

# Sustainable Redevelopment by Reuse and Recycle of C&D Waste in Mumbai

Ar. Ankita Ajit Kadam  
Bharati Vidyapeeth College of Architecture,  
Navi Mumbai, Maharashtra, India

**Abstract:-** Solid waste that is generated due to demolition or alteration, any renovation work, structure repairing work is known as Construction and demolition waste (C&D). This waste is considered low risk waste but found in high volume. This waste can be used as resource for recycling and reusing. Due to increase in C&D waste environmental concerns and public health concerns are also increased. This causes necessity for recycling and reusing of C&D waste. If proper waste materials are managed, cleaned and sieved in industrial crushing plants materials can be reused. In spite of this demolition waste is dumped into dumping grounds of Mumbai. Mumbai Metropolitan Region (MMR) has nine municipal corporations which has area of 4,355sq.km. Under 74<sup>th</sup> Constitutional Amendment, Municipal Corporations in India are mandated to have solid waste management. In MMR all municipal corporations have centralized waste management that is dumped into nearby landfills. There are multiple players including informal sectors who are merging in managing C&D waste to decentralized the process. Due to increase in C&D waste in dumping grounds of Mumbai necessity to develop waste management plan is important. Working towards achieving this will help to reduce hazardous effect on humans and environment. This study highlights the need of reusing and recycling of C&D waste with proper management for sustainable development in city of Mumbai.

**Keywords:-** C&D Waste; Recycling; Management; Sustainable; MMR.

## I. INTRODUCTION

MMR is witnessing rise in C&D waste which is observed by Municipal corporation of Mumbai. Municipal corporation of Greater Mumbai (MCGM) is facing issues in collection of C&D waste, its segregation and waste disposal. Inadequate methods and planning are creating necessity for corporation to adopt different scientific techniques for collection of waste, segregating waste and disposal of it. Nearly 2000 tons debris is generated in Mumbai every day, major part of it is dumped into nearby landfills. Remaining debris is dumped into creeks or nearby roads and railway tracks or in some open places. For The remaining debris is spread next to the roads, in the creeks, next to railway tracks and on open grounds. Due to major development happening in Mumbai and suburbs there are

many redevelopment projects coming up in Mumbai. Redevelopment of structure creates demolition of existing building or some renovations in it which generates C&D waste. That is the reason construction industry is major contributor of C&D waste in Mumbai. Currently Mumbai has two dumping grounds in Mulund and in Deonar which charges Rs. 350 per ton for disposal of waste. Apart from this more 1200 metric ton of waste is dumped in dumping grounds. Due to huge quantity of debris dumped in dumping ground incidences of repetitive fire are seen as method used for clearing the landfills. This fire incidences caused large amount of air pollution recreating hazardous environmental effects and also proving hazardous to human health.

Aim of this study is redeveloping sustainable structure by recycling and reusing demolition waste to minimize waste generation from a particular site which is dumped into dumping grounds of Mumbai. Objective of this study is to understand C&D waste management by understanding the properties of generated waste, techniques of recycling and reusing of waste, disposal of generated waste and ways to minimize hazardous effects on environment and human health. To learn C&D waste management practices by local bodies. To create awareness about need, benefits and scope of C&D waste management among construction industry. Redeveloping structure using its demolition waste and how it can reduce cost of project and delay in project. Solving Solid waste management issues in city of Mumbai. Advantages of developing sustainable structure using recycled and reused materials.

## II. CONSTRUCTION AND DEMOLITION WASTE

### A. C&D Waste:

Construction and demolition (C&D) waste is waste generated by demolition of structure or due to any renovation work of structure in civil sector. Demolition may include breaking of columns, beams, walls, foundations, slabs, door and windows. It may also include roads, runways, services lines, like electric or water supply, sewages, water reservoirs and dams.

