

# Solid Waste Management—A New Perspective

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**Abstract**—A harmonious and a balanced relationship between man and nature are absolutely necessary for the continuous sustenance and development of both. As man has been advancing in all aspects of life, directly or indirectly, sometimes deliberately he is being involved in activities which is causing huge imbalance in the man-nature relationship leading to environmental problems. Most noticeable problem amongst them is the accumulation and lack of managing solid waste.

Due to the industrial revolution in the country, there has been a huge influx of population in the urban areas and by 2020 it is expected that nearly 51% of India's population will be residing in urban areas. This increasing population is resulting in a tremendous load on our existing garbage handling system and clearly it is not designed to handle this. Therefore, going forward, garbage handling is a major concern in Metropolitan and Tier 1 cities in India.

With the 'Swachh Bharath Abhiyan' initiated by the Prime minister the focus is already on complete handling of Municipal solid waste as well as on scientific conversion and disposal and recycle of the same. Nevertheless, the most important factor in the success of the above is 'Community Participation' and this can be achieved only when the public has awareness on the basic aspects of waste handling like segregation, treatment and generation of useful by products from solid waste.

In achieving this, the architect's contribution would be to visualize the components – both built and unbuilt – of the waste handling process and design appropriate facilities for different scales.

This paper tries to explain the problem of solid waste management, its components, its significance, probable contextual solutions and the future ahead. It includes solutions for different scale of operations viz. household level, community level, town and urban level.

## 1. INTRODUCTION

*"A society is defined not only by what it creates, but by what it refuses to destroy"*

—Robert Rutherford

With the country racing constantly on road to be called a 'Developed country', it is aiming towards achieving high GDP, GNP, high per capita income, increasing the level of industrialization, widening the infrastructure range along with the standard of living of people. But in this process the society has become ignorant consciously or unconsciously about one of the key aspect of being called a developed country i.e handling the solid waste. Most surprisingly it is noted that the

serious problem of solid waste management is majorly seen in core urban cities of the country like Kolkata, Bengaluru etc. This clearly indicates that the tier 1 cities of the country are not well prepared for their future expansion as they seem to have already reached the peak of their crisis when it comes to managing the solid waste. An average of 32,000 people will be added to urban India every day, continuously, until 2021. This number is a warning, considering how India's waste management infrastructure collapsed trying to deal with just 25,000 new urban Indians per day during the last decade. The scale of urbanization in India and around the world is unprecedented with serious consequences to Earth's limited material and energy resources, and its natural balance. Rate of increase in access to sanitation infrastructure generally lags behind the rate of urbanization by 33% around the world; however, the lack of planning and impromptu piecemeal responses to waste management issues observed in India might indicate a much wider gap. This means urban Indians will have to wait longer than an average urban citizen of our world for access to proper waste management infrastructure.

## 2. SOLID WASTE-ITS NATURE & COMPOSITION

By definition, solid waste means garbage, refuse or any discarded material from the society be it solid or semi-solid which is disposed off as trash. Composition-wise the solid waste contains the following which represents a typical classification:

- Biodegradable waste: food and kitchen waste, green waste.
- Recyclable material: paper, glass, bottles, cans, metals, certain plastics, fabrics, clothes, batteries etc.
- Inert waste: construction and demolition waste, dirt, rocks, debris.
- Electrical and electronic waste (WEEE) - electrical appliances, TVs, computers, screens, etc.
- Composite wastes: waste clothing, Tetra Packs, waste plastics such as toys.
- Hazardous waste including most paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and containers

- Toxic waste including pesticide, herbicides, fungicides
- Medical waste.

The percentage of composition of solid waste generally varies by country-to-country and hence the below graph shows the percentage of composition of solid waste in India.

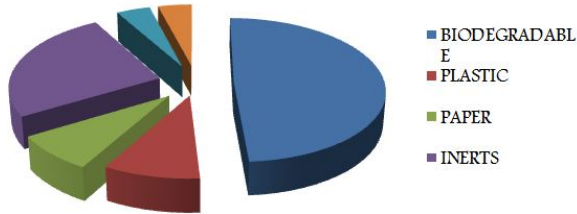


Fig. 1: Pie chart showing waste trend in the country

India generates around 300,000 tons of municipal solid waste (MSW) per day. Out of this approx. 15,000 tons per day is plastic waste that is 5% of the total waste. At overall 60% recycling, surplus waste plastic is 6,000 tons per day which includes multilayer pouches, metallized films and packs, thermocol (Styrofoam), EPS disposable cups, plates, etc. such post-consumer items which litter all around choking drains, defacing water bodies and beaches. Another item in MSW is construction and demolition debris (C&D debris) which comprises from 20 to 30% of it. These are real problems causing landfill volumes, environmental problems, etc.

