

An Approach To Sustainable Solid Waste Management In A Hilly Region: Case Of Shillong, Meghalaya

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Abstract: *Solid waste management has emerged as one of the most challenging subject in urban planning. The harsh reality is that, the proper management of waste is still a neglected aspect by policy makers and urban planners in many cities of India. Shillong is one of the most beautiful, yet populated hill station in North-East India and is also capital of the state Meghalaya. Because of the increasing infrastructure and Urban Growth, there has been an increase in waste generation which is imposing pressure on existing waste management practices. In order to reduce improper waste management, Shillong Municipal Corporation has taken many sustainable approaches such as, zero litter campaign, use of local bamboo bins which are well supported by traditional governance system & existing housing typology in Shillong, which establish this place a good example of waste management practices. This research is an attempt to evaluate present solid waste management practices, environment concerns and successful implementation of sustainable interventions with the help of community engagement regarding solid waste management in this hilly city of Shillong.*

Keywords:

Sustainability, Solid Waste Management, Urban Planning, Traditional Governance

I. INTRODUCTION

Meghalaya ‘an abode of clouds’ is one of the states in North-Eastern India. Meghalaya egressed as a state in the union of India in 1972, but its first elections outside Assam were imparted in 1971. The state is divided into eleven districts. Shillong being the capital of Meghalaya is known as the ‘Scotland of the East’ is the headquarters of the East Khasi Hills district and is situated at an average altitude of 4,908 feet (1,496 m) above sea level. Shillong is connected to all major cities of the region as well as across the country. No rail connectivity exists for Shillong because of its hilly terrain, although it can be accessed by road and by air. The climate of Shillong is characterized by moderate warm wet summers and cool dry winters. Shillong experiences a humid sub-tropical climate which is influenced by the North –East winter winds.

A large number of developmental sectors of the city have given rise to increasing population and results in expansion of the city. The expanding urban sprawl is gradually affecting and putting pressure on various sectors like transportation, water, energy, environment & waste management. Due to continuous increase in population & urban growth, there has been continuous

increase in waste generation which is imposing pressure on existing waste management practices. Indeed, various sustainable practices have been followed by the residents of the city introduced by the local government through its local administrative setup.

A. Demographic Scenario

Shillong is essentially the creation of the British Raj and it was established as a hill-station. This tiny Settlement has now grown to a flourishing city with a population of 1, 43,229 according to the 2011 census.

Table 1: Data from Census of India.

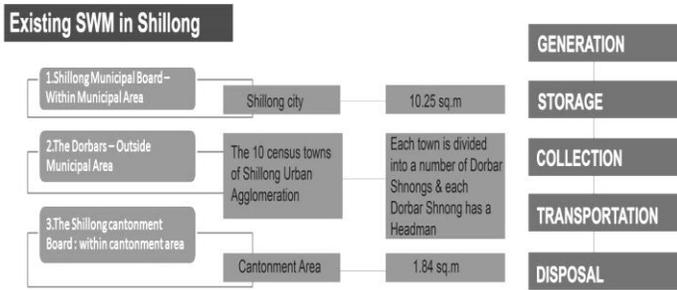
Census data	Shillong
Total population of Meghalaya	2,966,889 persons
Total Population of Shillong	1,43,229 persons
Total no. of Households	31,025 HH
Households size	4.61 persons/HH
Density	12825 persons/sq.km
Total population living in Slums	10.09% of total
Sex ratio of Shillong	95.951 %

II. SOLID WASTE MANAGEMENT IN SHILLONG

A. Present Scenario

With the increasing population and demand in various development sectors the waste management in Shillong is characterized by tons of generation of wastes per day which occupying the dumping ground of the city. The Meghalaya State Pollution Control Board (MSPCB), has reported that Greater Shillong Planning Area(GSPA) generates about 150 MTPD of solid waste of which 120 MTPD of waste is generated within the Shillong Municipal Board(SMB) area, while the remaining 30 MTPD of waste is collected and transported to the landfill disposal site at Mawiong.

Figure1: Existing Solid Waste Management in Shillong managed by different authorities.



B. Waste Characteristics

Solid waste generation is high from household which is 59% followed by market (24%) due to the CBD area Police Bazar and least generation is from construction side (2%). Percentage of Composting Waste is more in Shillong followed by Indian standards, which is ideal for conversion into organic fertilizer by composting (SMB Report, Shillong). The household waste material is amongst the highest in Commercial Waste category contributing to 59% of the total and market waste contributes to 24% of the total commercial waste. Other waste materials add to be construction (2%), Roads sweeping (7%) and Hotels and restaurants (8%). In the Domestic Waste category, Organics contributes to be the highest in amount which is 87% of the total domestic waste. Other than this Plastic (6%), Glass (5%) and Metal (2%) contributes to the Domestic waste category.

