

**Sixth Regional 3R Forum in Asia and the Pacific**

*“3R as an Economic Industry - Next Generation 3R Solutions for a Resource Efficient Society and Sustainable Tourism Development in Asia and the Pacific”*

Malé, Maldives, 17-19 August 2015

# **City Report**

**(Draft)**

**< Ahmedabad >**

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This city report was prepared by Ahmedabad Municipal Corporation as an input for the Sixth Regional 3R Forum in Asia and the Pacific. The views expressed herein do not necessarily reflect the views of the United Nations.

## **Guideline for City Reporting on Major Initiatives/Achievements in 3R areas**

The main objective of the City Reporting is to share among international community the progress, achievements and best practices, including various challenges faced, in the areas of **3R (Reduce, Reuse, Recycle)**, and sustainable waste management. This would help development agencies, donors, including development banks, in assessing the needs and challenges of cities to better devise their existing as well as future capacity building programmes and operations in the field of 3Rs and sustainable waste management.

It would be appreciated if a consolidated city report could kindly be prepared by answering the following questionnaire (7 Questions in total) and submitted to the **Secretariat of the Regional 3R Forum in Asia and the Pacific** by email to [3R@uncrd.or.jp](mailto:3R@uncrd.or.jp)

Timeline for submission: **17 July 2015**

Secretariat of the Regional 3R Forum in Asia and the Pacific  
United Nations Centre for Regional Development (UNCRD)

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**Q 1** **What are the roles of local government stipulated in the 3R-related policies, acts, laws, or regulations?**

The local government has started and continued various initiatives based on the 3R-related policies developed in vision documents such as “Road Map for Zero Waste Ahmedabad” and “Ahmedabad City Solid Waste Management Master Plan 2031”

Ahmedabad Municipal Corporation has developed a Roadmap with 10 focus areas with 34 strategic actions that can make the city a zero waste city by the year 2031 with the support from UNCRD, Japan in the year 2012-13.

#### **34 strategic actions proposed under 10 focus areas**

##### **10 focus areas**

1. Environmental Protection
2. Health and Safety standards
3. Dedicated Institutional Structures & Governance arrangements
4. Community awareness & ownership
5. Segregation of waste streams
6. Partnerships & Collaborations
7. Sustainable innovative Infrastructure & Technologies
8. Education & Awareness at all levels
9. Investment in 3R Infrastructure (Eco-Towns, Science Parks, Eco-Industrial Zones)
10. Implementation & Systematic Review Process

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## **34 strategic actions**

### **Strategic Action 1**

Ban open dumping of waste and develop a comprehensive master plan for the Pirana dump with an aim to reduce the current and future environmental impacts. The master plan should cover areas such as:

- a site operation plan
- environmental clean-up, a site remediation plan
- separation / buffer distances
- security and access
- an environmental monitoring plan
- a post-closure plan and a long term vision for
- value added / beneficial use of the landfill site
- landfill gas extraction and use for energy

### **Strategic Action 2**

Develop a comprehensive litter awareness and prevention plan for the City, backed up with stringent regulation and an enforcement mechanism. Work with key NGOs to promote better compliance.

### **Strategic Action 3**

Introduce tighter regulation and enforcement to prevent illegal disposal and dumping of wastes. This regulation should cover all sections of the community (individuals, business, industry) and particularly target items such as plastics, food waste, paper, hazardous wastes and packaging material.

### **Strategic Action 4**

Work with the Gujarat Pollution Control Board to introduce better environmental management practices for the private sector involved in waste management and recycling. Introduction of licensing and enforcement mechanisms to monitor adoption of good environmental practices has been successful in other parts of the world and can be considered for Ahmedabad.

### **Strategic Action 5**

Develop appropriate policies and regulatory measures to formalize and systemize the informal waste management sector (rag pickers, scavengers, etc) to reduce the current high level of exposure to health, safety and environmental hazards.

### **Strategic Action 6**

Develop a comprehensive health, safety and environment plan covering the entire waste management workforce.

### **Strategic Action 7**

Introduce appropriate safety gear and provide regular training to the workforce to improve skill level.

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## **Strategic Action 8**

Introduce a system of regular audits and a health monitoring program for the workforce.

