Assessing the Strategies for Reducing Masonry Material Wastage in Building Sites

A Case study of Rivers State Nigeria

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Abstract: *The increasing rate of generation of masonry material waste and it's consequently implication on the project cost, quality and client satisfaction is a great concern in recent time. This paper sought to assess strategies for reducing masonry waste generated in construction sites using the construction sites in River state as a case study. The research was pursued through the use of a well-structured questionnaire and interview of respondents. A total of a hundred and thirty-eight questionnaires were distributed with one hundred and twenty returned adequately filled and the result analyzed using the SPSS version16.0. The result of the analysis revealed among others that: An obvious increase in the generation of masonry material waste; Blocks as the most common masonry waste often generated in the construction site; the major cause of masonry waste generation of arranged in their order of severity are: quality of masonry materials, method of transportation with the site, mixing method, poor supervision and the storage methods in the construction sites. Also, result identified the major effect of masonry was as; high cost of project, Project Abandonment, delay in project delivery and lack of satisfactory output. Finally, the study revealed and recommends the possible strategies that can be adopted to reduce the increasing masonry waste generation in most sites in rivers state and these strategies arrange in their order of efficacy are: Training of craftsmen and artisans on masonry material handling, Project planning, generation of policy on material quality control and the use of experienced workers.*

Key words: Masonry material Waste, Reduction Strategies

I. INTRODUCTION

In the construction industry, it is well known that there is a relatively large volume of materials being wasted due to a variety of reasons. The problem of material waste in sites is not an isolated issue and is of environmental concern. Therefore, waste minimization has become an important issue in the construction industry. Waste minimization is defined as; any technique, process or activity which avoids, eliminates or reduces waste at it source. Bathurst P.SE (2005).

Materials waste reduction is an important factor which must be considered in carrying out any form of building project.The essence of reduction is to minimize or eliminate completely waste of materials and in most cases make some savings Abborth (1996).

Lan FE.C (2003), getting rid of material waste has become a big issue with many builders.With disposal fees steadily rising in most of the countries,some builders have begun viewing their debris as to be managed rather than simply discarded in fact,a realistic waste reduction strategy can provide both short term and long-term payoffs in the short-term,many builders realize that anything wasted on the job costs them twice,when it is purchased and again when it is handled off for disposal.While in the long-term,minimizing the waste generated can enhance the standing among potential customized by giving a reputation as someone who strives to protect the environment.

In the construction of building and its facilities,there are numerous variables of materials than can be adopted.Among these materials are commonly used; Concrete, Morter, Aggregates, Timber, Steel, Plastic, Glass,etc.

Davis Langdon (2007) these materials are resources of a fixed quantity description for a particular project as can be argued that no two projects are equivalent. This will also be argued that the quantities of provisional materials that is estimated for building project cannot be equal to another building project elsewhere with background, materials, concrete in particular would have been given a constant quantity and overhead for the completion of a destined project, it is very realistic in almost at all the cases there is after the initial usage of quantities of materials estimated, there is in a services of subsequent addition. These additions are borne out of carelessness of the production team in the wastages of material which can be seen under these stages of concrete works. Mansin Jain (2012).

The aim of the study was to find the effective means of reducing the material wastage in the building with emphasis on the Prodeco Construction site at Onne in River State. it considered identifying materials that their waste are increasingly noticeable, the effects of material waste and identify the challenges facing the industry in material wastage control.

This research work on conclusion will help in creating awareness on the effective method of reducing masonry material waste by the construction workers.

II. LITERATURE REVIEW

Concept of Building Material Wastage Reduction

The responsibility for material wastage reduction is divided between head office and construction site (Tom Napic 2012).Material management begins with planning, estimating, selecting and costing material listed the specification and bills of quantities, and this is the starting point in material waste reduction in construction projects. The suppliers with their basic production are listed, and selection made on the basis cost effectiveness or lower costs without compromising quality.

Davis Langdon(2007) opined that material waste reduction stems from the desire to organize, coordinates and control available scarce material resources in their procurement and application in order to achieve maximum and judicious utilization of materials and eventual minimization of materials wastes.

As earlier defined, an object is regarded as a waste when either as a part of as a whole of an originally grid material. It is left to rotten away or kept unusual and useless. Even though, there is no way a whole building will be completed without a single evidence of materials waste there is good room available for its control and management which lead to material waste reduction.Tom N.(2012) expresses that materials waste can be broadly classified as:Direct wastesand Indirect wastes.These classifications can be further analyzed in the following:Design/Interpretation errors, Quantities/cost estimating errors, Material handling errors.