### B. Waste Generated during Construction:

#### ➤ Major Materials in C&D Waste:

- Concrete
- Stone rubble

- Bricks
- Steel
- cement
- Timber or wood
- Marble/ Granite
- Glass
- Metals

➤ *Minor Materials in C&D Waste*

- Wiring/ Electric fittings – including copper, aluminum wires, plastic switch boards, wire used for insulation etc.
- Wooden panels, laminates, wooden frames
- Galvanized iron pipes, PVC pipes
- Ceramic tiles, glazed tiles, terracotta flooring
- Aluminum frames and glass

Table 1: Quantity of Generated Waste Materials in Million Tons p.a:

Constituent Materials	Quantity in million Tons p.a.
Gravel/ sand and soil	4.20 tons - 5.14 tons
Brick masonry work	3.60 tons - 4.40 tons
Cement Concrete	2.40 tons - 3.67 tons
Metals (Iron, steel, aluminum)	0.60 tons - 0.73 tons
Timber	0.25 tons - 0.30 tons
Bitumen	0.25 tons - 0.30 tons
Miscellaneous	0.10 tons - 0.15tons

**III. C & D WASTE MANAGEMENT**

Construction and Demolition waste management can be done by using following steps:

➤ *Storage and Segregation of Demolished Waste:*

- Waste generated after demolition of structure can be stored at site of generation.
- To avoid scattering of waste proper screen needs to be provided.
- At site itself segregation of waste can be done and unwanted materials can be removed.
- It is necessary to segregate wastes into materials used for road work, structural material, temporary used materials and material to be completely cleared from site.
- Segregation of materials that can be reused or recycled should be done at site itself.

➤ *Waste Collection and Transportation:*

- For C&D waste that is stored in skips, skips lifters with hydraulic hoist system to be used from removal.
- If tailers are used then for removal tractors can be preferred.
- For large volumes of waste front-end loaders with trucks that are sturdy tipper can be used for minimizing loading -unloading time.

➤ *Recycling of C&D Waste and Reuse of Waste:*

- Stones, bricks, wood, timber, metal, pipes can be reused at site depending on their condition.
- Material that can be recycled includes - metals, plastic, glass etc.
- Building construction activities such as levelling, coating of lanes- materials like brickbats, stone rubble, broken plaster, concrete can be used.
- Sanitary landfills can be covered by dust, sand, plaster powder.
- Processed waste can be used in pavement of roads, creating compact layer of roads etc.

➤ Disposal:

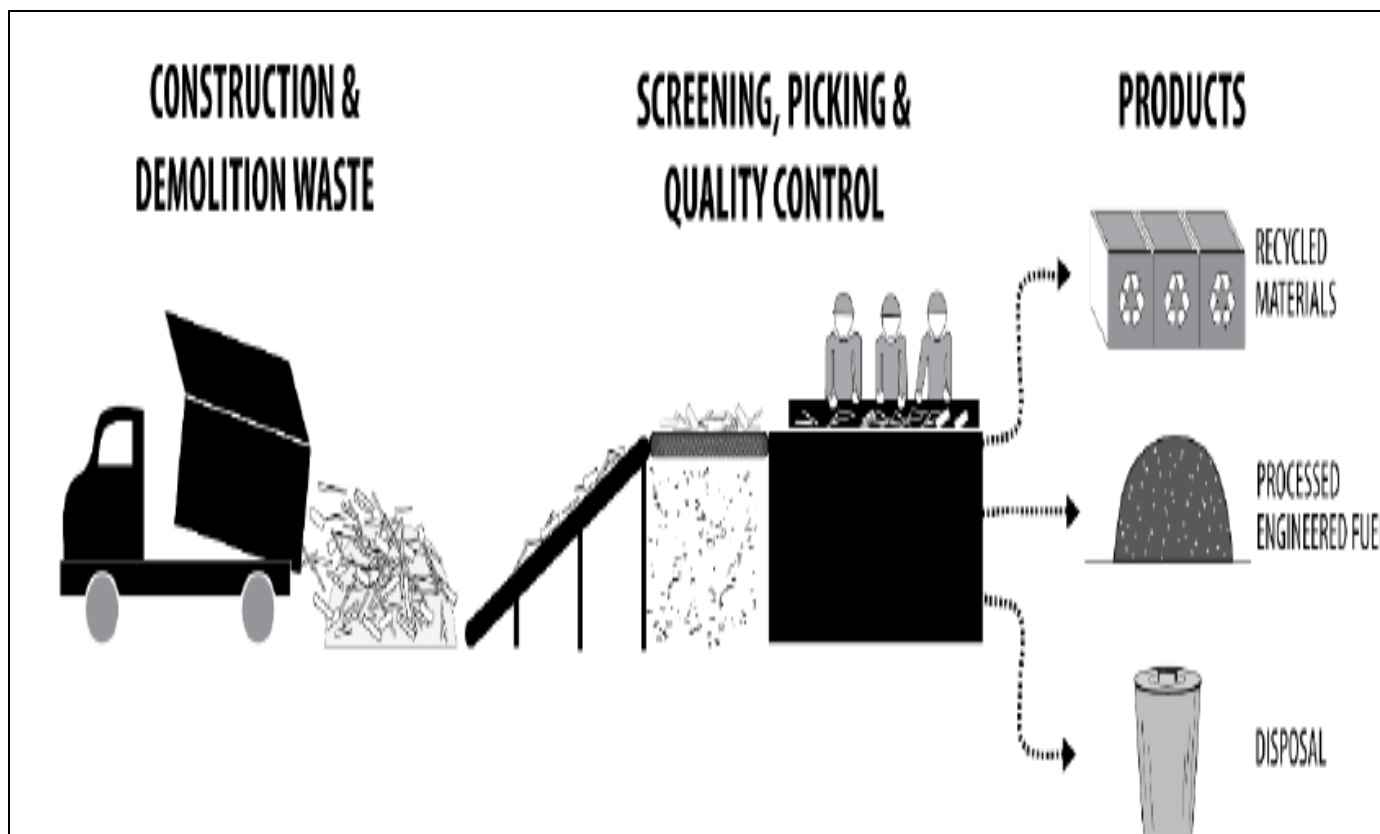



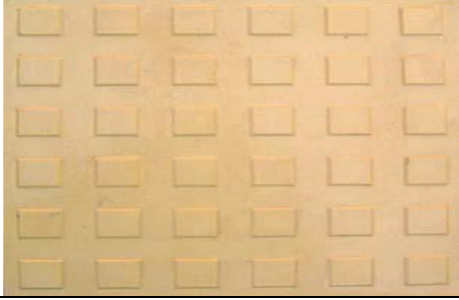






Fig 1: Process of C&D Waste Management

Table 2: C&D Waste Recycled Products& its Applications

Material	Reference Image	Uses/ Applications
Ready-Mix Concrete (RMC)		Used widely in construction for casting of all RCC members.
Recycled Hollow Bricks		Partition wall construction. Compound walls
Recycled paver blocks		Paved area Landscaping Walkways Parking areas

<p>Recycled Tiles</p>		<p>Passages walkways wall tiling landscaping</p>
<p>Material</p>	<p>Reference Image</p>	<p>Uses/ Applications</p>
<p>Kerb stones</p>		<p>Used in subways, drive ways, Parking lots</p>
<p>Granular Sub Base (GSB)</p>		<p>Adding load bearing layer above pavement layer. Support and strength is provided to pavement layer.</p>
<p>Manufactured Sand</p>		<p>Landfilling and construction of structure.</p>
<p>Aggregates</p>		<p>Used in manufacturing of concrete.</p>

