

# The Impact of Material Management on Construction Project

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**Abstract-** In a construction project, the cost of construction material may range from 60-70 % of total construction cost. The main aim of this research paper is to examine the current material management practice and its impact on the delivery of building construction projects. A questionnaire survey administered to a purposive sample of main contractors and sub-contractors, eliciting current material management practices through semi-structured interview and obtaining their perception root causes of ineffective material management toward 34 causes that were extracted from an extensive literature review. Moreover, the relationship between different material management practices and project delivery in terms of cost overrun and delay were acquired from this questionnaire. There are two distinguish material management practices that were followed. The top three most common root causes of ineffective material management identified were matching price to competitor's price; time spent investigating non-qualified suppliers and unavailability of material.

**Index Terms-** Construction projects, Material management, Cost overrun, Delay, Main contractor, Sub contractor, Engineer.

## I. INTRODUCTION

Constructions projects are one of the greatest common activities we meet in our lives, yet it is also known as one of the most difficult civilization endeavors. Construction is the process of constructing a building or other structure. In point of fact each project consist of sophisticated and complex processes which need to be carried out by different individuals of different authorities, who have special set of skills and knowledge. Construction differs from manufacturing in that manufacturing typically involves mass production of similar items without a

designated purchaser, while construction typically takes place on location for a known client. Construction starts with planning, design, and financing; and continues until the project is built and ready for use. Large-scale construction requires collaboration across multiple disciplines.

Large construction projects are sometimes referred to as megaprojects. All the talent and skills have to be channeled towards a common goal to producing the project. To accomplish this goal, time and money are required. At the end these construction projects, provide us with facilities that are useful, well designed, visually attractive and enjoyable to occupy. Effective delivery is all about the control and management of ambiguity. Therefore, one needs to identify the ambiguity related to the project, the best strategy to deliver the project so that the chances of success are increased.

Material management can be considered as a prime uncertainty in a construction project. Every organization, big or small, depends on materials and services from other organizations to varying extents. These materials and services are obtained through exchange of money. The main reason for construction material to be so leading in a construction project is that the cost for material handling may range from 60 – 80 % of total construction cost. Therefore, ineffective material management can cause unavoidable loss for a construction project. Material management can be considered as a prime uncertainty in a construction project.

“Material management is defined as the process for providing of right material on right place on right time in right quantity so as for reducing the cost of the project”.

## II. RESEARCH OBJECTIVES

1. Examine the existing material management processes in construction projects of Surat city.
2. Identify the root causes of ineffective material management in Surat construction projects.
3. Explore the relationship between MMP types and project delivery in terms of cost overrun and delay.
4. Calculate the correlation of coefficient by spearman, between all 3 respondent, to identify the similarities of their responses.

## III. MAJOR FINDING FROM LITERATURE REVIEW

1. The study revealed that one of the problems local contractors face is obtaining finance that is to be used in the procurement of the building materials. The source of materials was also a problem they faced.
2. The increasing complexity and uncertainty, project delivery is not only management of three project constraints: cost, scope and time, but perceive it to be an assessment of the uncertainty within which the project is operating and its continuing ability to respond to the reason why it was needed in the first place.
3. There is the need to track and manage materials on all construction projects. SMEs do not undertake detailed site activity planning because of lack of people, skills and finance.
4. The Materials management processes require a transformation to improve the overall in handling of materials for more efficiency and effectiveness on the construction site.
5. The cost of construction materials may be up to 65% or more of the total cost. Utilization of appropriate construction materials coupled with effective management of this construction materials largely help successful completion of the structure.
6. Storage issues have been a well-known problem among the construction professionals.
7. There is a significant relationship between material management process type and project delivery in terms of delay and cost overrun.

## IV. QUESTIONNAIRE DESIGN

The questionnaire is designed based on the research method to be used after the thorough investigation of the literature and identification of various factors affecting Material Management of building projects. The questionnaire is categorized into two parts.

The first part is related to information regarding the company and respondent profile, while the second part consisted of the main questionnaire. The questionnaire is designed with a view of saving in time while answering questions so that respondents do not get tired mentally while filling it. It contains simply factors affecting performance categorized into 4 groups and respondents have to simply share their perspective regarding that factor based on their understanding, knowledge and experience by choosing only one choice.

Next objective of the study was to identify the root cause of ineffective material management in Surat construction projects. Root causes of ineffective material management identified by other countries' construction projects are discussed in the literature review. This information helped to formulate the questions for the section III. In addition, these questions were designed based on 5-point Likert Scale, which measures from 1 - 5 according to the level of contribution and impact of each factor.

- Strongly Agree (5)
- Agree (4)
- Neutral (3)
- Disagree (2)
- Strongly Disagree (1)

## V. RESEARCH METHODOLOGY

Research process consists of a series of actions or steps necessary to carry out research effectively and the desired sequence of these steps. The Figure 4.2 shown, the well illustrates a research process adopted in this research work.

The research methodology chosen for this research consists of intense literature review, mail questionnaire to stakeholders of Surat construction industry, conduct structured interview and a statistical and qualitative analysis of the survey.

