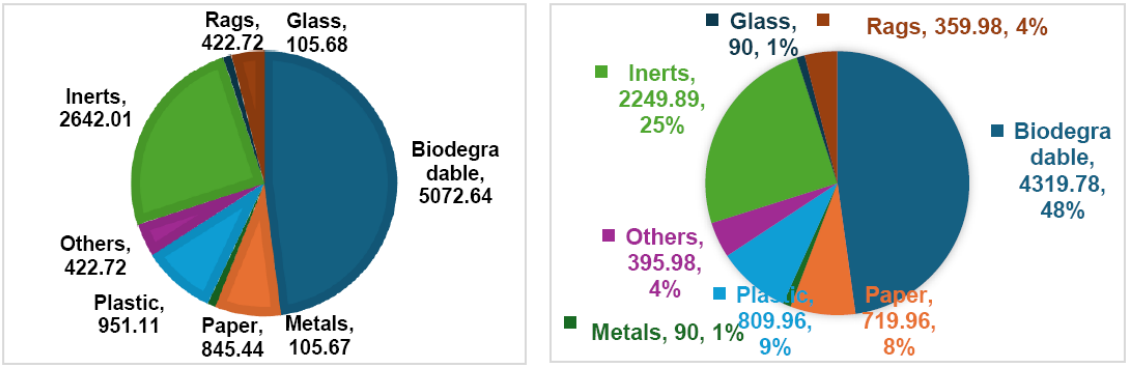
Source: As per table 1

Population in Nagpur Municipal Corporation could have 1065.93 MT (66.15 percent) of solid waste in current period. Nagpur is third largest city in Maharashtra. It is fastest growing metropolis in state. The industry in Nasik Municipal Corporation could have 478.17MT (36.55 percent) solid waste in current period. Many industries are in Nasik region. In Nasik Municipal Corporation, the colleges could be contributing 24.62MT solid waste in 2025. In Nagpur Municipal Corporation, the health care institutions could be contributing 112.86MT (7 per cent) solid waste. Commercial establishments could have 102.23 MT (7.81 percent) solid waste generation in current period. Gardens in Nasik city could have 83.64MT (6.39 percent) solid waste generation in 2025. Many people visit regularly to gardens and parks in region. We have calculated that Nagpur Municipal Corporation could have 1611.45 MT solid waste from all the sources in 2025. This city is growing very fast in terms of population and other units.

Composition of Solid waste in Municipal Corporation of Maharashtra:

The major categories of waste are generally found in MSW of India as follows. Biodegradable Waste: Food and kitchen waste, green waste (vegetables, flowers, leaves, fruits) and paper. Recyclable Material: Paper, glass, bottles, cans, metals, certain plastics, etc. Inert Waste Matter: C&D, dirt, debris. Composite waste: Waste clothing, Tetra packs, waste plastics such as toys. Domestic Hazardous Waste and toxic waste. Waste medicine, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer. and pesticide containers, batteries, and shoe polish (Joshi, R., Ahmed, S., and Ng, C. A. 2016).

Figure 1 Composition of solid waste in Corporations in Mumbai Metropolitan Region



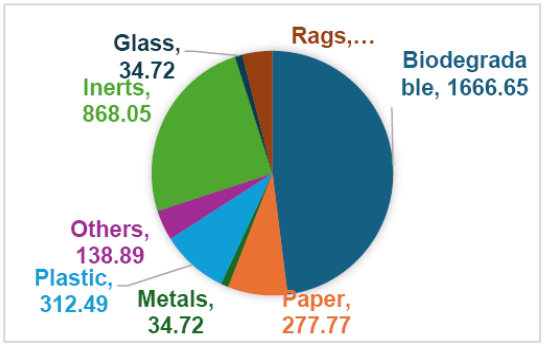
Mumbai City

Thane District

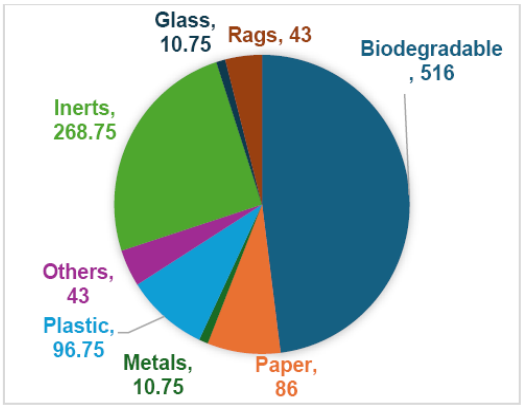
In Mumbai city, the biodegradable is observed as 5072.64 MT in 2025. Biodegradable waste contains food and kitchen waste, green waste including vegetables, flowers, leaves and fruits. People put maximum waste food in dustbins. They eat fruits and vegetables in their balance diet. But the waste part is put in the dustbins. The glass comprises in 105.68MT solid waste. The rags could be 422.72MT

