Management Strategy for Indian Housing Development Waste

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Abstract Housing development waste (HDW) comprises both construction and demolition waste. (define) HDW has been on the increase in India because raw materials and energy are consumed by India's housing development business due to the rise in population and the accompanying increase in the need for building/housing. Construction and demolition debris includes building material from debris and rubble from any civil structure being built or remodeled or repaired or torn down. Construction and demolition waste is among the most common types of waste generated in India. The Ministry of Environment, Forest, and Climate Change (MoEF&CC) notified the current India legislation on Waste Management Rules, 2016, on March 29th, 2016, to implement housing development and demolition waste prevention and recycling measures. However, there are insufficient tools to accelerate the development of waste recycling. As a result, it lacks resources that would allow Aggregates and Sand

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Manufacturing from Demolition Waste to grow more quickly and efficiently in the future. This study was conducted to determine the necessity of recycling factories that produce aggregates and sand from demolished concrete from housing development trash. Therefore, providing tools to accelerate the development of waste recycling.

Keywords Aggregates · Construction and demolition waste · Housing development · Recycling

1 Introduction

Housing is a fundamental human right as well as a requirement for earning a livelihood [32]. With India's population expected to reach 1.39 billion people (139 crores) in 2021, according to the most recent estimates from Unique Identification Aadhar India, which were updated in December 2020. Still, in the last 15 years, India has seen a significant increase in urbanization. An estimated 30 individuals move from rural to urban India per minute. In 2011, the urban population of India accounted for 30% of the country's total population [5]. This ratio is predicted to rise to 40% by 2030 when India's urban population would total 630 million people. Because of this rapid urbanization [21], cities and government agencies face challenges in housing development and construction waste management [15, 21]. There is an essential need for everyone to be able to exercise their right to Housing. [34], Housing in cities is currently short by roughly 10 million units, as reported. (M. S. [12] Due to rapid urbanization, construction and demolition operations have increased, resulting in massive amounts of waste. As a result of its significant environmental consequences and the efficiency of the building industry, the development of construction waste is widely regarded as one of the most pressing issues facing the industry. This brings about the development and redevelopment of the building [35].

1.1 What is Consturuction and Demolition (C&D) Waste?

Construction and Demolition waste means any waste generated during construction, demolition or re-modeling of any civil structure, such as buildings, bridges, flyovers, roads, drainage and laying of services etc. or associated activities for infrastructure provision such as, site preparation by way of digging, leveling, laying of pipelines, cables etc. Figure 1 shows construction and demolition waste/Almost 95% of waste of every construction activities can be recycled. Many countries is processing up to 90% recycling of C&D Waste, while other developed countries are trying to improve the processing efficiency. More than 50% waste generated worldwide is C&D that is generated from construction activities. Still people are dumping the C&D waste to low lying areas & MSW land fills and government is trying to educate them & imposing fine for illegal dumping of C&D waste. Figure 2 shows typical methodlogy adopted for demolition of C&D waaste.

Fig. 1 Construction and demolition waste

Fig. 2 Typical disposition methods for C&D Waste

1.2 Justification of Study

While construction and demolition waste may seem like a waste products, they are valuable if used properly. Most of them can be repurposed as recyclable resources after sorting, shredding, and recycling; the materials used to create steel can also substitute sand in masonry and plastering mortars and make paving bricks, lattice bricks, and other building materials [24, 31]. In addition, wood, plastic, even doors and windows can be utilized as fuel for generators and heaters [20]. Despite several trash quantification methods available in the literature, waste generation measurement in India is grossly inadequate. The lack of common construction and demolition waste estimating approach and lack of awareness of construction and demolition waste processing by stakeholders such as generators, collectors, operators, regulators, and the general public can be related to these inadequacies [9]. Therefore, it is necessary to quantify the amount of construction and demolition waste generated and handled 12]. When it comes to tackling dwindling resources and accompanying pollution, recycling has been identified as a targeted strategy that reduces the demand for natural resources [30]. Recycling materials in the construction industry can assist in reducing the need for raw materials, which can lessen resource depletion and other environmental challenges in the long run [36]. It is, therefore, necessary to comprehend the significance and benefits of good management of construction and demolition waste and the difficulties and bottlenecks that must be overcome to develop effective implementation strategies. (Building Material and Technology Promotion Council, 2018).

