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Review on Construction Materials Management Practice on Project Sites

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Abstract
This paper reviews the research and development activities conducted over the past few decades on construction materials management practices. And it studies to block a void created by the absence of proper materials management on construction sites. It is on the analysis of factors affecting effective materials management in building construction projects. Material management is an important tool and element in project planning and controlling in order to improve productivity in construction projects. Having the right materials in the right place at the right time is important for effective execution of a building project. Manyresearchers have shown that, construction materials and equipment may constitute more than 60-70% of the total cost for a typical construction project. Improper handling and management of material on the site adversely affects the cost of the project. This makes it necessary to implement material management practices on construction industry projects. A properly implemented materials management program can achieve the timely flow of materials and equipment to the jobsite, and thus facilitate improved planning, increased labor productivity, better schedules, and lower project costs. Further, the proper management of materials component can improve the productivity and cost efficiency of a project and helps to ensure timely and effectively completion of construction projects. One of the major problems in delaying construction projects is deprived materials and equipment management. Hence, it becomes necessary to study and implement material management practices in all construction industry. However, this review paper focuses on different materialmanagement practices adopted on sites and discusses their advantages and disadvantages of materials management in construction site.
Key Words: *Construction Materials, Construction site, Material Management*

1- INTRODUCTION

Materials management is a process for planning, executing and controlling field and office activities in construction industry. Construction projects depend upon having the right people with right skills and equipment those are able to deliver the project on time and on budget [1]. In construction field, the total cost of project is divided into number of parameters like cost of materials, manpower, equipment etc. It is the system for planning and controlling all of the efforts necessary to ensure that the correct quality and quantity of materials are properly specified in a timely manner, are obtained at a reasonable cost and most importantly are available at the point of use when required. The main intension for this study is, to provide right materials at the right time quantity and place so it matches the exact demand when needed. Materials represent a major expense in construction industry. Hence, minimizing procurement costs improve opportunities for reducing the overall project costs [2]. Materials management plays significant role in every of construction industry for the successful completion of the construction Projects. Every construction

firm requires knowledge regarding to management techniques and their effects towards successful completion of work. Pitiable materials management can result in increased costs during construction. Effective material management can result in substantial savings in project costs. Materials may deteriorate during storage or get stolen unless special care is taken. Ensuring a timely flow of materials is an important concern of material management. For effective managing and controlling mechanisms of materials, the performance of all the works in materials management should be measured. A performance measurement indirectly calculates the effectiveness of the working. This performance measurement might be differing from system to system based on the type and capacity of the Project work. The performance measurement divides the materials management system into parts and it makes the work of the system is more efficient. In materials management program, an appropriate operation can achieve sufficient availability of materials and machineries on the construction site, and thus fulfills requirement of work on planning phase so it leads to increased labor productivity, better schedules, and minimum project costs. Generally, materials management can be defined as a process of planning, executing, and controlling the right source of materials with the exact quality, at the right time and place suitable for minimum cost with highly quality construction process. Material management integrates purchasing, shipping and material control from suppliers to the end users. Based on this, selection of personnel for marketing, purchasing, inventory control, stores management and materials handling with full of their training and placement is also to be monitored by the materials management department. This indicates that, it is very essential to have a materials management department in any organization to support the Organization in the production activities. It also helps in the marketing, sales promotion and control of all the types of materials for its quantity, quality and cost. Thus, this review paper helps to find out the factors affecting material management on construction site & suggest remedial measures on it. Also, the study will see general material management procedure followed by small, medium &large

Scale construction firms in construction sites and we analyze factors in all three sizes of construction firms. To overcome these factors some remedial measures were suggested at the end of the study.

2- LITERATURE REVIEW

Researchers study about construction materials management in construction sites and they brought different result on it. From those studies, et.al N.B. Kasim is the one and he states that, it is clearly important to manage all materials from the design Phase upto the Completion of construction stage. He also states that, it is important to develop new approaches to materials management in fast-track construction projects in order to improve the efficacy of the production process [2].Again et.al Dr. Kevin Okorocha, stats that, decent construction material management lead to benefits for construction industries [3]. Another study by Ashwini Patil explains that, Construction material constitutes a major cost component in any construction project. The total cost of material may be 50% of total cost; so that it is important for contractor to consider that timely availability of material is potential cause of successful completion of any project [3] Again according to T. Phani Madhavi, in construction project operation, often there is a project cost variance in terms of the material, equipment, manpower, subcontractor overhead cost, and general conditions [4]. Therefore, if the material management is not properly managed it will create a major variation in the project cost . Project cost can be controlled by taking corrective actions towards the cost variance. It is often necessary to dedicate