- Literature gathering
- Prepare literature review

- Identify material management processes and root causes in ineffective material management in other countries to formulate the questions
- Preparation of the questionnaire
- Identify the targeted response group
- Distribute the questionnaire to the targeted response group
- Conduct structured interview
- Data collection
- Data analysis

the questionnaire survey was reinforced by conducting a structured interview. The interviews were conducted through phone. The time and date were set according to the convenience for the interviewees. The period allocated to conduct the interview was set from mid- February 2017 to end of March 2017. Hence, the interviews were conducted between these times. The participants who fill the questionnaire survey and agreed to take part in the interview were included in the present interview study.

The last objective of this research is to explore the relationship between project delivery and existing material management processes in practice. Section IV included close-ended questions to find out about cost overrun and delay in construction project. The data from this section are cross analyzed with the findings of section II and section III. This analysis will help to find out the impact of material management on the project delivery.

### VI. DATA COLLECTION

Engineer, contractors and sub-contractors of this Surat city were targeted for the survey. The details of various firms and their contacts were obtained through the internet and personal references. 61 samples of responses were to be collected from Engineer, contractors and sub-contractors. As the response rate is very low, the questionnaire was distributed to the various parties more than the sample size requirement. A total of 65 questionnaires were distributed to different respondents in Surat. The response rate was slow and timely reminders were also required. This study has received 61 responses. This was more than the required sample size. The Table-1 and figure-1 shows a stakeholder wise response rate as follows

Table-1 Stakeholder Wise Response Rate

		Frequency	Percent	Valid Percent
Valid	Contractor	16	24.61	26.22
	Sub-Contractor	6	9.23	9.83
	Site Engineer	39	60	63.93
	Total	61	93.84	100
Missing		4	6.15	
Total		65	100	

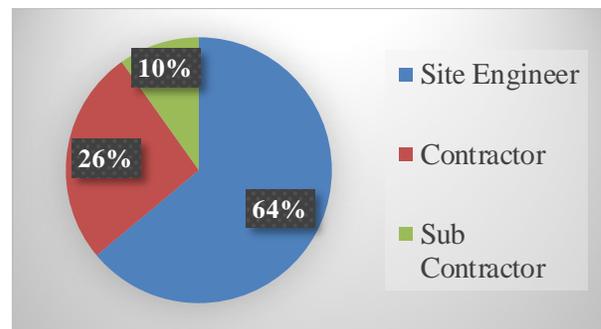


Figure-1 Stakeholder wise response rate

### VII. DATA ANALYSIS

#### Relative Importance Index Technique

Relative Importance Index method to determine the relative importance of the various factors among various parties. The Five-point Likert scale was adopted and it ranged from 1 (Strongly Disagree) to 5 (Strongly Agree). This was transformed to Relative Importance Indices (RII) for each factor as follows:

$$RII = \frac{\sum W}{A \times N} \quad \text{.(eq.1)}$$

Where W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i.e, 5 in this case), and N is the total number of respondents. The RII value had a range from 1 to 5 and higher the value of RII, more important was the cause of delays. The RII rankings made it possible to cross compare the relative importance of the factors as perceived by the four groups of respondents (i.e., Engineer, contractors and sub-contractors). Each individual cause's RII perceived by all respondents should be used to assess the general and overall rankings in order to give an overall picture of the

impact of material management on construction project in Surat.

The ranking of factors has been done based on the relative important index (RII) value calculated for each group of respondent (i.e. Engineer, contractors and sub-contractors) and the overall respondents. Appendix-1 shows RII ranking of factors provided from Engineer, contractors and sub-contractors. The table 2 shows the top most significant factor influencing Green building, their RII value and rank obtain from overall respondents.

Table-2 The top most significant factor of Green building ranked by overall respondents

	Factor	RII	Rank
D4	Keeping track of material	0.72	1
C5	Delay in Unrealistic delivery date	0.64	2
B3	Time Spent in Investigation Non-qualified suppliers	0.63	3
D7	Damage of material while installing	0.6	4
A7	Difference between Plans and Specification	0.59	5
B1	Incomplete proposal Fill by Vendor	0.58	6
C9	Damages accure on materials at storage	0.53	7
A3	Incomplete Drawing	0.53	7
B2	Uncontrollable bid list	0.49	9

From the analysis of results, it was found that Keeping track of material, Delay in Unrealistic delivery date, Time Spent in Investigation Non-qualified suppliers, Damage of material while installing, Difference between Plans and Specification, Incomplete proposal Fill by Vendor, Damages accure on materials at storage, Incomplete Drawing, Uncontrollable bid list are ranked high by respondent. These most significant factors discuss in more detail as follows provided by the Engineer, contractors and sub-contractors.

### VIII. CONCLUSION

1. There are 2 unique material management process types practicing in construction projects.
2. There is an important relationship between these material management process types and project value.
3. Top 3 root causes of ineffective material management were identified as Keeping track of material; Delay in Unrealistic delivery date and Time Spent in Investigation Non-qualified suppliers.

4. The identified top root causes of ineffective material management are consequences of existing problems in Surat construction industry such as depending on imported construction material, and lack of skilled workers.
5. Storage issues have been a well-known problem among the construction professionals that it is no longer categorized as a threat as they are well prepared and mitigated from this problem.
6. There is a significant relationship between material management process type and project delivery in terms of delay and cost overrun.
7. Material management type 1, phase-by-phase delivery suffered severe cost overrun compared to the other types and material management type 2, better than type 1 in terms of delay and cost overrun.

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