Mansin Jain(2012)also confirmed that waste of materials could be either direct while Davis(2007)considered that some waste could be avoidable and others unavoidable.

The main sources of information for materials waste reduction is the feedback and control of material procurement, requisition, receiving documents, bids and quotations, purchase orders and subcontractors, receiving documents and invoices (Okonkwo 1997) for projects involving large scale use of critical resources, the owner may initiate the procurement procedure even before the selection of a contractor in order to avoid shortages and delays under ordinary circumstances, the contractor will handle other procurement to shop for the materials with the best prize performance or quality characteristics as specified by the designer. For effective material waste reduction, proper site planning in terms of access road to the site storage area, dumping bags etc. must be assured. Again, material ordered must arrive at appropriate time.

Causes of Masonry Material Wastage

Wastes of masonry materials occur on building site for a number of reasons.

(a.) **Design Alteration;**be avoidable and other unavoidable. The following are some of the causes of the building materials material waste as opined by Mansin Jain(2012)is introduced into the building process due to the intermittent changes in the clients desire and tastes including poor briefing/design information received from the inception and pre-contract stages. Any error in design and work specification due to this design alteration which is carried into the construction proper might lead to the need for variations in design and work and, possibly causing alteration and demolition of work that has already been erected in error. In this circumstance materials use to execute the work will be lost or wasted resulting in additional cost of materials actually expected to be used in the work and, possibly delays in the progress of the work execution and delivery of the building project.

(b) **Over estimation of Building Materials;** Mogba (2004), the work of the building cost expert and estimator is usually centered in extraction of quantities from working drawings of the architect or engineers and thereafter costing of the quantities of work to be done where there is an undetected design errors in the working drawing and specifications, there is bound to be quantities of elements of work extracted from the working drawings. Cost of the work among other things will be based on the extracted quantities of work in this circumstances materials waste could occur due to over purchasing of materials littered and lying waste all over the building site during and after construction.

The best way to check quantities/estimating errors is critically study the working drawings from the architect and engineer and spot out errors in design and computation and make such errors are dully corrected before any attempt is made in quantifying and costing the working drawings.

Wildermuth (2008), generally recommended the use of modern and imported material that have stood the test of time and comply with international rules and regulation". The reason for this assertion is not unconnected to the incidence of material waste in building is due to inclusion of poor quality materials in building work which quickly deteriorate and wear out resulting in unplanned and scheduled early replacement. Another reason is that most imported materials waste as those prototype materials will just be fixed to the work as they are brought in to the site.

(c). **Transportation waste/Transit Waste delivery:** example of materials occurring from transportation and delivery includes wastages arising from loading and offloading of materials especially when these operations are done carelessly. Some brittle and delicate materials like glass, asbestos roofing and ceiling sheets are prone to break up easily when carelessly loaded or offloading in vehicles meant to transport them to site. A little extra care in this operation could prevent material wastages occurring.

(d). Over Ordering of Construction Material: According to Karrar R.K (2013) over ordering of construction materials is type of material waste that comes from unguided surplus **purchases** made in excess of contractor' reasonable future requirements. Such unplanned purchases could be due to the alteration of provision of bonuses and discount facilities by the supplier/merchants. It could also result from poor materials estimate of the actual quantities of material needed for work. When these excess materials are leftover after completion of the building project they either rot away or are left for resale which it is been resale it may be at a very low price as against the price it was brought.

(e). Inadequatestorage facilities on site: According to Anumba (2006), a good inventory on good and materials on site would help to keep records in respect of material issued out from the store and the quantities that are not yet used this control process will indirectly check incidence of pilfering and theft the application of first in first out" (FIFO); first in last out" (FILO), "last in first out" (FIFO), "last in last out" (LILO) modules will put an end to material deterioration resulting from protracted long time storage of materials.

(f). inadequate supervision: Anumba (2006) is of the view that inadequate supervision of constructionmaterial which results to lack of monitoring and control of material used on site. Wastage of materials occurs due to poor and inefficient supervision and administrative incapability's in taking correct decisions for purchases when contractor use unskilled labour to attempt to do specialized items of work. Incorrect use and the application of materials that is not suitable to a particular work always results to wastage of materials.