## **Strategic Action 9**

Moving towards zero waste requires sustained focus and commitment of significant AMC resources. This can be facilitated by developing strong and dedicated institutional arrangements. AMC may consider either restructuring/redesigning the existing Solid Waste Management & Conservancy Services section, or consider establishing a dedicated entity (for example Zero Waste Ahmedabad) to raise the profile of the road map and to achieve greater efficiencies. The new entity should have a clear mandate to implement the road map with delineated authority, responsibility, staff and budget.

## **Strategic Action 10**

Establish a regulatory framework with by-laws to support the new institutional arrangements.

## **Strategic Action 11**

Undertake measures to build technical capacity within the new entity and within the waste sector generally in Ahmedabad.

## **Strategic Action 12**

Liaise to establish political support from all political parties to ensure long term certainty for the new entity. The achievements will be gained over a long time frame and the institution will need to meet key performance indicators along the way.

## **Strategic Action 13**

Foster broader community ownership and individual responsibility through education, regulation, stringent enforcement and appropriate pricing mechanisms to influence and bring about behaviour change.

## **Strategic Action 14**

Systematically introduce improvements to waste collection systems to encourage individual responsibility, behavioural changes, waste segregation and discourage littering.

## **Strategic Action 15**

Introduce means based pricing mechanisms such as 'pay as you throw' so that residents are charged for waste collection based on the amount of the household's waste.

## **Strategic Action 16**

Introduce reasonable fines and penalties for littering and illegal dumping of wastes. The fines need to be severe enough to act as a deterrent and should be tightly enforced.

## **Strategic Action 17**

Identify and implement strong policies that will enable better waste collection, transport and storage infrastructure to maximise collection and segregation of recyclables from the waste streams.

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## **Strategic Action 18**

Progressively introduce measures to modify the waste collection system with particular focus on collection bins and collection frequency. The current system of daily collection is not sustainable and does not encourage waste segregation at source or household.

## **Strategic Action 19**

Progressively introduce regulation imposing bans on landfilling of recyclables (plastic, paper, metal, food, greens, construction and demolition waste, E-waste) as systems become better used and patronized. This ensures a supply of materials to the new recycling industries that will emerge to service Ahmedabad.

## **Strategic Action 20**

Partner with research institutes and industry to develop practical solutions to deal with waste management issues, including development of local capacity to implement energy and resource efficient technologies in business and industry sectors. This would require public-private partnerships and co-investment opportunities to find solutions.

## **Strategic Action 21**

Play a strong advocacy role in introducing product stewardship arrangements for a range of consumables such as electronic goods (TVs, computers, IT equipment), lead acid batteries, tyres, consumer packaging (including plastic bags), paint and mercury containing lamps.

## **Strategic Action 22**

Work with other arms of the government and industry groups to promote business assistance programs for industry with a focus on lean manufacturing, cleaner production and waste recovery.

## **Strategic Action 23**

Work with the manufacturing industry, business community and financial institutions to facilitate the creation of strong and sustainable markets for recyclables and green jobs

## **Strategic Action 24**

Use a holistic Total Cost Assessment (TCA) approach to introducing technologies for waste collection, segregation and processing. A TCA approach helps in quantifying direct and indirect costs and encourages consideration of life-cycle impacts in decision making process.

## **Strategic Action 25**

Encourage and support investment in innovative resource management technologies and infrastructure, for example recycling precincts with dedicated facilities for recycling plastics, aluminium, steel, paper, glass and other recyclables. This can be done through subsidy schemes, soft loans and other economic incentives.

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## **Strategic Action 26**

Deliver clear and targeted education and awareness programs to meet the needs of the community, businesses, industry and the waste management industry.

## **Strategic Action 27**

Introduce a best practice waste management demonstration program at strategic locations in Ahmedabad to raise awareness of the community, including awareness raising programmes and activities related to health and safety aspects of e-waste.

## **Strategic Action 28**

Develop measures to influence behaviour and build a 3R culture so that households and businesses are encouraged to take responsibility for minimizing their own waste and using resources effectively.

## **Strategic Action 29**

Work with the education sector to introduce zero waste education in the school curriculum.

## **Strategic Action 30**

Develop policies and programs favorable to promoting triangular cooperation between government, private/industry sector, and scientific and research institutions towards realizing eco-towns, science parks, eco-industrial zones.

## **Strategic Action 31**

Establish a '3R Think Tank' with participation from experts and leaders in the private sector, research institutes and government.