important resources like money personnel, time, etc. to monitor and control the process. The last one is A.A. Gulghane. He describes that, materials management processes require a transformation to improve the overall in handling of materials for more efficiency and effectiveness on the construction site [5]. This is because poor handling of construction materials affects the overall performance of construction projects in terms of cost, time, quality, and productivity.Material management can be defined as a process thatcoordinates planning, assessing the requirement, sourcing, purchasing, transporting, storing and controlling ofmaterials, minimizing the wastage and optimizing theprofitability by reducing cost of material. Building materials account for 60 to 70 percent of direct cost of a project or afacility, the remaining 30 to 40 percent being the labor cost. As a project management, special training sessions should be arranged on site to update the workers regarding the latest techniques. Plant and machinery should be checked regularly in order to avoid any failure. Workers and contractors should be guided for correct methodology to execute a particular task. Regular check should be kept on planning so as to overcome any error. Proper supervision should be done on site to improve the level of workmanship. Taylor (1913) pointed out that the economic losses caused by material waste are smaller than those related to the inefficiency of human work. Ford (1927) also suggested that human work should be the focus of waste convention since the value of materials depends, to a great extent, on the work that has been spent on them. Berliner B. says project control in many companies is based mostly on financial performance measures, which tend to be backward focused and do not make it easy to trace operational costs. Materials Movement, Cost estimates, Supplier development, introducing new materials, Safety margin, distribution of material, inventory control activity, ordering of material, using standard components and related things are listed under the determination of material management.

The following chart shows the flow of materials management in industry.

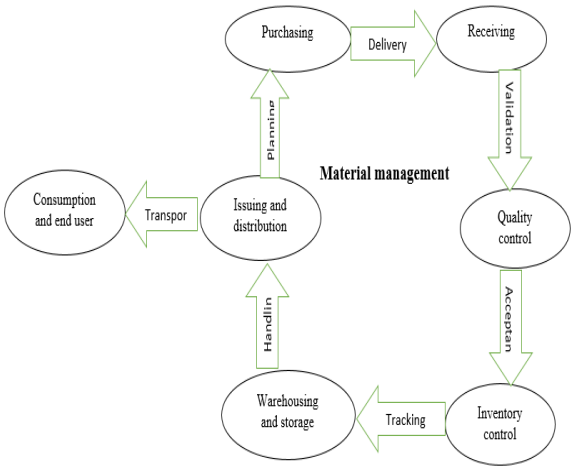


Chart 1: - Flow of material management

Benefits of material management

Material management can give as so many benefits for all works that link with construction materials. It improves in labor productivity, improves in project schedule, in quality control, better in field material control, it creates better relationship with suppliers, better handling of it, highly reduction of delay, achieves quality of the construction, reduce the overall costs, reduction in technical problems, avoids seasonal problems, reduces overall project cost, etc. are some of benefits of materials management.

And further, in order to fulfill the objectives of materials management as stated above and to meet the basic objectives and goals, the functions of the materials management are categorized as primary and secondary functions. Requirements planning (MRP), purchasing, inventory planning and controlling, ascertaining and maintaining the flow and supply of materials and quality control are prime functions of it. Standardization, forecasting and planning are some of the secondary function of material management. The responsibility of material management begins from the flow of material including ordering,

receiving, storing up to end process of construction. Meaning, in order to make materials management on site Cost-effective for fast-track projects, there needs to be an integrated material handling process from the design stage to the end user of materials. To ensure the materials are available at their point of use when needed, efficient procurement of material represents a key role in the successful completion of the work. Three important phases that hold the key to a successful materials management are materials purchasing, usage, and storage.

Georgekutty (2012) had undergone literature review to find out the causes for incompletion of project. A questionnaire survey was conducted in Kerala. From the research, the main delay or incompletion of project could be solved by proper pre-planning and scrutinize material procurement frequently to cut off the exceeding of project cost. Case study was carried out by Phani Madhavi (2013) in material management in construction site. The objective of the study was to understand about all the problems occurring in the company because of improper application of material management. Analysis was done on site and management, Inventory controlling, purchasing procedures, Procurement and Tracking and cost. Stocks were analyzed by FIFO (First In First Out method). Cost estimation was done by ABC analysis. From the analysis, data were driven and new appropriate technological implications were introduced like RFID (Radio Frequency Identification), PDA (Personal Digital Assistant) which helped us in a proper scheduling and financial control.

