

ANALYSIS AND MANAGEMENT OF CONSTRUCTION WASTE BY DEVELOPING METHODOLOGICAL APPROACH

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ABSTRACT

Development industry majorly affects the earth as far as waste creation. The development business is in charge of delivering distinctive on location squanders; the sum and sort of which relies upon variables, for example, the phase of development, kind of development work, changes in outline and practices all through the venture lifecycle. An assortment of development squander minimization methods and instruments are right now accessible to redirect squander far from landfill. Enormous increment in measure of waste era attributable to the development in development industry can prompt wastage of materials which has its economic esteem. This theory concentrates on General reasons for development material waste, significance of waste acknowledgment, obstructions to execute squander administration and their effect on the development venture through poll review, level of development squander happened on chose contextual investigation, setting up a survey for contractual worker, site administrator, site supervisor, site designer and work to know their knowledge of waste administration and Developing a methodical Approach to limit the development squander.

Keyword : - Construction squander, Construction squander minimization, Material waste

1. INTRODUCTION

Development industry is one of the quickest developing economies in India. As needs be, presentation of proper administration framework as far as development materials and authoritative set up might be gainful to not just the development organizations yet in addition the general public and condition. The achievement of a development organization is considerably reliant upon the execution of a compelling administration arrangement of the development material. Amid the most recent couple of decades, this industry has advanced alongside the consistently developing prerequisites and multifaceted nature of ventures. Development materials constitute a noteworthy cost segment of a structural designing structure. The cost of development materials might be upto 65% of the aggregate cost caused in the development of a structural designing structure. In any case, it is reliant upon the kind of task, and the development strategy and plant utilized. Suitable arranging and development administration diminishes wastage of development materials considerably. This thus enhances the execution and economy of the association. Material administration works as a team with arranging and control of material stream. One of the real difficulties confronted by development organizations is keeping the advance according to plan. Poor advance of development may in dominant part of cases be because of lack of foresight and administration of development material. It is worried about arranging, securing, getting, stacking and conveyance of development materials at proper time and place. Development squander comprises of undesirable material delivered specifically or by chance by the development or enterprises. Development and decimation squander is created at whatever point any

development/destruction movement happens. Development squanders in any venture are through building trash shape pulverization exercises, rubble, earth material, solid squanders, steel squanders, timber squanders, and development site leeway development materials, emerging from various development exercises of task including land exhuming or arrangement on development site, common and building development materials, development site freedom squander, obliteration exercises squander, roadwork waste, and building renovation squander. Lessening of waste should be possible by honing state of mind towards Zero wastage, appropriate choices at configuration arrange, development site administration, legitimate institutionalization of development materials, and Codification of the same. Development waste can likewise be decreased by utilizing waste administration framework on venture. The undertaking exercises are to be arranged at each phase by each development faculty, who are included, in limiting the general waste era at project. Waste rate estimation technique can be utilized to enhance the taking care of material, lessen the waste rate, and enhance efficiency.

2. LITERATURE REVIEW

1. Prof. B. Prakash Rao, Shivkumar B, H S Suresh (), This exploration paper depends on material waste administration in building development through the exposition work, endeavour is made to distinguish general reasons for material waste, boundaries to usage of waste administration and what are the waste minimization measures rehearsed in development industry by directing poll review. This investigation Identifies wellsprings of waste materials which not just have money related and natural advantages yet in addition demonstrates the territories which require act of spontaneity and furthermore completes the undertaking on time. Consequently exertion can be made to diminish the general cost of venture by squander minimization or most extreme usage of assets.

2. Jee-Hye Kim, Jae-Moon Kim, Hee-Sung Cha, Dong-Woo Shin (), The concentration of this paper is recognizing waste administration execution factors and building up an applied model for the assessment instrument. Keeping in mind the end goal to accomplish this goal, in the first place, different waste administration execution factors are recognized through broad writing surveys. Second, a poll review for development administrators who manage squanders is directed to investigate both weight and need of the recognized elements. At long last, an assessment device is produced, which depends on the components and their weights and needs. In this exploration paper, 59 persuasive elements have been distinguished and classified into five classes, i.e. labor, material, technique, administration, and approach, as far as the attributes of the variables. Moreover, an assessment apparatus has been produced keeping in mind the end goal to viably evaluate all the 59 factors in light of an intensive industry study. The yield of the Tool, which is Waste Management Index, adequately survey the level of waste administration execution for a specific undertaking and give the most utilized factors in requirement for development in squander administration execution.