## **Strategic Action 32**

Prepare an implementation plan with a 3-5 year term. The plan should demonstrate adherence to the 3R waste hierarchy and strategic actions outlined in the Zero Waste Road Map. The plan should include targets and key performance indicators for review on a yearly basis.

The plan should cover:

- The projects to be undertaken each year listed under the strategy headings, including a brief description of the intended activities and outcomes and budget
- The positions and roles responsible for delivering the project.
- A 3-5 year sequential funding outlook for the project or project area.

## **Strategic Action 33**

Introduce an independent, third party review process. The review will include an analysis of how AMC is meeting the overall objectives of the Zero Waste Road Map. The review will track progress made by AMC in delivering the implementation plan and measure achievements against the key performance indicators.

## **Strategic Action 34**

Prepare a data collection matrix to include key data parameters for measuring progress against the key performance indicators. Continually improve the quality of data collection, management and reporting throughout the life of the Zero Waste Road Map.

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	<p>The future roles of a local government stipulated in the 3R-related policies, acts, laws, or regulations:</p> <ol style="list-style-type: none"><li>1) Need partnerships, concerted effort and coordination between all levels of government, scientific and business sectors and consumers.</li><li>2) Whilst the initial focus would be on reuse and recycling, this will need to shift to fundamentally re-designing products, their manufacturing process and associated packaging.</li><li>3) Throw-away products will need to be replaced with products designed for reuse, repair, recyclability and decreased toxicity.</li></ol>
<b>Q 2</b>	<p><b>Is 3R policy integrated in your city development strategy or master plan?</b> (Please attach photo(s) of your city's waste management if available.)</p> <p><input checked="" type="checkbox"/> Yes =&gt; Please share goals/visions/major achievements/important lessons learnt that could be replicated elsewhere.</p> <p>➤ <b><u>Solid Waste Management Master Plan upto the year 2031</u></b></p> <p>Ahmedabad Municipal Corporation (AMC) awarded consultancy work to Urban Management Centre (UMC) for preparation of Municipal Solid Waste Management Master Plan upto the year 2031 for AMC jurisdiction in November 2011. UMC conducted numerous visits between November 2011 and April 2012 for the purposes of data collection, field visits, interaction with AMC officials, citizens, focussed groups, etc. In addition to data collection, detailed site visits were conducted at the following locations to assess the status of MSWM services:</p> <ul style="list-style-type: none"><li>- Waste collection points in residential, commercial, special market areas (including meat &amp; vegetable); formal and informal open dumping sites in and around the city, etc.</li><li>- Natural water bodies including <i>nalas</i>, river, lakes, ponds, etc. to assess the environmental degradation caused due to lack of MSWM services in the city.</li><li>- Public toilets, urinals and open defecation (OD) spots</li><li>- Special areas such as Railway station, Gujarat University, other campuses of large institutional areas, GIDC estates in the city, etc.</li><li>- Some select outgrowths/ contiguous settlements to the city</li><li>- Other site visits included areas such as the slums, residential areas, municipal civic centres, retail and wholesale markets, health and educational institutions, etc.</li></ul> <p>Quantity of solid waste generated follows is a sinusoidal pattern and historical records showed that it peaks in the month of December. Hence, for the purposes of this master plan, December 2011 (for the FY 2011-12) has been taken to compute all functions related to quantity of waste and make projections until 2031. Continued efforts are being undertaken by AMC to improve services by bringing process changes as well as augmenting existing infrastructure and equipments for solid waste. Status of existing equipments and vehicles has been included in plan and all computations factor these</p>

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additional equipments and vehicles.

## 1. Concept of Zero Waste Cities

Increasingly the concept of sustainable cities has been gaining prominence in management of cities. Zero Waste Management is a key component of the sustainable management of cities.