### 3. THE FIRST STEP

Man-kind has always generated waste on day-to-day basis and never really given a thought as to what would happen to it after it is disposed?? The rapid increase in Solid waste generation and lack of its management in the country shows a clear trend in outbreak of epidemic.

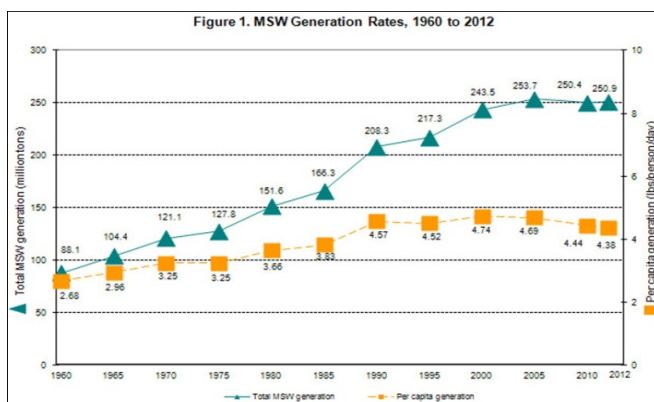


Fig. 2: Graph showing the increase in MSW generation from 1960-2012

But unfortunately, they think such a crisis is required to bring about policy changes, as they generally tend to happen only after the damage has been done. This attitude is unfortunate

because it indicates a lack of or failed effort from the sector to change policy, and also the level of India’s planning and preparedness.

Hence it’s time for us to get into a Radical thinking zone and go in search of the suitable contextual solutions at various scales like household, community and City scale and initiate a country-wide cleanliness drive.

### 4. SIGNIFICANCE OF COMMUNITY PARTICIPATION

One of the most important factors for the success of the above depends on level of involvement of public in the whole process and the system. Unless and until the public engages in depth into the management of waste no matter how much ever government and the decision makers come up with national level policy for maintaining the waste, the issue will not be resolved.

Community participation includes the public getting involved in understanding of solid waste, the procedure to segregate, treating the same and recycling some of the components and using the useful by-products of the same and encouraging the others to use it as well. So to start with, at house-hold level a basic segregation of solid waste as dry and wet waste is the responsibility of the people. Next at community level people should encourage to set-up local decentralized small scale dry waste treatment plants and at the same time private companies or NGO’s need to take the initiative of setting the plant up. Then next at large scale city level, the community at large can encourage and use the useful by-products or recycled products made of plastic waste, paper waste E-waste etc. A good way of achieving this is through setting up of “Awareness Centers” across the country and initiate mass cleanliness drives. Also community needs to be aware of the potential the solid waste has in itself to get converted into another form of energy like Refuse Derive Fuel (RDF), Bottled methane gas etc.



Fig. 3: Community awareness and participation

In this respect, we have a lot to learn from western countries where the above is actually practiced by the citizens.

## 5. CONTEXTUAL SOLUTIONS FROM AN ARCHITECT'S PERSPECTIVE

After painting the picture on issues related to solid waste management and stressing on the importance of community participation, it is important to derive the solutions. And the reason it is stated as 'Contextual' solution is because India being a country spreading across different climatic zones, different culture and tradition and also variations in the terrain, it may not be a wise idea to restrict ourselves to a set of solutions and apply the same across the country. As an example, sometimes the weather conditions may restrict us to follow the a particular treatment method whereas some other time the terrain of the region or vicinity of the residential area to the waste handling unit may be another reason which may restrict us to opt for a particular treatment process. Coming to an Architect's perspective to the whole issue of managing solid waste, there is tremendous amount of contribution Architects can do from their side as they are constantly involved in designing spaces for people from different backgrounds and most importantly they have the ability to change people's life for a greater good! Therefore here's an attempt to resolve the problem of managing different categories of solid waste by giving a more customized and contextual solutions by looking into resolving the issue at different scales.