➤ *Technique for Waste Management at Demolished Site*

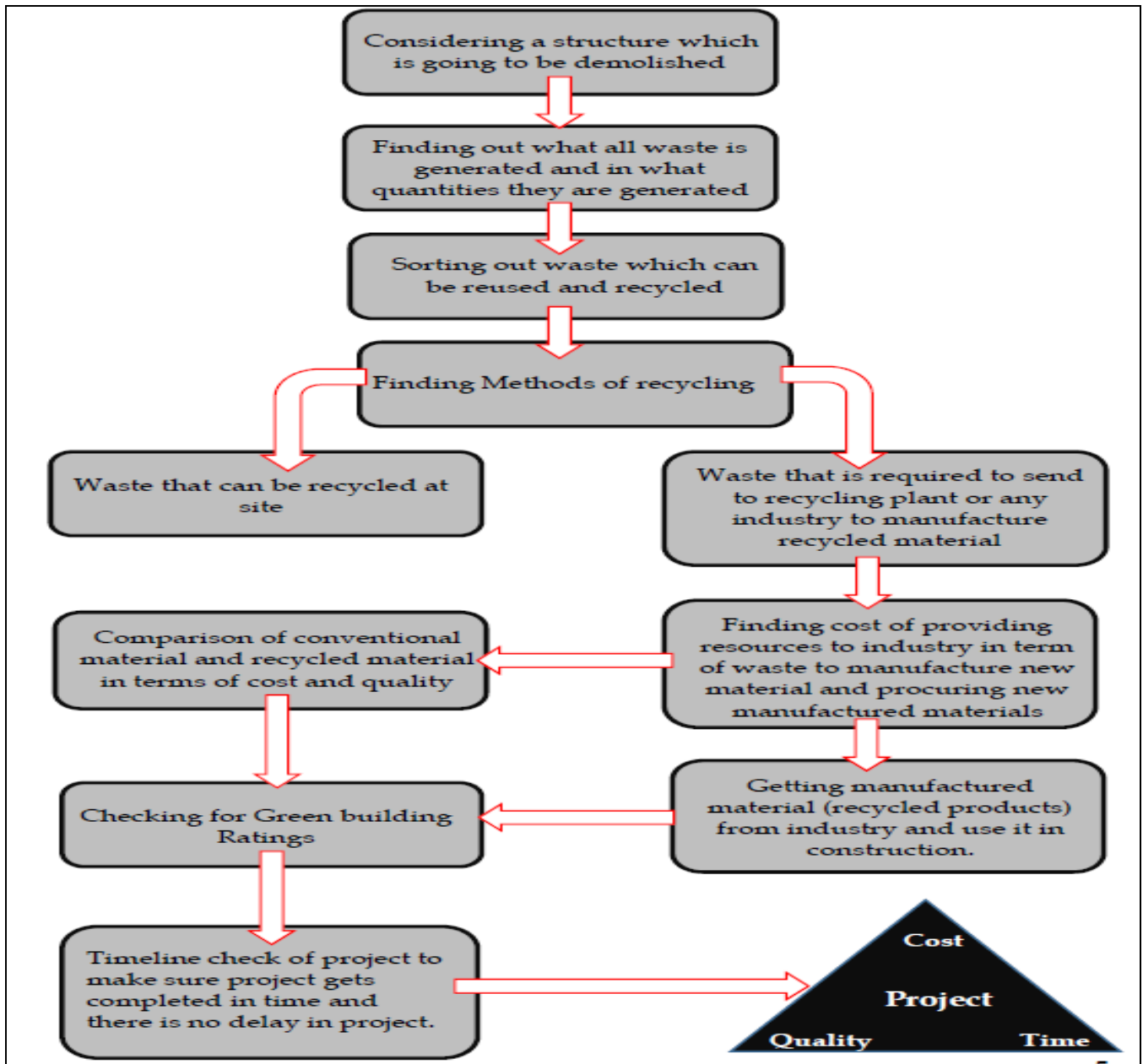


Fig 2: C&D Waste Management Plan

➤ *Methods used for Sustainable Redevelopment:*

- Waste management plan
- Identify target materials
- Adopt green purchasing policies
- Select markets and collectors
- Make decisions on site logistics
- Monitor
- Educate and train
- Document

➤ *Site Data Collection*

- Site location: Mumbai- Bhendi Bazar
- Project: Karimabad housing society redevelopment
- Total Built-up Area =29,172 sq.m (314004.79 sq. ft)