Zero waste is defined as *“a lifestyle where no waste is generated, i.e. any object that has completed its life-cycle can be re-consumed locally in any natural and/or industrial process without generating any solid, liquid or gaseous waste.”*

## 2. Strategy for Zero Waste Ahmedabad

Sound Material Cycle Society (SMC) provides zero waste solution in true sense. However, as SMC involves initiative at international, national and local levels, it is a long term goal and other approaches can be aligned to increase preparedness of cities to adopt SMC principles in the future. Other options include Reduce-Reuse-Recycle as an effective way to achieve zero waste cities and are implementable in our cities in the current circumstances. In case of Ahmedabad, a combination of SMC and 3Rs provides a viable solution as an intermediary stage to eventually achieving SMC. As per the timeline of this master plan, Phase 1, i.e. upto 2021 can be planned for incorporating principles of 3Rs, while during the next ten years, i.e. upto 2031, measures to improve AMC's preparedness to adopt SMC principles can be planned. Implementation of SMC however, involves much larger policy initiatives at national and state level which can be relooked at in a periodic manner. For preparation of MSWM Master Plan 2031 for AMC, various micro planning scenarios have been explored to achieve targets set in the previous section towards zero waste. Under the current circumstances, any scenario can be assessed with 2 pre-conditions:

- i. Mixed waste entering the municipal stream
- ii. Segregated (at source) MSW entering municipal stream

The three scenarios which have been assessed for MSWM collection are

Scenario 1 : Bin Free City

Scenario 2 : Strengthened Secondary Collection System

Scenario 3 : Improved Door Step and Optimized Secondary Collection System (Minimized Bin City)

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Based on analysis of existing system of MSWM in Ahmedabad, the existing mechanism (combination of door/gate collection and secondary collection) should be strengthened to integrate various ongoing initiatives by AMC. The proposed strengthening of the existing system has been suggested which explains the collection chain from source to treatment/ disposal by 2031 while identifying various infrastructural requirements for the same.

As proposed in the report, collection and transportation of MSW should be improved through strengthening the current chains based on source. Subsequent sections further detail out each chain of MSW collection, transportation, processing and disposal of MSW based on the source of generation as per the preferred scenario for the master plan.

The proposals in the Municipal Solid Waste Management Master Plan 2031 include procurement of equipment and vehicles for different streams of waste, conducting various studies and programmes (including city wide IEC Campaigns, preparation of extensive database of MSWM services in GIS and training and capacity building of municipal as well as contracted staff) and improvements in current monitoring systems within AMC.

➤ **AMC has prepared Public Health Bye-laws (PHBL) for effective enforcement and maintaining discipline.**

- Classification of waste in 25 categories
- Generators of waste based on their type, 21 categories
- Segregation of waste
- Storage of waste
- Delivery & collection of waste
- Processing & disposal of waste
- Liquid Waste Management
- Prevention of Waterborne, Vector borne and Food borne diseases
- Offences under the bye-laws
- General offenses which is applicable to all the citizens within city limit, (23 in number)
- Enforcement of the provisions
- Schedule of Fines

The main objectives of preparing the Public Health Bye Laws are

- to develop a tool for Municipal authorities to regulate the implementation of Municipal Solid Waste Management (MSWM) which will help improve the services to protect public Health, the environment and natural resources (water, land, air).
- to promote the ecological management of solid waste in compliance with the principle

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of the 4Rs: Reduce, Reuse, Recycle, Recover and safe disposal.

- an effective MSWM service can be achieved only by improving the efficiency of MSWM activities, thereby leading to the reduction of waste generation, separation of MSW and recycling and recovery of materials, and generation of compost and energy.

After reviewing following documents of various cities, PHBL -2012 for Ahmedabad city is prepared

- Cleanliness and Sanitation Byelaws, 2009 of Delhi city
- Cleanliness and Sanitation Byelaws, 2006 of Mumbai city
- SWM Bye-laws of Nagpur city
- Compiled document of circulars, Rules and Acts regarding Sanitation and cleanliness – Madhya Pradesh
- Comparison of the fines imposed by different cities

#### **The PHBL covers:**

- 1) Segregation, storage, delivery & collection, processing and disposal of solid waste
- 2) Liquid waste management
- 3) Prevention of waterborne, vector borne and food borne diseases
- 4) General Offenses
- 5) Enforcement
- 6) Obligatory Duties of Municipal Corporation
- 7) Schedule of fines

#### **The PHBL classifies waste as:**

- 1) Generator wise categorization
- 2) Categories of waste -30
- 3) Stage wise implementation of segregation starting with the basic categories:
  - 1) Wet waste
  - 2) Dry waste, and
  - 3) Other waste
- 4) Powers to Municipal Commissioner to make necessary amendments in PHBL

#### **The PHBL classifies Generators into 20 categories and separate provisions for each generator Penalty mentioned in PHBL as:**

