

# Feasibility Study of Proposed Plan of Kolhapur Municipal Corporation for Construction & Demolition Waste Management

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**Abstract** - It is estimated that 50-60 metric tons of construction and demolition (C&D) waste is produced per day in Kolhapur city. However, the waste generated is currently not being disposed in scientific and safe manner. Shortage of land in Kolhapur region is causing constraints for waste disposal, resulting in unauthorized dumping in areas such as rivers and lakes. In order to facilitate proper management of this waste the Kolhapur Municipal Corporation is planning to take an initiative to set up a proper project for Collection, Transportation, and Processing and Management of C&D waste in KMC area. The current scenario analysis of Kolhapur region helped to understand the current C&D Waste Management, challenges and barriers in its implementation. The analysis is carried out through research of secondary sources in the public domain, site visits, stakeholder consultation and interviews which provided a baseline for recommending appropriate interventions. The analysis provided a basis for identifying the barriers in implementing an integrated C&D waste management plan in Kolhapur and the required interventions to overcome these challenges. These interventions formed a basis for the feasibility study of the processing project and overall management of C&D waste in Kolhapur region. Based on the studies carried out in the phases as well as interaction with the stakeholders and study of other best practices a financial feasibility report may be drafted.

**Key Words:** C&D waste; Collection; Transportation; Processing.

## 1. INTRODUCTION

### 1.1 BACKGROUND

It is estimated that 50-60 metric tons of construction and demolition (C&D) waste is produced per day in Kolhapur city. However, the waste generated is currently not being disposed in scientific and safe manner. Shortage of land in Kolhapur region is causing constraints for waste disposal, resulting in unauthorized dumping in areas such as rivers and lakes. In order to facilitate proper management of this waste the Kolhapur Municipal Corporation is planning to take an initiative to set up a proper project for Collection, Transportation, and Processing and Management of C&D waste in Kolhapur Municipal Corporation area.

### 1.2 PROPOSED METHODOLOGY

Population of Kolhapur city is 5, 49,236 (as per 2011 census). The Kolhapur city has seen very rapid growth during the last few decades. The heavy influx of professionals has resulted in housing and infrastructure along with industrial and commercial complexes. The city also generates about 170 metric tons per day of municipal solid waste at per capita generation of 342 grams per day (source: Kolhapur CDP). The same is managed by the KMC's Solid Waste Management Department. With this regard it has been noted that construction and demolition activities that generate the types of waste which requires similar framework for their regulation are not limited to only activities such as construction, repair, re-modelling, renovation, but also includes land clearance activities, activities related to digging of trenches, creation of underground facilities, clearing drains and water bodies within the city. It also been noted that waste generated from construction and demolition activities can compromise of a large amount of different elements which include both hazardous and non-hazardous materials. The unauthorized dumping of solid waste from construction and demolition activities is a major cause of nuisance and pollution within the city. Kolhapur Municipal Corporation needs to allot a few acres of land for the processing and disposal of construction and demolition waste of Kolhapur city. The Kolhapur Municipal Corporation would also like to implement an integrated C&D Waste Management project including the collection, transportation, recycling, processing and disposal.

## 2. MATERIALS & METHODOLOGY

Kolhapur Municipal Corporation is being contacted for support on information and data wherever required. There is not much work done on subject of C&D waste till now. This is a fact that at there is no separate department available with KMC for C&D waste. Also at present there is no centralized collection, transportation & disposal system for C&D waste a research on the international and national best practices and policies is being done to identify the most viable methods for the implementation of safe and scientific disposal of C&D waste. Following data is being studied in best practices analysis-

## 2.1 MATERIAL ANALYSIS & PROJECT SCOPE

Kolhapur like many other cities is witnessing rapid industrial and technological development which is result of increase in population. Waste management is a major challenge for these cities due to increase in generation of waste quantity. While much has been done to address the issues of municipal solid waste, construction and demolition waste remains unaddressed with growing construction activities. Proper collection and disposal methods are not applied in the practical world because of which such waste finds its way to illegal road side and empty site dumping as shown in fig.1 (a) & (b). Construction and demolition waste contains mainly of concrete and other inorganic materials which hamper soil quality. Therefore there is a huge need to establish proper methods and practices to dispose off, recycle and reuse such wastes.



