

## STRATEGIES FOR EFFICIENT CONSTRUCTION WASTE MANAGEMENT PRACTICES BY FIRMS IN NIGERIAN URBAN CITIES.

W.E. Dzasu\*, A. Calistus\*\*, T.A. Bello\*\*\*, K. J. Adamu

Department of Building, Federal University of Technology Yola\*

Department of Building, Federal University of Technology Minna\*\*\*

Department of Architecture, Federal University of Technology .Yola\*\*

### Abstract

*The study reviewed relevant literature central to waste management practices and procedures in the construction industry. Structured questionnaires were administered to professionals in selected firms in the study area using the random sampling survey. Personal interviews were also arranged with the respondents in order to clear ambiguities resulting from their responses. Results obtained were analysed using the ranking order on a scale of 1-5. The study gives an insight on the activities involved in construction waste management in Abuja the Federal Capital Territory. The paper identified factors that influence construction waste management activities and the requirements for achieving efficient construction waste management by Nigerian construction firms. The study revealed that wood waste constitutes 33% of the total quantum of waste in Abuja metropolis; masonry waste constitutes 26% by volume; other waste like waste from aluminum, glass, plastics, ceilings tiles and land clearing debris all make up 28.33% by volume of the total quantum; metals and cardboard constitutes 5% each while drywall which is not a common construction material in Abuja constitutes just 2.67% by volume of the total construction waste generated on jobs in Abuja metropolis. This result shows a significant departure from the quantities of construction waste by volume generated on jobs in the United States as revealed in the study. The study established that availability of disposal facility and appropriate landfills licensed for construction waste ranked top among the requirements necessary for efficient waste management by firms. Furthermore, the research identified Lack of market for recycling and re-use of materials as the least factor that influences construction waste management activities while role of the site managers and contractors was discovered to be the most influential factor among others.*

**Keywords:** Strategies, Efficient Construction Waste Management, Firms, Nigerian Urban Cities.

### Introduction

The construction industry produces huge quantities of wastes, about four times the rate of household waste production. According to the Welsh School of Architecture the construction industry has a major impact on the environment, both in terms of the resources it consumes and the waste it produces. Lambert and Domizio (1993), opines that construction and demolition waste disposal triggers a sequence of adverse effects that are not apparent to building professionals. These

include the loss of building materials, wasted embodied energy, greenhouse gas generation, environmental degradation and environmental stressors associated with producing new materials instead of using existing materials and According to Napier (2007), effectively managing waste on a construction jobsite is a vital component of sustainable building.

According to the NigeiaBusinessInfo.com (2004), Abuja is the fastest growing city in the world; in fact Abuja is presently referred to as a

construction haven with so many construction works going on. Also with the sale of government buildings to private individual's, a lot of deconstruction and renovation works are being carried out on this buildings. These massive construction works going on in Abuja also constitute a large amount of construction waste production which if not checked and effectively managed will amount to environmental risk to the city and further result's to unsustainable environmental development and environmental degradation.

The University of Cambridge department of Estate Management and Building Services (2005), defines waste as "any substance or object that you discard, intend to discard, or are required to discard. Even if the material is sent for recycling or undergoes treatment in-house, it can still be waste". Furthermore the National Park Services Envirofacts (1998) defines construction waste as "the waste of building materials, packaging and rubbles resulting

from construction, renovation, repairs and demolition operations on pavements, houses, other buildings and structures". According to Napier (2007), Construction Waste is defined as "Waste materials generated by construction activities, such as scrap, damaged or spoiled materials, temporary and expendable construction materials, and aids that are not included in the finished project, packaging materials, and waste generated by the workforce". It includes land clearing debris and demolition debris which are vegetable waste materials removed from a site and waste resulting from removing a building from the site by wrecking respectively.

Waste of construction materials on site refers to the difference between materials delivered to site and that actually used on the construction as specified by (Onabule, 1991) hence from Onabule's specification it can be affirmed that construction waste are those materials supplied to site for construction and are not being used in the construction constitute.

**Table 1:** Construction Waste types and Quantities

S/N	Construction Waste	% by Volume	% by Weight
1	Wood	24	42
2	Cardboard	38	4
3	Drywall	11	26
4	Masonry	1	11
5	Metals	4	2
6	Others	22	15

Source: Green Building Source (2008).

Research by the Green Building Source, (2008) as seen in table 1 above shows the quantities of construction waste generated by volume on jobs in the USA to be as follows: wood 24%, cardboard 38%, drywall 11%, masonry 1%, metals 4%, other waste 22%. In 1998, the U.S. Environmental Protection Agency estimated that 136 million tons of building-related waste is

generated in the U.S. annually, which is 25% to 40% of the national solid waste stream. A 2003 update shows an increase to 164,000 million tons annually, of which 9% is construction waste, 38% is renovation waste, and 53% is demolition debris (Napier, 2007).