- 1) Penalty for 20 general offenses and 38 specific offenses  
[breach of bye-laws from 33-71(2)]
- 2) Compromise fees and administrative charges ranging from Rs. 100 to Rs. 50,000
- 3) Powers to attach the property for the defaulters in major offences
- 4) Penalty varies for repeated offense

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## 5) Penalty varies across generators

Specific provision is mentioned for formation of Nuisance Detection Squad (NDS) in PHBL. If the offender does not produce an identity proof, the Authorized Officer of Ahmedabad Municipal Corporation or the officer of Nuisance Detection Squad (NDS), shall exercise the powers under section 42 of the Criminal Procedure Code, in pursuance of the powers of the additional officers, as conferred on him under section 22 of the Gujarat Police Act.

Same has been approved by the Urban Development Department of Government of Gujarat and put into practice in April, 2015.

## ➤ **Use of Vehicle Tracking Systems (VTS) for solid waste management vehicles at Ahmedabad Municipal Corporation (AMC)**

### **Project Brief:-**

AMC has invited bids for installation of GPS and RFID technology based solution for the vehicles deployed for collection & transportation of solid waste management of Ahmedabad city for 5 years on two bid system with a technical demo as a part of bidding process. AMC has engaged (n) Code Solutions (A Division of GNFC) as a consultant for this project and assigned this work to Infinium Solutionz Private Limited, Ahmedabad.

### **AMC has taken following parameters into consideration before selecting the technology partner:**

AMC has specified device specifications in tender itself as per industry standards and AMC requirements. For selecting technology partner, AMC kept very tough eligibility criteria. Also for evaluating technical capabilities, AMC has observed prototype pilot run in live environment for 4 weeks.

### **Scope of work of project:**

AMC follows two methods for waste collection.

(1) Door to door waste collection (2) Bins placed at fixed locations.

#### (1) Door to Door Collection:

AMC has 6 Zones and 64 Wards. In each ward, there are fixed number of routes for waste collection covering all the societies, apartments and areas of the Ward. A vehicles traverses through the route, collects garbage from pre-defined points (POI) in the route. One can just imagine the volume of work and complexity in solid waste management by following figures:

Total Routes	: 600 plus
Total Door to Door vehicles	: 700 plus
Total POIs (Point Of Interest)	: 25,000 plus

Current status is:

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- Ward wise route details and POIs are provided to the computer system.
- GPS device is installed in each vehicle.
- Pilot Run for 2 Wards in live environment was carried out and results were satisfactory.
- Presently trial run for all routes is going on.

(2) Bins:

Bins are placed at fixed locations. Bin Lifter vehicles lift the Bins, travel to transfer station / dump site, and transfer garbage to big truck or dispose off at dump site.

The volume of work is:

Total Bins : 1000 plus

Bin locations (Bin POIs) : 1000

Total Bin Lifter Vehicles : 200 plus (including hook loaders)

**RFID Technology:**

AMC is also using RFID technology for effective monitoring of solid waste management activities.

- RFID Technology comprises of two parts (a) RFID tag (b) RFID reader.
- RFID Tag contains a unique number which only RFID reader can read.
- RFID tag is mounted on each vehicle as well as on each Bin.
- RFID reader is placed at selected locations (i.e. Transfer station weighbridges, dump sites, Ward offices).

**Current status of project is:**

- Zone wise Bin Lifter vehicle details and Bin locations is provided to the computer system.
- GPS device is installed in each Bin Lifter vehicle.
- RFID Tag is mounted on each Bin.
- RFID readers are installed at Transfer stations, dump site weighbridges and all the Ward Offices..
- Project Go-Live (100% in operation) in December, 2014.

**Various outcomes / learning of AMC during the project:**

- AMC found that routes and POI data is critical for the success of this system. All further reports and monitoring depend on the correct data of POI.
  - ✓ AMC has verified Route/POI data before entering in the system and also in the system after entry is over.
- AMC team has physically verified the correctness of system generated reports.
- During pilot run, AMC has re worked on following to improve the system:
  - ✓ Geo-fence definition of POIs.

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✓ Educated drivers about locations of RFID readers, so that vehicle attendance can be recorded automatically.

✓ Sometimes, it was difficult to determine whether POI is served or not.