The benefits of material management to the organization were clearly explained by Siddharth Nair (2014) through his paper. The author also explained that the objectives of the material management to be regular uninterrupted supply of raw-materials maintain a high inventory turnover, providing economy in purchasing and minimizing waste, minimize the overall cost of acquisition and to maintain high degree of cooperation and coordination with user departments. He concluded that major benefits of material management were excessive investment in stocks will be avoided, there will not be stoppage of work because of lack of materials, productivity will be improved, Inventory losses will be minimized and the wastages are minimized. Olusakin S Akindipe (2014) made a study on role of raw material management in production operations. The author was conscious about the inefficiency in raw material management and the alternate solutions to overcome the problem. He found the relationship between raw material and Inventory management to solve the crisis. From this he had concluded that, the inefficiency were due to illiterate andnon-experts involvement in management, mishandling of materials and inability to use proper inventory model in the site. He added that, all the above said reasons are mainly due to the managers involved in the management process. The role of material management in organizational performance was analyzed by PaulineJeruto Keitany (2014) in Kenya. For that the author had chosen a case study of New Kenya Cooperative Creameries Limited. A sample of 49 respondents was selected from 56 employees of New KCC Ltd. Data were collected through questionnaire from seven departments such as Purchasing, Quality Control, Warehouse/store, Human Resource Development, Finance and audit and Physical Distribution departments. The data was evaluated through descriptive statistics such as mean, median, standard deviation and percentages. Results showed that there was increase in organizational performance due to inventory control system involvement. Additional, results showed that lead time was highly significant by acquiring and delivering the needed materials within the shortest time.

3- BASIC CONSTITUENTS OF MATERIAL MANAGEMENT

As we have seen before, material is a significant element in project planning and control in construction industry and it represent a major expense of the industry. So, there are four basic components of material management: purchasing, material handling, store keeping and recycling or disposals are the basic components of it. Material estimation, budgeting, planning and programming, scheduling, purchasing and procurement receiving and inspection, Inventory control, storage and warehousing and waste management are some of other basic constituents of it.

And lastly, systematic operations, reduction in cost handling, reduction in overall cost of the project, increase in productivity of the labors, time management, quality control, better relations with suppliers and better relations with customers are merits of construction material management.

4- DATA COLLECTION AND ANALYSIS

Data collection in this review was questionnaire and survey study with related previous written documents and research papers. For this review total of 15 firms (5 small, 5 mediums and 5 large) were selected randomly in the study region. The data gathered from the questionnaire survey and from the related data were arranged and studied properly. According to data gathered, it was found that there were few flaws in the material management systems of all three sizes of construction firms which is affected by material management System.

5- OBSERVATION AND DISCUSSION

5.1- OBSERVATION

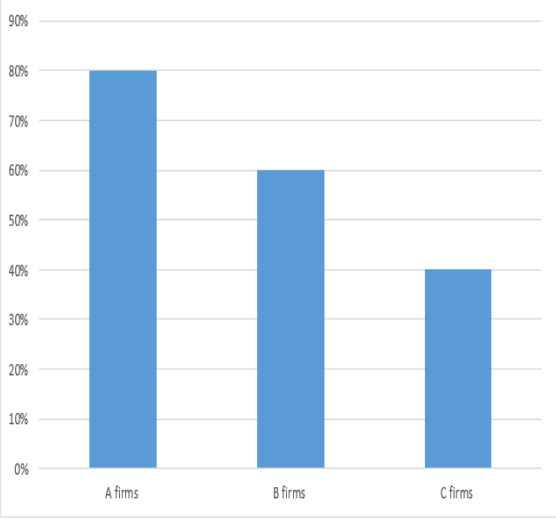
From the investigation, it was observed that only large firms use typical material management practice and somehow, they prepare material data sheet for material management and they have technical persons for any Rework or maintenance and the maintenance person initiates appropriate action well to resolve problem. On the other hand, medium and small firms have less in material management practice. Again, it was observed that, there is no any material management technical department exclusively for small & medium construction firms even in some of the large firms. But comparatively, somehow large construction firms are better in material handling practice and management techniques than medium and small firms. However, still they are facing so many problems for proper management and control on the site works. Lack of material management ultimately results delay of the work, project cost over runs, decrease productivity and wastage of materials and also it influences the quality of the project.