3. Ibrahim Mahamid, Isam A.Q. Elbadawi (), This examination uses Likert scaled reactions through a two-section survey circulated to 42 contractual workers situated in the Northern locale of KSA. The initial segment of the survey goes for recognizing reasons for material waste in building development ventures from the temporary workers' perspective. The second part tries to rank the considered materials as indicated by their level of significance from the temporary workers' perspective. The gathered information was dissected through Minitab measurable programming. It was discovered that the most huge components causing development squander are: (1) incorrectness in amount studies prompting overordering or under-requesting; (2) the choice of low quality items; (3) detail mistakes in plan and development; (4) the request of provisions in free frame; (5) and the wastefulness in asset administration. The aftereffects of this examination demonstrate that development material taking care of and administrative choices critically affect the circumstances and end results of the level of development squander. The investigation discoveries exhibit that the most vital advantages for considering development squander are to know the correct required amounts for a development venture and to design and set up an exact calendar for material arriving supply.

3. DATA COLLECTION AND ANALYSIS

3.1 DATA COLLECTION

To know the exact quantities of construction waste of cement, steel, aggregate, sand occurred on construction site following data is collected from different sites which are as follows-

Wastage of Material Verification Sheet

Name of Site: Marvel Edge.

Details of Site: Viman Nagar, Pune.

Sr.NO	Materials	Unit	Requisition Qty	Estimated Qty	Received Qty	Consumed Qty	Balance Qty site/store/T transfer	wastage Qty	% wastage	Allowable wastage	% variance excluding Allowable wastage
1	Cement	Bags	1,57,526	1,85,220	197,530	191030	6500	6500	3.40%	2.00%	1.40%
2	Steel	MT	4555	4250	4555	4350		165	3.75%	2.50%	1.25%
3	20 mm.	Bags	15680	14280	15680	14350		1350	9.42%	8.00%	1.42%
4	10 mm	Bags	8579	8320	8580	7890		690	8.94%	8.00%	0.74%
5	Sand	Bags	12690	12120	12700	11320		1380	12.19%	10.00%	2.19%

Site Engineer: 

Authorized Signature: 

PARTNER

Fig -1 Wastage of material verification sheet for case study 1

Wastage of Material Verification Sheet

Name of Site: Akshay Classic.

Details of Site: A/P Pimpale sandayon Pune (Residential Project)

Sr.NO	Materials	Unit	Requisition Qty	Estimated Qty	Received Qty	Consumed Qty	Balance Qty site/store/T transfer	wastage Qty	% wastage	Allowable wastage	% variance excluding Allowable wastage
1	Cement	No	80,000	75,000	80,000	78360	1700	1700	2.17%	2.00%	0.17%
2	Steel	MT	1600	1550	1600	1550		50	1.34%	3.00%	-1.66%
3	20mm	Bag	1520	1530	1590	1590		-70	-4.60%	5.00%	-9.40%
4	10mm	Bag	1600	1500	1600	1515		85	5.61%	5.00%	0.61%
5	Crush sand	Cum m Bag	350	320	350	323		27	2.90%	2.00%	-0.90%

Site Engineer: 

Authorized Signature: 

AKSHAY CLASSIC

Fig -2 Wastage of material verification sheet for case study 2

Wastage of Material Verification Sheet

Name of Site: opus 77 (Shanadeang Dev.)

Details of Site: - Bhunkar Chowk, Vinodk wasti, wakad Pune-

Sr.NO	Materials	Unit	Requisition Qty	Estimated Qty	Received Qty	Consumed Qty	Balance Qty site/store/Transfer	wastage Qty	% wastage	Allowable wastage	% variance excluding Allowable wastage
1	Cement	NO	92,000	90,000	92,000/-	91,700	300	300	3.56%	2%	1.56%
2	Steel	MT	1500	1450	1500	1495		5	3.34%	2.5%	0.84%
3	20mm BEASS		1510	1400	1510	1432		78	5.45%	8%	-2.55%
4	Crush Sand	BEASS	1680	1600	1680	1623		57	3.51%	8%	-4.49%
5	River Sand	BEASS	950	900	950	945		5	0.53%	10%	-9.47%

Site Engineer:  **Site Engineer**



Authorized Signature:  **Authorized Signature**

Fig -3 Wastage of material verification sheet for case study 3

By observing the above details it is clear that the construction waste occurs on the site in the form of different materials and activities during the various stages of construction project which directly affects the profit margin of project. To overcome these problems and to know the causes of construction waste a questionnaire is prepared and which is distributed and collected from contractor, site engineer, site manager, site supervisor and labour on different construction sites.