(a) (b)  
Fig-1: (a) & (b) Showing unauthorized dumping of C&D waste

## 2.2 NATIONAL & INTERNATIONAL BEST PRACTICES

Scotland	Denmark	Singapore	Hong Kong
<p>1. About 63% was recycled in 2000 remaining 37% disposed in landfill.</p> <p>2. The government is working out specifications and code of practice.</p> <p>3. Attempts are being made to facilitating agencies for adoption of recycled aggregates.</p>	<p>1. According to the Danish environmental agency in 2003, 30% of total waste generated was C&amp;D waste</p> <p>2. 70-75% waste is generated from demolition activities, 20-25% from renovation &amp; remaining from new buildings.</p>	<p>C&amp;D waste is separately collected &amp; recycled. A private company (Sembwaste) has built an automated facility with 300000 ton per annum capacity</p>	<p>Concrete bricks and paving blocks have been successfully produced impregnation of photo catalyst for controlling NOx in ambient air.</p>

Fig-2: Selected international experience has been outlined here which have relevance for the Indian situation.

C&D waste management Burari, Delhi – experiences of first pilot project of C&D management in Delhi in year 2009. Municipal Corporation Delhi and IL&FS infrastructure took a pioneering initiative of setting up a pilot project to process 500 TPD of C&D waste in Burari, which was a first kind of plant in country on PPP model. Under Indian conditions the cost of setting up 500 tons per day C&D plant is Rs 180million. Operating and capital related cost for operating a 500 TPD, C&D processing plant is RS 420/t where as from product sale the cost recovery is about Rs 120/t. Cost of scientific land filling is about RS 650/t. as compared to scientific land filling processing of C&D waste is Rs 300/t cheaper. The cost of collection of C&D waste is about RS 350/t whereas on MSW about Rs 1000/t.

## 2.3 TECHNICAL FEASIBILITY

Construction and demolition waste means the waste comprising of building materials, debris and rubble resulting from construction, re-modeling, repair and demolition of any civil structure. Construction waste is generated during building construction and renovation and results from surplus material, damaged or broken material, processing waste, dismantled

shuttering and used tools. Demolition waste can be result from demolition of built structures for renovation or complete removal or renewal or can result from natural events.

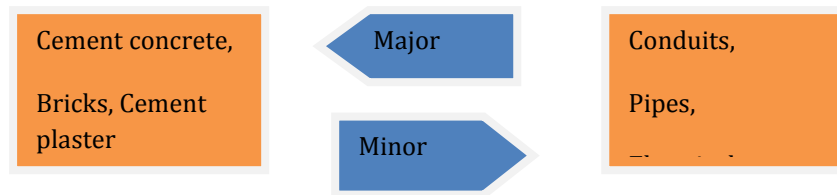


Fig-3: Composition of C&D waste

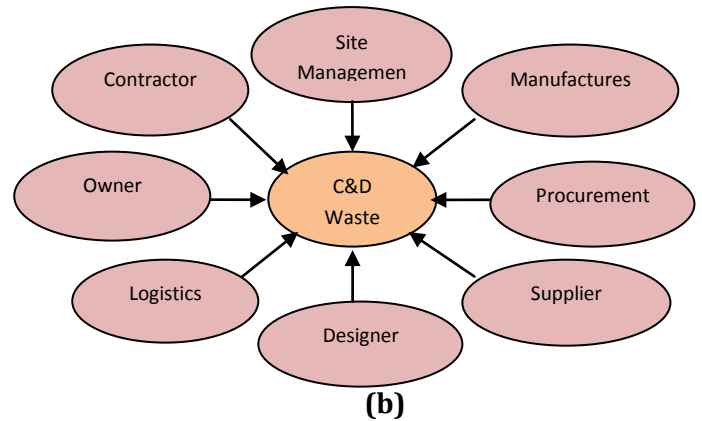
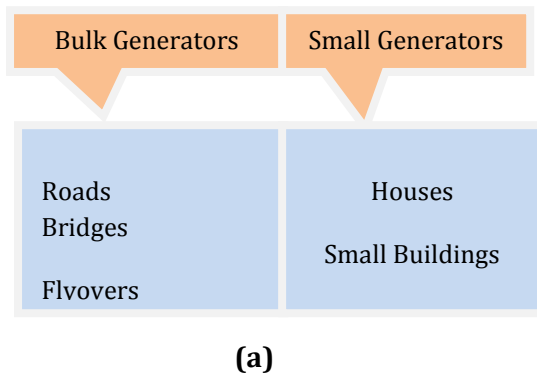


Fig-4: (a) Sources of C&D waste generators. (b) Contributors of the C&D waste in the project.

