"Case study of construction & demolition waste management in surat"

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Abstract - *Construction and demolition (C&D) waste generation have risen due to the rapid growth of towns and cities. Due to the increase in the economic growth after development and redevelopment projects in the country and subsequent increase in the urbanization in the cities has made construction sector to increase drastically, but also environmental impacts from construction and demolition (C & D) waste are increasingly becoming a major issue in urban solid waste management. Environmental issues such as increase in the flood levels due to the illegal dumping of construction and demolition waste into the rivers, resource depletion, shortage of landfill and illegal dumping on hill slopes are evident in the metro cities. The study report stresses the importance of recycling construction waste, creating awareness about the problem of waste management and the availability of technologies for recycling.*

***Key Words*: Construction, Demolition, Waste Management, Data Collection of Waste Material, Reuse, Recycling, etc**.

1.INTRODUCTION

1.1 General

Construction and demolition waste has been defined as "wastage which are arising from construction, renovation , explosion activities, surplus and damaged products and material arising in the course of construction work and on site work. The primary method is adopted in waste handling is carried through by interviewing professionals like project managers, architects, civil engineers, contractors and government officials like city engineers, solid waste management officials.

The agriculture is the largest industry in India. According to the eleventh five year plan, construction is the second largest industry after agriculture. India's most population skilled/semiskilled and significantly labour class unskilled is dependent upon the construction work. Material is the major part of all types constructions projects. The success and failure of every construction project is by and large depends on the material management. In country like India where on one hand side the growth of development and redevelopment project has considerably increased and on the other hand the bad impacts of construction sector on the environment is also amplified.

Today the environmental issues such as flood levels due to the illegal explosion of waste into the rivers, resources are depletion from the earth and illegal explosion of hill slopes are evident in the metro cities. In India infrastructural facilities are increased due to the construction, refurnishing and explosion of buildings, bridges, runways, flyover, roads, factories, industries, hospitals and other similar formulations. The waste material generally consist of powerless, inactive and non-biodegradable materials such as

- Plaster
- Plastics
- Wood
- Brocken tiles
- Metals
- Excavated materials
- asphalt concrete
- Concrete rubbles
- Steels, Masonry etc.
- Wastage of Chemicals

This type of waste material is most usually seen on the road sides, communistic dustbin, occupy the land space, and reduce the use of land and fertility of land . If we say a statement that in most of the world when we travelling a few kilometers by road we saw huge piles of such type of waste and which is very heavily and that wastage is from the industrial or constructions project wastage and the effect of that is traffic congestion. From that type of waste material there is increase in floods, earthquake, and ecology imbalance, effect on the wild life, low space for living, reduction in the land fertility and adverse effect on the environment and peoples. So there is a need of proper planning of waste management and recycling of waste material. In India being developing countries, there is immense need of awareness for waste management. Due to lack of awareness waste management project is not working well. From the last few decades, European countries make excessive growth on the waste management and utilize the construction waste and recycling that waste.

1.2 Classification of wastes

- Recyclable waste
- Non- recyclable waste

1.2.1 Recyclable waste

- **PLASTIC:-**

  - There is an over abundance of waste plastic.
  - It is very difficult to dispose plastics.

- Waste plastics can be shredded & used as filler in other materials such as concrete & also in construction of roads.
- House hold plastic waste can also berecycled to obtain artificial light weight aggregates for mortar.Plastics reduces the possibilities of cracking.

Figure 1 Plastic

❖ **STEEL:-**

- Steel is most commonly used metal in the world.
- Steel reinforcement from demolished concrete is usually separated from the rubble on site & sold scrap to recycling plants.
- The world produces over 783 million tons of raw steel. It currently recycles over 320 million tons of iron & steel every year.
- Scrap metal can yield energy savings of upto 76%.
- In Europe steel is most recycled.