Table -1: Data collected

Job Profile	Questionnaire sent	Questionnaire received	Percentage
Contractor	40	25	62.5
Site Supervisor	35	17	48.5
Site Manager	44	22	50
Site Engineer	30	20	66.6
Labour	26	17	65.3
Total	175	101	57.71

3.2 DATA ANALYSIS

The Relative Importance Index (RII) positioning strategy had been connected to decide the positions of the distinctive reasons for Construction squander. From the positioning allocated to each reason for development squander, it can recognize the most basic reasons for development squander factors in the development business. The RII has been utilized as a part of numerous areas to assess the near significance of a solitary thing to others. The condition expressed beneath was utilized to figure the relative significance record for every one of the causes.

The five-point scale ranging from 1 (very low) to 5 (Very high) was adopted and transformed to relative importance indices (RII) for each factor as follows:

$$RII = \frac{\sum W}{A \times N}$$

Where:

W = Weight age given to each factor (ranging from 1 to 5)

A is 5 (the highest weight) and

N is the Total number of Respondents

The RII value had a range from 0 to 1 (0 not inclusive), the higher the value of RII indicates that the more important was the waste factor to the Construction industry.

The survey is investigated by utilizing relative importance index and with help of RII the most imperative variables which are for the most part in charge of the development squander are resolved.

4. RESULT AND INTERFERENCE OF CASE STUDY

Case study is taken to prove that the construction waste occurs on site which affects the overall cost of the project. Even 1% of waste from each industry can be a cause to the environment. In order to find out the solution for this first we need to know causes of construction waste and then give remedies or plan strategies to minimize and manage the construction waste. Following are the most important factors and their solutions.

CONTRACTOR-

Table-2 : Most important factors and their impact which affect the overall cost of the project and their solutions.

Causes	RII	Solutions
Poor site management	0.78	1. Supply chain management consisting of appropriate recycling suppliers can effectively help to manage waste on site. 2. With the help of Lean construction or Just in time delivery waste can be prevented. 3. Provide Specialist for on-site waste management.
Poor specification and drawings	0.96	1. The detailing of drawing should be checked and verified. 2. The specifications should be right, bold, clear and it should be readable.
Inappropriate design	0.94	1. Well qualified and experienced designer should be appointed. 2. Third party can be appointed for checking of design.
Financial rewards for site personnel	0.76	1. Clear guidelines to be set for employees to minimize wastage.

		2. That guidelines should be circulating amongst the employees.
No financial incentives for site personnel	0.74	Provide financial incentives to the employees in terms of bonus to encourage their work.
Waste accepted as inevitable on site	0.93	Authority and responsibility should be clear cut mention for control of wastage on site.
No waste management policy / strategy on site	0.73	Prepare a waste management policy at the construction site before the execution of the project.

SITE SUPERVISOR

Table-3: Most important factors and their impact which affect the overall cost of project and their solutions.

Causes	RII
Waste management plan	
Propose methods for on-site reuse of materials	0.78
Propose areas for waste storage	0.81
Propose list of materials to be reused or recycled	0.80
Identify different types of waste	0.79
Propose methods for reducing waste	0.79
Estimate quantities of waste requiring off- site disposal	0.75
Propose methods for onsite waste operation	0.79
Propose disposal outlets	0.80
Reluctance in waste minimization implementation	
Low disposal cost	0.79
Importance of the following practise in waste minimization	
Education and training	0.79
On-site sorting of construction and demolition materials	0.80
Implementation of environmental management	0.78

systems	
Central areas for cutting and storage	0.81
Use of prefabricated building components	0.80
Proper site layout planning	0.80
On-site waste conservation	0.79
Identification of available recycling facilities	0.79
On-site waste recycling operation	0.79

Solutions-

For Waste Management Plan

1. For reduction of wastage of construction material the method of construction plays very important role.
2. Proper method of construction should be adopted by considering the expert views and by studying the previous construction project methods.

For Reluctance In Waste Minimization Implementation

1. Along with minimization of wastage of construction material the disposal of waste material is equally important i.e materials can be reused in future.
2. The proper disposal of material should be done to avoid the environmental pollution and disposal method should not be harmful to local community and it should be in economical manner.

For Importance Of The Following Practise In Waste Minimization

1. The materials which are wasted on construction site should be sorted by technical person to see whether that material can be reuse or not , if not proper disposal should be applied.
2. Authority should promote to the owner to use the maximum prefabricated and precast components which are made up of high accuracy and technique which significantly reduce the wastage of material on site.
3. Proper storage of different materials should be technical manner with well define site layout can reduce the wastage of material.