Role of KMC in C&D waste management

- Identify suitable location for under 1MT waste deposition
- Create a system of renting containers for storage & transport by involving private partners.
- Prescribed rates to be published
- Citizens should be informed to avail this facility
- Transportation through skip lifting system
- Plan for reuse and recycle
- Avoid spillage during deposition in bins

Collection and Transportation in large cities above 1lakh population,

- Skip and hook loader containers
- Skip container or large roll on roll off bins
- Tipper trucks in conjunction with front end loaders are suitable for collection of construction and demolition waste

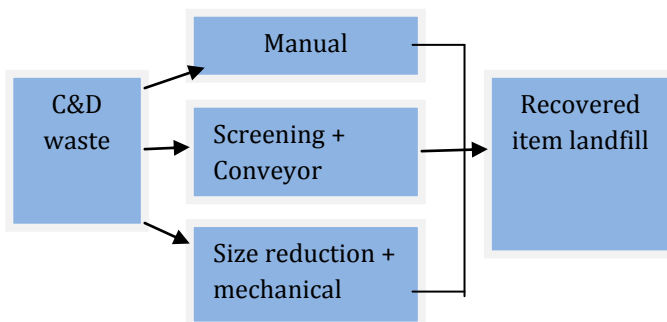


Fig-5: C&D waste treatment methods.

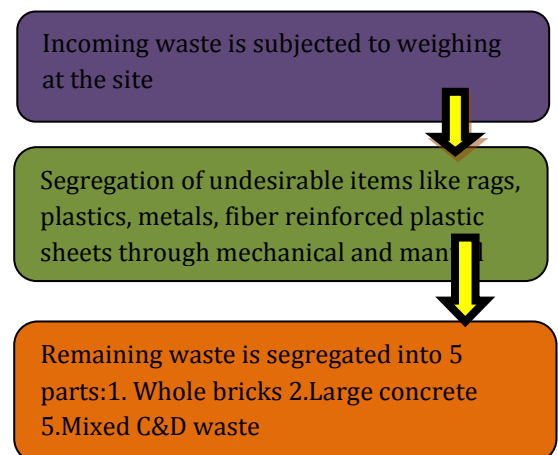
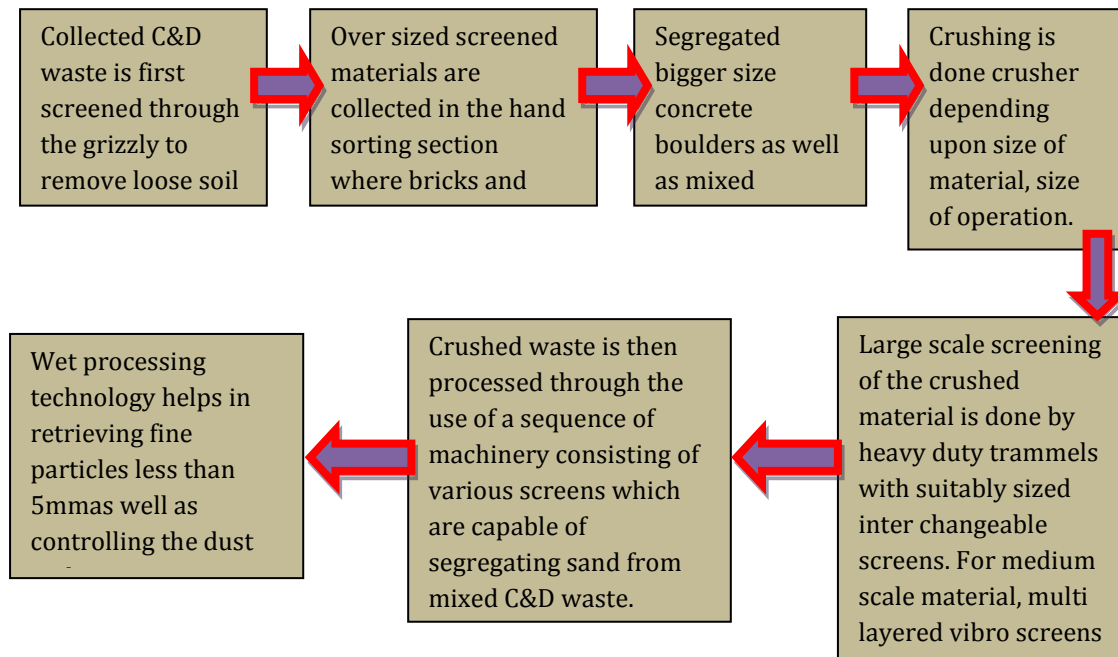


Fig- 6: Process Flow.



