

ATTITUDE OF CONSTRUCTION PROFESSIONALS ON BUILDING MATERIAL WASTAGE IN GWALIOR, INDIA

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Abstract

Wastage of building materials is perceived as an imperative dilemma in construction destinations and vital ramifications. Building materials wastage has been considered to have high effect on construction ventures. It influences both condition and economy of a nation. India is a creating nation which requires a ton of construction materials for its practical advancement. The construction business is in charge of creating an entire assortment of wastage relying upon variables, for example, phase of construction, kinds of construction works and practices on destinations. The administration of construction materials has been dangerous throughout the years prompting lack of materials amid construction and deferral in finish of task as a consequences of malignant age of construction wastage. The construction has been accounted for to create grievous level of material waste in India. Construction industry accounts 19 percent of GDP of India in year 2016-17. Wastage of materials builds cost of task. This examination concentrated on the reaction of construction proficient towards wastage of materials at construction destinations. The finding of this examination is to recognize the reaction related reasons for materials wastage, materials most wastage as an aftereffects of people reaction and key rules to changes the reaction of construction experts

Keywords: *Construction Industry, Material wastage, building material, Gwalior division.*

1. INTRODUCTION

Wastage of building materials is perceived as an imperative dilemma in construction destinations and vital ramifications. Building materials wastage has been considered to have high effect on construction ventures. It influences both condition and economy of a nation. India is a creating nation which requires a ton of construction materials for its practical advancement. The construction business is in charge of creating an entire assortment of wastage relying upon variables, for example, phase of construction, kinds of construction works and practices on destinations. The administration of construction materials has been dangerous throughout the years prompting lack of materials amid construction and deferral in finish of task as a consequences of malignant age of construction wastage. The construction has been accounted for to create grievous level of material waste in India. Construction industry accounts 19 percent of GDP of India in year 2016-17. Wastage of materials builds cost of task. This examination concentrated on the reaction of construction proficient towards wastage of materials at construction destinations. The finding of this examination is to recognize the reaction related reasons for materials wastage, materials most wastage as an aftereffects of people reaction and key rules to changes the reaction of construction experts The majority of construction waste of resource occurs not only because of poor workmanship, inadequate supervision. Improper design or poor organization of a site, but because of the pre-notion of the construction professional that wastage is part of the normal procedure.

The majority of construction waste of resource occurs not only because of poor workmanship, inadequate supervision. Improper design or poor organization of a site Construction materials waste adds no value to the overall outcomes of a construction material. The existence of these materials waste are both intentionally or unintentionally, which could be avoided during production phase through adequate evaluation of response and practices of the construction participants.

Appropriate planning and construction management reduces wastage of materials at construction sites. This is turn to improve or increase the performance and economy of the organization. The main objective of materials waste is to reduce the cost of the project, delay in the project completion time and most importantly pollution free sites

Lastly it is concluded that construction materials waste is avoidable and this can be achieved through practicing positive response which include self- motivation, developing better Communication within the organization, providing proper training to construction professional regarding waste management practice

2. OBJECTIVE AND SCOPE

The research work reported in this paper is part of on-going projects under Gwalior division in India. The main objectives this paper is:-

- ⇒ To investigate the main building material wastage factors of construction projects.
- ⇒ To distinguish the factors which are affecting the building material wastage of construction projects.
- ⇒ To find out the relative importance of the factors affecting material wastage.
- ⇒ Determine factors that encourage construction participants’ attitudes towards material wastage.
- ⇒ To find out the most critical building material wastage factors for providing success in construction projects in Gwalior division India.

3. SOURCE OF BUILDING MATERIALS WASTAGE

For discovering out the most building material wastage factors in the construction projects, a literature survey is lead in which many works of the researchers have been analyzed and the factors are chosen which was common in most of the research. Total 5 main factor group and 68 sub- factors are taken by literature study and these factors are classified into five categories as shown in Table. 3.1.

Table 3.1: List of building material wastage factors which are affecting the success of construction project.