Figure 2 Steel

❖ **BRICKS:-**

- Broken & discarded brick can be used as construction infill or as aggregate for non-structural concrete.
- Brick that are part of demolish rubble can be crushed and used in the same way.
- Brick masonry rubble contains mortar up to 20% by volume.
- Crushed brick & roofing tiles are the bulk of demolition waste which were earlier being dumped in landfills, but now they can be recycled into mortar plaster & building block.

Figure 3 Bricks

❖ **GLASS:-**

- One ton of recycled waste glass corresponding to savings in energy equivalent to 125lit of fuel oil &1.2 tons raw materials.
- Recycling of glass reduces non-biodegradable glass out of landfills.
- Glass can be used as substitute for Quartz & Feldspar in the manufacturing of high strength percolation sanitary ware.
- It can also be used to make mineral wool- an insulation product & in granular form as part of the aggregate in concrete mixes.

Figure 4 Glass

1.2.2. Non–recycled

❖ **CONCRETE:-**

- Concrete is one of the most important construction materials.
- Approximately one ton of concrete is used per capita per year throughout the world.
- Recycling of concrete reduces:-

• Cost of aggregate
• Disposal costs
• Environmental damage
• Consumption of natural resources
• Valuable landfill space

Figure 5 Concrete

❖ **TIMBER:-**

- It is mostly crushed in to chip & used as fuel.
- It can also be utilized to manufacture wood-chip concrete by injecting cement grout into voids of compacted wood-chips in moulds.
- Wood-chip concrete can be used as building material.
- This chip can be sawn & nailed as well.
- In japan alone about 12 million cubic meters of used timber from demolished houses are used.

Figure 6 Timber

❖ **SANITARY WARE:-**

- Sanitary ware includes tiles also.
- There can be reused as it is, if they are not damaged.
- If sanitary ware are chipped or cracked otherwise damaged are advised to crush and use them as construction infill or as filler in concrete.
- Pozzolanic value of such crushed & powdered sanitary ware, is a desirable property in concrete mixes.

Figure 7 Sanitary ware

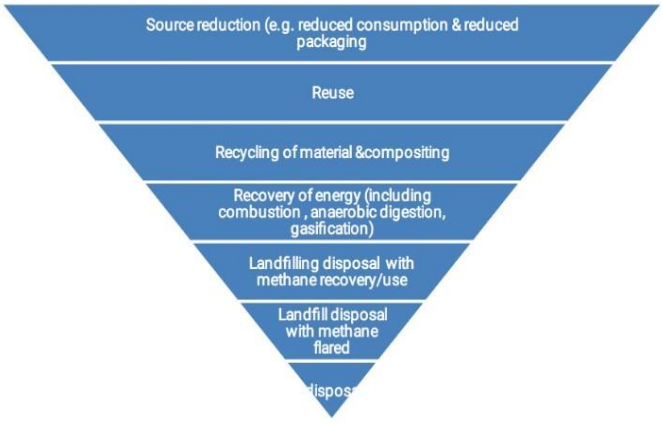
2. Methodology

1. Method of recycling
    a. Chemical mineralogical appraisal
    b. Closed cycle construction
    c. Mechanical sorting
2. Method of collection
3. Reuse
4. Disposing

Examples include:

- Ensuring materials are ordered on an "as needed" basis to prevent over supply to site;
- Purchasing coverings, paneling or other materials in shape, dimensions and form that minimises the creation of excessive scrap waste on site;
- Ensuring correct storage and handling of construction materials to minimise generation of damaged materials/waste *e.g.*, keeping deliveries packaged until they are ready to be used;
- Assigning individual responsibility (through appropriate contractual arrangements) to sub-contractors for the purchase of raw materials and for the management of wastes arising from their activities, thereby ensuring that available resources are not expended in an extravagant manner at the expense of the main contractor.