**Fig- 7: Process Technology**

#### Final products from C&D waste

- Making of road sub-base
- Making of pavement blocks and precast products like kerb stones, paver blocks and tiles.
- The loose soil and sand is sold in the market and the byproduct is also used in construction of bus shelters in the city.

## 2.4 PLAN PROPOSAL

#### Responsibility of waste generators

- Every waste generator shall be responsible for collection, segregation and storage of C&D waste.
- Large generators to segregate the waste in categories:
  - Concrete
  - Soil
  - Steel, wood & plastics
  - Bricks, mortar
- Builders to give undertaking for disposal of C&D waste.
- Large waste generators shall submit waste management plan.
- Waste generators to keep C&D waste in their own premises or handover it to authorized processing facilities.
- Every waste generator to pay relevant charges for collection & transportation of waste.

#### Responsibility of Urban local body

- To issue detailed directions with regard to proper management of C&D waste in accordance with MSW Rules 2015.
- ULB to make proper arrangements for placement of appropriate containers and their removal at regular intervals.
- ULB should give incentive to any generator who plans proper salvage plan, processing and recycling.
- ULB to keep track on generation of C&D waste within its jurisdiction and keep a data base for the same.
- Identify suitable sites for processing facilities.

#### Plan Approval by Local Body

- Prior to construction or demolition work the generator shall obtain permission from local body and shall submit the waste management plan of C&D waste.

#### Storage, collection and Transportation of C&D waste

- Littering of C&D waste shall be strictly prohibited.
- C&D waste shall be stored separately and not allowed to get mixed with other waste.
- The storage bins shall be in accordance to the quantum and nature of C&D waste.

- Collection of C&D waste shall be done at regular intervals.
- The collected material shall be transported to the identified location for further processing.
- The generators of C&D waste shall have to pay for the services rendered for its storage, collection and transportation at a fixed rate.

#### Processing and Disposal of C&D waste

- Reuse as much as possible
- Whatever cannot be reused, process & recycle, the residue after processing and recycling only be disposed in the place designated by the authority.
- Use of recycled C&D waste products such as in non structural concrete, manufactured sand, pavement blocks, lower layers of road pavement etc. shall be incentivized.
- Procurement of such materials shall be made mandatory to certain percentage in municipal and government contracts.

Kolhapur Municipal Corporation has recently been allotted approximately 05 acres of land (located behind Tawade Hotel, Kolhapur) for the processing and disposal of Construction and Demolition waste.



**Fig.-8:** Photographs of Proposed Land.

## 2.5 RECOMMENDATIONS FOR KMC

#### Proposed role of KMC in collection of C&D waste

- Notify suitable locations for local collection center of C&D waste ward wise.
- Make it mandatory for large private waste generators and Civic projects to either install captive C&D processing facility at site or directly transfer to the C7D waste processing center of corporation.
- Make it mandatory for the developers to submit C&D waste management plan before acquiring permission for development of structures.
- Illegal disposal of C7D waste should be banned.
- Promote separation of C&D waste at the site itself.
- Arrange for transportation of C&D waste.
- KMC should fix and notify charges for door step collection and transportation of C&D waste.
- Responsibility of KMC will be to collect or accept the waste at the transfer station and transport it to processing facility.

#### Proposed role of KMC in utilization of C&D waste

- KMC should plan for reuse and recycling of such waste with the private sector participation.
- Should formulate relevant policies for use of the recycled aggregates in the construction sector.
- Should utilize the recycled aggregates for the corporation works in the roads sub-base, pavements, gardens, kerbs and other such.
- Should promote the market for recycled aggregates
- All new structures should mandatorily use the non structural members made by recycled material.

- The corporation should promote and procure value added items like pre-cast members in the form of kerb stones, road medians, and manhole chambers etc, made from recycled materials.
- KMC should keep the tipping fee for the private party to a minim and instead market the recycled products as it is major revenue source.

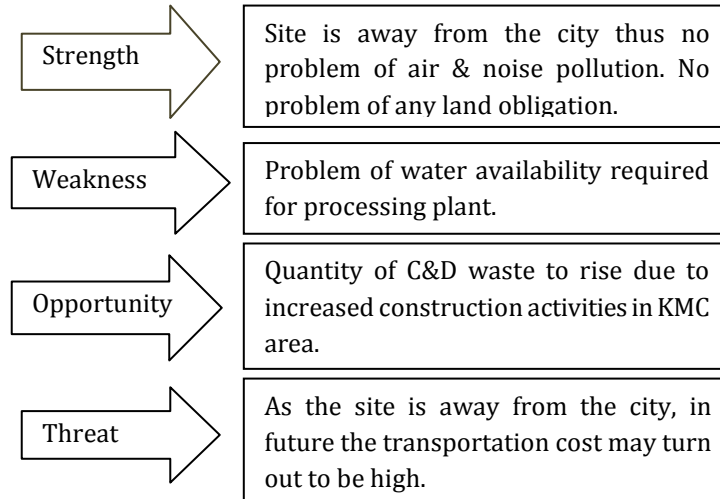


Fig-9: SWOT Analysis of Proposed Site.