Sr. no.	Group	Factors
1.	DESIGNING Factors	Lack of sub-contractors skills and experience
		Selection of low quality products
		Lack of influence of contractors and lack of knowledge about construction
		Error in the contract documents
		Improper management of the material handling at site
		Lack of attention paid to dimensional coordination of products
		Complexity of detailing in the drawing
		Change made to the design while construction is in progress
		Change in common schedule of rates of governments
		Damage by the other participants
		Weather Effects
2.	PROCUREMENTS Factors	Purchased products that do not comply with specification
		Process of selection of procurements methods
		Less use of information technology
		Level of cooperation from suppliers
		Lack of conflict resolution skills
		Supplier relationship with contractors and engineers
		Obligation of professional ethics in the company
		Ordering error
		Follow-up system during delays
		Lack of possibilities to order small quantities
		Suppliers are delivering the right goods at the right time
Shortage of transporting means		

3.	OPERATIONAL Factors	Poor site layouts
		Rework due to workers/poor workmanship
		Waiting for materials
		Waiting for materials
		Imperfect planning for construction
		Use of incorrect materials
		Poorly scheduled delivering of material to site
		Delay in material delivery
		Waste of raw material at site
		Waiting for design documents and drawing
		Too much over time for labors
		Choice of wrong construction method
		Severe or inclement weather
		Delay in passing of information to the contractor on type and size of product to be used
Equipment's mal functioning		
4.	Material handling Factors	More distance between plant to the working place
		Unfriendly attitudes of project team and labors
		Lack of attention paid on site material control
		Experience of production control person
		Lack of storage facility at site
		Flow rate, routine and scheduling of materials
		Lack of attention paid to the safety equipment and facility of workers
		Unpacked supply
		Experience of workers
		Less use of automated handling
		Use of whatever material which are closer to working place
		Damage during transportation
		Thieves
5	Materials most wastage as a result of human attitude	Steel bars
		Plasterboard
		Bricks and Blocks
		Tiles
		Concrete
		Mortar
		Cement
		Coarse aggregate
		Sand
		Paint
		Pipes
		Metal
		Insulation
		Plastic
		Plumbing and electrical fixture
Chipping		
Glass		

Table 3.1 will be used for analyzing the data to find out the relative importance Index of the factors. Project participant is the legal entity that participates in a project and takes over all respective task and responsibility.

Reason of reducing material waste

The reduction of material waste can be beneficial to the construction industry. Reducing material waste can be great financial benefit for construction professional for cost increase problems on construction sites. The cost of material waste is not included in a tender price. Reducing the material wastage can be a benefit to sub-contractors and can result in either a total saving to the project or a increase in project for sub- contractors. There would be drop in tender price and competitive advantage achieved. Sub-contractors are to benefit from using their materials more efficiently. If subcontractor show initiative to support and engage best reduction measures, they can improve their chances of being known as preferred bidders as they can help main contractors meet their material waste targets.

Sources of material waste in construction

As I studies many paper of past about materials wastage and I decided that there are many categories of material waste but I decided to write only five categories: design, procurement, handling of materials, operation and Materials most wastage as a result of human attitude. As I think that the process of waste minimization must be started at the early stages of the project. The most frequent measures practiced to minimize and reduce material waste are staff Training, adequate storage and just- in time delivery of materials are one of the most important.

Factors and sources responsible for material wastage on construction projects

The construction industry is responsible for generating an entire form of construction waste, depending on factors such as the stage of construction, type of construction work and practices on site. (Agyekum et al. 2012). Material waste due to Over ordering/excess, wrong storage, wrong handling, overproduction, manufacturing defects, Theft or vandalism further stated the most dominant causes of waste generation are Late Information, Uncompleted design, Inadequate information, Untrained labor, Work not done, Poor technology of equipment, Changes to design, Damage during transportation. (Garas et al. 2001) Al-Hajj and Hamani (2011) agreed on lack of consciousness as a factor for construction waste generation. Attitude allied issues among construction workers to material waste generation include poor communication among the parties involved in a project; rework due of mistake/ poor workman skill, poor communication among the parties involved in a project, human error and carelessness, improper interaction between engineers and workers and provision of insufficient information to project participants among others (Gandaa 2014). Furthermore, (Gandaa 2014) through the review of extant literature opined that sources of waste are characterized by four key causes such procurement, handling, operation and culture.

