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An Assessment of Construction and Demolition Waste Management in India

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Abstract:
By its very nature, construction is not a sustainable endeavour. At now, the Indian construction industry is expanding at a yearly pace of 10%. In 2012, very strong growth rates of up to 14% are anticipated in the housing sector. A growing trend indicates that construction represents around 65% of infrastructure spending. India is expected to finish building 20 million square meters of office space by 2013. India's metropolitan areas will provide half of the demand. Redevelopment projects are on the rise due to the limited amount of available land and the growing demand for developed spaces. The Indian construction industry is concerned about the handling of trash from construction and demolition (C&D). About one-third of the waste generated is C&D waste. India's fast urbanization and infrastructural development present major issues for the management of construction and demolition (C&D) waste. This study evaluates the state of C&D waste management in India today, emphasizing significant issues, gaps in the legislation, and possible fixes. The study conducts a thorough literature review, data analysis, and case studies to identify areas for improvement and provide ideas for improving sustainable waste management techniques. Environmental problems such as resource depletion, a lack of landfills, and illegal dumping on hill slopes are visible in metro areas, and unlawful building and demolition trash dumping into waterways has caused flood levels to rise, pollution, land wastage etc.

Keywords: construction and demolition waste, waste management, recycled concrete aggregate (RCA), Recycled fine aggregate (RFA), Technology Information Forecasting and Assessment Council (TIFAC).

2. Literature Review:

The literature has described a number of C&D waste quantification techniques, based on the kind of waste producing activity and the level of estimation. At the regional and project levels, the

area-based waste generation rate computation approach is the most often utilized methodology for estimating construction and demolition (C&D) waste. This approach measures the weight and amount of garbage produced per unit area during building, remodelling, or destruction (kg m−2, tonne m−2, m3 m−2).

The population growth, the expansion of the IT sector, the acceleration of industrialization, and the introduction of new infrastructure projects have all contributed to the construction industry's extremely rapid growth in recent decades. Because of this, there is a high demand for building materials in the construction industry (**Neha et al., 2022).** India's infrastructure and industrial expansion are closely related to the construction sector. Building roads, bridges, and other built infrastructure is crucial to determining the destiny of a nation. As a result, the construction industry generates a large amount of waste that is bad for the environment, expensive for project budgets, and affects the project's expected cost **(Meckwan and Patel ,2016).**The strength of mixes made using recycled material is 10 to 15 percent less than that of concrete made with natural aggregate. In contrast to the global average of 5.5% each year, it has been increasing at a pace of 10% annually over the last ten years and is already 10% of the GDP. In India, almost 70% of the building stock has not yet been constructed. By 2030, the built-up area is projected to increase by about five times, from 21 billion square feet in 2005 to roughly 104 billion square feet.

The manufacturing of concrete in this study involved the use of recycled coarse aggregates that came from crushed concrete. The amount of recycled coarse aggregate used in the four distinct recycled aggregate concretes that were created was 0%, 25%, 50%, and 100%, respectively **Elshaboury et al. (2021)**

To assure the same compressive strengths, the mix proportions of the four concretes were calculated. To regulate the qualities of fresh concrete, lower strength variability, and an effective weight-to-cement ratio, recycled aggregates were used in a wet but not saturated condition. Given the required volume of cement, it was confirmed that recycled aggregate concrete with a moderate to medium compressive strength was required. The effect of adding recycled aggregate to concrete during the manufacturing process on the splitting tensile strength of the finished product was examined.

Components of C & D waste	TIFAC (%)	MCD Survey (%)	Survey IL & FS (%)
soil/sand, Gravel	36.0	43.0	31.5
Bitumen	2.0	-	-
Metals	5.0	-	0.4
Concrete	23.0	35.0	-
Wood	2.0	2.0	1.5
Others	1.0	1.0	7.6

Finding an efficient method to reduce waste and prevent pollution while making the greatest use of the dwindling natural resources presents a difficult challenge for many project practitioners.

Nevertheless, because the majority of these initiatives are concentrated on planning and/or design methods, they fall short of fully addressing the environmental concerns related to the degree of building execution. In addition, there are no management-level guidelines or quantitative measurement systems. In order to get over these restrictions, this study suggests a novel methodology that helps project managers evaluate a project's performance level with regard to waste management practices. The methodology for this investigation is twofold. The first is determining the elements that have a significant impact on waste management and help reduce trash and increase recyclable resources.

According to **Rathore et al. (2016)** attitude is the assessment, whether favourable or unfavourable, of a person's behaviour. According to **Jain et al. (2020)**, the construction personnel have a more favourable attitude about the recycling of C&D trash. They found that contractors showed favourable sentiments toward putting C&D waste management into practice in a similar way. Project managers typically have a good attitude about cutting down on construction waste.

3. Methodology:

In order to combine quantitative analysis of C&D waste statistics with qualitative evaluations of stakeholder viewpoints and policy efficacy, this research uses a mixed-methods methodology. Surveys, industry expert interviews, and case studies of C&D waste management initiatives are some of the techniques used to collect data.