## 2.6 SCOPE OF WORK FOR THE INTEGRATED C&D WASTE MANAGEMENT PROJECT

### Collection and Transportation of C&D waste

- C&D waste in divided into two categories: Claimed C&D waste- generated by identified generators & Unclaimed C&D waste – where the generator of C&D waste is difficult to identified, for the instance the C&D waste which is mainly found dumped across road sides or open areas.
- The concessionaire after agreement should prepare and submit comprehensive C&D waste management plan, covering segregation, storage, collection, transportation, reuse, recycling and disposal.
- The concessionaire should be responsible for the collection, storage, transportation of all claimed & non claimed C&D waste to facility for its further processing.

Table-1: Vehicles & Bins required for collection and transportation of C&D waste.

Type of vehicles/bins required for collection & transportation of C&D waste	Minimum required quantity (nos)
Wheel loader	1
Back hoe loader with bucket	2
Hydraulic excavator	1
Site supervision vehicle	1
Management Information System	Lump sum
Storage containers skip bins of 2cu.m. volume compatible with bin lifter	5
Storage containers skip bins of 5cu.m. volume compatible with hook loader	2
Storage containers skip bins of 10cu.m. volume compatible with hook loader	2

Skip vehicles/Bin lifter mounted on LCV/MCV capable for 2cu.m containers.	2
3.5cu.m Twin bin dumper placer on LPT 1613/42,BSIV	1
Hook loader on LPT 1613/697 TCIC/42,BSIV	1
Hook loader on LPT 2521/48,BSIV	1

NOTE: the quantity of vehicles and equipments mentioned is estimated quantity used for estimation and financial modelling. However the successful party shall have to carry out its own evaluation (as per C&D waste management rules 2016) for type, capacity and number of vehicle and equipments. However to keep the uniformity in financial model for arriving the rate all bidders must consider above quantity as minimum quantity of new vehicles & storage containers to be deployed for the project.

#### Processing of C&D waste

Characterization of incoming C&D waste material at the processing site and carry out various tests and investigations to determine the useful constituents which can be recovered and recycled.

#### Site Development

- The concessionaire should carry out necessary geotechnical surveys for considering the hydrological and flooding potential at sites, in order to mitigate any effect on the activities of the plant and also the impact on immediate environment,
- The processing facility should be properly fenced and provided with proper gate to monitor incoming vehicles.
- The approach and internal roads should be concreted so as to avoid generation of dust particles and ensure free movement.
- Concessionaire should provide weighbridge at entry, exit and appropriate places, to measure quantity of waste brought at the site and shall have online monitoring connected to KMC.
- Provide utilities such as drinking water facilities and sanitary facilities and lighting arrangements for easy operation during night hours.

#### Construction & Operation of C&D waste management facility

- The concessionaire is expected to use a combination of mechanical process that includes crushing, washing, screening and separation which would maximize waste treatment and ensure zero land filling.
- The concessionaire will be required to look into the quality and quantity of waste generated in the designated area for arriving at the technology selection. The total system would work as per C&D Rules 2016, and can follow the practices as suggested in MSW Manual of the Ministry of Urban Development.
- The concessionaire shall undertake crushing in such a manner that noise and dust pollution are controlled.
- The concessionaire shall ensure that end product complies with the code of practices and standards as specified by the Bureau of Indian Standards (BIS) and the Indian Road Congress (IRC) for use of recycled materials and products of C&D waste in respect to construction activities of road.
- The concessionaire will be separate mixed C&D waste from different parts of city and from various activities after crushing and screening. Air blowers, magnetic separators or manual separation can be employed for this purpose.
- The concessionaire shall identify and develop end markets for recycled C&D waste products. The concessionaire will provide facilities for crushing, screening and separation of wastes in various grades and sizes for sale to respective consumer and process for production of various precast structure, paver tiles and road side kerb bricks.
- The concessionaire should maximize the recycling, reusing as well as reducing the waste at the end of treatment cycle.
- The concessionaire shall set up a wet C&D waste management facility. Wet process is to be used as dust generation is minimized.
- The concessionaire will make non structural pre cast elements such as utility ducts, kerb stones, road medians etc.
- Recycled products will include recycled concrete/stone aggregate in different sizes, recycled manufactured sand.
- The concessionaire shall furnish full details of the technology he proposes to adopt and submit designs, drawings and specifications to be used.
- The concessionaire shall have internal performance monitoring mechanism foe effectiveness in project implementation covering all areas.
- Concessionaire may first be required to sell recycled products to KMC if required or else can sell to open markets.