(Number of minutes stay at specific POI varies, sometimes vehicle stops little far due to narrow road, but manually lifts the garbage from inside of the society, sometimes vehicle of some other route serves the POI, some Bins are not served for 2 – 3 days because people have parked vehicles around it.)

- Before starting this initiative, AMC has assured capacities, sustainability and robustness of the device for functioning in such environment, so technological hurdles were not faced.

## **AMC is considering to manage the bins across the city by combining GPS data with GIS through ‘geo-coding’**

AMC has already done Bin management in this system using RFID technology. The RFID Tag mounted on Bin will be read by RFID Reader at Weighbridge / Transfer station / dump site. All Bin locations are geo-coded on GIS platform.

With this system, AMC will be able to:

- Know how many / which Bins are served / un-served in a day.
- Which Bins are not coming at transfer station since n number of days?
- Location of each Bin (inventory)
- Complete tracking of Bin movement.
- Daily availability of quantity of waste collection by each of the contracted vehicles.
- Rapid resolution process of citizen complaints for garbage collection.

## **Some of the realized benefits after installing VTS in AMC vehicles are:**

- Efficient monitoring of Solid Waste Management process.
- Efficient utilization and tracking of vehicles.
- Citizen complaints can be handled with actual details.
- Analytical reports are available for operation monitoring and decision making.
- Bin movement can be tracked live.
- Vehicle movement can be tracked live.

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- Fleet monitoring: Improvement in vehicle productivity and performance.
- Alerts for important information to take timely action.
- Route optimization: resulting in reduction in kilometers.
- Integration of dumpsite and weigh bridge data.
- Effective assessment and evaluation of Contractor Performance.
- Increase in service, accuracy and safety in solid waste management.
- Overall improvement in the solid waste collection resulting in improvement of cleanliness of the city.
- The technology will help in identifying the gaps in Solid Waste Management. Although this system is first version, AMC can improve by experience and by providing solutions to the system. Such modern technology provides solutions, but after all it's the people who make any system successful. With the co-operation of citizens, civic body and technology, Ahmedabad will become 'Zero-Waste' city in coming years.

➤ **There are couples of initiatives started by Ahmedabad Municipal Corporation which are directly related to 3 R.**

## **(A) C & D Waste Collection, Transportation and Treatment / Processing :-**

### **300 TPD Construction & Demolition Waste Management in Ahmedabad city**

#### **Situation before the Initiative**

Earlier, 300 Tons per Day (TPD) of Construction and Demolition (C&D) was being disposed without any treatment / recovery which resulted into wastage of land and loss of valuable materials.

#### **Timeline of the Initiative**

- Ahmedabad Municipal Corporation (AMC) issued an Expression of Interest (EoI) on 18/03/2012 for Design, Build, Finance, Own & Operate for 30 years on PPP (Public Private Partnership) Mode. Subsequently, 6 companies sent their offers to this EoI.
- The technical, commercial and financial evaluation of these offers was done by experts as the project has a time frame of 30 years and is significant from environment point of view.
- Work order was issued to Ahmedabad Enviro Projects Ltd. and 5 acres of land was allocated by AMC for this project.

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## Present status of the Initiative

- Ahmedabad Enviro Projects Pvt. Ltd. has commenced the plant phase wise from December 2013 and the plant is fully operational since June 2014.
- AMC has designated 16 spots around the city where citizens will have to bring the C&D waste at their own cost. Also, the C&D waste generated by AMC civil works will be collected at these spots. The agency then collects C&D waste from these spots by their own vehicles. AMC is paying Rs. 155 per ton (with an escalation clause of 5% yearly increase).
- Citizens can register their complaints for collection of construction debris by phone call on AMC operated Comprehensive Complaint Redressal System (CCRS) phone no 155303.
- After the successful resolution of the complaint, the citizen and the concerned municipal authority shall be informed by agency through CCRS.
- As per Mapping and Scheduling for C&D waste below 1 ton, 4 to 5 spots can be covered per trip for which citizens shall be charged a minimum flat charge of Rs 200 per trip.

Weight	Per Metric Ton Rate	Per Trip (Minimum Rate)
Less than 1 MT waste	-	Rs. 200/-
For 1-5 MT waste (Minimum quantity)	Rs. 225/-	Rs. 675/-
More than 5 MT waste (Large quantity)	Rs. 212.5/-	Rs. 1700/-

- The collected waste will be weighed at AMC weigh bridge and also at weigh bridge of company's plant which will be offloaded at municipal plant.