C. Solid Waste Generation

The amount of municipal waste generated from a town or city is a very important criterion in planning of collection, transportation and ultimately disposal systems to be adopted for a definite time frame or the design period. Waste segregation is not practiced and generally the community is not aware of the need and its importance at source.

D. Solid Waste Collection

In Shillong Municipal Board (SMB): Collection method – Door to door collection. Outside SMB, Collection method managed on ad-hoc basis and operated along the lines of system established by the respective Darbar Shnongs (Local governance) & transported to Mawiong (Land fill site)

Table 2: Waste generation and collection for each town

Towns	Class	Generation (day (mT/	Collection /day (T)	Gap
SMB Area	I	120	100	20
Shillong Cantonment	IV	6	5.5	0.5
Mandanriting	IV	8	6.4	1.6
Mawlai	III	18	14.4	3.6
Nongthymmai	III	16	12.8	3.2
Pynthorumkhrah	III	10	8	2
Nongmysong	IV	5.3	4.2	1.1

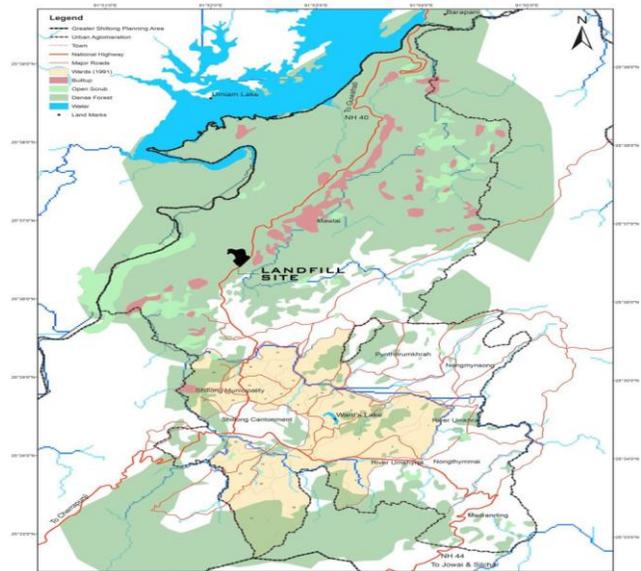
E. Solid waste transportation

Transportation of solid waste is usually done by trucks and dumpers at wide roads and junctions but for small roads small vehicles and hand pulled carts are used to collect and transport it to the large vehicles. The Shillong Municipal Board has 6 LCV's, 4 trucks, 4 dumpers and 3 tractors which are in operation presently for transportation of garbage to disposal site at Mawiong. These are being manned by 17 drivers and 60 attendants.

F. Solid Waste Disposal

Waste collected from GSPA dumped at Mawiong disposal site, 7km away from the city and adjacent to NH-40 (the Shillong Guwahati Road). The site (area of 4.706 hectares) is located within the Riat Khwan forest with hills on one side and a deep valley on the other and is operational since 1938.

Figure 2: Map of Shillong showing Location of Landfill site



III. WASTE MANAGEMENT: MAJOR CHALLENGE IN SHILLONG

In a hilly city, Shillong, capital of Meghalaya, waste management is one of the major challenges in city planning. There were several issues arising due to improper SWM, lack of implementation strategies.

- (i) Challenges in previous WM system
 - Social structure with strong traditional system.
 - Insufficient community bins.
 - Gap between Generation, Collection & Transport
 - Burden on existing landfill site leading to mismanagement.
 - Lack of public involvement.
- (ii) Environmental Impacts
 - Chocking of River Umshrympi & its catchment area because of excessive garbage disposal.
 - Pollution in Umium Lake: Dumping of waste materials into rivers and streams
 - Roadside dumping leading to unhygienic conditions in residential areas of Shillong.

In order to minimize above major issues in Shillong, government have formulated different implementation strategies along with the help of traditional governance system, local residents & various eco-friendly approaches, and are discussed in *Chapters IV & V* below.

IV. TRADITIONAL GOVERNANCE AND ITS ROLE IN SWM OF SHILLONG

In general, the social structure with a strong traditional system is considered as a big challenge, as there are trust deficits between traditional institution & government. But this case of waste management in Shillong illustrates how this challenge has been turned into an opportunity.