in solid waste of Mumbai city. It is piece of cloths which are regularly found in solid waste. The inert could be 2642.01MT in solid waste in current year. The plastic in Mumbai city is calculated as 951.11 MT in 2025. People wrap maximum commodities in plastic. They carry vegetables in plastic bags, bottles, plastic bags used in day to today life. Papers could be 845.44M T in solid waste of city. The metals could be 105.67MT of solid waste in Mumbai city in 2025. In Thane district, the solid waste from Municipal Corporations comprises as 4319.78MT biodegradable waste. The rags could be 359.98MT in solid waste of Municipal corporation of Thane district. The glass could be 90MT in solid waste. The inert could be 2249.89MT in municipal corporations of Thane district. The plastic is calculated as 809.96MT in municipal corporations. Most of the plastic is not collected and segregated. But it is thrown in open area. The Metal in solid waste is calculated as 90MT. The papers could be 719.96 MT in solid waste of Municipal Corporations in Thane district. All the generated solid waste in Metropolitan Region required different kinds of skills to segregate, dispose and landfill.

Figure 2 Composition of solid waste in Pune metropolitan Region



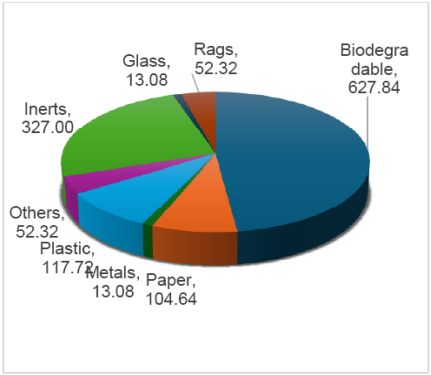
Pune City



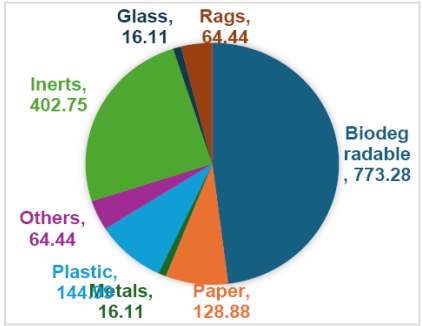
Pimpri Chinchwad Municipal Corporation

Urbanisation is increasing fast in Pune region. In Pune city, the biodegradable waste could be 1666.65MT in 2025. It is food waste which mainly comes from kitchen waste. The rags could be 138.89MT in Pune city in current year. The glass in solid waste may be 34.72MT in Pune city. Inert in Pune city could be 868.05MT in 2025. Plastic waste in Pune Municipal Corporation could be 312.49MT in 2025. Use of plastic is very high by different strata of people. Metals in Corporation might be 34.72MT in 2025. The papers in Pune Municipal Corporation are calculated as 277.77MT in 2025. In Pimpri Chinchwad Municipal Corporation the biodegradable waste could be 516MT in 2025. Due to less number of households, the solid waste due to The rags (10.75MT) and Metals (10.75MT) slightly lower as compared to rags and metals of Pune Municipal Corporation. But the inert in Pimpri Chinchwad Municipal Corporation is calculated as 268.75MT. The Plastic (96.75MT) and Papers (86MT) is also higher in Pimpri Chinchwad Municipal Corporation.

Composition of solid waste in Nasik and Nagpur Municipal Corporation (2025) (MT)



Nasik Municipal Corporation



Nagpur Municipal Corporation

In Nasik Municipal Corporation, the biodegradable waste calculated as 627.84MT in 2025. It is slightly lower as compared to Nagpur Municipal Corporation. The rags could be 52.32MT in solid waste. The quantity of glass (13.08 MT) and metals is calculated as same in Nasik Municipal Corporation. Inert is calculated as 327MT in Nasik Municipal corporation in 2025. The plastic (117.72MT) and Paper (104.64MT) is also calculated in Nasik Municipal Corporation in 2025. The plastic generation is more corporation as compared to papers. Now the use plastic has increased more for different purposes.

In Nagpur Municipal Corporation, the biodegradable solid waste could be 773.28MT. The rags and others are calculated as same (64.44MT) in Municipal Corporation. The glass and metals are calculated as same (16.11MT) in Municipal Corporation for 2025 year. It required different types of segregation in corporation. Inert could be 402.75MT in Municipal Corporation. The plastic could be 144.99MT in corporation during 2025. The paper in solid waste is calculated as 128.88MT in Nagpur Municipal Corporation. Municipal corporation must segregate the solid waste before sending it to dumping grounds.