5.2- DISCUSSION

As we have seen from the observation above and from the three firms, the first called large firms have better material management practice. But, due to inessential rejection of materials, inferior quality control team, transportation problems and some of the seasonal problems of the industry delay in delivering on time has occurred but comparatively it has better material management practice comparing to medium and small firms and it is more encouraging. In some parts of the study, Moreover, to the above said points, they are offering warranty claims for their customers and they use on time delivery (OTD) principles. Early deliveries without customer approval are defined as OTD or delivered on time. However, from the study, 80% of the large firms are used construction materials management techniques. The rest 15% are not properly using the techniques but somehow, they were trying to use the management techniques. The second firms called medium firms. There is a big gap between large and medium firms. From the beginning, this medium firm is doing medium construction works based on his efficiency. So, we might not expect large

materials management practice like large firms. From the investigation, 60% of the industry used management practice. The rest 40% of it is somehow in fewer amounts. However, comparatively, medium firms have less controlling practice than the large one. This might affect in overall works of the buildings. Practically we observe this thing from large and medium firms of the industry. The third and the last firms are called small firms. In this firm, from the collected data, only 40% of the firms have management practice. This 40% is the average value for all small firms. In general, due to this fewer controlling mechanism of the industry, construction factors highly affect the buildings. The following factors are present in small firms of the industry. Construction delay,poor in quality control, materials transportation problems, material seasonal problems, cost overruns, labor strikes, communication problems and increases in material prices are some of them.

The following chart shows the variation of construction management practice in different firms.



As we have seen from the above discussion, and from the chart, there is a big gap between the firms. The large firm has high material management practice. And we concluded that large firms were somewhat good and capable enough in managing materials in construction sites. And they use some techniques on materials management practices. Due to the material management techniques, OTD or on time delivery is highly applicable in large firms. On time delivery is a measure of process and supply chain efficiency which measures the amount of finished goods or services delivered to customers on time and in full.

Medium firms have somewhat good but it still needs improvements Medium firms have technical as well as some seasonal problems as they don't use any other techniques on the management of materials. Here, they used techniques of material management but lower than that of large firms. The cause of it is may be from cost or may be from working background of the site. And the last one is called small firms. It has very poor strategies in material management practice and it needs highly improved techniques. It has very poor management practice compared to medium & large firms. It is due to lack of skill man power, and may be has a limited power of working. And maybe they do not have enough efficiency to protect and to follow the well-being of the materials.

6- INVENTORY MANAGEMENT: Modeling of inventory management in construction operations which involves on-site fabrication of raw materials was made by Do Young Jung (2007). The research was done to decide an optimal level of material inventories on considering vibrant variations of resources under uncertainty is very critical for the economic efficiency of construction projects. This paper developed a probabilistic optimal inventory management model on the process of on-site fabrication of raw materials such as iron-rebar process. From the research it was concluded that, the amount of inflow and outflow iron-bars at the temporary shop attained a stability by applying the pull system to the phase of raw material inventory management, moreover average inventory quantity were reduced, and by eliciting optimal time lags

linking to the start of fabrication/assembly works, it was likely to reduce the holding time of assembled products, and inventory management costs could be reduced around a total of 25%. For improving on-site materials tracking for inventory management in construction projects, Narimah Kasim (2012) made a research. The improper handling and storage of materials in construction site was difficult to track and locate materials. The on-site materials tracking and locating were made complicated by using traditional tracking process which is labour intensive, error-prone, unreliable and add to the raise in construction costs. Failure in organizing site inventory will result in cost overrun and reduce overall project performance. He concluded that, RFID in materials tracking helped in inventory control and retards the increase of project cost.

7- TECHNIQUES OF MATERIAL MANAGEMENT

S curve analysis was done to check the deviations in the progress of the scheduled project. The tracking should be done then and there to find the fault in earlier stage itself. Aditya A. Pande (2015) carried out S curve analysis using MSP software. S curve analysis was done to compare planned and actual material consumption. The deviations curve in the S shaped graph produced by the increasing expenditure of certain parameters against time was the representation of project path. This analysis was carried for comparison of planned and actual cost for material. The author concluded that due to deviation in items the consequences would be on material procurement which affects the project budget. EOQ analysis was done after the delay in the project. The delay was due to the deviations in the scheduled project. EOQ analysis was made to reduce the increasing project cost. Ashwini R. Patil (2013) carried out this method and found the frequent order quantity. The frequent order quantity should be known to purchase the required materials on time. Moreover, the order of frequency could also be achieved. The Economic order quantity was calculated using the formula, √ where, Q=Economic Order Quantity C0= Ordering Cost Cu= Cost of Item S= Total Consumption I=Inventory carrying Cost By using the formula, total cost of inventory and economic order quantity were found. The cost obtained after adoption of EOQ analysis was less than without adopting EOQ. Thus, the cost was minimized and this analysis was recommended.

