# CONSTRUCTION WASTE MANAGEMENT PRACTICE: BANGLADESH PERCEPTION

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## ABSTRACT
Construction sector involves several regulation policies including environmental protection, energy efficiency, work safety, taxation, and public procurement. Environment friendly and sustainable construction practice with competitiveness is essential for the balanced development of a country. Being and part of that, proper management of construction wastes is an important issue now a days. Being a developing country, Bangladeshis in the face of massive construction development work considering its current socio-economic condition. However, construction waste management practice is very poor in most cases. It is high time to think about some timely steps in order to implement different strategies for overall management. For successful waste management strategies, reliable and examined case studies are necessary. This study considered reviews on construction wastes, their generation and available management strategies. Finally, recommendation is provided on Bangladesh perspective.

Keywords: Waste management; construction waste; project management; sustainable development

## INTRODUCTION
In recent years, landfill loading and operation is heavily burdened with construction and demolition (C&D) waste. Eurostat reports illustrates that around 2 billion waste is being produced every year in European Union, which includes 31% of construction waste (DEFRA, 2007).About 29% of world's municipal solid waste is generated at China; among which 40% comprised of construction waste (Wang *et al.*, 2010). Study reported that 3158 tons material waste were disposed every day at landfills which is23% of the total solid waste generated at Hong Kong (EPD, 2008). Land filling process is inefficient due waste of resources as well as inducing substantial adverse impacts on environment. Old landfills are almost reaching their capacity to its fullest, uncontrolled landfill sites chose for C&D waste are enlarging, because, strong pressure still exists to merely landfill construction debris (Kartam *et al.*, 2004).

Construction waste generation has become a major concern owing to it direct impacts on environment while affecting the efficiency of this industry (Formoso *et al.*, 2002). Building activity has huge environmental impacts from air pollution, noise pollution and water pollution (EPD, 1999). The most important and unpleasant environmental effect is from incineration which discharge pollutants to air (Kartam *et al.*, 2004). Contractors have to bear profit loss because of additional overhead costs and delays and loss of efficiency due to further time spend for cleaning (Skoyles and Skoyles, 1987). Since subcontractors have to estimate the amount of cost and involvement of time for waste generation during bidding, subcontractors are often blamed form construction waste generation (Johnston and Mincks, 1995). Construction organizations are willing to imply environmental friendly ways towards waste management only if they are profitable since profit maximization is their main objective (Hao *et al.*, 2008).

Any practices that might induce waste reduction must be prompted while deciding optimum waste handling methods by considering cost implications. A successful waste management can be promoted by developing a CWM plan and thus incorporation of the plan in construction specification. Reduction of construction waste on a project site can meet its sustainability objectives.

Depending on the economic and cultural characteristics the amount of waste generation, data used for categorization of waste and recording methods differs country wise (Kourmpanis *et al.*, 2008). Similarly, the effective execution of WM strategy is swayed by the affinity of WM plans with the actual situation (Manowong, 2012). Being a densely populated country Bangladesh cannot afford waste management by land filling, therefore, research is required to identify useful methods to mitigate construction waste generation and its management. This research aims to explore effective approaches to sort out and/or reduce waste generation in construction projects in Bangladesh.

## CONSTRUCTION WASTE & ITS GENERATION

Construction waste is principally a mixture of surplus materials generated during new construction or a demolition waste. It can be a mixture of lot many materials or in some cases can be individual ones depending on the type of work. C&D waste could be formed due to excavation work, clearance of any project site, road works and renovation or demolition of structures etc. Masonry wastes can be easily mixed up with other wastes such as wood and drywall.

Some of the more common C&D wastes can be lumber, drywall, metals, masonry (brick, concrete), carpet, plastic, pipe, rocks, dirt, paper, cardboard, or green waste related to land development (AIA,2008). Inert materials such as brick, concrete, rock etc. generally considered as masonry construction waste. Dirt removed from a demolition site is also included in that part. Waste materials from new wood for construction works like plywood, chipwood, dimensional lumber, shavings and sawdust and different demolition wood waste is considered as wood waste in construction site. Cut pieces of metallic materials such as new metal studs, metal beams, pipes are considered as metallic waste. Besides these, plastic and other different types of waste materials can be found in any construction site. Table 1 shows sequential list of construction wastes considering hazardousness nature adopted from the government of UK website.

