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RECYCLING OF CONSTRUCTION & DEMOLITION WASTE

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Abstract:

Buildings are a necessary component of development in every area of economic expansion, and they use resources both during construction and operation throughout the course of their lifetime. Buildings need a lot of resources during their design, construction, operation, upkeep, and finally disposal. The fact that construction represents a sizable portion of each development project allows us to estimate the quantity of resources used and waste produced.
In each of the country's five-year plans, the construction sector in India has contributed almost half of the total capital expenditure, and the trend in anticipated investment is still upward. C&D (construction and demolition) trash accounts for 25% of the 48 million tons of solid garbage produced yearly in India. Despite this, very little recycled material is used in construction. This is largely due to a number of reasons, including a lack of awareness on the part of designers and engineers, a lack of awareness campaigns and appreciation of using recycled materials, an unorganized market for recycled construction materials, a lack of an adequate solid waste management system in urban areas, a lack of tax incentives, and a lack of effective legislation on the use of recycled materials. It is past time to address the aforementioned difficulties with the usage of recycled materials in building in our nation in order to achieve economy in construction while also lessening the impact on natural resources, leading to a cleaner environment.

Keywords: sustainable, vast amounts of garbage, contaminate the air and water, use a lot of energy, water, and building materials

Introduction:

There is an urgent need for "building of Roads, Railways, Airports, and Power plants" in India, which has a population of over one billion people and an economic growth rate of more than 8%. A sizable portion of India's middle class, which is both vast and expanding, needs new homes. The consumption and waste production caused by people moving from rural to urban areas has put a significant strain on natural resources in order to supply the growing demand for goods and services as well as food, water, and energy.The Government of India has given the energy sector high priority due to the current conditions

of rapid urbanization, where "the dependence on energy is expected to increase further to achieve the targeted Gross Domestic Product (GDP) growth rate of 8% during the Tenth Five-year Plan." India is concerned about the strain that the growing population and increased energy demand in various economic sectors are putting on the country. Energy demand is projected to increase by 5.2% during the tenth five-year plan, with a target GDP growth rate of 8%.Buildings are a crucial component of development in every area of economic expansion. Buildings use resources not just for their initial construction but also for ongoing maintenance. Our health and the environment are impacted in a variety of ways, whether directly or indirectly, by the structures that house our homes, offices, places of amusement, and many other activities. Buildings create a lot of trash, use a lot of energy, water, and materials throughout their design, construction, operation, maintenance, and removal. They also contaminate the air and water.The fact that construction accounts for around 50% to 95% of each development project allows us to estimate the quantity of resources used and trash produced. In India, the construction sector accounts for almost 10% of GDP and is expanding at a pace of 9.2% yearly, which is faster than the 5.5% average for the world. Although cities play a significant role in the economic development of our nation, patterns of expansive land consumption are also a major contributor to environmental degradation trends including climate change, global warming, and biodiversity loss.Buildings are now India's third-largest energy user, and their energy consumption is rising at a rate of over 9%, well above the country's overall energy growth rate of 4.3%. As a result of energy shortages of over 11.3% during peak demand and a 7% supply shortfall, rolling blackouts and power outages, which are frequent in the majority of our nation's cities and towns, have already started to put pressure on the power industry. (CEA 2006)". Contrary to popular belief, buildings really use between 30 and 40 percent of the energy generated, thanks to things like HVAC systems, lighting, and transportation. Another crucial consideration is the excessive energy consumption in our nation.Uncertain climate changes, an ever-widening energy supply-demand imbalance, a lack of resources, and greenhouse gas (GHG) emissions are only a few of the negative consequences that building activity has so far had, and if prompt action is not done, the situation is certain to get worse. As previously said, the building industry in our nation is experiencing a significant boom that will last for another 20 years. The current economic growth rate has made significant infrastructure building necessary.Over 12 million residences, 600 malls, 80 million square feet of office space, 200 townships, airports, hotels, hospitals, and schools are all expected to be built by 2010 in response to this rising demand for real estate. Furthermore, it is predicted that "up to the year 2030, the commercial sector would develop at a compound annual rate of 7%. India currently only has 200 million square metres of installed base, and by 2030, 869 million square metres more space is anticipated to be built. Alternatively, 70% of the commercial buildings are yet to be constructed.Therefore, the growing urbanization rate and rising building activity will inevitably have an impact on energy output. The data cited above clearly show that there is a sizable demand for green buildings in India. India has become one of the top locations worldwide for green buildings, given the volume of development activities (projected) during the next two decades.This is opening up a wide range of opportunities in urban planning, architecture and engineering design, building services, building materials and

equipment manufacture". Besides this, the cheap availability of labor from highly unorganized labor sector is attracting people to construction Industry in India.[1]

Definition:

Waste is any material created by industrial or human activity that is no longer needed. C&D causes significant amounts of solid waste to be left behind, including concrete, wood, bricks, gravel, soil, iron, and glass. In addition to disasters, which may often be significantly more destructive, demolition can also create this trash. When a disaster happens, especially in highly populated places, massive amounts of building and other types of debris are suddenly formed, needing quick treatment.