SITE MANAGER

Table-4: Most important factors and their impact which affect the overall cost of the project and their solutions.

Causes	RII	Solutions
Errors in contract document and design	0.81	1. Get the information for the design of construction documents, good communication among project participants, effective project management, design reviews management, partnering. 2. Designers should also work with other designers while preparing construction documents.
Lack of information while preparing construction drawings	0.78	Provide all the necessary data which is required for the preparing

		construction drawings.
Changes in design	0.78	Try to reduce the changes in design by making correct design
Improper handling of material	0.77	Carefully handle fragile material and consider a secure method for unloading
Using untrained and unskilled labour	0.81	Train and employ the workers
Damage to the equipment which leads to rework	0.76	1. Regular preventive maintenance helps ensure that machine works properly. 2. There should be provision for alternate equipment, if necessary.
Using wrong construction method	0.76	Make sure that the construction methods which are used at construction site should be correct. Eg. Correct placement of steel, adequate cover to reinforcement, correctly made construction joints, no grout leakage , compaction of concrete, proper curing etc.
Using wrong equipment	0.76	Use the correct machine at construction site.
Severe weather conditions	0.78	Avoid placing washable materials at steep slope, built proper shelter
Improper material management on the site	0.77	Provides an introduction to handling materials on the job site, including moving, storing and disposing of materials.
Lack of waste management plans	0.81	Boost the companies to accept waste management plans
Lack of supervision and delays in inspection	0.75	1. There should be effective communication between employees, supervisors and management. 2. Team leaders, employees and supervisors should know their roles and responsibilities so that they can work according to their

		responsibilities.
Improper planning and scheduling of project	0.83	Prepare an overall project work plan before project starts. This will help to estimate the total project effect and duration.
Accidents caused due to negligence	0.80	Make compulsory to use safety props.
Lack of quality management system	0.82	Provide checklist before execution of any project.

SITE ENGINEER

Table-5: Most important factors and their impact which affect the overall cost of the project and their solutions.

Causes	RII	Solutions
Irrelevant cutting of bars instead of using short pieces	0.71	Avoid excessive cutting of bars.
Applying excessive thickness of plaster	0.73	Provide a surface that can be plastered to the required lines and levels by applying a coats of uniform thickness.
Inaccurate storage	0.73	1. Keep storage areas free from accumulated materials that cause fires or explosions. 2. Place stored materials inside buildings that are under construction and at least 10 feet away from exterior walls.
Blending greater quantities than required	0.73	1. Use of modern software for quantity and estimation to check quantities of material. 2. Use of ERP software should be implemented on construction site. 3. The quantities of material and demand of that material should be take at various level before placing the order.
Improper storage may lead to	0.71	1. Racks, shelving, bins, hoppers

damage		and other structure can be used. 2. Fire protective partitions can be used between stored items.
Manufacturing defects	0.78	1. The specifications about the material should be well defined before calling the quotations , it should be get verified from vendors. 2. The material order should be placed to well reputed companies.
Not able to use small pieces	0.71	Use the cut tiles away from the noticeable area like near walls, borders, under the cabinetry overhangs, etc
Irrelevant cutting of tile instead of using small pieces	0.71	1. Proper supervision should be done on construction site. 2. The dimensions and specifications should be examine before cutting the tile.

LABOUR

Table-6: Most important factors and their impact which affect the overall cost of the project and their solutions.

Causes	RII	Solutions
Employment of skilled labour	0.84	1. The recruitment procedure should be done in well manner so that suitable technical person can be appointed. 2. Training for existing employees should be continuously done on a regular periodic basis.
Use of more efficient construction equipments	0.84	The equipments can do the work in well manner to reduce wastage of material, so increase the use of construction equipments on site.

5. CONCLUSIONS

1. By literature survey it is found that the construction waste occurs at the construction site during different stages of project like design and documentation stage, while transporting, loading and unloading of materials , at the time of execution of project and during site waste management.

2. Case studies are taken in this project to prove that the construction waste occurs on site because of various reasons during the different stages of project. Even 1% of wastage can contribute to the environmental pollution. Three case studies are taken in this project and the materials like cement, steel, aggregate and sand is mentioned.

3. Questionnaire is prepared to know the causes of construction waste occurred on construction site. With the help of RII most important factors which are responsible for the occurrence of waste on construction site are determined and solutions are given to minimize and manage the construction waste.

6. REFERENCES

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