Solid waste management in Metropolitan Regions in Maharashtra:

In the following table, we have provided dumping ground of each municipal corporation with current and future capacity.

Table 6 Dumping grounds in Municipal Corporations in Metropolitan Regions:

Municipal Corporation	Dumping Ground	Capacity (HA)	Future area (HA)	Current Status	Recycling	Landfill
Greater Mumbai	Kanjurmarg	141	70.00	Operational		Bio reactor
	Deonar	132	1.4	Operational		Dumping
	Mulund	25	-	Operational		Dumping
Navi Mumbai	TTC area, Turbhe	26.32	6.58	Operational	Plastic	Sanitary landfill
Thane	Khardi	4.4	-	Exhausted		Dumping
	Mumbra	15	7.00	Operational		Dumping
	Kalwa	15	-	Operational		
Bhiwandi Nizampur	Chavindra	2.5	-	Operational		Dumping
	Dapoda	2.6	-	Proposed		
Kalyan Dombivali	Adharwadi	30	-	Operational		Dumping
	Umbarde	19	-	Proposed		Dumping
Ulhasnagar	Maharal	4	-	Operational		Dumping
	Kambe	18	-	Proposed		
	Shantinagar	-	-	Closed		
Mira Bhayandar	Pali Uttan	31	19	Operational		Dumping
	Saiwan	-	-	Proposed		
Vasai Virar	Gokhiware	19.33	10.54	Operational		Dumping
Pune	Fursungi	27.11	-	Operational		Dumping
	Devachi Urali	66.77	-	Operational		Dumping
	Hadapsar	8.90	-	Operational		Dumping
	Ramtekadi	4.04	-	Operational		Dumping
	Aundh	6.32	-	Operational		Dumping
Pimpri Chinchwad	Moshi	32.37	-	Operational		Dumping
	Punawale	24.68	-	Identified		Dumping
Nagpur	Bhandewadi	21.04	-	Operational		Dumping
Nasik	Pathardi	26.30	-	Operational		Dumping

Source: Development report of each Metropolitan Region

Mumbai Municipal Corporation has three dumping grounds Kanjurmarg (141Ha),Deonar (132Ha),Mulund (25Ha). All solid waste transported at these three sites. Now maximum solid waste is transported to Kanjurmarg dumping ground. Navi Mumbai Municipal Corporation transport solid waste to TTC, Turbhe (26.32Ha) dumping ground. Thane Municipal Corporation sends the solid waste to Khardi (4.4Ha), Mumbra (15Ha) and Kalwa (15Ha) dumping grounds. Solid waste is transported without proper segregation. Bhiwandi Nizampur Municpal Corporation has Chavindra (2.5Ha) Dapoda (2.6Ha) dumping ground. Kalyan Dombivali Municipal corporation has Adharwadi (30Ha) and Umbarde (19Ha) duping ground. All solid waste is deposited at open area. It causes health issue to local people. Ulhasnagar Municipal Corporation has Maharal (4Ha), Kambe (18Ha) dumping ground. The Mira Bhayandar Municipal Corporation has Pali Uttan (31Ha) dumping ground and 19Ha land is reserved for future dumping of solid waste. Vasai Virar Municipal Corporation has Gokhiware (19.33 Ha) dumping ground. Solid waste of each Municipal Corporation is regularly sent to allocated dumping ground. There are number of issues with the solid waste sent at dumping ground. First, the solid waste is not being picked from the sites properly. This causes the pungent odourto arise from the different sites where the stock of waste has openly occurred. This not only affects the environment of surroundings but also causes health problems in the individuals namely breathing issues, eye irritation and headache as well. The gases produced by the waste like methane not only cause lung infection but also can cause death of a person. Additionally, the eroded solid waste causes the deterioration of road networking in the city as well as affects the drainage system of a city very badly. Secondly, if solid waste is collected then it must be disposed of properly because the conservation of the environment is very important. Throwing garbage or solid waste openly on the grounds has a great impact on the depletion of the environment as it can germinate various diseases like Malaria which can be caused through the throwing of solid waste openly. Moreover, the burning of waste is the cause of global warming and the consequent rising of the temperature. The maximum treatment with solid waste is to be done to burn it (Ahmad Zubair 2024). All the issues are related to improper solid waste collection, transport, dumping grounds and environment,

Regression analysis for solid waste management in Municipal corporation:

We have total solid waste generated data of municipal corporations of Metropolitan Region in Maharashtra. We have used the ordinary least square regression (Greene, W.2003) to find the corelation of solid waste in each corporation with number of factors responsible for solid waste generation.

$$y_i = x_{i1}\beta_1 + x_{i2}\beta_2 + \cdots \ldots \ldots \ldots + x_{ik}\beta_k + \epsilon_i \quad (11)$$

Where

Yi : value of dependent or explanatory variable as total solid waste in metric tones

X1……..xk are independent variables

At the last ε is error term.