## PROCESS DESCRIPTION

### Removal of unwanted Material:

Segregation of the waste will be carried out by Manual Segregation or Hand picking.

The C&D waste is then fed into the hopper which then unloads the material to a screen which segregates the materials into sizes less than 6mm and greater than 6 mm.

### Air Pollution Control:

The site at which the loader feeds the material into the hopper generates lot of dust loaded with PM 10 and PM <10 sizes. To control this, mist system is provided to collect the dust particles and the settled dust particles are redirected into the feed line to use the flue dust as raw material. Similarly, the machinery operation site at the crushing unit too will be provided with mist system to control dust emission.

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## **Sand Washing System:**

Particles of <6mm size are segregated from the rest and the particles are then send to a slurry tank from where the slurry is fed into the hydrocyclone. The hydrocyclone separates the sand form clay and other particles. The sand is then dewatered in a dewatering screen and the sand is transferred by a belt conveyer to sand collection site. The slurry water from the hydrocyclone containing the clay and mud particles along with the dewatered water from the screen is then carried to a high rate thickener where the flocculation process causes the clay and other colloidal particles to settle down thus clarified water is obtained which is then recirculated in a closed circuit to the hydrocyclone, slurry tank and deck screen. The settled sludge containing the clay is send to the belt press where clay is dewatered and the water is send back to the thickener and clay containing 50% moisture is send for further processing. Thus an efficient water management system is being brought into play.

## **Aggregate production & Washing System:**

The clumps obtained from the primary screen of size > 6mm is fed into the hopper from where it is send to a primary jaw crusher from where it is fed into two numbers of secondary jaw crushers. The aggregates obtained from the secondary crushers are send to the deck screen where they are washed under a high pressure jet of water and then the vibrating screen segregates the aggregates into size of 10mm and 20 mm size respectively. Wash water from deck screen is re-circulated in a closed into back to the thickener. Aggregates of size bigger than 10 and 20 mm sizes are fed back into the crushers. Thus a closed loop system of water recirculation in maintained at each staged and water loss is mainly due to process loss due to moisture and product associated moisture content. These products i.e. sand clay and aggregates are further processed to get finished products.

## **Final Products from C&D Waste**

### **Use of Recycled Concrete Aggregates and Sand:**

- Bitumen bound materials – recycled concrete aggregate can be used may be used in a variety of base course and binder course mixtures.
- Concrete – recycled concrete aggregate is permitted for use in certain grades of concrete.
- Pipe bedding – suitably graded recycled concrete aggregate is used in pipe bedding.
- Hydraulically bound mixtures (HBM) for sub-base and base – recycled concrete aggregate can be suitable for use in HBMs.
- Unbound mixtures for sub-base – suitably graded recycled concrete aggregate are used as sub base.
- Capping – recycled concrete aggregate is suitable for capping applications.
- Embankments and Fill – suitably graded recycled concrete aggregate is used in these applications.

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Recycled concrete aggregates are also commonly used in precast concrete products:

- Precast RCC Benches
- Precast RCC Drains
- RCC Precast Concrete Manholes
- Precast RCC Slabs
- Precast RCC Sleeper, Louvers Fins, Pavers Rubber Mould, Precast Walls
- Precast RCC Drain Covers
- RCC Pipes & Cement Articles
- Precast Concrete Box Culverts, Precast Concrete Manhole
- RCC Fencing Pole, RCC Door Frame, RCC Grill
- Kerb Stone & Ferro Cover
- Kerb Stone, Road Edge Stone, Paving Stone, Kerb stone, Granite
- Paving Blocks Mortar less For Concrete And Interlock Pathways

Use of Recycled clay

- To make various types of bricks
- Hollow Block, Light weight blocks & Architectural Clay Product

## **(B) Using Plastic Waste for Construction of Roads**

Taking cue from Chennai, where roads have been built using polymer bitumen in coastal areas of Chennai and to curb the increasing plastic waste in the city and enhance environmental protection, Hon. Municipal Commissioner instructed officials from Road and Building Department of AMC visited Chennai to review the quality of roads built with polymer bitumen.