The importance of increasing volumes of construction and demolition rubbish in urban areas is emphasized, as are substantial differences in origin, quality, and recycling and reuse options. Therefore, they were revised in the rules (Building Material and Technology Promotion Council, 2018). This development reflects a growing understanding of the importance of managing construction and demolition rubbish separately from municipal solid waste, which is reflected in the development. Furthermore, it encourages the use of construction materials and recycled construction and demolition waste items to develop affordable housing units by 2022 to address the country's severe housing crisis. Recycling regulations are in place, but the practice has yet to gain traction. Several factors contribute to this situation, including poor plant capacity and insufficient government oversight [33]. However, the waste generated at various building sites can be transformed into valuable material for general construction by construction and demolition waste recycling plants [31]. The Bureau of India Standard recognizes different construction operations as a suitable substitute for fresh materials. Recycling materials in the construction industry can assist in reducing the demand for raw materials, which can lessen resource depletion and other environmental challenges in the long run. If India had complied with the regulations proposed in 2016, all India's cities would have had this waste collection, transport, and recycling network.

The Swachh Bharat Mission has realized the importance of adequately managing construction and demolition trash in India. Swachh Survekshan 2021 ranking points for construction and demolition waste management have been raised to 100 points, with infrastructure for waste management and processing efficiency shared evenly. Instead of being disposed of in landfills, construction and demolition waste is now being recycled into building materials (recycled aggregate concrete, produced sand, etc.) [37]. This helps conserve natural resources while also reducing the amount of waste generated. In the absence of efficient implementation and enforcement of measures to reduce and regulate construction and demolition waste, the country's environment may be jeopardized. Because of limited landfill space and the increasing amount of demolition trash, mitigate and treat construction and demolition waste. Otherwise, there may be challenges with waste management and the hunt for landfill space in the future. It would create further issues for waste management programs that are also attempting to find innovative approaches to dealing with the expanding urban population and changes in the composition of municipal trash across the world. It is necessary to employ various strategies and technologies for waste reduction to reduce construction and demolition waste, such as design for deconstruction or the reuse of raw materials [27]. [6] stated that the use of recycled building and demolition waste products is technically viable and regulated. There are numerous beneficial application examples; nevertheless, it is still unclear how to effectively engage key stakeholders to maximize this opportunity in construction projects [4]. According to a previous study, the utilization of recycled construction and demolition waste materials in housing development has been met with some reluctance in the past [28]. This underscores the crucial need to assess key stakeholders' needs and encourage the recycling and reuse of construction waste. There are still significant hurdles to employing recovered construction and demolition debris in construction projects.

1.3 Government of India Initiation for C&D Waste

Indian Government introduced **"SWACHH BHARAT ABHIYAAN"** to create awareness for cleanliness & proper disposal of waste.The Swachh Bharat Mission has realized the importance of adequately managing construction and demolition trash in India. Swachh Survekshan 2021 ranking points for construction and demolition waste management have been raised to 100 points, with infrastructure for waste management and processing efficiency shared evenly.

C&D Waste Management Rules, 2016 have already been notified on 29–03-2016 by Ministry of Environment, Forest and Climate Change, Government of India clearly mentioned that all C&D Waste generated should be transported to C&D Waste Recycling Plants only.BIS had also revised the IS specification (IS383) to IS 383:2016 and specified that for lead bearing structures, **up to a maximum of 25% of coarse and fine Recycled Concrete Aggregate (RCA) can be mixed with PCC and up to 20% of course and fine RCA can be mixed with RCC**. For lighter, non load

bearing structure using lean concrete, the entire amount **(100%)** of course and fine aggregate of both RCA and Recycled Aggregate (RA) may be used.

Public Works Department (**PWD**), Govt. of NCT of Delhi has also issued and advisory to **all Delhi Government** department to incorporate a clause in their tenders that mandates 2% to 10% use of recycled C&D waste products in Building and Road works respectively.

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2 Related Works

On August 25, 2020, the non-profit Center for Science and Environment, based in Delhi, released a new report stating that India recycles only one per cent of its construction and demolition trash, which is an alarming figure. Furthermore, unsubstantiated estimates place the country's overall waste creation at a level three to five times greater than the official amount. According to a subsequent study, India only manages to recover and recycle 1 per cent of its construction and demolition waste. As a result, landfills and unattractive blights on our landscape will account for more than half of all waste generated. A construction and demolition waste management plan try to limit the amount of building and demolition debris that ends up in landfills by diverting it away from landfills while the project is in progress. [12], stated that as India's second-largest business, construction had experienced an explosive expansion in recent years. Despite the existence of several policies and guidelines,

improper construction waste management continues. Therefore, it is required that practical construction and demolition waste management is vital when demolition stakeholders are hired [14]. Even though each organization has a particular set of duties in construction projects, it is generally accepted that practical construction and demolition waste management involves the effective engagement and collaboration of the primary and other project stakeholders. [13, 22], stakeholders are critical in garbage management as India's housing development business consumes more raw materials and energy than any other economic activity [15] stated that Construction waste must be appropriately managed to reduce the environmental strain on India's environment and preserve the country's natural resources.