The total solid waste (Dependent variable) of each municipal corporation is regressed on number of factors responsible for solid waste generation (independent variables). The results are presented in the following table.

Table 6 Regression analysis for Mumbai and Thane Municipal Corporation

Variables	Co-efficient (Standard Error)	T Test	Variables	Co-efficient (Standard Error)	T test
Population	0.228*(0.675)	19.43	Population	0.43*(0.09)	17.44
Hotels	13.21*(0.02)	6525.66	Industry	0.90*(0.03)	29.59
Health care	-0.114*(0.345)	-5.06	Primary schools	2.15**(0.53)	4.01
Industries	0.628*(0.23)	9.69	Colleges	5.50*(0.35)	15.42
Cinema houses	0.067*(0.023)	6.1	Theatres	14.30*(2.02)	7.06

Fire stations	0.075**(0.2451)	3.82	Restaurants	13.64*(1.95)	6.99
Municipal welfare centres/Recreation	0.017*(0.343)	4.62	Constant	1679.07*(57.95)	28.97
Registered shops and establishments	2.67*(0.00)	24049.29	R=0.99	R^2=0.99	
Constant	4959.648*(.045)	110728.77	Adjusted R^2= 0.99	Std. Error of the Estimate=6.612	
Std. Error of the Estimate	R R Square	Adjusted R Square			
0.03617	0.99 1	0.99			

*Significant at 1 per cent ** significant at 5 per cent

The solid waste in Mumbai city is positively co-related to population. It is statistically significant and positively co-related with total solid waste. Population is continuously increasing, and more solid waste will be generated in future. The hotels related solid waste is positively co-related and statistically significant with total solid waste. Number of people visit to hotels and order food from hotels. The solid waste is negatively corelated to health care institutions in Mumbai Municipal Corporation. Most of the health care facilities have their own arrangements of waste management. Therefore, is negatively co-related to total solid waste. Solid waste in Mumbai municipal corporation is positively co-related to industries. Many industries have staff and workers. They generate solid waste plus in production process more solid waste is generated. and cinema houses. Many people regularly visit theatres, they order food and cold drinks during break hours. The fire stations, municipal welfare centres and registered shops and establishments is positively co-related and statistically significant with total solid waste in corporation. Registered shops and establishment provide the commodities in plastic bags. The Solid waste in Thane municipal corporation is positively co-related and statistically significant to population. In Thane urban area, population will continuously increase in future. The industries are also located in Thane, Kalyan Dombivli and Ulhasnagar. During production and packaging, maximum solid waste generated. Hospitals are generating maximum solid waste during treatment of patients. The solid waste is positively co-related and statistically significant with total solid waste in district. People visit to restaurants, theatres regularly. They eat food and enjoy the shows. Therefore, it is positively co-related and statistically significant with total solid waste. Solid waste from educational institutions such as, primary schools and colleges is positively co-related and statistically significant. It means more youths involved in solid waste creation.

Table7 Regression analysis for Pune and Pimpri Chinchwad Municipal Corporation

Variables	Co-efficient (Standard Error)	T Test	Variables	Co-efficient (std.error)	T test
Population	2.10*(0.001)	3888.63	Population	2.00*(0.00)	7329.55
Hospitals	2.18*(0.08)	24.88	Industry	0.997*(0.002)	405.01
Hotels	0.02**(0.03)	2.00	Hospitals	0.99* (0.001)	1186.03
Restaurants	2.73(0.001)	24.88	Shops	0.989*(0.025)	40.25
Shops and comm-ercial units	0.03*(0.10)	4.97	Hotels	1.007*(0.008)	128.64
R =0.99	R square=0.99	Std. Error of the Estimate 0.013	Theatres	1.03*(0.021)	50.01
			Primary	1.01*(0.009)	115.73
			Secondary	1.107*(0.111)	9.98

			College	0.951*(0.034)	28.02
			Postgraduate	1.003*(0.010)	98.28
			Parks	1.00*(0.006)	171.52
			Constant	-0.232	-0.39
			R2=0.99	R=1.00 Adjusted R2=0.99	Std. Error of the Estimate=0.0062

