

# Sustainable Climate Impact Management through Solid Waste Planning: A Case Study of Solid Waste Management for Maha Kumbh Mela 2025

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**Abstract:** For a temporal mega city like Kumbh Mela, one of the challenges is to manage the solid waste. Kumbh mela is known as one of the largest and longest mass gathering of humanity on the planet, bringing tens of millions of devotees to visit the holy site during the course of 55 days, on bank of river Ganga. In upcoming festival of the maha kumbh mela 2025 there is going to be a population blast, attracting people from all around the world which will eventually pose an immense challenge and generate tons of solid waste at the site. There are various challenges that usually come across while conducting an event which leaves an undesirable impact on the environment. In 2019, national green tribunal (NGT) stated that Allahabad is on the verge of epidemic, if the solid waste generated from the kumbh mela is not planned and managed properly. The objective of this paper is to study and analyze the solid waste management activities during the tenure of kumbh mela 2019 and prepares a relevant action plan of solid waste management for kumbh mela 2025 in Prayagraj using various method and latest technologies which helps in collecting, monitoring and transporting of solid waste, with consideration of solid waste management rules 2016 and Uttar Pradesh state policy for solid waste management.

**Index Terms -** Solid waste management, Kumbh Mela, Epidemic survey, Mass gathering, Temporary mega city

## I. INTRODUCTION

Millions of people with different culture flock the area of Prayagraj, during the tenure of 55 days from makar sankranti to maha shivratri which includes rich and poor, young and old seeking something intangible and unmiserable. Some are spectacles, some come due too spiritual belief, some for salvation and some come to disappear. Kumbh the ultimate melting point! The biggest religious gathering on the planet earth. where the temporary mega city pops-up just few month before, addressing around 130,000,000 tents, 300 KM of road network and wide electricity network. The Maha Kumbh Mela is a Hindu religious festival that occurs every twelve years with an Ardh ("Half") Kumbh Mela six years later at the confluence of the Ganga and Yamuna Rivers in the city of Allahabad. [9]

Cities constantly keep on changing, but these changes becomes challenges when changes are instantaneous, or they deviate significantly from planning projections, or something unexpected mass movement occurs. Role of planners is very significant to regulate city changes. Here in the case of kumbh mela which take place at every 6 years of time interval bringing tens of millions of devotees at a place where a large number of mass movement occurs, hence which increases the number of temporary settlements near the sangam. These poses a great challenge to the city planner as the large number of floating population is been seen with the increasing number of pilgrims every time the festival take place.



Figure 1 Location of Kumbh mela at all places in India

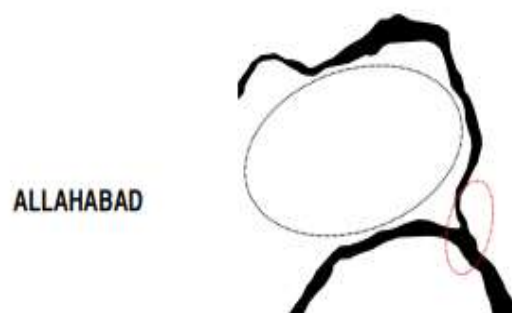


Figure 2: Built city relationship between Kumbh mela and Allahabad city

There is a gradual increase in the number of attendees every year

Table I: Number of visitors at kumbh mela

year	Number of visitors
1989	16 million
1995	25 million
2001	40 million
2007	70 million
2013	120 million
2019	150 million

(Source:- <http://kumbhmelaallahabad.gov.in>)

**II. STUDY AREA**

The study area is the city of Prayagraj in the state of Uttar Pradesh, India. It lies on coordinate 25.4500 °N, 81.8500 °E. Located in southern Uttar Pradesh, the city’s metropolitan area covers 63.07 km<sup>2</sup>. The population of Allahabad district in 2001 was 49 lakhs and in 2011 it was 59 lakhs according to census. It is connected by road to prominent cities of country like Jhansi, Kanpur, Lucknow, Jaipur, Bhopal, New Delhi etc. Buses operated by Uttar Pradesh and other state road transports corporation as important means of road transport. The four main stations in Allahabad are Prayag station, city station at Rambagh, Daraganj station and Allahabad junction. The city is connected to most of the Uttar Pradesh cities and other major cities like Chennai, Vishakhapatnam and New Delhi etc. Allahabad is served by Allahabad airport and inland waterways Authority of India connect Allahabad to Haldia. [6]