3. Waste Management Hierarchy



The highest priority and most preferred management option of the City's hierarchy is to minimize the creation of waste (source reduction). Source reduction includes broad actions at the beginning of product lifecycles, such as packaging redesign to reduce waste and consumer education to promote and encourage reduced consumption. Also at the top of the hierarchy is reuse. The next step in the hierarchy is recycling, which returns discarded materials to use in the form of raw materials for the production of new products. Recycling includes composting when the compost product is put to beneficial use. After recycling of materials to the extent feasible is recovery of energy. The last steps in the waste management hierarchy are disposal, with a priority given to

landfill disposal with energy recovery. Disposal is the least preferred management method, because it offers little or no recovery value, but is a necessary part of the hierarchy when considering consumer behavior as well as technical and economic feasibility of recycling options.

4. Selection of Recyclable Processing Facility for City-Collected Recyclables

The contract includes recyclable materials collected or caused to be collected by the City from residential, institutional, public, and small commercial properties through the City's recycling program, including the following targeted materials:

- Residential mixed paper
- Old corrugated cardboard
- Aluminum beverage cans and containers
- Tin, steel and bi-metal containers
- Plastic and beverage containers and packaging
- Aseptic packaging and gable-top cartons,
- Glass food and beverage containers

The business and financial terms of the City's current recyclables processing contract reflect industry challenges in the economics of recyclables processing. In general, the cost of processing has increased due to the increased complexity of sorting technology and the changing composition of source-separated recyclables. In addition, recycling markets remain highly variable, in large part due to macro-economic events.

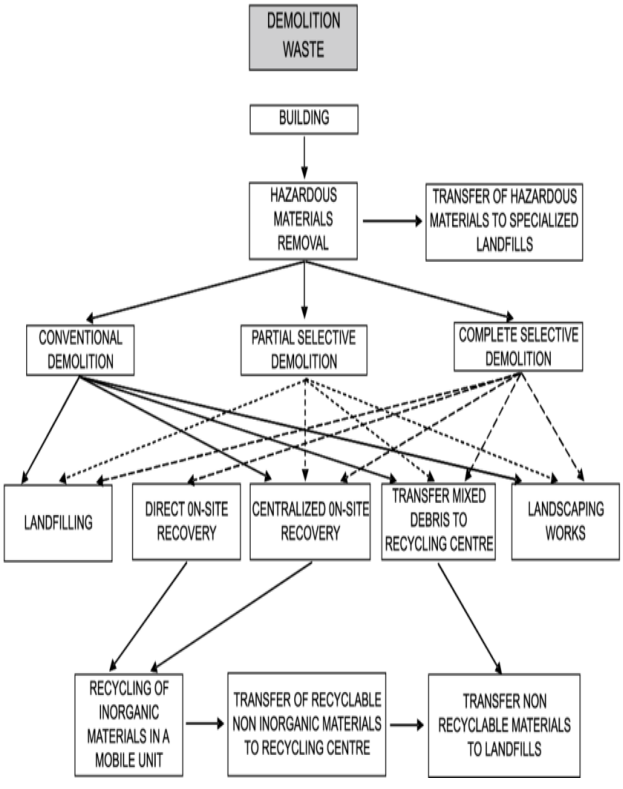


Figure 8 Demolition wastes

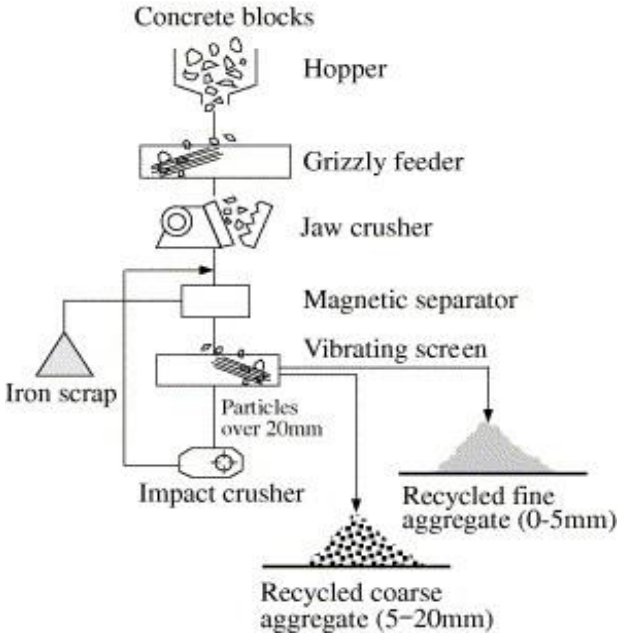


Figure 9 Concrete blocks recycled process

5. Selection of Processing

The City reviewed the proposals and based its selection on criteria that included, but were not limited to the following:

