Cost Optimization of Residential Construction Project through Waste Management Technique

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Abstract - Material waste has been recognized as a major problem in the construction industry that has important implications both for the efficiency industry and for the environmental impact of the construction projects. Moreover, waste measurement plays an important role in the management of production system since it is effective way to assess their performance, allowing areas of potential improvement to be pointed out. This thesis describes the main results occurrence of material waste at two building sites located in different regions of Ahmedabad. Some typical figures for the waste of some key construction materials are provided and the main causes of waste in the sector are discussed. The results indicate that the waste of materials in the construction industry is fairly high and that a large variability in waste incidence is found across different projects. Most of this waste can be avoided by implementing inexpensive preventive measures, mostly related to managerial improvements. The various material wastage which is occurred on construction site in different amount. This amount of wastage should be in control. The data of wastage of different materials on site will be carried out in a proper manner according to site scenario of work. Material waste has been recognized as a major problem in the construction industry that has important implications both for the efficiency industry and for the environmental impact of the construction projects. Moreover, waste measurement plays an important role in the management of production system since it is effective way to assess their performance, allowing areas of potential improvement to be pointed out. This thesis describes the main results occurrence of material waste at two building sites located in different regions of Ahmedabad. Some typical figures for the waste of some key construction materials are provided and the main causes of waste in the sector are discussed. The results indicate that the waste of materials in the construction industry is fairly high and that a large variability in waste incidence is found across different projects. Most of this waste can be avoided by implementing inexpensive preventive measures, mostly related to managerial improvements.

The implication of the conclusion of the study are reflected in terms of Cost & Waste Management. The lessons drawn from the study contribute towards a better management system for construction projects pertaining to private buildings as well as the methodologies there of. The major finding work are: introduction of the cost optimization through waste management, reduce, reuse, and recycle process of construction waste material, proposal for a shifting of views within the waste management.

Index Terms - material waste, Indian construction industry, economic relevance, cost optimization model

METHODOLOGY

- A system of method used in particular area of study. A methodology for investigating the concept of focal point mass noun courses in research methodology and practice.
- There are three types of research methodology to collect the data of construction waste material.
  - Qualitative
  - Quantitative
  - Questionnaire
- Qualitative: In there are beneficial in decreasing research bases and provided the added value of increasing community member awareness of their waste through engaging them in the integrated approach generally rest on cost yet potential solutions to this issue also exist.
- Quantitative: In order to develop effective waste management plans for a community, an understanding of the composition and quantity of waste. Quantitative research such as traditional waste characterization studied, have typically been used to provide relevant data.
• Questionnaire: The research gathered both qualitative and quantitative data with the help of self-completion questionnaire. Questionnaire is a collection of question administered to a respondent.

• From above the type there are used questionnaire method for the collecting the data of research methodology of construction waste.

• Methodology For Data Collection:
  • Methodology is adopted for determining data for quantifying and classifying waste generation are diverse and generally includes: direct observation on site, analyzing record of contractor, survey via questionnaire, on site weighing of waste materials.

• Data Sheet:

<table>
<thead>
<tr>
<th>Cycle No.</th>
<th>Material type</th>
<th>Site Detail</th>
<th>Particular Item</th>
<th>Estimating Quantity</th>
<th>Actual Quantity consumed</th>
<th>Permissible wastage</th>
<th>Actual wastage (in %)</th>
<th>Difference in percentage wastage</th>
<th>Cost of material wastage</th>
<th>Remark</th>
</tr>
</thead>
</table>

Permissible waste percentage:

<table>
<thead>
<tr>
<th>Sr no.</th>
<th>Material</th>
<th>Permissible waste %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concrete</td>
<td>3-5</td>
</tr>
<tr>
<td>2</td>
<td>Reinforcement</td>
<td>2-3</td>
</tr>
<tr>
<td>3</td>
<td>Block/Brick</td>
<td>5-7</td>
</tr>
</tbody>
</table>

The permissible waste criteria as per respondents from questionnaire survey.

Questionnaire survey:

• The practical limitation of resources has constrained the survey component of this study to the construction field in Ahmedabad. A questionnaire is chosen as the principal survey.

• This is essential to conduct a special survey of experts in the construction to get their guideline for perception of wastage in construction, extent and composition of wastage, cause of wastage and recommendation to reduce the wastage.

• Quantification of data extracted from contract document and data collected from sites. A discussion with concerned site engineer followed the survey to get his perception about construction waste.

Questions of questionnaire survey:

• The below questionnaire survey carried out from 8 different sites to collect the reason and reuse for waste on sites.
  1) Which type of construction waste materials generated on sites which affect the project cost more?
  2) What are the reason for steel waste generation?
  3) How to manage the reuse of steel waste?
  4) How to reduce the steel wastage on site?
  5) What is the reason for concrete waste?
  6) Reuse of concrete waste on site?
  7) What is the reasons for block waste?
  8) How to reuse of block waste?
  9) Can Surplus wastage of construction materials are directly affect the cost of project and also affect an environment?