*Significant at 1 per cent ** significant at 5 per cent

The solid waste in Pune is positively co-related and statistically significant with population. Population in Pune Municipal corporation is rising due to high level of migration. It will continuously rise in future also. The solid waste from hospitals and hotels, restaurants is also found positive and statistically significant with total solid waste. The number of hospitals and patients, hotels and customers are increasing in city. There are number of shops and commercial units increased in Pune city. Many people buy commodities in shops and commercial establishments. Such activities will continuously grow in future. Therefore, solid waste will also increase in Pune city. Urbanisation is continuously increasing in Pimpri Chinchwad Municipal Corporation. People are migrating in corporations and work in different industries. The solid waste in Pimpri Chinchwad Municipal Corporation is positively co-related to population and industries. Such trend will continuously grow in future also. The number of hospitals, shops and hotels also increased in corporation. They are also responsible for solid waste generation. People visit to theatres and watch cinemas. They generate maximum solid waste in corporation. The educational institutions and children in primary, secondary schools, colleges, post graduate institutions also responsible for solid waste generation. Therefore, solid waste from educational institutions will also grow in future. People visit public parks and gardens. Solid waste is generated every day in such places. Regular sweeping in gardens and parks shows the positive trend of solid waste in municipal corporation.

Table 8 Regression results for Nagpur and Nasik Municipal Corporation

Variables	Co-efficient (Std. Error)	T test	Variables	Co-efficient	T test
Population	1.321*(0.015)	90.65	Population	0.16*(0.000)	152.74
Industry	0.948*(0.160)	5.93	Industry	1.00*(0.000)	5372.75
Secondary schools	12.115*(2.31)	5.23	Health care	1.00*(0.002)	562.38
Health care	0.713*(0.129)	5.528	Hotels	0.99*(0.010)	200.05
Constant	-232.66*(15.80)	-14.72	Commercial units	1.00*(0.003)	299.145
R=1.00	R^2=1.00 Adjusted R^2=0.98	Std. error of the estimate =3.57430	Primary	26.18*(0.010)	2360.83
			Secondary schools	0.06**(0.020)	4.70
			College	0.10*(0.00)	7.57
			Gardens and streets	1.00*(0.004)	240.95
			R=0.99	R^2=1.00 Adjusted R^2=0.99	Std Error of the estimate =0.07834

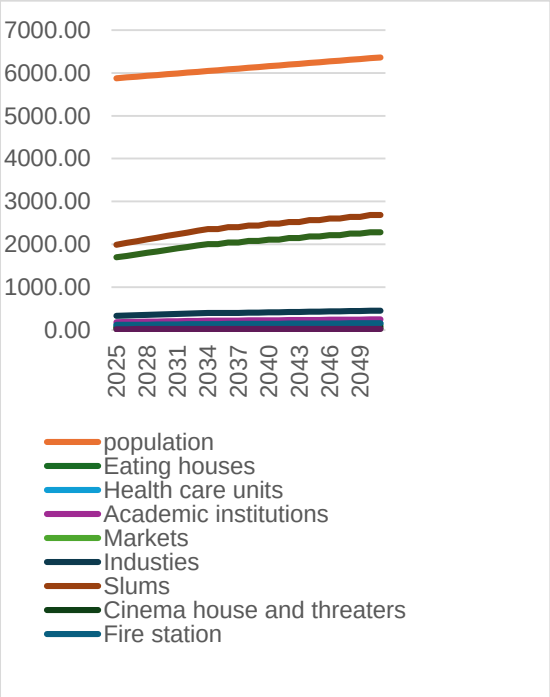
*Significant at 1 per cent ** significant at 5 per cent

The solid waste in Nagpur is positively co-related to population. The population in Nagpur city is growing fast. The number of industries is also growing fast. They create maximum solid waste in production process at region. The children in secondary schools are also creating maximum solid waste. They use pen, pencils, cardboards for study and create more solid waste during study hours. The number of health care institutions are growing in corporation. The solid waste generated by number of health care units is positively co-related and statistically significant. The solid waste in Nasik Municipal Corporation is positively co-related to Population and industry. The urbanisation is responsible for growth of population. People work in different industries. During work process, more solid waste is generated in corporation area. The health care institutions are also growing in region. They treat patients and provide medicines. It is responsible for solid waste generation. People order food and eat food at different hotels and generate more solid waste in region. As the income increase of households, they visit to number of hotels. They generate more solid waste by ordering food, water bottles, ice-creams. They celebrate birthdays and other parties at hotels. The commercial units are also growing fast in corporation. They are also responsible for the growth of solid waste in corporation. The educational institutions are also increasing in corporations such as primary and secondary schools, colleges. The number of children is also growing. They are also responsible for the growth of solid waste in corporation. The people regularly visit garden and eat street food. Such activities also lead to more solid waste generation in corporation.