About traditional governance system in Shillong:

Governance in Meghalaya is governed by the rules of the 6th Schedule of the Constitution where stipulated provisions are furnished for the administration of the tribal dominated areas (BL, H., 1983). Shillong urban agglomeration has a fragmented governance structure with multiple agencies operating for urban service delivery. Thus, municipal affairs have been a challenge for the Khasi Hill Autonomous District Council under which various Dorbars (*local authorities*) came into existence. There are 100 Dorbar Shnongs (*defined localities like village republics*) in the Greater Shillong Planning Area (GSPA), 38 in Shillong Municipal Board (SMB) and 62 in areas outside SMB. Within 100 Dorbar Shnongs there are 378 Dongs (*blocks within the Dorbar Shnong, headed by a Rangbag Dong or Block Headman*) (H Bareh, : 234, 1997). The Dorbar Hima or the Dorbar Dong is the traditional council which acts as the functional institution for the Solid Waste Management in Shillong.

Collaboration of Traditional Dorbar system with Municipal governance in case of SWM of Shillong:

The city of Shillong produces 150 MT of garbage daily of which about 126 MT is collected by waste management authority. Dumping of waste materials into rivers and streams are practiced by over 20% households all along the rivers and streams. The Dorbars with the municipal governance took active participation for this situation to reduce waste flowing to the rivers and streams. The Dorbars endure various awareness trainings and events on best practices of solid waste management with demonstration on segregation of waste with traditional institutions and local bodies. Progressive movements take place as a joint platform to save the rivers and streams from the flowing of waste. Intensive awareness campaign among the local residents of the various Shnongs of the city is held exclusively where the attendances of households are being 98%.

These Shnongs also contribute to the performance rating in the localities in SMB area by capacity building and distributing household waste bins to families. Along with this, Shnongs are also involved in many monitoring of many sustainable initiatives such as, 'zero Littering Campaign' which is also a substantial initiative by the government of Shillong to reduce waste, particularly the littering of plastics in various public places and gatherings. Educational institutions were mostly

invited to participate in this campaign for Shillong city. Also a comprehensive Gender Action Plan for Shillong has been developed by the government where training on health and sanitation and segregation of waste has been conducted.

Shillong government has involved traditional Dorbar system for effective implementation of waste management strategies in Shillong. Along with traditional system, Myntris (Ministers) of the Syiem (King) Myllem Dorbar system, different NGO's, Ka Lympung Ki Seng Kynthei (women headed organization), active members of commercial establishments, teachers & students from schools were also made integral part of this movement. Involvement of all these local organizations along with resident engagement in waste management made these initiatives successful.

V. SUSTAINABLE APPROACHES IN SOLID WASTE MANAGEMENT OF SHILLONG

As discussed in *Chapter IV*, the hilly city Shillong follows traditional methods of ward wise waste Management which includes systematic door-to door collection, segregation, transportation & Waste disposal.

These methods are similar to those of the other Indian cities, but besides this, there are several eco-friendly, sustainable approaches & strategies which are also developed by local government. These strategies not only promote sustainability in terms of material, methods of disposal but also in terms of public awareness, and bringing about positive change in people's perspective about cleanliness. Few eco-friendly & sustainable Approaches taken by local government regarding SWM are discussed below set a good example for other Indian Cities.

1) Promotion of 'Zero Littering Lifestyle' in Shillong

Hilly city Shillong is setting an example of 'zero-littering lifestyle' with the help of awareness campaign started by Meghalaya Urban Affairs Dept. In this campaign, stakeholders from different background such as. School children, taxi drivers joined their hands to create awareness regarding proper segregation & disposal of solid waste (smartcity.electsonline, 2017). Goal of this Campaign is:

'For the People; With the People; By the People'

Also, in this campaign, major tourist destinations, public parks are kept free from litter by prohibiting any plastic waste inside the public parks and also, hawkers are banned. This unique approach helped to reduce tourism waste in a large amount.

Figure 3: Restrictions on the use of Plastic in Public Parks



(Source: Captured by Author during site visit in Sept, 2016)

2) *Distribution of 'Khoh': Bamboo made waste bins*

Generally, 'Khoh' is a multi-purpose basket which was used by 'Khasi' tribe of Meghalaya to carry goods. It is shaped like a cone that is made up of tightly woven bamboo strips to form a conical shape but, Local government of Shillong gave these 'Khoh' another usage, that of a 'Green Dustbins'. Since, bamboo is found in abundance in the North-east of India, these bins not only promote the handicraft of the state, but also promote the sustainability of the raw material. (www.greendiary.com)

Figure 4: Use of 'Khoh' in Shillong



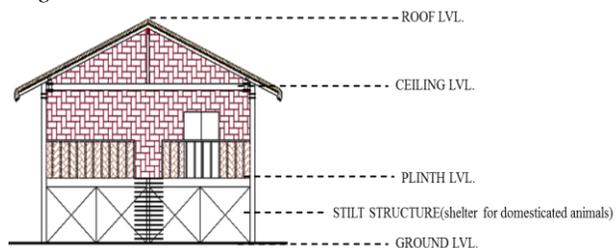
(Source: Captured by Author during site visit in Sept, 2016)

At present, instead of using plastic bins which are non-biodegradable, these bins are used everywhere in Shillong. They are placed along the side of the road at a distance of 4-5m approximately.