According to a recent assessment announced by the National Institutes of Health. Delhi-based non-profit Center for Science and Environment (CSE) on August 25, 2020, India recycles only 1% of its construction and demolition waste. It also recommends a workable strategy for better managing building and demolition trash in Indian cities. Only 13 cities had recycling facilities set up to recover material from construction and demolition waste by 2020. This is intolerable when demand for primary building resources such as minerals, stone, sand, iron ore, aluminium and lumber is growing unprecedented [18]. In addition to being recyclable and reusable, construction waste can be incorporated back into the construction process to replace organically obtained materials [8]. This needs a circular economy capable of repurposing construction and demolition waste as a helpful resource [1]. Although buildings and infrastructure can use less energy and have a less environmental impact if this is implemented, studies show construction debris like concrete, bricks, and metal was polluting Indian cities' waterways, green spaces, and public spaces[3, 23]. Furthermore, toxic dust particles from the waste were polluting the air when cities were required by the ongoing National Clean Air Program to cut particulate pollution by 20–30% by 2024. Despite removing legal barriers to employing recycled and demolition material in construction, the lamentable situation about construction and demolition trash persists.

According to the Bureau of Indian Standards, recycled concrete and processed construction and demolition waste can be used in place of regular concrete. India, in comparison, has a dismal track record. Before two years ago, municipal solid waste and construction and demolition waste were considered the same thing. As stated in the Municipal Solid Garbage (Management and Handling) Rules, 2000, construction and demolition waste shall be collected and disposed of separately according to State laws. "Only a small number of states had passed legislation at the time! However, in 2016, the Ministry of Environment, Forests and Climate Change separately notified the Construction and Demolition Waste Management Rules 2016. These 2016 Solid Waste Management Rules replaced the previous rules from 2000 recognized. Composting or bio methanation is less successful when construction and demolition waste is included in the mix, and the calorific value and combustibility of Municipal Solid Waste are also reduced [25]. A comparable degradation of recycled construction and demolition trash occurs when Municipal Solid Waste is present in the residue. While contractors and renovators are required to separate construction and demolition garbage, urban municipal governments enforce the Rules. Examples

include rules stating that between 10 and 20% of construction and demolition recycled products shall be used in all government construction projects, regardless of level (aggregates, kerbstones, paver blocks, tiles, and manufactured sand). Despite the National Green Tribunal's and other regulatory organizations' instructions, this hasn't happened. Furthermore, the 2016 Rules and Regulations for Construction and Demolition Waste require the usage of recovered materials.

However, building companies can save 12.3 million tonnes of raw material per year by using recycled materials such as demolition aggregates [19]. The construction sector can save 12.3 million tonnes of raw material annually [17], but we do not pay enough attention to the construction and demolition waste we produce, such as bricks, concrete, stones, hardcore subsoil, topsoil, lumber, glass, gypsum, ceramics, and even plastics. Aside from that, the massive amount of unprocessed Construction and Demolition waste poses significant challenges in some areas, notably in areas with a high concentration of residential, institutional, industrial, and commercial construction [9]. These materials are generated during the construction and demolition process. It's bad for the ecology and public health to ignore this garbage[16]). As reported by the World Resources Institute, practical construction and demolition waste management increased the life span of landfills, decreased the need for raw materials, decreased the costs of projects, created new business opportunities, and demonstrated the environmental commitment of project stakeholders [7]. On the other hand, state that The implementation of construction and demolition waste management has not yet met the expectations of project stakeholders, despite numerous attempts.