Common construction waste materials include lumber, drywall, metals,



masonry (brick, concrete and so on), carpet, plastic, pipe, rocks, dirt, paper, cardboard, or green waste related to land development. Of these, metals are the most commonly recycled material while lumber makes up the majority of debris that still goes to a landfill. This study is aimed at realizing the following objectives;

- 1 To investigate the type and quantity of waste produced as a result of the various construction activities carried out by firms in the study area.
- 2 To examine the factors that influences the management of construction waste by firms in the FCT, Abuja.
- 3 To determine the strategies required for achieving an efficient construction waste management practice by firms in Nigeria.

### Methodology

Both theoretical and empirical methods were adopted in the collection of data for this study. The theoretical aspects involved a review of related literature, journals, periodicals and the internet. While the empirical study involved visits to Development Control Departments in the Federal Capital Development Authority, Federal Ministry of Environment and Housing, Abuja Environmental Protection Board and other relevant government agencies and head offices of construction firms.

The data for this study was collected through questionnaires. A total of fifty five (55) questionnaires were administered to staff of Abuja Environmental Protection Board (AEPB) and to professional staffs of some selected construction companies in Abuja, the FCT. A total of 50 duly completed questionnaires were returned. The target audience for the study was drawn from firms engaged in building construction

works only, firms engaged in both building and civil engineering construction works and firms engaged in other construction activities other than Building Construction and Civil Engineering Works.

The questionnaires were designed to investigate the level of awareness of construction waste management as well as its levels of practice. The data collected were analyzed using the ranking Method. The rating value of 4, 3, 2, and 1 were assigned to the options “Strongly Agree”, “Agree”, “Disagree” and “Strongly Disagree” respectively in obtaining respondents perception on construction waste management activities by respondent’s organization.

The ranking method is suitable for a number of measures, which is above six and less than thirty (Youngman, 1981). In using the ranking method, weights or scores of 1.....n are assigned to the factors to be measured.

$$S = \sum nW$$

Where:

S = is the rank sum,

n = number of respondents

W = corresponding weight/score of rank category

RI = is the relative index

The relative index is calculated as  $RI = S/4n$

The relative index ranges from 0 – 1. The item with the highest relative index is considered the first in the rank order.

### Data Presentation and Analysis of Results

#### *Construction Waste Quantities*

Table 2 shows quantities of construction waste generated on jobs by respondent’s organizations in Abuja metropolis. The table indicates that wood waste constitutes 33% of the total quantum of waste generated by these firms in Abuja metropolis; masonry waste constitutes 26% by volume; other waste like waste from aluminum, glass, plastics, ceilings tiles and land clearing debris all make up 28.33% by

volume of the total quantum; metals and cardboard constitutes 5% each while drywall which is not a common construction

material in Abuja constitutes just 2.67% by volume of the total construction waste generated on jobs by the firms in Abuja.

**Table 2:** Quantities of Construction Waste in Percentage Volume, Generated On Jobs by Respondents Organization

Respondent Construction Waste	A	B	C	D	E	F	MEAN
Wood 33%	42	28	38	30	25	35	33
Cardboard 5%	2	3	0	10	5	10	5
Drywall 2.67%	0	0	0	5	1	10	2.6667
Masonry 26%	29	28	27	33	19	20	26
Metals 5%	2	5	8	5	5	5	5
Others 28.33%	24	36	26	15	49	20	28.3333

Source: Field Survey, 2010

***Factors that influences construction Waste Management activities***

Table 3 shows that the role of the site manager/contractor ranked 1<sup>st</sup> with a relative index of 0.88. This result is an indication that in construction waste management the site manager/contractor has a big role to play for any success to be achieved. Amount of funds available; designs and forms of buildings and; Lack of facilities and

technology for recycling, deconstruction and re-using are ranked 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> with relative index of 0.835, 0.82 and 0.785 respectively. Lack of interest for re-use and re-cycling as well as poor information and partnership between parties to the contract are both ranked 5<sup>th</sup> while Lack of market for re-cycling and re-used materials is ranked 6<sup>th</sup> with relative index of 0.575.