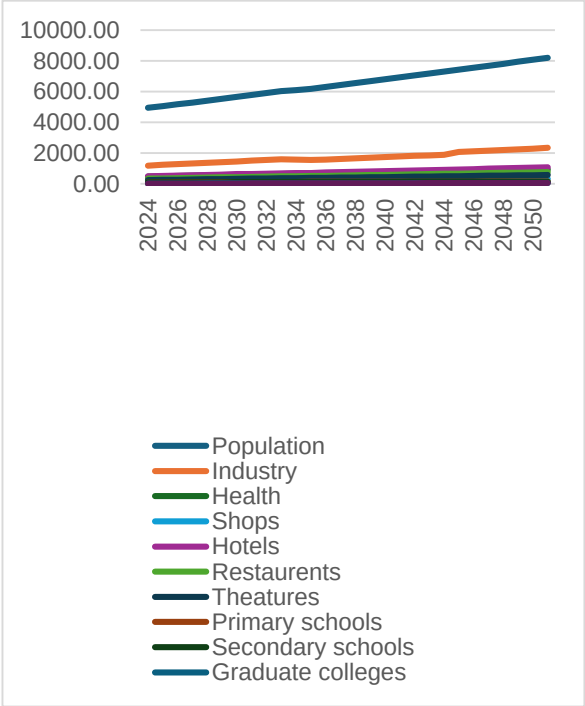
We have estimated the solid waste generation by each municipal corporation in metropolitan region of Maharashtra. It is shown as graph as follows