Techniques of construction material management

Construction material waste management is categorized to five processes these processes are majorly followed on construction site they are namely 1.Planning, 2. Procurement, 3. Logistics, 4. Handling and 5 Waste control processes. Construction materials planning include quantifying, ordering and scheduling. Construction materials handling encompasses virtually all aspects of various movements of raw construction materials, work in process, or finished goods within a construction site.

4. Survey

To complete the questionnaire section, a pilot study was accompanied. This section contained identification of different causes, collection, and conclusions of data. The applications of this section benefited in better formation of the survey development. Total 5 main factor group and 68 sub- factors are taken by literature study were personally filled by contractors, architectures, owner, project managers, and project engineers of various construction organizations.

Data Collected From the Survey

For successfully study, one of the most important part of the study is the “collection of accurate data”. Take a certain sample number of people for collecting crucial data record. For calculation and result arrange all data. Collected Total 5 main factor group and 68 sub- factors are taken as questionnaires used for study.

Measurement of Data Collected From the Survey

It is true, while performing any task on construction projects; disturbances can exist with different degree of danger. In order to overcome with these different degrees, it was decided to consider from condition level i.e no effect, little effect, moderate effect, strong effect, very strong effect. A clear specification of the standard conditions was necessary to enable respondents to clearly distinguish the degree of each adverse condition level. Standard conditions, discussing to five different degrees of severity for each field. A detailed questionnaire was developed to calculate the R.I.I. of factors affecting construction material wastage. For suitable technique of ordinary study scales used for representation of the effect different factors on material wastage used in the questionnaire survey.

Table 4.3 represents the ordinary scale. The assigned number 1, 2, 3, 4 and 5 are a numerical indication of different level of degree.

TABLE NO. 4.3

EFFECT OF FACTOR ON MATERIAL WASTAGE					
TYPES OF EFFECT	NO EFFECT	LITTLE EFFECT	MODERATE EFFECT	STRONG EFFECT	VERY STRONG EFFECT
SCALE	1	2	3	4	5
FACTORS	N1	N2	N3	N4	N5

Method Used For Analysis of Data

In order to facilitate the study, after the Literature Review and the personal interviews, a plan was formulated for collecting field information and creating an evaluation process and numerical values. R.I.I. method used to analyze the survey results.

RELATIVE IMPORTANCE INDEX METHOD (%)

$$\frac{5(n5) + 4(n4) + 3(n3) + 2(n2) + 1(n1)}{5(n1 + n2 + n3 + n4 + n5)} \times 100$$

Where

N1=number of respondents who selected factor for no effect

N2= number of respondents who selected factor for little effect

N3= number of respondents who selected factor for moderate effect

N4= number of respondents who selected factor for strong effect

N5= number of respondents who selected factor for very strong effect

Table 4.6: Main Group comparison & Ranking.

Main Group categories	R.I.I	Rank
<i>DESIGNING</i>	64.2390	3 rd
<i>PROCUREMENTS</i>	63.4975	4 th
<i>OPERATIONAL</i>	69.1746	2 nd
<i>MATERIAL HANDELING</i>	69.8700	1 st
<i>MATERIAL MOST WASTAGE AS A RESULT OF HUMAN ATTITUDE</i>	51.6041	5 th

The relative importance index, comparison and ranking of the main group is shown in figure. 1.11.



Table 4.7: Ranking of top seven designing group factor

Designing related factors	R.I.I	Rank
Lack of sub-contractor skills and experience	79.33	1st
Selection of low quality products	76.67	2nd
Lack of influence of contractors and lack of knowledge about construction	72	3rd
Error in the contract documents	68	4th
Improper management of the material handling at site	66	5th
Lack of attention paid to dimensional coordination of products	65.33	6th
Complexity of detailing in the drawing	64.67	7th

Table 4.8: Ranking of top seven procurement group factors.

Procurement related factors	R.I.I	Rank
Purchased products that do not comply with specification	70.67	1st
Process of selection of procurements methods	70	2nd
Less use of information technology	69.37	3rd
Level of cooperation from suppliers	68.67	4th
Lack of conflict resolution skills	66.67	5th
Supplier relationship with contractors and engineers	65.34	6th
Obligation of professional ethics in the company	62.67	7th

Table 4.9: Ranking of top seven operational group factors.