• The below questionnaire survey carried out from 2 different sites for data collection of how much waste generated on that sites:
  1) On average how much waste does your project generate on a monthly basis?
    The avg waste amount of steel:
    The waste amount of concrete waste:
    The waste amount of masonry brick or block waste:
    The amount of soil waste:
    The waste amount of wood or wire:
  2) Do you think using Waste Management will help reducing construction waste?
  3) The purchase cost of materials:
    Sand:
    Wood:
    Binding wire:
  4) How much percentage of permissible waste of materials on site during construction?
    Cement:
    Sand:
    Steel:
    Concrete:
    Brick/block:
  5) What is the cost of disposal of materials from site to disposal area?
On your site have you recycle any waste materials to reduce the waste cost?
Do you think that there should be a contract clause that requires the contractors to use recycled material where possible?
can the waste materials cost affect the retention policy after the completion of project?
Do you think penalties should be charged against contractors who don’t have waste management plan?
Have you ever use the recycled materials on site for reduce the waste on site?
Cost of disposal of waste on dumping zone with transportation cost and shifting cost?
What discipline do you think generates the most amount of waste?
Do you think that there should be more support to apply Waste Management on construction sites?
Any suggestion about waste management techniques on site?
Negative impact of waste materials on site or on environment?

Data collection:
This chapter is all about the data collection from two different sites and it is only collected on the base of questionnaire survey.
Data collection collected in a working condition of site which is based on the site condition and its ability to work in reduce the waste of materials.
Data will be collected about wastage of steel, concrete and block from sites and gather all data then find out the actual wastage.
The data will be collected in a proper manner on the basis of questionnaire survey or monitoring the work process on site by labors or engineers.

Detail of site:
(A) Manor Greenz
(B) Omkar Height

Respondent for questionnaire survey:

Reason for concrete waste:

Reusue of concrete waste:

Reason for steel waste:

Reusue of steel waste:

Reason for block waste:
Reuse of block waste:

The steel waste was reused as a structural steel in beam which was based on test verification of steel:

Details of typical welding for 25mm and 32mm dia for reuse of steel
Actually reused on site by welding:

The reason for steel waste due to bar bending error: the below fig. showing the stirrups improper cutting length.

Concrete waste due to improper shuttering of lift column.

The above fig shows the column longitudinal bar are in confining zone due to improper cutting length of steel.

The concrete waste due to backstock of pumping lines after pouring process.
Block waste due to changes in floor plan after masonry work.

The negative impact of waste on site activity:

- The waste of steel when generates in a higher content then there are problems create for the placing and storage of new steel, and it also affect the making process on site.
- If steel waste generates due to bar bending or structural drawing blue print error then it will affect the steel quantity order and its usage on site.
- The concrete waste generates on site due to improper placing method and improper handling on site then it will also affect the quality of work and there is possibility of effect on estimation of quantity of concrete.
- The concrete waste is also generating due to over timing in pouring process, due to it the concrete can be set in transit miller, and therefore ultimately it is pointed out as scrap of concrete.
- Due to setting of concrete in transit miller there are possibility of mixing of setted concrete with the fresh concrete and it may lead to honeycombing effect in rcc structure, if the transit miller doesn’t chipping regularly.
- The block waste can be generating on site in a higher content if the supervision is very poor, and it may lead to block waste on site.
- The block waste can affect the reuse of it in a proper manner in main masonry wall.
- During the data collection the waste of sand, concrete scrap, block waste and cement waste was thrown on the garbage duct from the height, due to it the dust and cement particles were spread in an air and it directly affect the labors who work in that zone.
- So this waste dumping from height can lead to air pollution and it may also harmful for the labors health such as skin disease, suffocation problem etc.
- Ultimately these all the negative points can affect the retention policy of contractor which is directly audited with the owner.
- The retention policy is a one type of security deposit which is deducted by the owner from the every bill of constructed work. And it is in a fixed percentage such as 5%. And this amount will be returned to the contractor after the completion of contract and if the waste generated on site is higher then the amount of that waste materials are deducted from that amount.
- And this policy has been already conducted in contract system which generated by the agreement of both parties.

<table>
<thead>
<tr>
<th>Material</th>
<th>Permissible waste</th>
<th>Actual waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>7.305</td>
<td>3</td>
</tr>
<tr>
<td>Reinforcement</td>
<td>6.27</td>
<td>7</td>
</tr>
<tr>
<td>Block</td>
<td>12.38</td>
<td></td>
</tr>
</tbody>
</table>

The above chart shows the waste percentage on both sites of various materials.

CONCLUSION

The construction industry has been assessed on the amount of waste produced each year. Most construction companies concentrate on reducing cost by improving productivity and compressing schedule without realizing that managing construction waste is another huge cost saving factor that they need to take in consideration. Although all the concentration is on
construction phase at construction sites, but one major factor that affects the amount of construction phase is the design. Engineering firms must establish new design standards to help reduce the amount of construction waste by designing to dimensions available in the market that will eliminate cutting and shaping steel frame, plywood, and drywall. During the data collection the thing had been known that the both the site doesn’t use the recycled material on site but they produce the waste due to lack of waste management plan. The training should be given to the labors about how to minimize the waste on site and how to reuse the waste on site. the concrete waste mainly generated due to back stock of pumping line and now a days the consultancy has not any implication of reduce the waste, the spunching ball should be used for cleaning of pumping lines due to it the concrete cannot stuck in pipelines and it may help to reduce the waste.

REFERENCE

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