Figure 3: Geographical location of Allahabad

Table 2: Land use pattern

Sr no.	Infrastructure	Unit	Kumbh 2001	Ardh Kumbh 2007	Kumbh 2013	Ardh Kumbh 2019
1	Area	Hectare	1495.31	1613.80	1936.56	3278.30
2	Sectors	Number	11	11	14	20
3	Length of road laid	KM	96.50	116.50	156.0	254.0

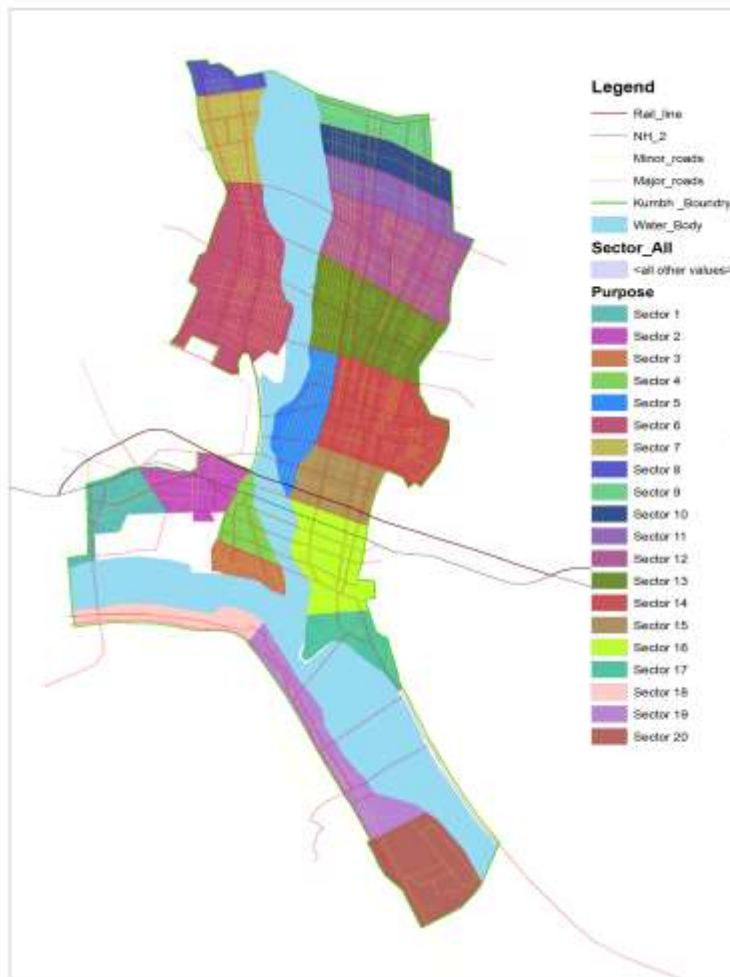


Figure 4: land use map of Ardh Kumbh

### III. STUDY JUSTIFICATION

After every successful event at Allahabad which is the kumbh mela, it started attracting more number of devotees after every successive event. Such event at large scale poses challenges to all the infrastructure facilities provided during the tenure to kumbh mela. National Green Tribunal also informed to the government of Uttar Pradesh that the solid waste generated from the kumbh mela was not segregated and treated at all. And the head of Uttar Pradesh pollution control board department said they did not have any proper planning proposal for managing such humongous amount of waste.

Table 3: General comparison of all Kumbh Melas

Nasik Simhastha Kumbh 2015	Ujjain Simhastha Kumbh 2016	Haridwar Ardh Kumbh Mela 2016	Allahabad Ardh Kumbh Mela 2019
100 million	75 million	107 million	150 million
No permanent location is observed and does not feature Ardh Kumbh Mela	Does not feature Ardh Kumbh Mela.	Organised on the banks of river Ganga.	Organised at Sangam, the confluence of three of the holiest rivers Ganga, Yamuna and Sarasvati.

Prayagraj Kumbh is regarded as holiest of all Kumbhs because it includes a famous story that it was in Prayag where Lord Brahma, the one who created the universe, attended a sacrificial ritual and thus the place is of great importance for Hindus.

The other reason is that the tradition of long-term Kalpvash is practiced only in Prayagraj and thus the city Allahabad during the Kumbh Mela witnesses large number of pilgrims.