Operational related factors	R.I.I	Rank
Poor site layouts	84	1st
Rework due to workers/poor workmanship	82.67	2nd
Waiting for materials	76.67	3rd
Equipment's mal functioning	76.66	4th
Imperfect planning for construction	76.65	5th
Use of incorrect materials	75.33	6th
Poorly scheduled delivering of material to site	72	7th

Materials most wastage as a result of human attitude related factors	R.I.I	Rank
Cement	90.67	1st
Plasterboard	89.33	2nd
Bricks and Blocks	87.33	3rd
Concrete	72	6th
Mortar	80	4th
Steel bars	72.67	5th
Coarse aggregate	60.67	7th

Table 5.1 Ranking of top seven material handling group factors.

Material handling related factors	R.I.I	Rank
More distance between plant to the working place	76.67	1st
Unfriendly attitudes of project team and labors	76	2nd
Lack of attention paid on site material control	75.34	3rd
Experience of production control person	74	4th
Lack of storage facility at site	72	5th
Flow rate, routine and scheduling of materials	72	6th
Lack of attention paid to the safety equipment and facility of workers	70	7th

Table 5.2: The relative importance and over all ranking & comparison of factors is shown in table 4.7 Over all ranking of the Factors.

Lack of sub-contractor skills and experience	79.33	7 th
Selection of low quality products	76.67	8 th
Lack of influence of contractors and lack of knowledge about construction	72	22 nd
Error in the contract documents	68	34 th
Improper management of the material handling at site	66	38 th
Lack of attention paid to dimensional coordination of products	65.43	39 th
Complexity of detailing in the drawing	64.67	42 nd
Change made to the design while construction is in progress	62.67	43 rd
Change in common schedule of rates of governments	57.33	51 st
Damage by the other participants	48	59 th
Weather Effects	46.67	60 th
Purchased products that do not comply with specification	70.67	24 th
Process of selection of procurements methods	70	26 th
Less use of information technology	69.34	28 th
Level of cooperation from suppliers	68.67	31 st
Lack of conflict resolution skills	66.67	35 th
Supplier relationship with contractors and engineers	65.35	40 th
Obligation of professional ethics in the company	62.66	44 th
Ordering error	60.12	48 th
Follow-up system during delays	60	49 th
Lack of possibilities to order small quantities	59.33	50 th
Suppliers are delivering the right goods at the right time	56	54 th
Shortage of transporting means	54	55 th
Poor site layouts	84	4 th
Rework due to workers/poor workmanship	82.67	5 th
Waiting for materials	76.66	10 th
Waiting for materials	76.56	11 th
Imperfect planning for construction	76.46	12 th
Use of incorrect materials	75.34	14 th
Poorly scheduled delivering of material to site	72.69	18 th
Delay in material delivery	69.33	29 th
Waste of raw material at site	68.66	32 nd
Waiting for design documents and drawing	66.66	36 th
Too much over time for labors	65.33	41 st
Choice of wrong construction method	62	45 th
Severe or inclement weather	60.89	46 th
Delay in passing of information to the contractor on type and size of product to be used	52.66	56 th
Equipment's mal functioning	50	58 th
More distance between plant to the working place	76.68	9 th
Unfriendly attitudes of project team and labors	76	13 th
Lack of attention paid on site material control	75.33	15 th
Experience of production control person	74	16 th
Lack of storage facility at site	72.34	20 st
Flow rate, routine and scheduling of materials	72.33	21 st
Lack of attention paid to the safety equipment and facility of workers	70.89	23 rd

Unpacked supply	70.12	25 th
Experience of workers	69.35	27 th
Less use of automated handling	68.87	30 th
Use of whatever material which are closer to working place	68.23	33 rd
Damage during transportation	66.12	37 th
Thieves	50.67	57 th
Cement	90.67	1 st
Plasterboard	89.33	2 nd
Bricks and Blocks	87.33	3 rd

Tiles	56.67	53 rd
Concrete	72.89	17 th
Mortar	80	6 th
Steel bars	72.67	19 th
Coarse aggregate	60.67	47 th
Sand	56.78	52 nd
Paint	31.34	62 nd
Pipes	34.67	61 st
Metal	26	64 th
Insulation	23.34	65 th
Plastic	22.68	66 th
Plumbing and electrical fixture	23.33	67 th
Chipping	28	63 rd
Glass	22.67	68 th