3) *Traditional Khasi house and SWM*

The traditional houses in Shillong are mostly seen in the GSPA area where the density of population is less. Traditionally these houses are built in stilt structure to have a common base for its undulating ground which is in contours. These houses have a flight of 5-7 stairs with a big hall and a central kitchen. The lower part of the house is used to provide shelter to domestic animals like poultry and pigs which are being feeded from the domestic waste from the house particularly from the kitchen that is dumped from an opening on the kitchen floor (Mario Pathaw) This is traditional method of organic waste disposal which further reduces the amount of degradable, organic waste from each household of an area by involving sustainable process cycle efficiency.

Figure 5: Traditional Khasi house



(Source: North east tribal museum and cultural center report)

4) *Segregation of bio-degradable & non-biodegradable Waste at household level*

Colour Coded dustbins (Green for Bio-degradable waste & Blue for non-biodegradable waste) have been distributed in Shillong Municipal area & 27 Dorbar Shnongs. Around 63,000 bins have been distributed to 31,000 families and along with this, 1.3 lakh people in the city have also been trained about the solid waste

management and majority of them are now practicing segregation of wastes. (cleanshillong.nic.in, 2017)

5) *'Garbage to Gold' Initiative*

Shillong local government has developed Indigenous Compost Technology from collected bio-degradable waste & this initiative is known as 'Garbage to Gold'. Prepared good quality organic compost is sold at a very nominal price to local citizen in the same area.

6) *Preparation of Overall 'Sustainability Plan' in SWM in Shillong*

These solid waste management strategies are accompanied by preparation of 'Sustainability Plan' and the major steps includes:

a) *Formation of Task Force at Locality*

In order to ensure community ownership & sustainability of the process, Task force (comprising of active & responsible citizens of each locality) is formed.

b) *Institutionalization of best practices*

Segregation of waste becomes an institutionalized daily norm for every family & is achieved through different community awareness programs.

c) *Institutionalize a management system*

Each locality takes ownership by framing their own rules for the residents of their locality, which are put up on signboards & hoardings & are circulated. This majorly includes inclusion of traditional governance system into urban planning.

d) *User charge contribution*

As per this plan, each household should pay a nominal user fee per month to be used for meeting the operation & maintenance cost. This will ensure long term supply of manpower & machines for the waste management of the city. (SIPMIU, Shillong)

7) *Waste Management & Climate Change*

According to UNEP, 3-5% of the total emissions are contributed by 'Waste Management' Sectors. In the waste generation statistics of Shillong, the overall percentages of organic waste is more and were dumped on Land fill site. This results into release of Methane, Carbon-di-oxide & other trace amounts of gases. Therefore, government of Shillong is adopting sustainable practices such as, Waste Recycling, Waste reduction & waste to energy. These practices not only contribute in reduction of GHG gases, but also reduce the burden on existing landfill site.

8) *Other Innovative measures in Waste Management*

a) *Children as the 'Zero Littering crusaders'*

In zero littering campaign children were considered as the co-creators of the best practices in waste management. In this campaign, 12,000 students from 119 schools participated in order to maintain a stretch of road clean. Children were given the Zero Littering crusaders badge, signature campaign from &

Pledge postcard. This is unique way of involving young children in Cleanliness campaign.

b) Public Fine

In order to keep the spirit of 'Clean & Green Shillong', the East Khasi Hills district police also have adopted a stringent approach to deal with pollution and littering in public places and tourist spots and violators are liable to pay fine of around 5,000 Rs.

c) Use of Technology to ensure cleanliness

With the use of various technological solutions, Government of Shillong is promoting use of modern technology in collaboration with the residents to monitor cleanliness in the city.

VI. CONCLUSION

This paper examines different approaches taken by Government of Shillong to minimize environmental degradation occurring due to improper waste management practices. These approaches include, incorporation of traditional governance system, zero litter campaign, use of Green-bins made up of local materials, Cleanliness rallies initiated by local residents etc. Waste management system of Shillong also illustrates the importance of involvement of traditional governance along with Public participation.

With all these attempts Shillong is establishing an example for other hilly cities in India with the help of successful public engagement & integration of modern as well as traditional methods of waste management to achieve sustainability in the hilly region.

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