### 5.1 HOUSE-HOLD SCALE

As mentioned earlier not all types of waste need to be treated at a large scale and in fact that may lead to loss of efficiency of the by-products.



Fig. 4: Bio-gas generating cylinder

Hence at house-hold scale the best way to contribute can be first to segregate the dry waste and the wet waste and next would be to directly treat the wet waste of the house like kitchen waste, food waste etc by converting it into organic manure and using the same to grow vegetables in their

gardens/pots. For a residence in rural setting, it can collect the wet waste and convert it into bio-gas and make use of the energy to run their cooking gas. To add to this, an Architect can design a dedicated space in or outside the house or even on the terrace of the house and making it a 'sustainable or a smart rooftop' so that it encourages the users to develop the habit of waste segregation and treating the wet waste at household level and also the external footprint of the house regarding wet waste can be made 'zero'. This way about 40%-50% of the country's solid waste can be managed at household level without depending on municipal authorities.

### 5.2 COMMUNITY/LAYOUT SCALE

Considering that most of the bio-degradable waste is not taken to the next level, the next big chunk of solid waste is the plastic/paper/glass/cans/metals etc which are mostly considered as dry recyclable waste and can be best treated at community scale. One of the intelligent ways of managing it would be by setting up decentralized treatment or conversion plant in the urban voids at small scale which can handle say about 5 TPD, 10 TPD or even 25TPD of recyclable waste. This way it is economical and affordable as not much initial capital is needed and if such decentralized plants are set up in every layout then the recyclable waste from that layout need not be transported to a large scale treatment plant which is set up away from the city limits due to Municipal solid waste 2000 rulebook. This in-turn saves lot of embodied energy (Total energy required to manufacture, transport, install and maintain it) involved and in fact it can be used to produce energy by manufacturing Refuse Derive Fuel (RDF) which is enough not only to self-sustain the plant but also can be used to power the machines in the neighboring small scale industry or any workshop.



Fig. 5: Furniture made of recycled tetra-pack material

When it comes to rural setting, a small scale plant to collect paper waste or certain plastic like milk packets or even fabric to some extent can be set up and it can be turned into a small scale industry which can manufacture recycled goods eg.

Bags, covers etc. and can earn money out of it. Again in this case the Architect can be part of studying the local solid waste generation trend with the help of an Environmental engineer and understand their need and create an infrastructure to match their needs.

### 5.3 TOWN OR URBAN SCALE

Talking about the other solid wastes like medical waste or hazardous waste, this needs to be treated in a particular way adhering to the rules and regulations. Hence these can be best treated at slightly larger scale away from the city limits. In certain situations if the biodegradable waste cannot be treated at house-hold level then it can be taken at a larger level. However, in this case WtE (Waste to Energy) may not be a good option. Apart from totally losing all the organic nutrients that can otherwise be retained as organic fertilizer / manure from the MSW by anaerobic digestion, which can be a very good alternative to chemical fertilizers. When this is produced on a larger scale then it can also be sold out to the nearest local farmers at concessional rates so that they are encouraged to buy more of organic fertilizers than the chemical fertilizers. Again providing space designs for all these can be the Architect's job.

The plastics like thermocol (styrofoam), thin and metallized films, construction & demolition debris, etc. can be used to make lightweight bricks, blocks and panels for construction. Toilet blocks, which can be assembled at site, are one if the prime products which can use this technology. In all these, Architects need to promote increased use of recycled construction material or materials which consume less embodied energy. Some examples of this are –

- Using the soil of the excavated site to make mud-blocks for construction;
- Using construction debris as a part of filler slab.

### 6. SUMMARY

In conclusion, the country's waste management system should factor in requirements of varying scales, waste compositions, climatological, geological and hydrological conditions and contextualize the solutions. Needless to mention, community participation needs to be encouraged in a strong manner. All the above should be an integral part of the government's waste management policy. By encompassing all of the above aspects in our policy, we will truly have a sustainable approach towards managing the solid waste.

In doing so the Architect needs to foresee the future expansion and design both built and unbuilt spaces in such a way that it can serve for a longer period of time even when the requirement multiplies.

No wonder visionaries like Peter Druker have said "Best way to predict the future is to create it".

### REFERENCES

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