## IV. DATA COLLECTION

## GENERAL DATA

Population (2019)	150,000,000
Forecasted Population (2025)	209,583,334
Area	32.783 Sq. Km
Number of Sector:	20
Number of Houses:	130,053,000
Total road length:	308 KM
Waste Generated:	853 MT

## Population growth and density

Year	Population (numbers)	Area (Sq.Km)	Gross Density (person/Sq.Km)
1989	16,000,000	11.5400	1,386,481.80
1995	25,000,000	12.4254	2,012,007.66
2001	40,000,000	14.9531	2,675,030.59
2007	70,000,000	16.1356	4,338,233.47
2013	120,000,000	19.3656	6,196,554.71
2019 (present year)	150,000,000	32.7830	4,575,542.20
2025	176,302,000	40(expert opinion)	4,407,550.00

## Sector wise waste generation per day

Sector	Generation per day (ton)
Sector 1	39
Sector 2	43
Sector 3	39
Sector 4	48
Sector 5	45
Sector 6	39
Sector 7	25
Sector 8	23
Sector 9	28
Sector 10	37
Sector 11	44
Sector 12	38
Sector 13	45
Sector 14	55
Sector 15	53
Sector 16	48
Sector 17	54
Sector 18	37
Sector 19	39
Sector 20	48
<b>total</b>	<b>827 MT</b>
Hospital waste	6
Commercial waste	20
<b>total</b>	<b>853 MT</b>

(Source: - Prayagraj Development Authority)

Generation rate

Population (A)	Generation rate kg/day/capita (B)	Solid waste generated per day (A*B)
150,000,000	0.57	853 MT
176,302,000(Forecasted)	0.57	1102.57 MT

## V. DEDECIENT ANALYSIS

Action	MSW Rules 2016 [4]	Present Status of SWM
Segregation	To organise awareness program. Segregation to wet and dry waste at sources. Promoting recycle & reuse of segregated material. Program to ensure community participation in waste segregation.	No awareness program. Not done segregation at all at source. No promotion of recycle and reuse of segregated materials.
Primary collection	Door to door waste collection. Slum, bulk generators, commercial and agriculture waste should have separate collection system. MSW should not mix with hospital and industrial waste. No burning of waste. Recycling biodegradable waste.	Yes, done efficiently. Only follows separate collection system for hospital waste. No burning of waste is done. No segregation done at transfer station.
Secondary collection	Adequate number of covered storage bins. Colorization of the bins. Avoid manual handling of waste	Biodegradable polybags used in storage bins. No colorization of bins followed. No manual handling of waste at transfer site
Transportation	Covered transportation vehicles. Avoid multiple handling of waste. No open dumping. Clearance frequency.	Covered transportation vehicle observed. No multiple handling of waste. No open dumping observed. Regular clearance frequency.
Processing	Recyclable should be recycled. Biodegradable waste has to be inserted and preferable reused after processing like compost..etc.	Processing done at dumping site, segregating biodegradable and processing.
Disposal	Land fill/ incineration plant	Open dumping

## VI. RECOMMENDATION

### Segregation

Not followed at source hence proposal for MRF plant should be implemented at every transfer station.

### Collection

Collection points should be proposed for more effective and feasible planning for SWM of upcoming kumbh mela, 2025

### Transportation

Transfer station is located in the centre area of the mela hence for better feasibility proposed transfer station at the periphery of the mela area.

**Processing**

20% out of total waste is been handled manually. No processing for segregation of material is done hence the waste stays unmanaged for years. Try to implement on innovative segregation at source or at the mela area.

**Disposal**

All the unsegregated solid waste is loaded in the compactor and dumped at 15 KM far away from the mela area at Baswar dumping site where opening dumping is observed which leads to distorting the land and polluting the environment. Hence focusing on initial segregation at source or site area would be beneficial.

**VII. CONCLUSION**

Kumbh the world biggest religious mass gathering on the planet earth which happens on the temporary basis after every 6 years and after that it just disappeared leaving the lightest ecological footprint, the time period is around 55 days.

This paper has covers the overall effects on environment due to conductance of Maha Kumbh by data analysis and few technological advancements which may prove useful to other events over the world like Hajj, Rath Yatra, Durga Puja etc, other fairs and festivals. The means of sustainable development can be achieved by fulfilling the basic needs of the masses by focusing on the planning and management factor.

To provide proper planning recommendation for the upcoming mega festival in 2025, population projection and future generation rate has been calculated.

The past deficient analysis is done of the site area of solid waste management comparing with the rules of SWM, 2016 and then proper suitable recommendation is given of the processing, collection of solid waste and relocating of transfer station at the periphery of the area.

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