## Operation & Maintenance of Infrastructure and equipment

The concessionaire shall be responsible for construction, operation of facility, maintenance of bins, trucks, mechanical lifting arrangements, weighbridge etc. the concessionaire should maintain the facility and machinery in order to operate for the concession period.

## Management Information System (MIS)

### I. MIS Reporting System

Collection and transportation of C&D waste from small and bulk generators. To the extent possible aggregating the data using automated method and minimal manual intervention shall generate reports e.g. GPS feed, SMS from field, real time bio-metric attendance etc. These reports are submitted to employer in printed format daily duly signed by authorized person.

### II. Procedure for generating MIS reports

- Daily bio-metric attendance shall be taken of staff deployed and data pushed into the system.
- At the start of an activity the concerned person will send a start sms to the system.
- Thereafter will take over to see the progress of the activity and shall automatically prepare the progress report.
- When a collection vehicle clears waste from a bin, the operator shall through a mobile application click a photo of cleared item. The app shall automatically upload the clearing information and the photo through GPS system. When the vehicle reaches disposal site the vehicle shall be weighed at the weighbridge. The weighbridge operator shall online report the receipts at the disposal site into the system.
- For inspection reports the concerned inspectors shall be provided with a mobile application through which he can feed and upload his inspection report in the system.
- Employer shall also be provided view access to the data and reports generated through this system for his use.

### II. Customer Care Center/ Control Room

Agency shall develop customer care center/control room which has following key components

- Dedicated phone lines and staff to receive complaint or request from public and employer staff.
- Mobile phone's short code number to receive complaints sms and web interface for customer to directly feed complaints.
- Tact the work that is reported and report back to person originating the complaint.
- Appointed monitoring agency at its discretion would be at a liberty to check the working of the customer care center/Control room.

### Dedicated Phone Number

- A dedicated phone number with minimum 1 line. Maximum call waiting time shall be 2 minutes for any received complaints. While the customer is waiting a recorded voice message indicating that complains can be logged by sms or on web shall be played in addition to general greeting.
- All calls shall be recorded and shall be reviewed for the quality of interaction of their staff with the customers.
- Report received from customer shall be stored online directly. Unique ticket number shall be generated and communicated to caller along with expected time for correcting issue.
- Control room shall be staffed adequately to receive and process the complaints. Control room shall be operational from 7am till 10pm on all days.

### SMS to Receive Complain

- Short code based sms service shall be developed by agency to receive complains in structured sms form.
- Similar short code based sms service shall be developed by agency to receive requests from employer staff.
- User friendly web shall be created to receive complaints from customers online.

### Workflow to Track Status

- Each complaint request shall be assigned a unique ticket number.
- Each complaint shall be forwarded via sms and system to the concerned executing person with a copy to reporting supervisor.



- Once ticket is closed it shall be updated in the database. In case complaint is not addressed within specified time, reason for delay along with likely resolution time shall be supplied in the database.
- Customer feedback shall be taken on completion of task and stored in the database.
- Current status of all open and closed complaints shall be visible online and user shall be able to view their status by complain number.
- On completion of work sms shall be sent back to the customer indicating completion of work. Systems shall have provision to take feedback of customer on level of satisfaction based on service provided.

**IV. Hardware & Other Components**

- Agency shall be prescribing the system and type of the hardware, MIS software to be installed. All required software's shall also be designed by the agency. Agency shall be responsible for installing hardwares as well as developing software for monitoring of project.
- Agency shall be provided the independent user id and password to the concerned officials of employer to access the real time monitoring. Employer may get the authenticity of the reporting mechanism and software.