Future forecast of Solid waste in Municipal Corporation of Metropolitan regions

Graph 1 :Solid waste in Mumbai Municipal corporation

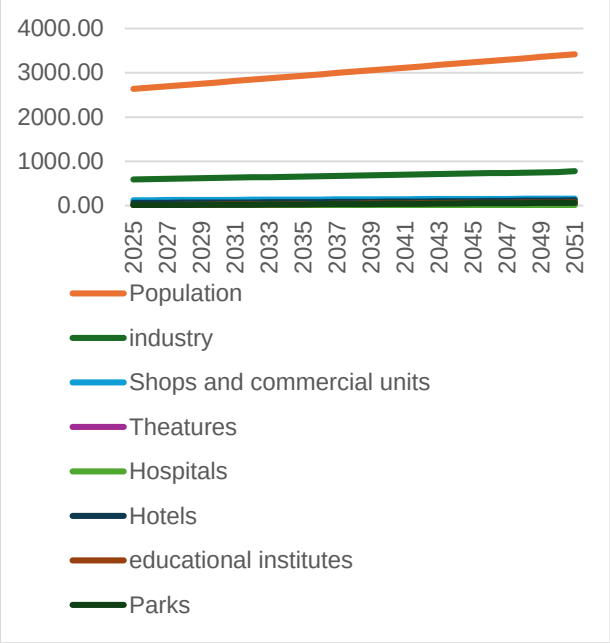


Graph 2 Municipal Corporations in Thane district and solid waste

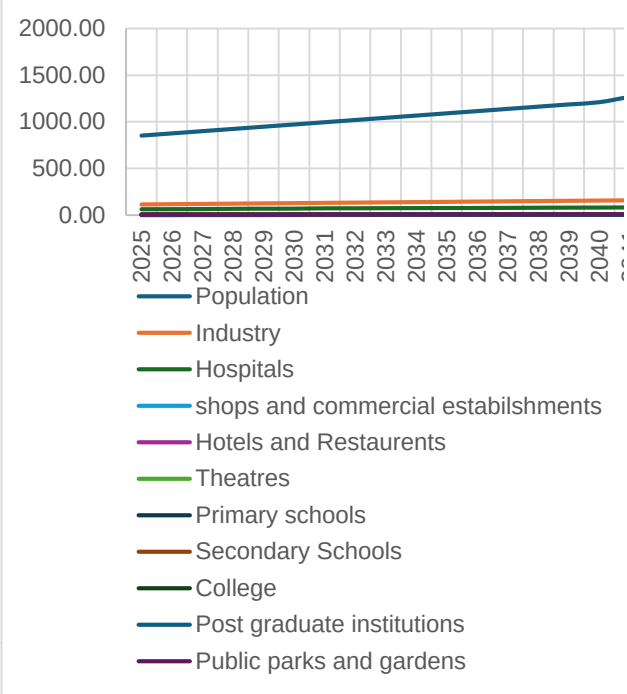


Graph 3 Solid waste from Pune Municipal Corporation

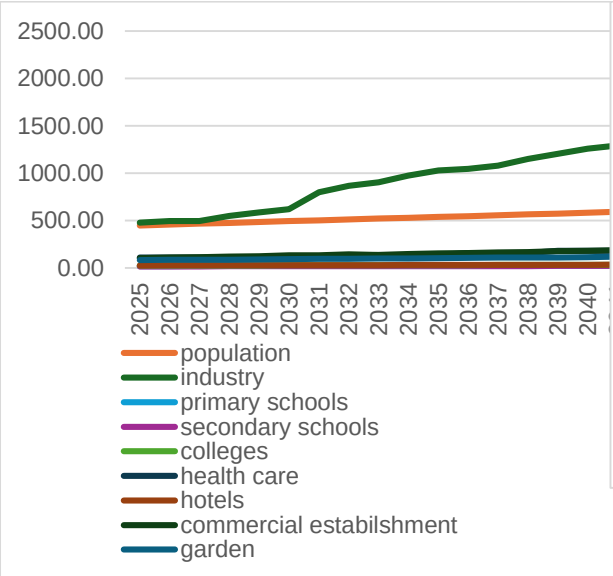
Graph 4 Pimpri Chinchwad Municipal Corporation with solid waste generation

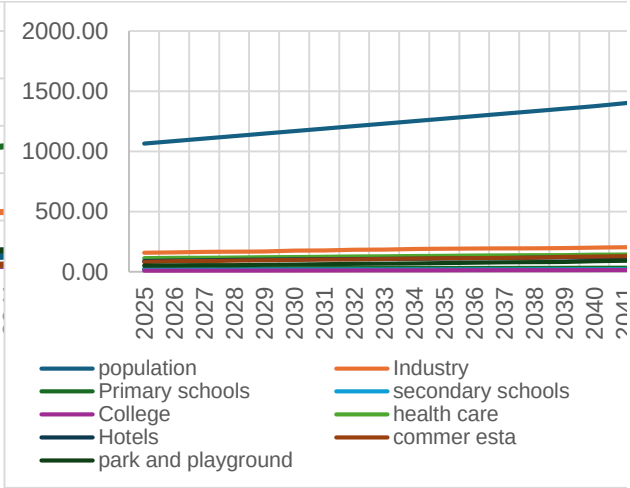


Graph 5: Solid waste in Nasik Municipal Corporation



Graph 6 Nagpur Municipal Corporation and solid waste





The solid waste in Mumbai city from population is calculated as 6000MT in 2031. Population will continuously grow in corporation. It will reach up to 6400MT till 2051. The solid waste from slums is calculated as 2000 MT in 2025 but it will reach more than 2500MT in 2045. Due to lower physical space in city, the slums population will continuously grow. Solid waste from eating at houses will not grow fast in Mumbai city. The number of eating houses will grow with income of households in city. Academic institutions will not grow significantly over the period. The solid waste in Municipal Corporations of Thane district will have high growth from different units. The population will grow fast, and it will add to solid waste from 4000 to 8000MT from 2025 to 2051. Along with industries, the workers will also grow in city. The industries will contribute more than 1000MT to 2000MT solid waste from 2025 to 2051. The solid waste will get more than double from industries in Thane district. Kalyan Dombivli, Ulhasnagar, Navi Mumbai has more industrial units and they will grow with time. The Solid waste from hotels would reach up to 1000MT in Municipal Corporations of Thane

district. The solid waste from educational institutions, shops and health care institutions will not grow significantly in Municipal Corporations of Thane district. In Pune Municipal Corporation, population growth will be responsible for growth of solid waste. The solid waste will grow from 2500MT to 3500MT from 2025 to 2051. The industry could contribute 500MT to 800MT solid waste in city. The solid waste from hospitals shops and commercial units will not grow significantly over the period. In Nagpur municipal Corporation, the population would be contributing 800MT to 1500 MT solid waste from 2025 to 2051. Industry could contribute from 160MT to 200MT from 2025 to 2051. The hospitals could be contributing smallest rise in solid waste in region. Hospitals will not grow significantly in corporation. In Nasik Municipal Corporation, the population could contribute 1000MT to 1600MT solid waste from 2025 to 2051. Industrial units' growth is observed in corporation. The industry is expected to contribute around 200MT plus solid waste in Nasik Municipal Corporation. Other units such as educational institutions, health care units, commercial units, may be contributing up to 200 MT of solid waste till 2051.