(g) **Change in taste and methodology:** Karrar R.K (2013), change in taste and methods of construction results to wastage of materials on site. This material becomes redundant,obsolete and scraps due to sudden change in constructionmethodology. Material waste that arises from redundant obsolete and scrap materials which are kept away as unusable on site.

(h) **Work variations:** according to Davis Langdon (2007), misinterpretation of drawings can cause work variations and redesigning of building already in progress. This is one of the major causes of materials wastages on site especially for works that are in progress. As a result of such redesigning of drawings changes occur in the work in progress. When such variations occur, some demolitions of the whole building or components of the building will take place and definitely not all materials used in the demolished parts will be recovered for re-use that is why much care must be applied during proposal planning, and design in order (to eliminate design errors,which might cause changes in future.

Precaution Measures Against Material Wastage

Having seen the causes of materials wastage in building project on construction site, the following perceptional measures are adopted for the reduction 0f material waste

(a) All proposed building projects must have accurate designs reflecting the client's ideas and tastes clearly and fully articulated to form basis of extraction of quantities for bills of quantities from where relevant materials are scheduled out eventually.

(b.) Ordering, purchases, and delivery of stocks of materials should be guided and related to programmed time. Schedule for various components and segments of the works in order to ensure that material were bought on basis of needs and help to eliminate stocking of unnecessary bulk materials which ends up untying the scarce fund to materials need alone.

(c). Anumba (2006), transportation and delivery process which usually give to transit and delivery wastes should be handled with great care especially in areas of loading, off-loading packing and stocking. Careful inspection and maintenance of vehicles in use for the transportation of building material is of great importance in reducing material waste.

(d). Good storing and stocking facilities should be provided for various materials each according to their types and at positions where they will not constitute obstructions for work process site.

(e). Experienced skilled workers should be used in the areas of work were they are most suited to perform effectively and deficiently this will ensure that wastage of materials that usually come up due poor workmanship is reduced to a minimum or eliminated completely.

(f). Materials handling and security are other areas that attention must be given on materials wastages and this calls for effective management. In the first place, the impact of technology in design, manufacture use, and application of materials in building works should be constantly appraise in order to be abreast with new changes in construction process and use materials. New technology in most cases supersedes the old system in which wastages of materials and delays are prevalent and replaces the outdated system with new modern, mechanized, digital and computerized methods which make building process much easier.

(g) Tight security at single gate house and the storage REA should be mounted to check both internal and external attempts for pilfering; theft and vandalism. if security is porous losses will be incurred as results of lack of provision of security.

(h) The use of unskilled labourers, workers entraining and sometimes quacks to execute the work will lead to much wastage of materials, this practice should be avoided because it may not only end up in wastage or lose of materials but will probably lead to the collapse of the building and perhaps the loss of lives too.

(i) Every worker must be checked that they don't come into the site with any similar materials like those on site and when they are going after the end of work each day. They must be searched to ensure that they are not making away with materials from site. All vehicles coming into the site or leaving the site must be thoroughly checked for the same purpose for vehicles that belong tovisitor the best approach to security is to build a car lot outside the site. This helps to check materials waste.

(j). All form of materials waste on site constitute heavy financial loss if not properly handled. Where wastes occur in any way, immediate action should be taken to resell the bits of materials and leftovers in order to recoup at least some if not all the fund that could have gone into the drain indirectly in form of materials wastes.

III. RESEARCH METHODOLOGY

Research Area

The area chosen for this research work is Onne community in Eleme L.G.A, Rivers State, Nigeria. This community was chosen because of the massive construction activities going on in communities due to the massive urbanization of the area. The research was carried out in the community to analyze the strategies for reducing material wastage in building project in the area of Onne and Eleme community respectively because of the increasing masonry waste and high cost of project delivery.