Table 1: Construction and demolition waste classified according to hazardous characteristics. (Adapted from Govt.UK (2016))

| Hazardous | Non-hazardous |
|---|---|
| Insulation and asbestos materials | Insulation and asbestos materials |
| Concrete, bricks, tiles and ceramics in mixtures | Concrete |
| Treated wood, glass, plastic (alone or in mixtures) containing hazardous substances | Bricks |
| Mixed metals containing hazardous substances | Tiles & ceramics |
| Cables containing oil, coal tar and other hazardous substances | Concrete, bricks, tiles and ceramics in mixtures |
| Soil and stones | Wood - untreated |
| Dredging spoil | Glass - uncontaminated |
| Gypsum materials | Plastic - excludes packaging waste |
| Un-used or un-set cement | Metallic waste, including cable<br>Copper, bronze and brass, Aluminum<br>Lead, Iron and steel, Tin |
| Paints and varnishes | Soil and stones |
| Paint cans | Dredging spoil |
| Adhesive or sealant containers | Gypsum materials |
| | Paints and varnishes |

Cheung (1993) defined construction waste as the "by-product generated and removed from construction, renovation and demolition work places or sites of building and civil engineering structures". Similar to definition of waste, waste measured is considered in different ways. While Treloar *et al.,* (2003) in terms of embodied energy of materials, Bossink and Brouwers (1996) described three case studies where waste of each type of material considered in different ways such as (i)

percentage of total construction waste; (ii) percentage of purchased materials and (iii) percentage of total cost of waste. However, categorization of waste streams along with volume/weight waste generated is essential to calculate these percentages. Some factors always influence the production of wastes during the life cycle of any construction projects, viz. design, procurement, materials handling, construction/renovation, demolition (Graham and Smithers, 1996). Patel *et al.* (2016) stated a conceptual framework at their study, where the sources of construction waste was organized into five categories as presented in figure 1. Ekanayake and Ofori (2000) limited the causes of waste into four major categories such as Design, Procurement Operation and Material handling.

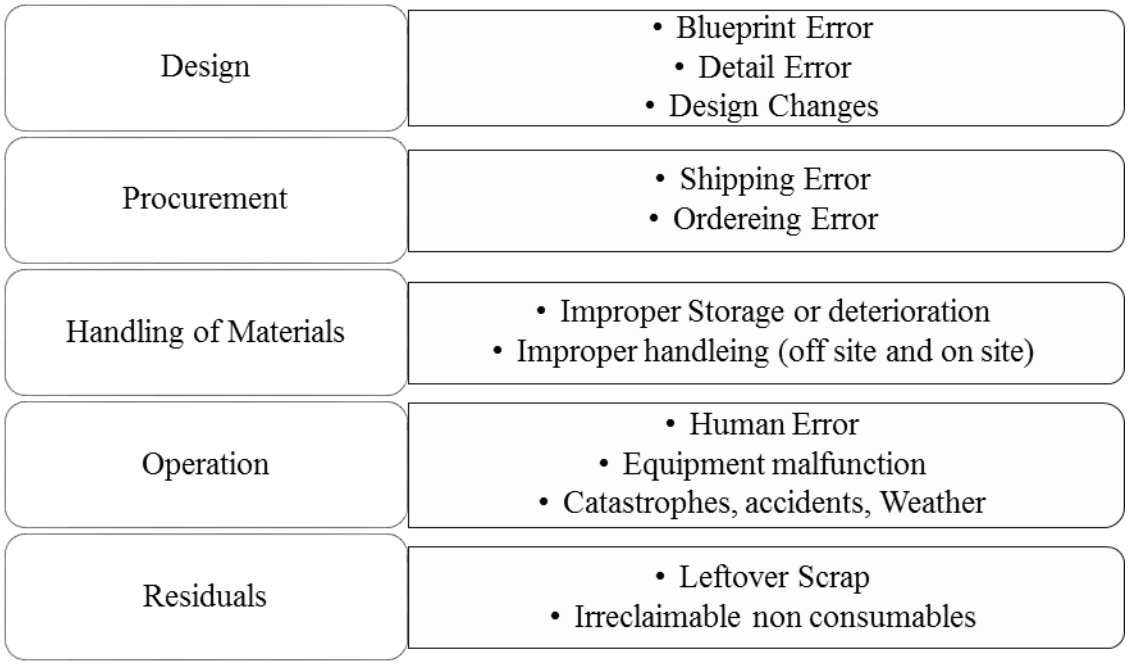


Fig. 1: Waste generation sources; adapted from Patel *et al*. (2016)

## ENVIRONMENTAL ISSUES

Impact of construction waste on the environment is always a major issue and proper management is required to avoid environmental liabilities. Natural resources of a region are affected during construction activities required for the development work. From the study of Kumar & Kaushik (2005), it can be inferred that construction related energy consumption, including both direct and indirect activities, amounts to around 50% of national energy use. The activities also associated with transport of materials. The negative effect of construction wastes inaugurates by dumping activities viz. dumping into forests, streams, ravines, empty land etc. which leads to cause erosion, contaminates wells and affects water tables and surface water (Arslan *et al.*, 2012). With proper synergy between build environment and natural environment can influence the hydrological system (Dixon, 2010). Using thoughtful planning system, design of buildings and landscapes can play role in operating construction development activities without causing any desolation of environment.