The subject matter experts (SME) provide expert judgments that are utilized to evaluate the content validity of the variables collected from earlier literatures. The heterogeneous sampling technique (HSA) is used to choose the SME. To achieve the varied qualities of expert interviews, the HSA is employed. When asked about the variables employed and their applicability in the study, the SME is given the choice to respond "yes" or "no." Fifteen SME in total—five academics, five structural engineers, and five site managers. They are chosen based on (i) their familiarity with CWM. (ii) Putting CWM into practice (iv) companies with a service life of more than ten years; (iii) responders with an experience of more than five years.

This results in a questionnaire that is structured into two parts. The initial segment covers the fundamental demographics of the participants, while the subsequent piece comprises the main investigation of 21 variables (closed-ended questions based on a five-point Likert scale spanning from "1 strongly disagree" to "5 strongly agree"). Because the 5-point scale is more generally used and user-friendly than the 7-point scale, it is chosen **(Jain et al., 2020)**. The data was gathered using both online and offline modes.

CONCLUSIONS

There is very little emphasis on behavioural components of adopting CWM in the government of India's current projects. Thus, an analysis of the numerous behavioral and attitudinal elements related to CWM implementation in India is attempted in this paper. A comprehensive image of the connected elements for the non-implementation of CWM in Indian construction projects is provided by the article's major contribution, which is the application of psychological theories, namely the notion of theory of planned behaviour (ATT, SN, and PBC) and institutional theory (KN and PU). Perceived utility and expertise, as partially mediating factors, explain the intricate and dynamic decision-making process behind WM deployment in competing situations.

After processing of C&D waste ,nearly 45% of total mass of waste is generated as soil in slurry form, aggregates are nearly 38% of total mass, medium sand are about 15% and refused dried fuel and other wastes like paper plastics, metals etc. are approximately 2% in actual most of refused dried fuel contains plastics, papers, clothes, fabrics, thermocol, etc. and in other parts some

metals and other materials also present but that are separated manually or mechanically before processing of waste . Above mentioned data is a observed data at various C&D plants so it may vary at different location and different cities due to various type of construction and on the basis of age of cities.In public sectors wastes are generated in government's development works.it is major waste generator part due to development of infrastructure like roads, canals, highways, flyover, railways track, etc. In India during 2016 and onwards infrastructure development is in its highest phase due to large investment and promotions of make in India .so large quantity of wastes are also generated. In the public sectors C&D waste different types of wastes like bituminous concrete, soils, iron and steel bars, high strength concrete are generated at large scales so it is largest source of C&D waste.Residential sectors are the sectors from where wastes are generated on individual basis and also in small quantity but accumulatively it is 3rd largest waste generators field in India. waste of residential waste is a location specific, because it depends on location example-if a city is old, then most of waste are generated from demolition and in demolition wastes, type of waste composition is different due to way of construction are different of previous generation. Before 2000most houses are constructed on the basis of heavy walls that is load bearing structures but in now days most structure is either combined or framed .so different types of waste are generated from old and new cities. In new cities mostly wastes are generated from construction itself.

As the report discusses, there are now gaps in the legislative and regulatory framework. It will be evident even as these frameworks are strengthened that legal and regulatory measures by themselves are unable to address environmental problems. The following tactics are recommended for efficient C&D waste management:

1. Comprehensive legislation that includes required measures, waste reduction methods, and waste management plans must be developed.
2. Local governments are responsible for developing infrastructure, such as recycling facilities. Development plans should designate the locations of these facilities and land filling sites. Pune's abandoned stone quarries can be used again by designating them for the land filling of construction and demolition debris.
3. Plans must be evaluated in terms of design for adaptation and deconstruction (DFAD) in order to obtain building permits.
4. In addition to manufacturing equipment and machinery for recycled materials, proactive roles should be focused on supporting the development of reusable, recyclable, and recycled content construction materials. By implementing effective marketing methods, the Ecomark scheme can contemplate marking all building components.
5. Owners of buildings that use construction methods and materials with recyclable, reuse, and recycled content will get financial incentives from builders and developers. The amount of garbage generated will determine the charges that will be imposed when disposing of C and D waste at the specified landfill sites.

FUTURE SCOPE

There is some future scope of this study which is regarding data accuracy due to very diverse population and community, diverse form of living styles and living standards have to be seen in India so in every city different types of wastes are generated so there is little inaccuracy in study may be seen. This is study is near to qualitative assessment not near to quantitative assessment but author had tried as possible at his best level for quantitative assessment also.

There are some limitations for the current system to which solutions can be provided as a future development: The collection & transportation of C&D waste is not integrated with departments. The websites for the waste management is not accessible to everyone for disposal of C&D Waste at sites. It can be deployed on a web server so that everybody who is connected to the internet can use the application.

Segregation of C&D Waste is the big issue at all plants. Required segregation system at domestic level. Due to different type of wastes machines gets stocks during processing of C&D Waste. As India is the 2nd largest populated country, so it is normal to have a large quantity of waste and management of that much quantity of waste is very difficult.

There is a big gap for the sale of recycling products in market. Awareness is required for the use of recycling products. Due to huge amount of Delhi C&D Waste, plant working capacity goes down sometime. There are not enough plants for the processing of C&D Waste at many cities and which effect on environment.

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