Sample Size and Sampling Techniques

A Simple Random sampling which is a probabilistic sampling technique will be adopted for this study because each of the respondents has an equal chance of selection. Sample size pertains to key questions like "how big" or "small" a sample must be for it to be representative (Sarantakos, 2006)

The sample size which represents the targeted population was determined from the formula below since the targeted population is unknown

$$\mathbf{n = \frac{z^2pq}{\alpha^2}}$$

Where;

n = The desired sample size

p = Population proportion (normally between the range of (0.1 -0.5))

q = 1.0 – P

α = Margin of error (level of confidence)

z = The ordinate on the Normal Curve corresponding to **α** or the standard normal deviation,

considering that:

i. A 90 % level of confidence has α = 0.10 and critical value of Z α/2 = 1.64
ii. A 95 % level of confidence has α = 0.05 and critical value of Z α/2 = 1.96
iii. A 99 % level of confidence has α = 0.01 and critical value of Z α/2 = 2.58
iv. A 99.5 % level of confidence has α = 0.005 and critical value of Z α/2 = 2.81

For the purpose of this study, a confidence level of 95% was adopted in an attempt to get a reliable data. Consequently, the sample size is determined thus,

α = 0.05, p = 0.1, q = 0.9, z = 1.96

$$\mathbf{n = \frac{1.96^2 \times 0.1 \times 0.9}{0.05^2}}$$

n = 138 = 138

Hence total number of 138 copies of the questionnaire will be distributed to the professionals and employees in the construction industry within Rivers state.

Data Collection Procedure

The data gathering procedure will be done by dispensing the questionnaire to the respondents who are professionals in the construction industry. The questionnaires would be distributed by hand to respondents while at some places; copies will be dropped with their front desk personnel and come back for the response. The secondary data were sourced from Journals, textbooks, seminar papers, etc.

Method for Data Analysis

Data for this study will be processed and analysed with the aid of the Statistical Package for Social Science (SPSS 20), the calculations will be done using descriptive statistics (e.g frequency distribution tables, percentages, and mean item score). Also, random sampling and Relative Importance Index (RII) will be used for analyzing data collected and variables were measured on a five-point Linker-scale scored as follows:1=strongly disagree,2=disagree,3=Indecisive, 4=agree and 5=strongly agree. The data analysis must answer the research questions and satisfy the research objectives. The results will therefore be represented in tables. Statistical methods made use of are descriptive methods (e.g., frequency distribution tables and percentages) and the result is presented in figures and tables.

While research questions two, three, and four were analysed using the relative importance index (RII), adopting the five (5) point Linker's scale. The data analysis, therefore, employed the following steps:

a. Computation of the mean using the formula

Mean (m) = $\Sigma FX / \Sigma F$

Where;

x = points on the Linker's scale (1, 2, 3, 4, and 5)

f = frequency of respondents' choice of each point on the scale

b. Computation of the relative importance index (RII) for each item of interest, using the formula RII = m / 5(highest linker scale)

c. Ranking of the items under consideration based on their RII values. The item with the highest RII value is ranked first (1) the next (2) and so on.

d. Interpretation of the RII values as follows:

RII < 0.60, the item is assessed to have a low rating

$0.60 \leq$ RII <0.80, item assessed to have a high rating.

RII ≥ 0.80, item assessed to have a very high rating

IV. PRESENTATION AND ANALYSIS OF DATA

Questionnaires Administered

A total of one hundred and thirty-eight (138) questionnaires were administered, with a total one hundred and twenty (120) returned adequately filled giving a percentage response of 88.9%. See Table 1

Table 1:Questionnaire Administered

Questionnaire Administered	Frequency (No)	Percentages (%)
Questionnaires Returned	120	88.9
Questionnaires not Returned	11	11.1
Total	138	100

Source: Field survey, (2015)

Respondents Profile

Table 2 presents the profile of the respondents assessed within the study area. From the Table it can be seen that a larger percentage of the respondents were male (77.5). it can also be seen that most of the respondents were builder (31.7%) which was closely followed by architects(27.5%), Quantity Surveying (15.83%) and Estate Manager (11.67%). With regards to the working experience of respondents a larger percentage of the respondents (39.17%) had working experience between 4-6years and 30.0% were within 7-9years. Details of the working experience of the respondents are as presented at the Table.

Table 2: Respondent Profile

S/N	Profile	Option	Frequency (No)	Percentage (%)
1	Gender:	a) Male	93	77.5
		b) Female	27	22.5
		Total	**120**	**100**
2	Profession	a) Building	38	31.67
		b) Architecture	33	27.5
		c) Estate Manager	14	11.67
		d) Engineer	9	7.5
		e) Project Manager	7	5.83
		f) Quantity Surveying	19	15.83
		Total	**120**	**100**
3	Duration of work experience	a) 1-3years	29	24.17
		b) 4-6years	47	39.17
		c) 7-9years	36	30
		d) Over 10years	8	6.66
		Total	**120**	**100**

Source: Field Survey, (2015)

Masonry Material That Are Increasingly Wasted In Sites

Table 3 presented the respondents opinion on the increase in the generation f masonry wate in the construction sites. From the Table, 92.5% of the respondents attested to the fact that there is an increase in generation of masonry waste in their various sites. Similarly, a larger percentage of the respondents (53.3%) attested to the fact that blocks is the major masonry materials wasted in most construction. Details of other masonry material waste on the increase are as presented in the Table.