Components of Green Buildings:

Green buildings are a suitable response to the need for space to carry out diverse activities since human efficiency is closely tied to the environment he lives or works in. The goal of green buildings is to decrease the built environment's overall negative effects on human health and the environment by:

- Site planning utilizing the most appropriate orientation for a particular site
- A design for the building envelope that uses less energy for air conditioning (HVAC, Lighting etc.)
- Using renewable energy sources in conjunction with on-site energy production.
- Eco-friendly building materials and requirements.
- Techniques for sustainable construction.
- Promoting worker productivity and safeguarding occupant health
- Efficient water and waste management, reduction of waste, pollution, and environmental degradation, and efficient use of other resources.

Recycled building materials from construction and demolition waste are the best choice rather than choosing new materials because the overall material/product selection criteria for the construction of Green Buildings include Resource efficiency, Indoor air quality, Energy efficiency, Water conservation, and Affordability. Reusing construction waste in new building will lessen the load on already-dwindling natural resources and reduce the need for incineration and other ways of trash disposal, hence lowering environmental pollution, which is endemic to most Indian towns. Currently, 22% of CO2 emissions come from the building industry.At 2500 X 106 GJ annually, or about 150 X 106t of coal equivalent, the consumption for the production of building materials is expected to increase to 5000 X 106GJ by 2020. [2]The retention of embodied energy is the main benefit of employing recycled materials in building. The energy required to recycle construction and demolition waste is much less than the energy required to create the same material from scratch. For instance, recycling aluminum uses between 15 and 25 percent of the energy needed to convert raw ore into finished goods.The majority of construction materials, including wood, glass, metal, plastic, and brick, can be recycled. Additionally, there are many opportunities for employment for both skilled and unskilled workers because the recycling of construction waste into new construction or for the production of

new construction materials using construction waste as a raw material requires labor. The graph below shows how cost-effective it is to use materials salvaged from construction waste instead of new materials for construction.The reuse of building materials commonly saves about 95% of embodied energy which would otherwise be wasted. Some materials such as bricks and tiles suffer damage losses up to 30% in reuse. The savings by recycling of materials for reprocessing varies considerably with savings up to 95% for aluminum but only 20% for glass. Some reprocessing may use more energy, particularly if long transport distances are involved".

Management of Construction and Demolition waste Materials:

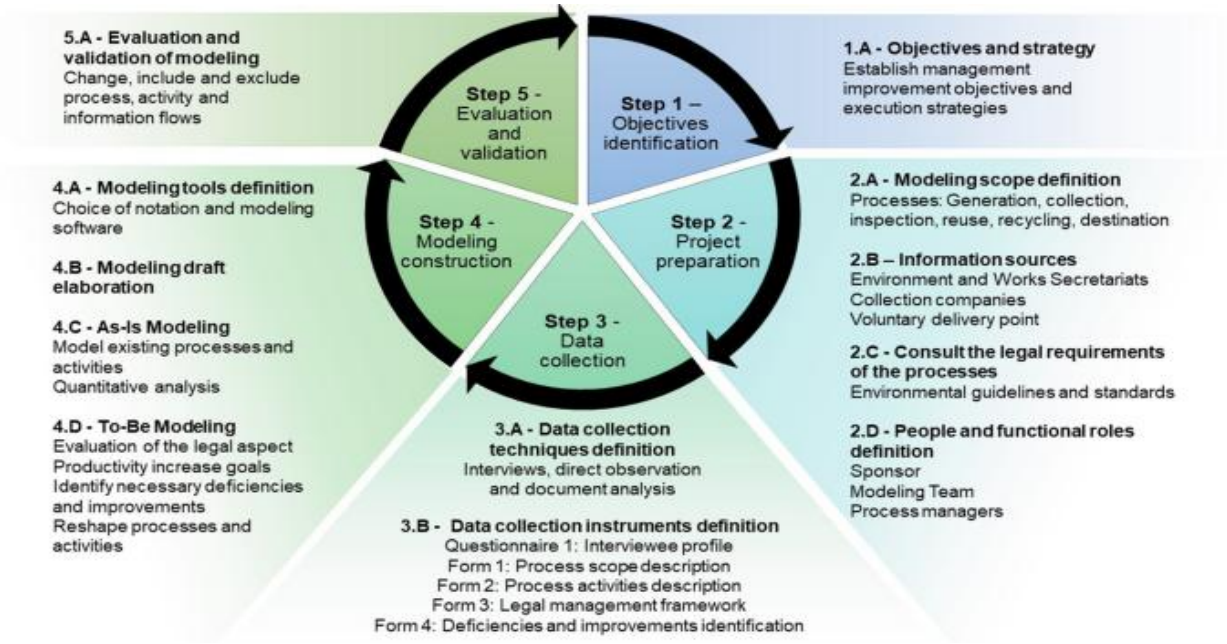


Figure 1 Management of Construction and Demolition waste Materials
Source- https://link.springer.com/journal/10163

Management of Construction and Demolition waste Materials:

C&D garbage accounts for 25% of the 48 million tonnes of solid waste produced yearly in India. Waste production during construction is anticipated to range from 40 kilogramme per m2 to 60 kg per m2. Similar estimates place the trash produced during restoration and repair projects between 40 and 50 kilogramme per square meter [1]. Building demolition is responsible for the majority of garbage production. The average amount of waste produced during the demolition of pucca (permanent) and semi-pucca structures is 300 kg per m2 and 500 kg per m2, respectively.The recycling of construction waste in India is generally done in a very haphazard way, with some building materials like bricks, tiles, wood, metal, etc. that are easier to handle being reused and recycled while materials like concrete and masonry, whose removal and final disposal require a lot of labor, are not properly recycled and reused in India. Fine dust-like material from C&D waste is currently wasted because it is not being used.[1]

Management of Construction waste in India:

In India, building waste management is not as well-organized as it is in the west. The already overburdened Municipal Solid Waste Management (MSWM) systems in Indian cities are coming under significant pressure from the rapid acceleration of urbanization and the sharp rise in construction activity. Due to a lack of adequate institutional, financial, and human resources for collection, transportation, processing, and disposal, this issue is growing to enormous proportions.In order to remove construction waste (items like concrete, bricks, and other similar items) from the site, the owner or demolition contractor provides these waste materials either free of charge or at throwaway prices to be dumped in low lying sites with little consideration for environmental pollution. The majority of building debris is dumped in landfills, which pollutes the soil and water. There are very few locations for the storage of construction and demolition waste in most Indian cities, despite the increase in construction activity.[3]However, there is still a lax attitude when it comes to the segregation, storage, recycling, and disposal of C & D waste, despite the fact that the Municipal Solid Waste (Management and Handling) Rules, 2000, clearly state that it will be the responsibility of waste generators to avoid littering and ensure delivery of wastes in accordance with the collection and segregation system of the concerned municipal authority. By notifying the "Maharashtra Non-Biodegradable Solid Waste (Proper Scientific Collection, Sorting and Disposal in Areas of the Municipal Corporation) Rules, 2006," Maharashtra has made history.whereby the action plan includes recycling this garbage. The Action Plan, among other things, calls for the separate collection and disposal of bulk garbage and debris. According to the supervising engineer of the Municipal Corporation of Gurgaon, IL & FS Waste Management and Urban Services Ltd (IWMUSL) established the first construction and demolition (C & D) and electronic waste management facility plant, which has been operating effectively for almost a year. The C & D Waste is used to create practical items including pavement blocks, curbstones, textiles, granular sub base, and RMC.The proper management of C&D waste is crucial to the development of Gurgaon as a world-class metropolis. Sanitary landfill (SLF) facility at Narela-Bawana Road, Delhi's first scientific landfill, opened for business in 2011 and has a daily capacity of 1200 metric tonnes of garbage. It will relieve pressure on existing landfill sites that are already overburdened. A materials recovery facility (MRF) is a feature of the system that receives materials, whether source separated or mixed, separates, processes, and stores them for use as raw materials for subsequent remanufacturing and reprocessing.MRFs can be high-tech or low-tech facilities, but their primary goal is to maximize the amount of recyclables processed while creating products that will bring in the highest possible profits from the market. Despite the growth of the aforementioned facilities in the majority of major cities, the following table amply demonstrates the lackadaisical attitude of building professionals toward the use of recycled building materials.[4]

The following factors are largely responsible for the situation described above regarding the use of recycled construction materials and products from C & D waste at the national level:

- **Lack of knowledge on the part of designers/engineers:** The green building movement in India has brought to the attention of the building professionals the long-term advantages of sustainability in design and construction, but there is a general lack of knowledge on the use of recycled construction materials. This is because there aren't any performance-based statistics or testing facilities to make sure recycled-content building materials are up to par. For the benefit of architects, planners, engineers, interior designers, structural and other consultants, sculptors, and environmentalists, it is imperative to set up the infrastructure where various construction materials recovered from C & D waste could be tested for structural strength, reusability, etc.
- **The absence of government or urban local bodies (ULB) awareness campaigns:** The Central and State Governments must launch coordinated and aggressive public awareness efforts regarding the long-term advantages of recycled building materials. Lessons can be drawn from the Solar Decathlon, an international competition held in the US that challenges 20 collegiate teams to create the most aesthetically pleasing, functionally efficient, and economically viable solar-powered home. The funds for the competition are provided by the US Energy Department. The team that successfully combines affordability, excellent architectural aesthetics, and design with maximum energy output is declared the competition's winner. The Solar Decathlon is a free event where attendees may get a personal look of energy-efficient structures. The state and national contests follow a similar pattern.
- **An unorganized market for recycled building materials:** The production of recycled building materials is site-specific, and there is no single repository for data on the actual destruction of structures and other infrastructure. Because of this, recycled building materials are only sometimes available on the market. They are hesitant to specify the same in new building because to the uncertain supply of certain recycled construction materials and components (in the absence of an established market for specific recycled materials). This is why recycled materials for construction cannot compete with new materials in terms of price and quality.
- **Lack of incentives for employing recycled building materials:** India lacks the indigenous technology to produce recycled building materials from C & D waste, which leads to a high reliance on new materials and raises the cost of construction. Another issue that has significantly raised the cost of building is the ongoing rise in fuel costs in recent years. To encourage the construction of energy-efficient green buildings (from recycled construction materials) and to make the green building movement successful in India, the users of recycled construction materials from C & D waste should be given relief by way of lowering interest rates and the completed buildings can be exempt from local taxes (until it achieves breakeven point).
- **Curriculum Modification:** In addition to introducing topics such building systems and energy modelling tools, the curriculum has to be adjusted by updating the syllabi of building materials in the context of Green buildings. "The ECO III project has formed an International Advisory Committee comprising 13 academics and 6 professions to adapt the current architecture education curriculum green building friendly in order to make the green building movement a success in India." It is imperative that students understand the need of taking sustainability into account throughout the whole construction process, from

planning to commissioning. Despite the fact that environmental challenges and their long-term effects are becoming more well understood, the research environment in this area is dismal. This may be explained by the absence of research resources and knowledgeable professors in architectural institutes that specialize in environmental sciences, building physics, etc. Another difficulty is the dearth of information on the effectiveness of recycled materials and parts made from C & D trash in India's various climate zones. Only "26% of faculty in environmental sciences and 35% of faculty in building services held doctorates," according to a survey on doctorates at architectural institutions. There is an urgent need to upgrade the curriculum to place more focus on the usage of recycled construction materials made from C & D waste and faculty and student engagement with industry professionals from both inside India and overseas, in India approximately 400 qualified green building professionals today.

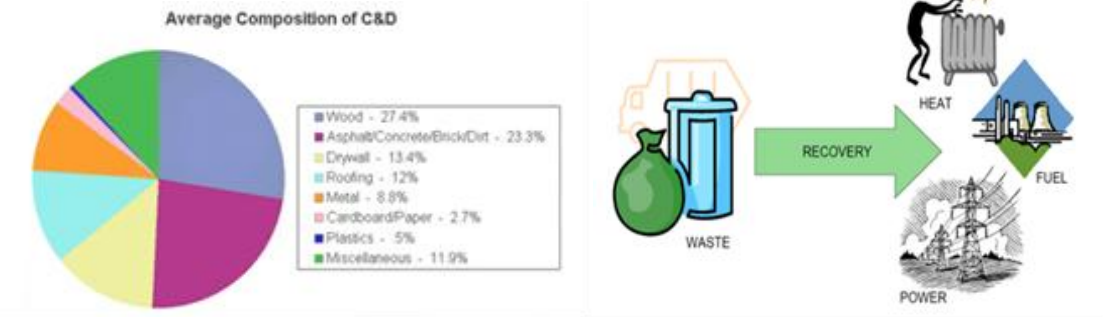
Forms of Environmental Waste:

It is commonly recognized that different types of trash exist based on their nature and effects on the built environment. As a result, they directly harm the ecosystem physically.