**GPS in all vehicles**

- Agency shall install GPS system in all the vehicles with latest best technology.
- On board storage of at least 2 days of data.
- Internal battery to sustain operation for at least 10hours with minimum recording and reporting time of 30s.
- Must be able to detect engagement of bins raising/lowering.
- 98% of installed GPS shall be operational all the time.
- Any non operational GPS shall be replaced within 24hours

**RFID (Radio Frequency Identification Reader)**

- RFID tag in non-breakable, non-removable enclosure shall be fixed on all vehicles and equipments.
- Vehicle RFID tags shall store information of RC and insurance details.
- Agency shall provide RFID readers to read RFID tags information.

**Mobile Application for Reporting from Site**

- Mobile application shall be able to send information to the control room about the ground situation along with photo, geo-tag
- This application shall work even when GPRS connectivity is not there and the moment when GPRS connectivity is available data will be uploaded to the server.
- The application shall be used for reporting arrival of tippers for collection of waste.
- Reporting lifting of bins from collection points.

**Table- 2:** Equipments required for processing of C&D waste.

Type	Minimum required quantity (nos)
C&D waste Crushing unit	01
10-20 TPH C&D waste recycling plant	01
Prefabricated SMC panel tank (98KL)	01
Manufacturing of value added products	01
Prefabricated steel building	Lump sum
Site supervision vehicle	01
Civil works	Lump sum
Weigh bridge	01
Area Lighting & Electrical work	Lump sum
Internal Roads	Lump sum
Tree Plantation	Lump sum
Water Tanket	01

**2.7. PROJECT COST ESTIMATE**
**Table-3: – Abstract of Project Cost Estimate**

COLLECTION & TRANSPORTATION OF C&D WASTE					
15	Wheel Loader	37,78,500	1.0	37,78,500	As per comparison of quotation
16	Backhoe loader JCB 2dx	12,69,125	1.0	12,69,125	Swachh Bharat Mission rate contract
17	Hydraulic Excavator	56,70,000	1.0	56,70,000	As per comparison of quotation
18	Site supervisor vehicle	8,96,348	1.0	8,96,348	As per comparison of quotation
19	MIS System	11,99,960	1.0	11,99,960	As per comparison of quotation
20	Storage containers skip bins of 2cu.m volume compatible with bin lifter	96,906	4.0	3,87,624	As per comparison of quotation
22	Storage containers skip bins of 5cu.m. volume compatible with hook loader	5,82,188	1.0	5,82,188	As per comparison of quotation
23	Storage containers skip bins of 10cu.m. volume compatible with hook loader	8,69,484	2.0	17,38,968	As per comparison of quotation
24	Skip vehicles/Bin lifter mounted on LCV/MCV capable for 2cu.m containers.	4,19,985	2.0	8,39,970	As per comparison of quotation
25	Hook loader on LPT 1613/697 TCIC/42,BSIV	31,35,938	1.0	31,35,938	As per comparison of quotation
26	Hook loader on LPT 2521/48,BSIV	40,10,250	1.0	40,10,250	As per comparison of quotation
<b>TOTAL B (Cost of C&amp;D waste processing plant)</b>				2.36	In Cr
TOTAL Project Capital Cost (A+B)				9.56	In Cr
Total after adding i) contractors profit 10% ii) Service tax 15% iii) IEC cost 2%				12.14	In Cr

**Table-4: – Comparison of Quotations for Processing of C&D waste**

SR. NO	Item	Vendor/Company Details	Rate(INR)	Selected Quote
1	C&D waste crushing unit	Terex India Pvt Ltd, Bangalore. Ph-8033151000	20,00,000	20,00,000
		Verder Scientific Pvt Ltd, Hyderabad. Ph-8142042481	56,96,522	

2	10-20 TPH C&D waste recycling plant.	CDE Asia limited, Kolkata. +91 3330292800	2,97,70,000	2,97,70,000
3	Water tank (98KL)	Ajmera Agency, Mumbai. Ph- +91 2223886378	1171620	1171620
		Auto Smart Agencies Pvt Ltd, Mumbai. Ph- 9820150573	1211498	
		Akol Kavyees Infra Projects Pvt Ltd, Mumbai. Ph- 9987757600	1235766	
4	Manufacturing of value added products	Micro Engineering Works, Coimbatore. Ph- 9894748600	74,33,400	74,33,400
		Revomac industries, Gujarat Ph- 9925067406	93,46,450	
5	Supply and erection of prefabricated steel building	DG infrastructure Pvt Ltd, Navi Mumbai. Ph- 9820103961	1,00,71,968	53,64,582
		Tushar Fabengineers Pvt Ltd, pune. Ph- 020-46765504	53,64,582	
		JPM engineers Pvt Ltd, Mumbai. Ph-022-27898687	4,00,00,000	
6	Water Tanker	Tata Motors Mumbai	16,64,491	16,64,491
7	Weighbridge	Techno Scale Industries, Ahmadabad-13, Ph- 7927461544	13,77,000	12,13,750
		Panchal Scale Co. Motipura, Sarbarkantha. Ph- 9427494318	15,39,800	
		Corona systems, Balaji nagar, Pune.	12,13,750	