- Superior ability or capacity to meet particular requirements of contract and needs of City Department and those it serves
- Eligibility under Code provisions relating to campaign contributions
- Superior prior experience of Applicant and staff
- Superior quality, efficiency and fitness of proposed solution for City Department
- Superior skill and reputation, including timeliness and demonstrable results
- Special benefit to continuing services of incumbent, such as operational difficulties with transition or needs of population being served
- Benefit of promoting long-term competitive development and allocation of experience to new or small businesses, including those owned by minority or disabled persons or by women
- Lower cost
- Administrative and operational efficiency, requiring less City oversight and administration
- Anticipated long-term effectiveness
- Meets prequalification requirements

6. Waste identification, management & marketing

1) A comprehensive and verifiable record (by weight) of all materials that leave the site, either as trash or recyclables
2) Documentation of where these materials have been sent

3) Information on the costs of hauling and disposing of all wastes and recyclables.

- The Waste Management Plan needs to spell out procedures to collect and manage this information. Four items are critical.

1. Weight slips:

Obtained from haulers or end markets, for each container that leaves the site.

2. Documentation of recycling (or disposal):

Obtained from all end markets (in many cases, weight slips are adequate to provide this documentation).

3. Transportation invoices:

Obtained from haulers or markets (in cases where transportation is provided by the market).

4. Recycling/disposal invoices/receipts:

The Waste Management Plan should specify who is responsible for acquiring and storing this information, where information will be stored (*e.g.*, on site, by the architect, by the contractor), who is responsible for using the information to produce operating and financial reports (including documentation), and how information will be transferred from one party to another. A few waste streams need special consideration.

7. Data collection of waste material

Example :- only one site data collected

- SITE NAME :-SAI MOHAN BUNGALOWS,SURAT.
- NO. OF BUNGALOWS :-6
- NO. OF FLOOR :-G+3
- AREA OF 1 PLOT :-814sq.ft

1. **BRICKS:-**

- NOS. OF BRICS :-2,05,000
- PRICE FOR 1 BRICS :-4.5/-
- TOTAL COST :-9,22,500/-
- TRANSPORTATION COST :-5,000/-
- WASTEGE MATERIAL COST :-46,125/-
- WASTE BRICKS :-5%

2. **CEMENET:-**

- NOS. OF BAGS :-4,000
- PRICE FOR 1 BAGS :-320/-
- TOTAL COST :-12,80,000/-
- TRANSPOTATION COST :-5,000/-

3. **STEEL:-**

- TOTAL COST :-30,00,000/-
- TRASPORTTATION COST :-4,000/-
- WASTAGE MATERIAL COST :-9,000/-
- WASTE STEEL :-3%

4. **SAND:-**

- WEIGHT :-1350 TON.
- PRICE FOR 1 TONS :-800/-
- TOTAL COST :-20,80,000/-
- WASTAGE MATERIAL COST :-62,400/-
- WASTE SAND :-3%

5. **AGGREGATE :-**

- WEIGHT :-545 TONS
- PRICE FOR 1 TONS :-750/-
- TOTAL COST :-4,08,750/-
- TRANSPORTATION COST :-3,000/-
- WASTAGE MATERIAL COST :-8175/-
- WASTE AGGREGATE :-2%