Demolition and construction waste

Construction and demolition waste, or C&D waste, is largely made up of municipal solid waste and is a major contributor to disasters. Because there are few places to dispose of C&D waste and there are few natural resources available, recycling C&D waste has received a lot of attention. Whether a storm, hurricane, or earthquake was caused by human activity or by the forces of nature, it is always associated with C&D waste. Depending on the waste type, the primary components of C&D trash include concrete, masonry, limestone, sandstone, metal, and wood. In addition, a significant amount of paper, plastic, and other materials are present in building waste is anticipated as a consequence of packaging materials, formwork timber that has been retired, and other items that are left behind. [3]Given that it has been rising for decades, this is not good for the environment. In Saudi Arabia, people who are beginning to construct their own homes have a tendency to forego more affordable materials in favor of more expensive ones.

Buildings often undergo changes and renewals every 10 years, with any leftover materials being thrown away. Saudi Arabia produces more than 15 million tons of solid trash annually while having just roughly 29 million citizens.



Economical Waste

It will be difficult to encourage recycling behavior in the absence of financial incentives. However, it is doable if one realizes that there is a minor economic inventiveness. For businesses, the process of gathering C&D waste products, recycling them, and then selling them comes at a significant expense. In addition, affordable disposal is pushing builders, contractors, and demolition workers to choose the lowest route, oblivious to any other options. The notion of the polluter pays principle, which is entirely legal, must be used. By expanding current industrial activities using recycled goods, this will encourage manufacturers to have less of an impact on the environment.

The Keys to Avoid Waste of Construction:

Preventing Waste

Waste prevention, also known as source reduction, involves utilizing fewer resources than necessary to reduce waste. There are several ways to accomplish this. For instance, reselling, trading, or giving household goods to particular charities. Additionally, through educating people on how to handle it and by emphasizing how harmful it is. The proportions of the design, the efficient amount of materials, and the choice of sturdy materials should all be known to contractors.

Waste Management

If waste prevention is not practicable, waste management should be done carefully. Perfect plans should be created before a disaster happens, yet in many cases they are only created after a crisis has struck.

- **Reusing**

It is simply employing the same substance again for the same purpose without changing it in any way. For instance, using bricks from a home that has been torn down to build another.

- **Recycling**

It is the process of transforming resources into other beneficial forms when direct reuse is not an option. C&D trash may be recycled in a number of different ways. For instance, among the materials collected from C&D sites, metals had the greatest recycling rate. metals of high value and great recoverability, such as steel.

- **Recovery**

Materials may need to be recovered after being used for a while in order to be utilized again in a variety of ways. Using garbage to produce heat is one example. A good solution is to convert waste to electricity.

- **Disposal**

Disposal is the last option that should be considered since it entails eliminating items that may no longer be useful after their first use. Burning and landfilling are thus included in this instance. But because it also has detrimental effects on the environment, this is not the best option to be taken into account. Before coming to this conclusion, it is important to carefully review the preceding key. Given that it is one of the primary causes of pollution.

Marketing Strategy for Non- Wastable Materials:

Price and quality determine whether consumers would choose recycled or virgin materials in a free market, therefore recycled products must meet certain technical requirements and be competitively priced in order to be offered as alternatives to common raw materials. For instance, among the materials collected from C&D locations, metals have the highest rates of recycling. Since we must begin investing right now, there are no concrete plans for C&D waste in Saudi Arabia. Before material recycling can become a reality, several key conditions must be met. [5]These conditions include a reliable source of suitable recycled materials, a lack of raw materials, the availability of markets for raw materials and products made through recycling methods, and a recycled product that can compete with natural resources in terms of quality and price. Future performance requirements may be met using carbon fiber while generating no additional building waste. In fact, unique for its very effective qualities, such as its great strength to weight ratio, stiffness, and resistance to 7 tensile strength, fire resistance, electrical conductivity, fatigue resistance, thermal conductivity, and governing thermal expansion law. Many different professions, including civil engineering, sports, the military, homes, industry, and medicine.

Marketing Strategy for Non- Wastable Materials:

- Finally, waste is described as unneeded materials that result in catastrophes. Wood, concrete, glass, and sand are the main materials used to create C&D waste construction. Wastes include those from manufacture and destruction. Additionally, to reduce waste and recycle, recover, or repurpose undesired materials
- Promoting strategies for effective supply also has a significant role in reducing waste. Hopefully, there will be numerous applications to limit waste and create a healthy environment as communities become aware of the problems associated with C&D waste.

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