**Table- 5:** – Comparison of Quotations for Management of C&D waste

SR. NO	Item	Vendor/Company Details	Rate(INR)	Selected Quote
1	Wheel Loader	L&T Ltd. Mumbai. Ph-022-67051975	37,78,500	37,78,500
		Total Earthmovers Pvt. Ltd. Thane. Ph- 022-41224520	39,23,438	
		Gmmco CAT, Pune. Ph- 9921827117	40,50,000	
2	Backhoe loader	JCB	12,69,125	12,69,125
3	Hydraulic Excavator	L&T Ltd. Mumbai. Ph-022-67051975	61,83,000	56,70,000
		Gmmco CAT, Pune. Ph- 9921827117	68,25,000	
		Total Earthmovers Pvt. Ltd. Thane. Ph- 022-41224520	56,70,000	
4	Site Supervisor Vehicle	Mahindra Bolero	8,97,694	8,96,348

		Tata Sumo	8,96,348	
5	MIS System	Develop Dreamz Industries Pvt. Ltd. Pune. Ph- 9325077775	11,99,960	11,99,960
		Divinity Soft-Solutions Pvt. Ltd. Pune. Ph- 020-65006588	20,38,100	
		JINIT Technology Pvt. Ltd. Pune. Ph- 9890015192	16,37,350	
6	2cu.m Storage containers	TPS Infrastructure Limited. New Delhi.	96,609	96,609
7	5cu.m Storage containers	TPS Infrastructure Limited. New Delhi.	5,79,656	5,79,656
8	10cu.m Storage containers	TPS Infrastructure Limited. New Delhi.	8,69,484	8,69,484
9	Skip vehicles/Bin lifter mounted on LCV/MCV capable for 2cu.m containers.	TPS Infrastructure Limited. New Delhi.	13,00,750	4,19,985
		Swachh Bharat Mission rate contract	4,19,985	
10	Hook loader on LPT 1613/697 TCIC/42,BSIV	TPS Infrastructure Limited. New Delhi.	33,48,425	31,35,938
		Swachh Bharat Mission rate contract	31,35,938	

### 3. CONCLUSIONS

India's first recycling plant for construction and demolition waste was constructed at Burari in Delhi. The municipal corporation of Delhi had started the plant in 2009, with Infrastructure Leasing & Financial Services (IL&FS) operating the 10 acre site Burari at Jahangirpuri in Delhi. With near constant buzz of construction activity across the country over 50000 tons of waste is produced by building, demolition and land clearing activities every day. The C&D activity within the KMC generates about 50-60 TPD waste. It is proposed that the KMC shall direct all the construction sites to collect and transport the waste to the proposed waste processing plant site. For small quantities of C&D waste produced in various wards KMC shall provide waste bins of suitable sizes and shall deploy adequate number of dumpers to collect and transport the waste from waste bins located in the wards. Once at the plant, the waste shall be segregated into big concrete pieces, mixed C&D waste as per size and unrecyclable materials like plastic and wood shall be separated. The plant shall use manual segregation for bigger plastic pieces. A magnetic separator shall be installed for metallic objects. The waste shall be crushed, washed and used to make ready mix concrete, kerb stones, cement bricks, pavement blocks, hollow bricks and manufactured sand. A wet processing unit shall be installed so that the sand will not fly around. The necessary water needed shall be supplied from the nearest STP and thus fresh water use shall be restricted. The products made at the plant shall be acceptable and applicable BIS standards. These shall be used in the projects of the KMC as paver blocks, aggregates and sand. Once the aggregates are allowed, the end products will be used by government departments and local builders and developers.

Benefits by establishing C&D waste processing plant

- 1) Once the construction and demolition plant is functional, it will put a check on the destruction of mangroves due to the dumping of all the debris. The big concrete pieces, recyclable waste and unrecyclable materials like plastic and wood all be segregated.
- 2) There would be an increase in the longevity of the existing landfill. Thereby the city benefits from less solid waste being disposed off in landfills.
- 3) Revenue would be obtained from the sale of reusable.
- 4) Establishing the C&D waste plant would conserve energy and prevent resources.
- 5) There would also be reduction in the construction waste.

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