**Table 3:** Ranking of factors that influences Construction Waste Management activities in respondents organization

Factors	4	3	2	1	Rank sum (S)	n	Relative Index R.I=S/4n	Rank Order
Role of the site manager/contractor	30	16	4	-	176	50	0.88	1 <sup>st</sup>
Designs and forms of buildings	18	28	4	-	164	50	0.82	3 <sup>rd</sup>
Lack of market for recycling and reused materials	-	19	27	4	115	50	0.575	6 <sup>th</sup>
Lack of interest for reuse and recycling	7	18	20	5	127	50	0.635	5 <sup>th</sup>
Lack of facilities and technology for recycling, deconstruction and reusing	15	27	8	-	157	50	0.785	4 <sup>th</sup>
Poor information and partnership between parties to the contract	10	15	17	8	127	50	0.635	5 <sup>th</sup>
Amount of funds available	25	17	8	-	167	50	0.835	2 <sup>nd</sup>
Others	-	-	-	-	-	50	-	-

**Requirements for achieving efficient Construction Waste Management**

The results shows that the availability of disposal facility and appropriate landfills licensed for construction waste ranked 1st with relative index of 0.93. The absence of this requirement could be responsible for the irresponsible way of construction waste disposal. Availability of facilities/equipments and technologies that will make deconstruction & recycling practicable is ranked 2<sup>nd</sup> with relative index of 0.89, the absence of this requirement will

make recycling and salvaging materials and components for reuse impossible leading to increase in the quantity of materials for disposal. Existing environmental legislation and Enforcement of environmental legislation are ranked 3<sup>rd</sup> and 4<sup>th</sup> with relative indexes of 0.86 and 0.775 respectively. In Abuja the enforcement of environmental legislation is the responsibility of the AEPB and the existing environmental legislation which they enforce is the Abuja Environmental Protection Board Act No.10 of 1997.

**Table 4** Ranking of requirements for achieving efficient Construction Waste Management in Abuja Metropolis

Requirements	4	3	2	1	Rank sum (S)	N	Relative Index R.I=S/4n	Rank Order
Existing environmental Legislation	22	28	-	-	172	50	0.86	3rd
Enforcement of environmental legislation	14	33	3	-	155	50	0.775	4th
Availability of disposal facility and appropriate landfills licensed for construction waste	35	15	-	-	185	50	0.93	1st
Availability of facilities/equipments and technologies that will make deconstruction & recycling practicable	32	14	4	-	178	50	0.89	2nd
Availability of market for Recycled and deconstructed materials	10	34	2	4	150	50	0.75	5th

**Conclusions**

The research work studied construction waste management practices by firms in Abuja the capital of Nigeria. The study established that the Availability of market for recycled and deconstructed materials ranked least with relative index of 0.75 among factors required for achieving efficiency in waste management by firms.

Availability of disposal facility and appropriate landfills licensed for construction waste was ranked 1st with a relative index of 0.93. Availability of facilities/equipments and technologies that will make deconstruction & recycling practicable is ranked 2<sup>nd</sup> with relative index of 0.89. Existing environmental legislation and Enforcement of environmental



legislation are ranked 3<sup>rd</sup> and 4<sup>th</sup> with relative indexes of 0.86 and 0.775 respectively.

The research also identified the role of the site manager/contractor, designs and forms of buildings, lack of market for recycling and reused materials, lack of market for recycling and reused materials, lack of interest for reuse and recycling, lack of facilities and technology for recycling, deconstruction and reusing, poor information and partnership between parties to the contract and amount of funds available for construction waste management as some of the factors that influences construction waste management activities.

The study shows that an investigation by the Green Building Source, (2008) reveals that the quantities of construction waste generated by volume on jobs in the USA are 24% for wood, cardboard 38%, drywall 11%, masonry 1%, metals 4%, other waste 22%. However, results from the study carried out in Abuja shows that waste from wood constitute 33%, cardboard 5%, drywall 2.67%, masonry 26%, metals 5% and other waste constituting 28.33%. This result is an indication of a significant difference in the type and quantity of wastes generated on sites in the USA compared to that generated on sites in Abuja, the capital of Nigeria.

#### References:

- Green Building Source (2008). Construction Site Waste Management. Retrieved April 17, 2008, from [www://oikos.com/](http://www.oikos.com/)
- Lambert, G. and Domizio, L.(1993). Construction and Demolition Waste Disposal, Management problems and alternative solutions.
- Napier T. (2007). Construction Waste Management Retrieved August 13,

- 2007, from [www.wbdg.org/index.php](http://www.wbdg.org/index.php)
- National Park Services Envirofacts (1998). Construction/Building Demolition Waste Management. Retrieved August 13, 2007, from [www.envirofacts.org](http://www.envirofacts.org)
- Nigeriabusinessinfo.com, (2004).Retrieved August 13, 2007, from <http://www.nigeriabusinessinfo.com/capitalmarket.htm>
- Onabule, G.A. (1991). Options for Efficient Management of Construction Resources on Site. In Oluteju, B. (ed). Effective Contract Management in the Construction Industry. University of Cambridge Department of Estate Management and Building Services
- (2005) Construction Site Waste Management. Retrieved August 24, 2007, from [www.admin.cam.ac.uk/offices/environment/guardance/building.htm/](http://www.admin.cam.ac.uk/offices/environment/guardance/building.htm/)
- Youngman, M.B. (1981). Analysis of Social Education Research Data, McGraw Hill Book Co. U.K. 235p.