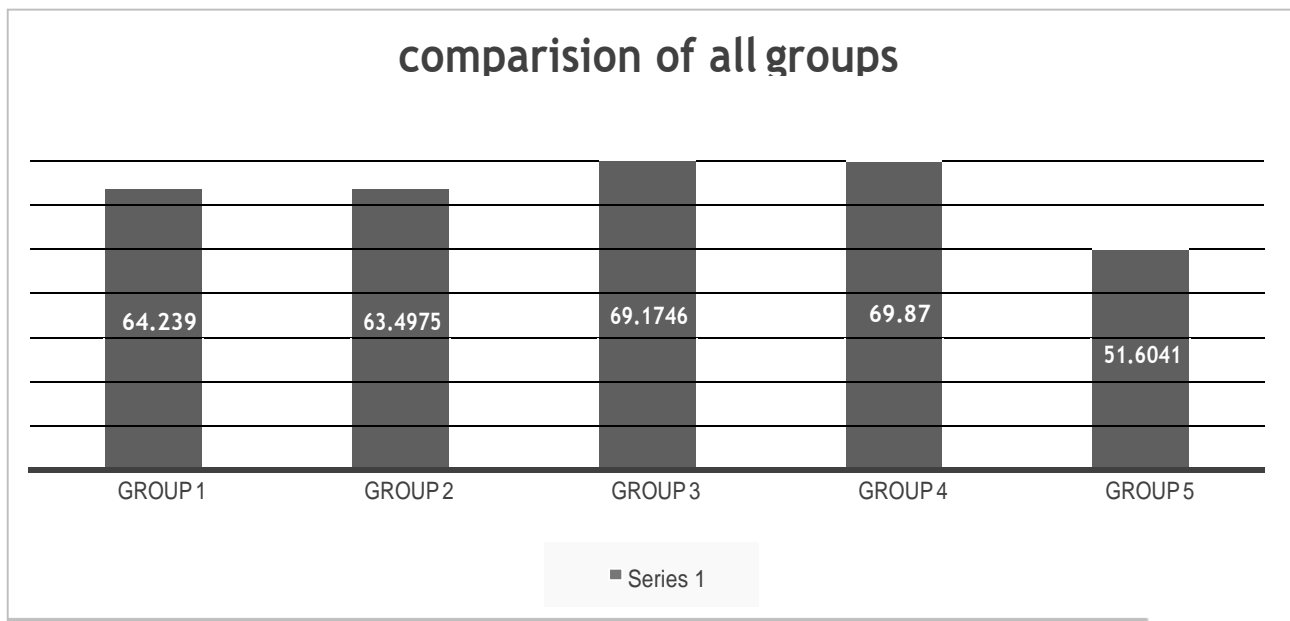



Fig. no 1.12



6. CONCLUSION

Construction waste minimization will certainly play an essential role in achieving the sustainable construction. Since the construction industries are labor-intensive, the attitude of the workers affects the growth and minimization of waste. Therefore, this study has focused on detecting the different factors related to the attitude which causes material wastage during construction. After conducting the study, it has revealed that material waste is avoidable especially which are done by construction participants like using excessive quantities of materials more than required, human error and carelessness; and Lack of supervision and delay of inspections.



Though construction materials waste is avoidable, it can only be achieved through practicing positive attitude which includes self-motivation, developing better communication within the organization, providing proper training to construction personnel regarding waste management practices. Thus, this study concludes that for the success of construction project, above factors have to be managed carefully. This investigation likewise gives an appropriate direction to construction team and significant data to managers which can be used to manage their projects in a better and efficient way.

7. RECOMMENDATION

- The construction participants which are involved in construction should be well trained in various strategies regarding reduction of material waste.
- Waste audit should be done to check the level of wastage which later helps in controlling the material wastage.
- The usage of barcode system can be employed by construction firm to check the amount of materials delivered on site and to trace the materials in transit which will provide real-time information on the status of materials.
- Government policy on handling and disposal of construction should be followed up with strict monitoring to ensure compliance.
- Government should set the encouraging scheme for construction firm which embraces construction waste management wholly.

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