3 Proposed Solution

Furthermore, the 2016 Rules and Regulations for Construction and Demolition Waste require the usage of recovered materials. Cities must set up a system for collecting construction and demolition waste, charge for construction and demolition services, and separate waste into five different streams. Ranking points will be provided depending on the amount of waste processed and repurposed as part of the waste processing efficiency requirement. Swachh Bharat Mission and construction and demolition Waste Rules acknowledgement accordingly offered an opportunity. This research has examined the present construction and demolition problem and the technological and regulatory hurdles that stand in the way of putting the Rules into practice. Several techniques have been established to expedite Rule implementation and the acceptance of recycled materials in the market. "Ground-reality assessments in several cities support the findings.

Also the establishment of processing plant an example is the Rise Eleven Construction &Demolition Waste Processing Plant, located at Bakkarwala, Delhi, India that convert construction and demolition waste into RCA (Recycled Concrete Aggregate) −10/20/40 mm, RA (Recycled Aggregates) −10/20/40 mm, Stone Dust, Washed Sand, Plaster Sand, M. Sand, Brick Sub-Base (BSB) −>26<50 mm,

Screened Soil, Interlocking Pavers of various size, shape & color, Chequered Tiles of different design & colored, Tech Tiles, Kerb Stones of various size & shapes, Concrete Bricks & Blocks (Hollow & Solid), Other precast concrete products like –Drain/Manhole and covers, Boundary wall panels etc. the plant used are dry Processing Unit –greater than 60 TPH capacity, wet Processing Unit (Log Washer & Sand WashingPlant),Automatic Batching Plant for Ready Mix Concrete, Manufacturing unit for precast concrete products, Fully equipped Laboratory with all required equipment for testing of concrete and its constituent materials,

3.1 Infrastructure Required to Setup Plants for Production of Recycled Materials and Ready Mix Concrete (Dry Processing Unit –Greater than 60 TPH Capacity)

Following are the steps for setting up plant based on construction demolition waste.

- Wet Processing Unit (Log Washer & Sand Washing Plant)
- Automatic Batching Plant for Ready Mix Concrete
- Manufacturing unit for precast concrete products
- Fully equipped Laboratory with all required equipment for testing of concrete and its constituent materials
- Fleet of Excavators, Dumpers, Transit Mixers & Concrete Pumps

Photographs of integrated plant of Rise Eleven Delhi Waste Management Co., New Delhi, India are shown in the subequent figures (Figs. 3, 4, 5 and 6).

Fig. 3 Front view of Water Conservation – Acqua cycle thicner

Fig. 4 Photograph of wet procession unit at New Delhi, India

Fig. 5 M Sand Production Unit, New Delhi, India-

Fig. 6 Photograph showing Ready Mixed Concrete Unit

Table 1 Products offered by C&D plants

Recycled materials	Readymix concrete
• RCA (Recycled concrete aggregate) −10/20 /40 mm	• Concrete of all grades as per IS
• RA (Recycled aggregates) − 10/20/40 mm	• Fiber-reinforced concrete (FRC)
• Stone dust	• High-volume fly ash concrete (HVFAC)
• Washed sand	• Self -compacting concrete (SCC)
• Plaster sand	• Light weight concrete (LWC)
• M. sand	• Temperature-controlled concrete (TCC)
• Brick sub-base (BSB) −>26 <50 mm	• Stamped concrete
• Screened soil	
• M Sand –super	

Table 1 provides a list of products which C&D plant can produce.

4 Conclusion

A sizable percentage of the construction industry supports the redevelopment of Housing. Rather than new construction, rehabilitation, or maintenance, demolition of an old building or structure generates the most trash in the construction industry. Construction and demolition waste is generated during the construction, demolition, or remodelling of any civil structure, such as buildings, bridges, flyovers, roads, drainage, and service infrastructure. By way of a brief discussion and a review of the literature, this paper analyses the current condition of waste management in the construction and demolition industries, the types of stakeholders involved, the factors influencing the recycling and reuse of recycled construction and demolition waste products, and the factors influencing stakeholders' decisions to use recycled construction and demolition waste products. As well as providing comments on how stakeholders' viewpoints, actions, and behaviour influence the use of recycled construction and demolition waste products, the paper also emphasizes growing enablers and the significance of recycled construction and demolition waste products. also contributing to the body of knowledge is the study's provision of insights into the current situation, which many stakeholders believe influences the need for recycled construction and demolition waste products, and it serves as a reference point for policymakers who wish to examine this strategy in the context of policy reform.

There are several benefits which are due to the installation of plant based on construction and demolition waste such as cost saving, job creation for local community and social responsiblity to stop pollution, saving of landfill spaace, energy and greenhouse effect, availability of building material products nearby to the project site.

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