## IMPLEMENTATION OF CONSTRUCTION WASTE MANAGEMENT

Construction waste management (CWM) can be termed as reduction and diversion of construction waste, demolition debris and land cleaning rubbishes from disposal and rerouting recyclable resources back into the construction process (AIA, 2008). It is seen that construction solid waste management is given low priority when there is financial limitations and considerable amount of waste minimization can be attained when waste management is implemented as part of project management functions (Coffey, 1999).

Construction waste management plans require cooperation between all personals involved in a construction project. The client, designer, contractor, site engineers, technicians, sub-contractors, workers, material providers all need to work from the pre planning stage till end of any projects for ensuring an effective and efficient waste management plan. A framework called Leadership in Energy

and Environmental Design (LEED) in which Green Building System is widely applied. A bunch of standards are set to practice environmentally sustainable construction including practices for sound waste management into construction activities (LEED, 2004). Several research studies promoted the importance of incorporating waste management process in design an procurement phases. (Lingard *et al.*, 2000; Mcdonald and Smithers, 1998). Some research outcomes support the attitudinal approaches than the technological improvements (Kulatunga *et al.*, 2006; Wong and Yip, 2004). Disparity among construction waste management performance can be caused by client contractor relationship even standing within same jurisdiction has been noticed by Tam *et al.* (2007).According to Kulatunga *et al.*, (2006) attitudinal variances between different working groups and inadequate training to support the importance of waste minimization practices have obstructed proper waste management practices in the construction industry. Further, lack of communication of strategies from the top level to the bottom level of the organization, and insufficient data flow from construction sites to estimators, negatively disturbs waste management applications. Moreover, research on CWM performance has commonly suffered from insufficient quality data to support an informed debate on CWM performance. One can link different construction techniques, work procedures and common practices during construction work with construction waste management performance and provide quantitative data for benchmarking construction waste management practices across different projects by investigating Waste generator rate (WGR) (Lu *et al.*, 2011). WGR is widely used as an indicator to measure construction waste management performance which can be calculated by dividing the waste is volume ($m^3$) or quantity by the amount of virgin materials purchased or the amount required by the design or per $m^2$ of gross floor area (GFA) (Formoso *et al*, 2002).

In an Australian federal government study (DOE, 2013), four key points were pointed out for improving the resource recovery from construction and demolition wastes viz. (i) design buildings or structures considering there deconstruction ability enabling resource recovery and reduction of integral energy; (ii) reduction of on-site contamination of wastes and segregation of materials; (iii) encouragement for using recovered waste materials with improved specifications and knowledge of implementation; and (iv) Promoting research and development activities for overcoming the business and technical barriers with innovation approaches. Yuan (2013) conducted an SWOT (strength, weakness, opportunity and threat) analysis aiming to understanding the status of construction waste management of a particular city in south China and suggested some government efforts for enhancing the awareness through some methods viz. launching of series of promotional activities via public advertisement, newspaper, radio and outdoor advertising, enhancing contractors, engineers and architects awareness through vocational training and establishment of awards for general public and industry stakeholders who actively participated in CWM activities.

## CONSTRUCTION WASTE MANAGEMENT IN BANGLADESH:

Being a developing country, Bangladesh continuing huge development works. Mega projects such as Padma River Bridge are ongoing around the country are copious and many to start in upcoming days. According to previous reviews, before starting construction work at any region waste generation and management becomes an important issue. But research and technical resource related to construction waste management scenario in Bangladesh is very poorly disregarded. Some statistics are available relating to solid waste generation and management. But when it comes to construction and demolition wastes, sufficient information is not available to predict a future condition and thus take preventive measures. Zahur (2007) published a research work considering the solid waste generation in Bangladesh, added brick, wood, metal, glass and industrial wastes as a part of solid waste. The prediction of solid waste generation gives us some idea about overall waste generation. The urban areas in Bangladesh generates approximately 16015 tons of waste per day and it is projected to grow up around 47000 tons/day in the year 2025 (Bahauddin & Uddin, 2012). So, serious thoughts should be given to construction waste generation and its management incorporating detailed research and study. Field survey can be an effective approach at the for the kick start. Collaboration and communication at different level of construction starting from client to field workers are essential. In Bangladesh concerns about construction waste management are hardly seen among consumers as well as clients. When profit maximization and completion of project within due time is the main goal, CWM could be regarded as extra burden. In addition to that skilled manpower is an important issue for the overall management.

However, minimizing the waste generation rates by effectively using raw materials represents an effective construction manager.

## CONCLUSION

For sustainable development, practice of sustainable construction process has received great importance throughout the world. The consumption of materials for construction purposes being huge, this sector has great responsibility to contribute to the term 'Sustainability'. With the continuing research activities and practical experiences of the personals related to this industry, proper management of construction waste is necessary. The government should introduce incentives and benefits to the projects implementing an effective construction waste management plan. Planning, assessment, selection of consultants and contractors, design, operation, each step has contribution to a successful waste management output. We would consider one step ahead towards the green building technology after being able to implement proper waste management practices in all major construction projects in Bangladesh.

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