Table 3: Masonry Material That Are Increasingly Wasted In Sites

S/N	Questions	Option	Frequency (No)	Percentage (%)
1	Are Masonry materials often wasted in sites	a) Yes	111	92.5
		b) No	19	7.5
		Total	**120**	**100**
2	Which of these materials are often most wasted	a) Cement	16	13.3
		b) Mortal	27	22.5
		c) Blocks	64	53.3
		d) Others	13	10.9
		Total	**120**	**100**

Source: Field Survey, (2015)

Causes of Material Waste

The respondents' opinion on the possible cause of the increase in the generation of masonry waste was assessed and the respondent's opinion is as presented in Table 4. From the Table, the respondents ranked Quality of masonry material (RII= 0.69) as the major cause of masonry material waste in sites. This was closely followed by the method of transportation within the site (RII=0.62); Mixing Methods (RII=0.57) and Poor supervision of workers (RII= 0.54) which ranked second, third, and fourth respectively. Details of the ranking of other factors are as presented in the Table.

Table 4: Causes of Masonry Material Wastage in Construction Sites in Rivers States
Source: Survey 2015

S/N	WEIGHTNG/RESPONSE FREQUENCY										
	Causes of Masonry material waste	**1**	**2**	**3**	**4**	**5**	**(∑f)**	**∑fx**	**MEAN**	**RII**	**RANK**
1	Transportation within site	16	27	22	38	17	120	373	3.11	0.62	2nd
2	Quality of masonry material	8	21	31	28	32	120	415	3.46	0.69	1st
3	Mixing method	21	29	35	17	18	120	342	2.85	0.57	3rd
4	Stealing of Material	33	29	26	22	10	120	307	2.56	0.51	5th
5	Poor supervision of workers	37	22	23	18	20	120	322	2.68	0.54	4th
6	Storage method	43	21	23	21	12	120	298	2.48	0.50	6th

Where 1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very high

Effects of Material Wastage
The following effects on the material waste were rated by the construction site workers, the table below shows the presentation of the effects and its analysis according to the rating.

Table 5: Showing the Effects of Masonry Material Wastage

S/N	WEIGHTNG/RESPONSE FREQUENCY										
	Effects of Masonry material waste	**1**	**2**	**3**	**4**	**5**	**(∑f)**	**∑fx**	**MEAN**	**RII**	**RANK**
1	Lack of satisfactory output	16	28	29	21	26	120	373	3.11	0.62	3rd
2	Working Condition	21	26	22	30	21	120	364	3.03	0.61	5th
3	High cost of Project	9	23	33	29	15	120	400	3.33	0,67	1st
4	Delay in Project delivery	13	29	30	27	21	120	374	3.12	0.62	3rd
5	Project Abandonment	11	29	32	24	23	120	281	3.18	0.64	2nd

Source: Survey 2015
Where 1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very high

Table 5 presents the respondents ranking of the effect of masonry material waste. From the Table, the respondent ranked High cost of Project (RII=0.67) as the predominant effect of masonry material waste. This was closely followed by Project Abandonment (RII=0.64); Delay in Project delivery (RII=0.62) and Lack of satisfactory output which ranked second and third respectively.

Challenges of Material Waste Reduction
The respondents further assess some of the challenges experiences in the masonry work waste reductions and the result is as presented in Table 6. From the Table it can be deduced that 92.5% of the respondents claimed that one of the major challenge is lack of material quality control in most sites. Similarly, 91.67% of the respondent also attested that the use of inexperienced worker contributes to the increasing generation of masonry waste in sites. Lacking of training of artisans and craftsmen on material handling was also identified as a major challenges in the increase in masonry material waste.

