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An Optimization Model on Construction and Demolition Waste Quantification from Building

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Abstract

Construction and Demolition (C&D) waste, which constitutes more than 30% of the solid waste stream in India is not given proper attention and loses it's recycling potential. Absence of enforcement and negligence on behalf of the authorities has given rise to independent overlords who fight among themselves for the control of waste thereby making it even more difficult to categorize and quantify C&D waste. Re-utilization of Solid Waste is in developmental stage and thus ends up mostly in landfills without taking into consideration the malignant effects on the environment. Elements like Lead, Arsenic, Cadmium and Silica find their way into the soil and are then transported into the ground water (Stefania Butera, 2015).So the directive is to minimize the exploitation on the environment and find a means for recycling the waste into environment friendly building materials. Estimation of CD waste is carried out by making use of Building specific and region specific waste generation rates. An all encompassing model which can successfully predict the total amount of waste generated from a particular project does not exist and this fact is quite evident given the diversity of construction techniques and composition of building materials .Even If such a database were to be compiled, end users would find it hard to comprehend and apply this data into meaningful quantity. The most appealing way of making users more aware of the need to recycle is by offering a perspective where they can perform a cost benefit analysis of the revenue that can be generated from proper optimization and reutilization of CD waste. Contractors can make a prior estimate of the investment for a particular project and order precise quantities of the materials required .This would not only eliminate the additional cost incurred but also reduce waste on site from off cuts and poor handling of surplus materials. Therefore the objective is to propose a model which makes use of easily available data like transportation rates and resale value of recyclable materials which would provide an intuitive and simple optimization model while imbibing the basic principles of Reduce, Reuse and Recycle into action.

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Introduction

Building materials account half of the solid waste generated worldwide. Construction and demolition (C&D) waste have an environmental impact at every step of the building process—extraction of raw materials, processing, manufacturing, transportation, construction and disposal at the end of a building's useful life. Governments across the world have responded to the need to reduce solid waste with regulation and legislation that have framed a market for building materials and products derived from the (C&D) waste stream.

"Sustainable building" has become a national catchphrase. Construction sites around the world are increasing emphasis on reducing the generation of solid waste both in renovation and new construction. C&D waste are produced directly by construction and demolition industry. This includes Building materials such as bricks, nails, wood, Reinforced Cement Concrete (RCC), lime concrete, mixed earth, electrical wiring and steel bars as well as from site preparation such as dredging material, tree stumps, and rubble. However, C&D waste can also contain lead, asbestos, or other hazardous substances.

Resource depletion coupled with global population growth means that the cost of raw materials, energy, minerals are growing rapidly. Constantly using new materials, results in landfill degradation, deforestation and loss of biodiversity. This is happening at such a rate that two-thirds of world eco-system is in decline. It is predicted that unless actions are taken properly , there could be a shortage of 40% of Gloabal Water Supply by 2030 (United Nations, 2015).Cost of Construction will also increase due to rise of the cost of raw materials.

Literature Review

There is a finite way of looking at CD waste ;

- C&D waste management in general
- C&D waste recycling
- C&D waste reduction
- C&D waste generation

Extensive work has been carried out in the course of the last two decades and it has seen a truly internationaleffort to acknowledge the problem and tackle it head on . In an attempt to expound the term, in addition to the solid waste that arises from construction, renovation and demolition activities, Roche and Hegarty (2006) added that C&D waste also includes surplus and damaged products and materials arising in the course of construction work or used temporarily during the course of on-site activities. The term C&D waste is defined as the waste which arises from construction, renovation and demolition activities including land excavation or formation, civil and building construction, site clearance, demolition activities, roadwork, and building renovation.Construction and demolition wastes may also be produced significantly from environmental disasters such as earthquakes, hurricanes, tornadoes, and floodwater (Tansel et. al.,1994).

Since the the term itself is self explanatory and goes by intuition, one can argue that the need to define CD waste is of subaltern importance .

Going through the Data available on the concentration of CD waste in Solid Waste stream, one finds verisimitude in the findings presented all over the world .

In Hong Kong, 38% of solid waste comes from the construction Industry (Hong Kong Government – Environmental Protection Department, 2006). According to Construction Materials Recycling Association (2005) and Hendriks&Pietersen(2000),the construction industry generates about 35% of industrial waste in the world . In India, C&D waste and other inert matters contributes to approxiamtely 33 % of the Solid Waste stream