Policy Implication and Conclusion:

Urbanisation growth is higher in Maharashtra state. The business units are growing fast in state. The solid waste is calculated more in Mumbai city as compared to other corporations in Metropolitan regions of Maharashtra. Pune Municipal Corporation has also high solid waste generation in Maharashtra. All municipal corporations, the solid waste contributed by population is much higher as compared to other units. The quantity of biodegradable is having maximum composition in solid waste. Maximum solid waste is carried by trucks and dumpers to the dumping ground that is Deonar and Kanjurmarg in Mumbai city. In Pune Municipal Corporation, the solid waste is transported to Fursungi, Devachi Urali, Hadapsar, Ram-tekadi and Aundh. Each municipal corporation has reserved the dumping ground. Improper management of municipal solid waste (MSW) causes hazards to inhabitants. Solid waste disposed of unscientifically in open dumps and landfills, creating problems to public health and the environment (Mufeed Sharholy et.al 2008). The solid waste in Mumbai city is positively corelated to Population, hotels, industries, cinema houses, fire stations, welfare centres, and registered shops and establishments. It is negatively co-related to health care centres in Mumbai Municipal Corporation. The solid waste is positively co-related to population, industry, hospitals, shops, hotels, theatres, secondary schools and post graduate institutions. It is negatively co-related to primary schools and colleges in Municipal Corporations of Thane district. In Pune city, solid waste is positively co-related to population, hospitals, hotels, restaurants and shops, commercial units. The solid waste in Pimpri Chinchwad Municipal Corporation is positively corelated to population, industry, hospitals, shops, hotels, theatres, primary and secondary schools, colleges, post graduate institutions and parks. In Nagpur Municipal Corporation, the solid waste is positively Corelated to population, industry, secondary school, and health care institutions. In Nasik Municipal Corporation, the solid waste is positively co-related to population, Industry, health care, hotels, commercial units, primary and secondary schools, colleges, gardens. The solid waste is not collected regularly from all areas of corporation. Non availability of dust bins, irregular visits of municipal vans for household waste collection and lack of knowledge regarding importance of segregation of waste were observed to be the principal problems in the practice of solid waste disposal by urban slum families (Nirgude A.S. et.al. 2014). The government should provide adequate refuse dump and sewages systems for urban slum dwellers and awareness should be created to residents in slum areas on the consequences of improper solid waste disposal and management (Bullem et.al. 2021). The main component of solid waste generated at home was largely food debris that has the potential to be composted and plastics that can be recycled, which were mainly disposed without separation. The local solid waste management authority should focus on utilizing this organic waste through a larger scale and wider involvement of the locals in composting program. The growth of small-scale community-based waste composting can act as a potential start up venue in accelerating this program, without the necessity of extensive investment by the local authority (Fadhullah, W. et.al 2022). Disposal of solid wastes is a stinging and widespread problem in both urban and rural areas in many developed and developing countries. Municipal solid waste (MSW) collection and disposal is one of the major problems of urban environment. MSW management solutions

must be financially sustainable, technically feasible, socially, legally acceptable and environmentally friendly. Solid waste management issue is the biggest challenge to the authorities (Hussein I. Abdel-Shafy, Mona S.M. Mansour 2018). Segregation of solid waste required immediately in region. Solid garbage is the unwanted, harmful, and wasted substance arising from day-to-day civic events. Management of the solid wastes can be described as the methodology of managing solid waste generation, storage, collection, transport, treatment and disposal (Choudhary, Shweta (2019). Solid waste management practices such as storage and disposal practices in the slums is unsatisfactory, and separation and composting are minimally practiced. Slum residents' practices, concerns, and attitudes indicated lack of sufficient knowledge about good waste practices, their responsibilities, and consequences of poor waste management. There is need to educate rich and poor, children adult and women related to segregation of solid waste. Regions required complete processing of solid waste. At the same time, the landfill and decomposing of solid waste need planning. The Maharashtra state must plan zero generation of solid waste. The concept of 3Rs need to be rethought and 5Rs need to come in place- Refuse, Reduce, Reuse, Replenish, Recharge and Recycle. That way, energy and material recovery need to take very seriously. The producers need to force to acknowledge the materials they use in their products and the packaging of their products. Without relevant and precise knowledge, expediting solutions would not be realistic (HamsaIyer (2016). The NGO's must work effectively to collect solid waste and segregation in corporation area. There is need of research and public sector investment on solid waste processing in every corporation. The Central and state government should have clear stand on collection, segregation and process of solid waste. The role model in solid waste management at municipal corporation level is important in state. All policies will certainly help to reduce the solid waste in all metropolitan regions in Maharashtra. Limitation of the study is that we have not calculated solid waste during Ganpati festival in 4 metropolitan Region.

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