Table 6: Showing the Challenges of Masonry Material Waste Reduction

S/N	Masonry Waste Reduction Challenge	Option	Frequency (No)	Percentage (%)
1	Lack of material Quality control	a) Yes	111	92.5
		b) No	19	7.5
		Total	**120**	**100**
2	Inexperience worker	a) Yes	110	91.67
		b) No	10	8.33
		Total	**120**	**100**
3	Lack of training of artisans and craftsmen on material handling	a) Yes	98	81.67
		b) No	22	18.33
		Total	**120**	**100**

Source: Field Survey, (2015)

Recommendation on the Strategies for Reducing Material Wastage.

Table 7: Showing the Strategies for Reducing Material Wastage.

Strategies for reducing material Wastage	1	2	3	4	5	Σf	Σfx	Mean	Rii	Rank
Supervision	17	28	31	24	20	120	362	3.02	0.6	5th
Policies on material quality control	14	23	29	25	29	120	392	3.27	0.65	3rd
Project planning	9	24	32	28	27	120	400	3.33	0.67	2nd t
Training of craftsmen and artisans on masonry material handling	11	23	28	20	38	120	411	3.43	0.69	1st
Use of experienced personnel	18	23	29	28	22	120	373	3.11	0.62	4th

Source> Survey 2015
Where 1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very high

From Table 7, the respondents ranked training of craftsmen and artisans on masonry material handling (RII=0.69) as the best strategy in tackling the increasing masonry material waste experience in most sites in rivers state. This was closely followed by Project planning (RII=0.67); generation of policy on material quality control (RII= 0.65) and the use of experienced workers (RII=0.62) ranked second, third and fourth respectively in the order of if efficacy.

V. Summary of Findings, Conclusion and Recommendation

Summary of Findings

From the ongoing the following summary can be reached: The respondent have reasonable experience in the site to make contributive and informative suggestions on the subject matter owing to their professional background years of working experience. A Large percentage of the respondents (92.5%) attested to the increasing generation of masonry material waste in the site. Similarly blocks were identified as the major masonry material waste often generated in sites in Rivers State.

With regards to the causes of masonry waste generated in construction sites, Quality of masonry material (RII= 0.69) was ranked first while transportation within the site (RII=0.62); Mixing Methods (RII=0.57) and Poor supervision of workers (RII= 0.54) which ranked second, third, and fourth respectively. Similarly, 92.5% of the respondents claimed that one of the major challenge is lack of material quality control in most sites. Also, 91.67% of the respondent also attested that the use of inexperienced worker contributes to the increasing generation of masonry waste in sites.

With regards to the effect of masonry material waste in the construction sites in Rivers State, the respondent ranked High cost of Project (RII=0.67) as the predominant effect of masonry material waste. This was closely followed by Project Abandonment (RII=0.64); Delay in Project delivery (RII=0.62) and Lack of satisfactory output which ranked second and third respectively

Finally, with regards to the strategy for reducing masonry waste respondents ranked training of craftsmen and artisans on masonry material handling as the best strategy in tackling the increasing masonry material waste experience in most sites in rivers state. This was closely followed by Project planning (RII=0.67); generation of policy on material quality control (RII= 0.65) and the use of experienced workers (RII=0.62) ranked second, third and fourth respectively

Conclusion

There is an obvious increase in the generation of masonry material waste in most of the construction site studied in rivers State and the most common masonry waste often generated in the construction site are waste from blocks. To this effect the study also revealed that the major cause of the generation of this masonry material waste arranged in their order of severity are: Quality of masonry materials, method of transportation with the site, mixing method, poor supervision and the storage methods in the construction sites.

The effects of the masonry material waste was also assessed and the result of the analysis reveal the following in their order of severity: High cost of project, Project Abandonment, delay in project delivery and lack of satisfactory output.

Finally, the study revealed the possible strategies that can be adopted to reduce the increasing masonry waste generation in most sites in rivers state and these strategies arrange in their order of efficacy are: Training of craftsmen and artisans on masonry material handling, Project planning, generation of policy on material quality control and the use of experienced workers.

Recommendation

Base on the findings of this study, the following are recommended

Training of craftsmen and artisans on masonry material handling and adequate project planning with the consciousness of removing or reducing to the bearable minimum the masonry waste generated

Proper quality control of masonry materials brought t sites before acceptance into site or even use in the site

Properly attention should be given to the method of mixing and transportation of the masonry materials within the site as this is a major means of masonry waste generated in the construction site in river state

Finally, there should be proper supervision on site during off-loading of materials

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