

A Review of Strategies for Minimizing Pollution from Construction and Demolition Waste for Sustainable Environment

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Abstract: The construction industry provides huge infrastructural facilities to the mankind but at the same time it generates extensive construction and demolition waste. This waste has enormous environmental impacts as it causes pollution from noise, dust and smoke, thus degrading the air, soil and water quality. The risk to environment created by such waste is life threatening can reach to an irreversible cycle. Various strategies have been suggested by private and government organizations like Central pollution control board (Ministry of environment, forests & climate change) and GRIHA, for the management of construction and demolition waste. This study aims to identify such construction and demolition waste products and present the methodologies suggested and adopted in the current scenario for waste management.

INTRODUCTION

The construction industry is a major source of pollution, responsible for around 4% of particulate emissions, more water pollution incidents than any other industry, and thousands of noise complaints every year. The main areas of concern are: air, water and noise pollution [1]. The construction sites especially in urban areas are a major source of pollution because of variety of materials involved. Construction and demolition is a continuous process and is very likely that the environment is degraded to the extent that survival of mankind becomes impossible. Various studies are focusing on use of sustainable material because they can either be reused or recycled or they are manufactured from recycling process. The 3 R's; Reduce, Reuse and Recycle, need to be emphasised upon for saving environment from further degradation. Some organizations like GRIHA and IGBC have been working on sustainable and green buildings to reduce the environmental impacts. GRIHA (Green Rating for Integrated Habitat Assessment) Council is mandated to promote development of buildings and habitats in India through GRIHA. GRIHA Council an independent platform for the interaction on scientific and administrative issues related to sustainable habitats in the Indian subcontinent. It was founded by TERI (The Energy and Resources Institute, New Delhi) with support from MNRE (Ministry of New and Renewable Energy, Government of India) along with a handful of experts in the sustainability of built environment from across the country. GRIHA, attempts to minimize a building's resource consumption, waste generation, and overall ecological impact to within certain nationally acceptable limits / benchmarks [2]. The Indian Green Building Council (IGBC), part of the Confederation of Indian Industry (CII) was formed in the year 2001. The vision of the council is, "To enable a sustainable built environment for all and facilitate India to be one of the global leaders in the sustainable built environment by 2025" [3]. The organizations are committed to reduce the impact of building industry on the environment.

PRESENT SCENARIO IN INDIAN CONSTRUCTION INDUSTRY

. It is reported that India produces 530 million tones of construction, demolition, and waste material annually (rough estimate 2013-14) [5]. The general traditional practice is to dispose of this waste in landfills or illegally dump in rivers and water bodies, which gives birth to environmental problems and enormous pollution of air and water. The data verifies that Delhi alone produces more than 4000 tones of C&D Waste and due to improper disposal. The improper disposal of C & D waste results in X choking storm water drains and polluting the Yamuna river bed [6].

A survey was conducted by Asian institute of technology, Thailand in various Asian countries in May 2008 to study the construction and demolition waste. The study report includes Asian countries like Bhutan, Japan, Hong-Kong SAR, China, Thailand and others including India [7].

Presently management of waste from construction industry in India comprises of the following elements [8]:

- Re-use of materials salvaged in good condition during demolition.
- All metal items are sent for re-melting through scrap dealers.
- Disposal of other items to low lying sites. Concrete and masonry constitute more than 50% of waste generated by the Construction Industry. Recycling of this waste by converting it to aggregate offers dual benefit of saving landfill space

and reduction in extraction of natural raw material for new construction activity. Various surveys conducted on reasons for less usage of recycling processes in India have revealed the following

- 70% of respondents have cited Lack of awareness regarding recycling techniques as one of the major reasons for not adopting recycling of waste from Construction Industry.
- 30 % of the respondents have indicated that they are not even aware of recycling possibilities.
- 67% of respondents from user industry have indicated non-availability of recycled product as one reason for not using it.

CHARACTERISTICS OF C & D WASTE

Although it is difficult to identify but the C&D waste can broadly be categorised as mixture of following materials [6];

Major components can be listed as: (a) Cement concrete, Bricks, Cement Plaster, (b) Steel (from RCC, door/window frames, roofing support, railings of staircase etc.), (c) Rubble, Stone (marble, granite, sand stone), (d) Timber/wood (especially demolition of old buildings), (e) Clay (Soil from excavation)

Minor components can be listed as: (a) Conduits (iron, plastic), Pipes (GI, Iron, Plastic), (b) Electrical fixtures (copper/aluminum wiring, wooden baton, Bakelite / plastic switches, wire insulation), (c) Panels (wooden, laminated), (d) Others (glazed tiles, glass panes), (e) Plastic carry bags, sachets of tobacco and other plastics, Clothes, Cement bags, gunny bags etc.

Among the above components, the most unpredictable and difficult materials are C&D Waste. Recycling Technology has provided the solutions to tackle these difficult materials and make C&D Waste an acceptable quality product for re-use.