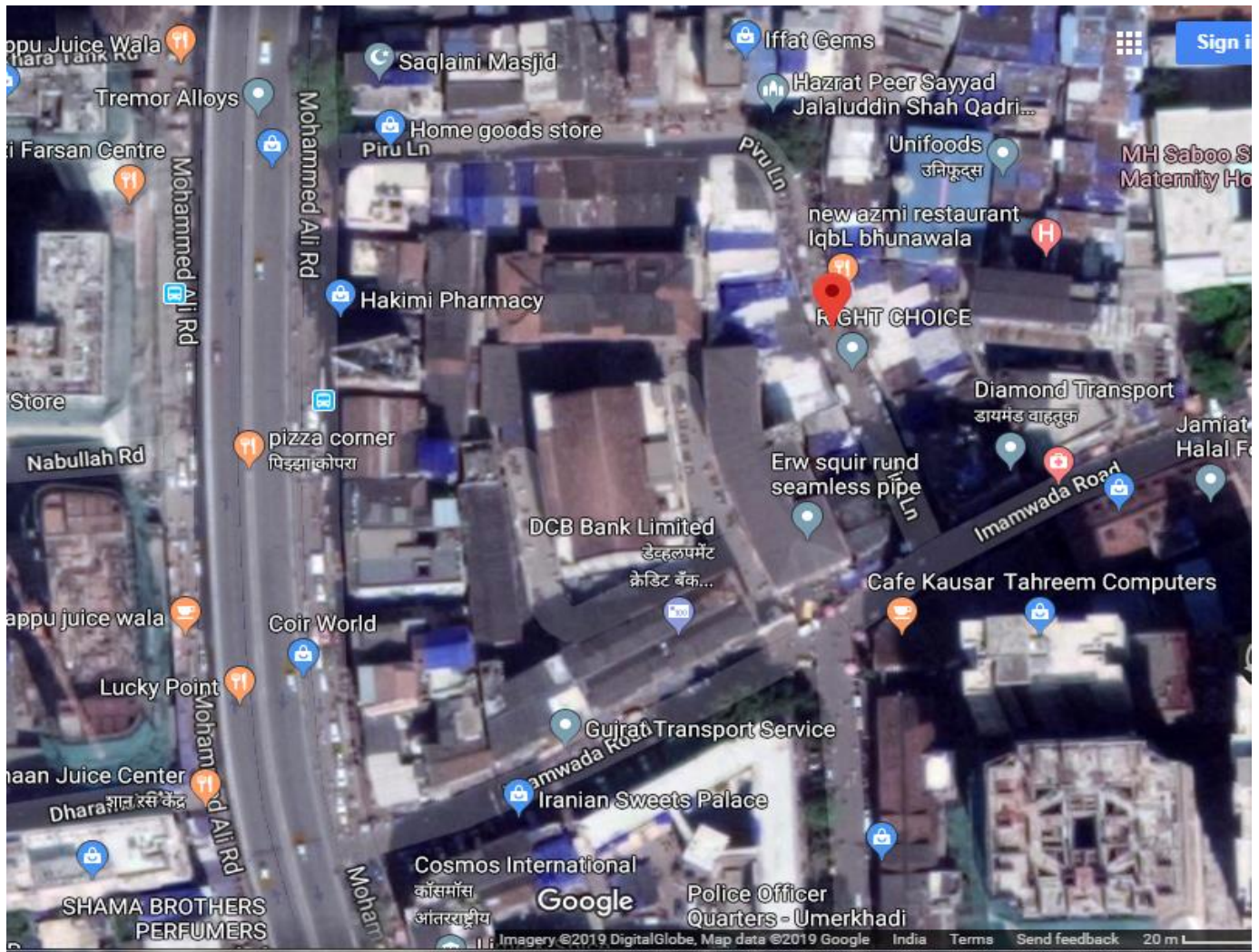


Fig 3: Site Location

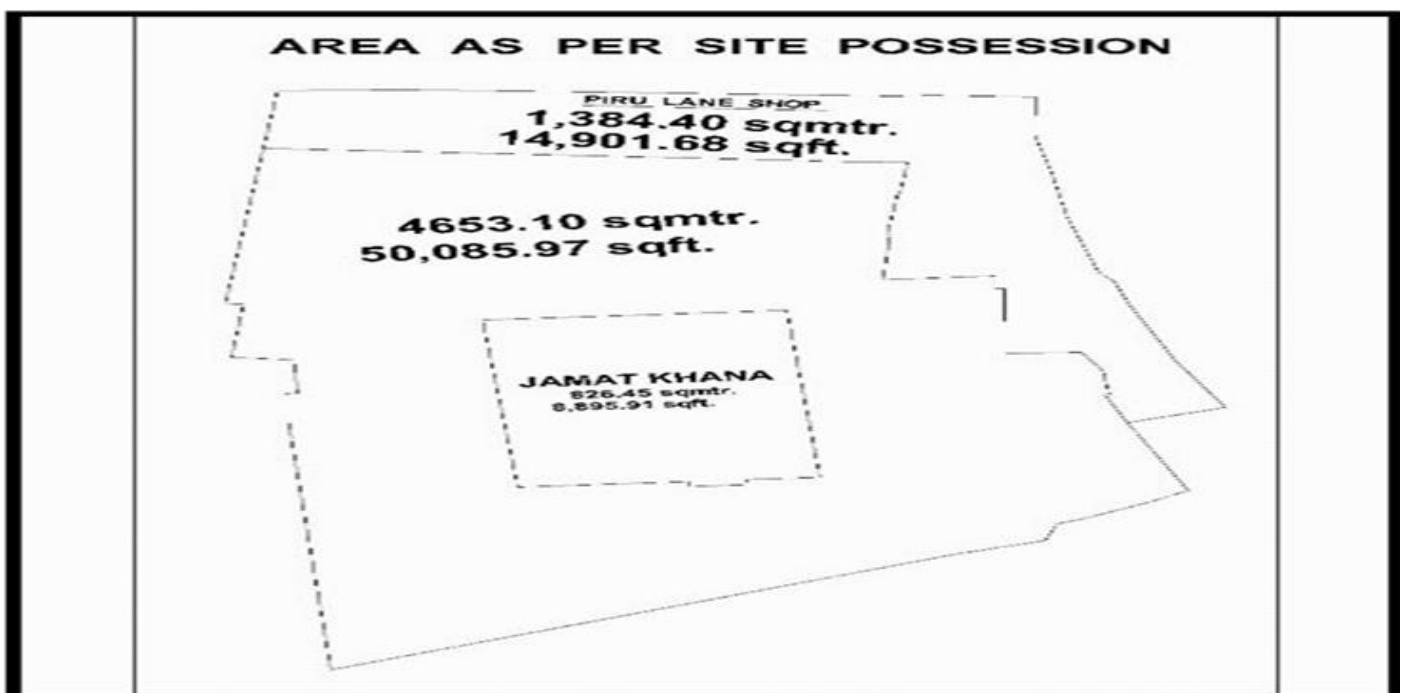


Fig 4: Existing Site layout

➤ *Using Recycled Concrete Block (Godrej Company) Instead of Siporex Blocks for Wall Construction:*

- Built up area = 29,172 sq.m
- Quantity of Concrete blocks required = 4,62,835

Table 3: Wall Material

Conventional material - concrete block (Rate / piece)	Total Amount using conventional material (Quantity x Rate)	Recycled concrete block (Rate / piece)	Total Amount using recycled material (Quantity x Rate)
65	3,00,84,275	50	2,31,41,750
<b>Total Savings = 69,42,525 (23% saving)</b>			

➤ *Using Recycled Brick Instead of Conventional Brick for Sunk Slabs, Parapet Wall.*

- Quantity required = 13,400

Table 4: Sunk slab/Parapet walls

Conventional material - Brick (Rate / piece)	Total Amount using conventional material (Quantity x Rate)	Recycled Brick (Rate / piece)	Total Amount using recycled material (Quantity x Rate)
7	93,800	2.5	33,500
<b>Total Savings = 60,300 (64% saving)</b>			

➤ *Using Recycled Paver Instead of Conventional Paver Blocks*

- Quantity Required = 24,650

Table 5: Paver Blocks

Conventional material – Brick (Rate / piece)	Total Amount using conventional material (Quantity x Rate)	Recycled Brick (Rate / piece)	Total Amount using recycled material (Quantity x Rate)
44	10,84,650	20	4,93,000
<b>Total Savings = 5,91,650 (54% saving)</b>			

#### IV. CONCLUSION

This study provides overview on emerging problems of C&D waste management in MMR. Major redevelopment, renovation, demolition work are seen in Mumbai which has caused increase in solid waste deposited at nearby dumping grounds which is creating health hazards for people of Mumbai. This study aims to switch to alternative material made up of demolished or recycled waste for new construction in MMR region where C&D waste disposal is a major problem.

C&D waste, poor management of site and lacking knowledge for reducing and reusing of materials is major problem of construction sites. This study provides management plan that can be adopted at site for proper site management which will reduce project cost and environmental benefits can also be achieved.

This study also focuses on findings of replacing recycled material with conventionally used construction materials for redevelopment of project in MMR region. The findings from this study shows that project cost can be reduced from 20% - 60% by replacing conventional materials with recycled material.

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