6. **CONCRETE:-**

- WASTAGE MATERIAL COST :-73,963/-
- WASTE :-2%

7. **CERAMICS:-**

- TOTAL COST :-50,45,500/-
- TRANSPORTATION COST :-2,000/--
- WASTE OF TILES :-2%

8. **GLASS:-**

- TOTAL COST :-40,00,000/-
- TRANSPORTATION COST :-4,000/-
- WASTE :-0.2%

9. **WOOD :-**

- TOTAL COST :-30,00,000/-
- TRANSPORTATION COST :-4,000/-
- WASTES :-0.5%

10. **FURNITURE STEEL:-**

- TOTAL COST :-1,05,500/-
- WASTES :-1%

11. **PLASTICS(PVC PIPE LINES & OTHER):-**

- TOTAL COST :-20,00,000/-
- TRANSPORTATION COST :-2,000/-
- WASTES :-0.1%

12. **ELECTRONICS:-**

- TOTAL COST :-30,00,000/-
- TRANSPORTATION COST :-1,000/-
- WASTES :-0.1%

13. **OTHER PLASTICS WASTES**

- WASTAGE MATERIAL COST :-NILL
- WASTES :-10%

- OVER ALL COST :-2,49,34,650/-
- OVERALL WASTAGE COST :-2,,63,718/-
- TOTAL WASTAGE (%) :-1.05%

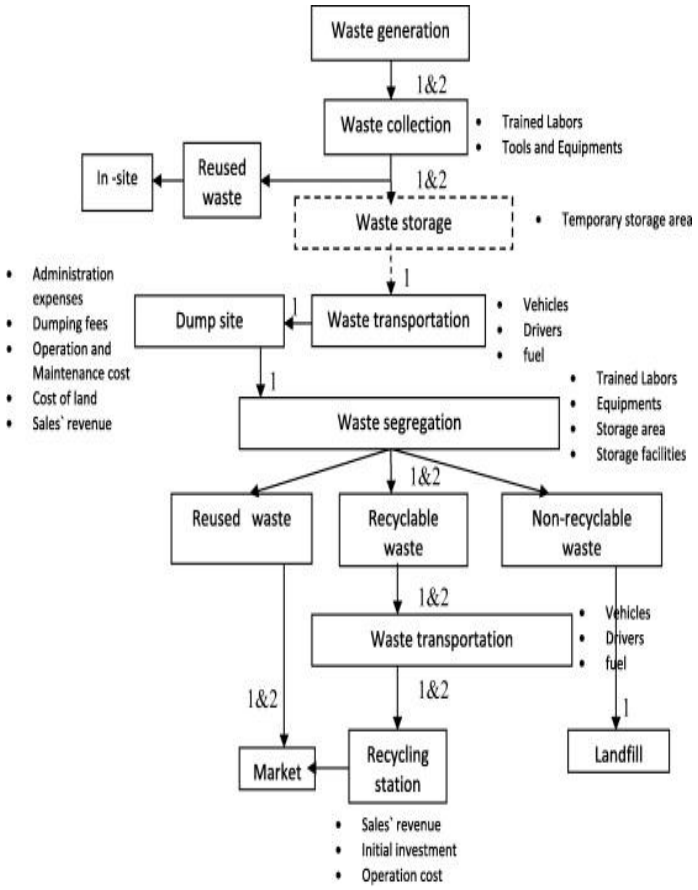


Figure 10 Data collection

8. CONCLUSIONS

- There is no defined manual framed by regulatory authorities for management of C & D Waste. This work is expected to be a pilot study towards preparation of such a manual. It also suggests improved methods of recycling/reuse/disposal of demolition waste and modifications required in regulations in vogue for demolition waste disposal.

- Construction and Demolition Waste (C&D) is characterized by large variation range of composition as well as physical properties.

- Main field of application of C&D: Unbounded systems like fills and embankments.

- Reuse of concrete C&D, as secondary aggregates requires incorporation of liberation techniques into the processing.

- Reuse of masonry C&D in construction requires technologies, which improve quality and homogeneity.

- Experiments show feasibility of masonry C&D as raw material for manufacturing of lightweight granulates.

- Properties of the lightweight granulates are rather constant or at least equal.

- Waste wood can be used for shuttering.

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