It is very difficult to segregate and identify materials like Clay (Soil) and all types of floating materials like plastic carry bags, sachets, thermocol etc. CDE Asia Ltd. Has innovated recycling technology that provides the solutions to tackle these difficult materials and make C&D Waste an acceptable quality product for re-use.

ENVIRONMENTAL ISSUES RELATED TO C & D WASTE

The building and construction sector is responsible for about 40% of global energy consumption and associated emissions. Broken down, the industry's contribution to air pollution is 23%, climate change 50%, drinking water pollution 40%, and landfill wastes 50%. It is for this reason that the Paris Agreement has tasked the sector with finding solutions to reduce the impact of greenhouse gas emissions [4]. GHG emissions produced by industry activities, mainly the combustion of fossil fuels, have continued to rise, contributing enormous 21% of emissions to the national footprint. According to the EPA (U.S. Environmental Protection Agency), the sector could reduce its emissions by around 25% if it implemented wide scale upgrading, and replacement, and deployment of the best available technologies [4]. Urban areas face major problems if the dust and erosion run off takes place from the demolition site and flows into nearby storm drains. The storm drains sometimes lead to water bodies that support wildlife and this human negligence may lead to imbalance in the aquatic life.

POLLUTION PREVENTION AND MANAGEMENT PRACTICES

The dust is a major source of pollution at construction and demolition sites. Several measures have been suggested for controlling the pollution from dust [9], such as; (a) using water sprays or sprinklers to keep the dust down during activities such as filling skips, breaking concrete and managing stockpiles, (b) washing the wheels of vehicles leaving the site, if they are carrying mud or waste, (c) putting up solid barriers around the site, (d) properly covering lorries that leave the site carrying waste, (e) cleaning the road and footpath near the site entrance when needed, (f) using dust bags, spraying water or, when using disk cutters, making the working area wet before using the machinery.

The waste material of the site should not be burned on site because it creates nuisance for the people on site as well as off-site neighbours and degrades the air quality. Such burns can create unwanted smoke containing carbon monoxide and other poisonous gases. Using silt fences and a proactive traffic control plan are the best lines of defense against erosion. Limit the areas where heavy equipment is allowed to go and make sure these roads stay in good shape. If these designated roads get too messy, adding some gravel can help restore the integrity of the road. Existing vegetation is another great way to prevent erosion. Letting trees, grass, and other plants stay where they are will help soak up excess water and prevent erosion. If water runoff is unavoidable, make sure to route the flow of water away from active demolition areas. This will ensure the water that leaves the site is not contaminated by any building materials.

Water pollution can always be avoided with the proper plan and strategy. Anytime you start a new demolition project, make sure your demolition contractor is taking the appropriate steps to keep demolition contaminants out of the water.

CDE Asia Ltd. is having rich experience in the processing of C&D Waste materials. They have set up the second C&D Waste recycling plant in Delhi which is expected to be rich in technological advancement in C&D Waste recycling as compared to the first plant. This washing plant is installed in the heart of the city and has a capacity of 500 tpd [6].

The new recycling plant consists of the following technologies:

1. Feed Hopper with Vibrating Grizzly Feeder
2. EvoScreen® - Pre Screen
3. RotoMax® - Log Washer for Aggregate cleaning
4. Trash Screen for removal of light weights
5. ProGrade® - Sizing Screen for washed Aggregate
6. EvoWash®-Dual Pass Hydrocyclone system for Sand washing
7. AquaCycle® - Water Management system for recycling of process water

Some of the suggestions for minimizing the environmental impacts by the construction firms, have been listed as follows [4]:

Energy efficiency—switch to more efficient industrial technology by, for instance, identifying manufacturers whose equipment and technology uses less energy to light and heat factories or to run equipment.

Fuel switching—change to fuels that result in less CO₂ emissions but deliver the same amount of energy when combusted. So, using natural gas instead of coal to run machinery.

Recycling—create industrial products from recycled or renewable materials instead of producing new products from raw materials. An example is using scrap steel and scrap aluminium instead of smelting new aluminium or forging new steel.

Training and awareness—educate stakeholders on ways to reduce or prevent emissions leaks from equipment. The EPA has a variety of voluntary programs that provide resources for training and other steps for reducing emissions.

Some of the best practices have also been identified as [10]: Preservation of Existing Vegetation, Construction Phasing, Construction Entrances, Silt Fencing, Storm Drain Inlet Protection, Vegetative Buffers, Site Stabilization, Equipment Fueling and Containment, Waste Management, Fugitive Dust Suppression.

CONCLUSION

In the present context the environmental pollution is a major issue before the world. There is a need to sensitize the stakeholders about these issues and preventions and precautions that should be taken care of. The construction firms shall play a leading role in regulating these issues. The government organizations are also taking suitable measures to prevent pollution but it is still a long way to go. Every organization shall prepare a checklist of do's and don'ts to take appropriate action in time and on site to save environment from pollution created due to construction and demolition waste. The increase in the awareness level of participants of construction industry is the only solution to solve the problem which can be done by propagating the idea or enforcing laws and penalties.

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