Based on the conclusions from this visit, AMC's Solid Waste Management Department dispatched the plastics waste to the hot mix plant to prepare the polymer bitumen.

Accordingly, AMC started road resurfacing in Ahmedabad using polymer bitumen.

Under this pilot project, one km long stretch was constructed.

Main points of adopted methodology for the construction of Polymer Bitumen Road in Ahmedabad are as under:

1. Waste plastic of 40 micron to 90 micron thickness was used in the process.
2. Waste plastic was shredded up to 2.36 to 4.75 mm to achieve required thickness.
3. To decide the proportion of waste plastic in Hot Mix, an analytical study was carried out by Road Project Department of AMC.
4. After carefully execution of various experiments to decide the content of waste plastic and on the basis of its results, it was decided to add 8% of Bitumen content waste plastic.

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5. Addition of waste plastic was done by placing on conveyer belt manually.
6. Hot Bitumen whose temperature is maintained between 150 C to 160 C is added thereafter.
7. Bitumen is bonded with the aggregate by means of plastic which acts as a binder.
8. The mix prepared by this method is called as waste plastics-aggregate-bitumen mix (Composite) which was laid at site by contemporary method at the temperature of 120 C to 130 C.
9. No extra machinery is necessary to construct the Polymer Bitumen Road.
10. Consumption of waste plastic per 1000 kg Bitumen is 80 kg i.e. 8% of Bitumen and in total 22 MT plastic waste was used.

There are a range of benefits by using plastic waste in road construction as below:

- Reduction in discarded plastics bags in the city
- Protecting the roads from washing out in monsoon
- Reduction in cracks in roads due to melting bitumen in summer
- Cost effectiveness in road construction
- Significant increase in the income of rag pickers
- Better protection against the rain water and thus better durability will be achieved

After examining the durability of this road, AMC is planning to resurface more roads in each zone of the city with polymer bitumen.

## **(C) Recycling PET Bottles**

The machine named 'My Pet' collects and crushes plastic (PET) bottles. The company, Arts Alive Ventures Pvt. Ltd has installed machines at Ahmedabad Railway Station, to crush the PET bottles and sell the shredded material to recycling companies as "PET flakes", which are then used as a raw material for a range of products like polyester sheets & fibers or back into PET bottles. In November 2014 as a Pilot project, AMC allocated 12 locations to this company to install machines to collect and recycle plastic waste. AMC will charge Rs 101 as token fees from the company. The company has signed a contract with AMC for one year.

No => Please go to Q6 (please also answer Q 4, 5, and 7)

Please attach photos with caption, if available:

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<b>Q 3</b>	<b>What are the major challenges and constraints faced by your city in implementing 3R policies and programmes?</b> (Please answer only if your <u>answer to Q2 is “Yes”</u> )	
	Financial constrains:	Yes
	Institutional/governance challenges:	Yes
	Policy gaps:	Yes
	Other challenges such as technical capacity, human resources etc.:	Yes
<b>Q 4</b>	<b>What programme is in place in your city to support NGOs activities towards promotion of 3Rs?</b>	
	At present no programme is in place but we have organized detailed multi-stake holders meetings for mainstreaming waste pickers in the solid waste management value chain.	
<b>Q 5</b>	<b>Is there any collaborative 3R related activity/project/partnerships with cities and organizations at international level?</b>	
	<input checked="" type="checkbox"/> Yes => Please brief the project(s) including objectives, project partners, target, period, budget etc.  <input type="checkbox"/> No Please attach photos with caption, if available:	
<b>Q 6</b>	<b>Even if your city doesn't have any dedicated 3R policies/ programmes /activities, what future prospects or opportunities does your city have in 3R areas?</b>	
	We have a dedicated 3R policies/ programmes /activities.	
<b>Q 7</b>	<b>What type of 3R infrastructure and facilities your city is equipped with? Please tick the appropriate.</b>	
	<input checked="" type="checkbox"/> waste collection facility <input type="checkbox"/> waste segregation facility <input type="checkbox"/> waste storage facility <input checked="" type="checkbox"/> waste processing & treatment facility <input type="checkbox"/> resource recovery facility <input type="checkbox"/> waste recycling facility <input type="checkbox"/> eco-industrial zones <input type="checkbox"/> science parks & theme parks covering 3R areas <input type="checkbox"/> others (please specify: )	

Thank you for your kind cooperation.