8- CONCLUSION& RECOMMENDATIONS

8.1- CONCLUSION

The following conclusions are addressed from the study: There should be a centralized material management team co-ordination between the site and the organization. Proper control, tracking and monitoring of the system is required. Awareness and accountability should be created within the organization. There has to be a need of an efficient integrating in all aspects of material management practices. Proper material management system is seen to have increased their overall efficiency by 35% of the industry. MMP is very important for the success of any mega project. It highly reduces the gap between a successful project and a project full of delays and claims. It is used for improving efficiency and minimizing costs. It is used for controlling direct cost. It minimizes risk of inventory loss. And generally, it is a device used to measure the successful completion of the project and it leads to reduction in loss of time and cost. Boopathi (2016) has made a study on material management using a real time residential project. The author had an opinion that the cost of the project increases mainly due to the improper material management. So, in this project, planning, scheduling and budgeting were done by PRIMAVERA. Since he had followed a proper scheduling method there was no increase in cost of the project. The material cost constitutes the 50% of total cost which is normal. The paper reports on

the premature stages of research which is developing a new ICT-based approach to managing materials on fast-track schemes by Kasim. Planning, procurement, handling, storing and control must be taken care to complete project on time with high efficiency were revealed from his research. Implementation of IT in materials management could ease the successful and proficient control of materials on site. He concluded that fast track construction was preferred to improve the merit of the production process.

8.2- RECOMMENDATION

The following recommendations were addressed for all size of construction firms:

- ✓ The management staff of the work site should give more attention for material management, sometimes use of software should be used to avoid manual errors in material management, to avoid delay due to rejection of materials by quality control department or seasonal problems, the construction firms should store extra essential materials like steel, cement, etc. for emergency purpose, to avoid communication problems, all the indents, requests, notes and records should be kept in the written format.
- ✓ To reduce the wastage due to improper material handling, equipment like conveyor belts, trolleys, cranes, etc. should be used. Again, it is recommended to prepare and follow the given procedure to implement the material management effectively. Implementation of a given procedure in material management may be important for the success of any mega project. To fill the gap between a successful project and it reduce full of delays and claims. It is used for improving efficiency and minimizing costs, for controlling direct cost, it minimizes risk of inventory loss, and in general the procedure it is called a device used for controlling on manufacturing cycle and it leads to reduction in loss of time of direct labor.

9- REFERENCES

i. Okorocha, K. A. (2013). Factors Affecting Effective Materials Management in Building Construction Projects- a Case Study of Selected Building Sites, in Imo state, Nigeria, *International Journal of Management Sciences and Business Research*, 2, 50-59.

ii. Kasim, N.B., Anumba, C. J. and Dainty, A.R.J. (2005). Improving Materials Management Practices on Fast-Track Construction Projects, *21st Annual ARCOM Conference, SOAS, University of London*. 2, 793-802.

iii. Ashwini, R. P., and Smita, V. P. (2013). Analyzing Material Management Techniques on Construction Project, *International Journal of Engineering and Innovative Technology*, 3, 96-100.

iv. Madhavi, T. P., Mathew, S. V., and Sasidharan,R.(2013).Material Management in Construction– A Case Study, *International Journal of Research in Engineering and Technology*, 2, 400-403.

v. Gulghane, A. A., and Khandvi P. V.(2015). Management for Construction Materials and Control of Construction Waste in Construction Industry: A Review, *Int. Journal of Engineering Research and Applications*, 5, 59-64.

vi. Kulkarni, V., Sharma, R., and Hot, M. (2017). Factors Affecting Material Management on Construction Site, *International Research Journal of Engineering and Technology (IRJET)*,4, 474-478.

vii. Pande, A. A. and Sabihuddin, S. (2015). Study of Material Management Techniques on Construction Project, *International Journal of Informative & Futuristic Research*, 2, 3479-3486.

viii. Angel Raphella, S. Gomathi Nathan and G. Chitra. (2014). Inventory Management- A Case Study, *International*

Journal of Emerging Research in Management &Technology, 3, 94-102.
ix. Wilfred,S. A., Deepak, M. D., Shivaram, N., Nataraj, M. and Khan, Y.(2015). An empirical case study of material management in residential project, *International Research Journal of Engineering and Technology (IRJET)*, 2, 1116-1119.
x. Zeb, A., Malik, S., Nauman, S., Hanif, H. and Amin M. O. S. (2015). Factors Affecting Material Procurement, Supply and Management in Building Projects of Pakistan: A Contractor's Perspective, *Proceedings of 2015 International Conference on Innovations in Civil and Structural Engineering (ICICSE'15) Istanbul (Turkey)*, 170-175.
xi. Patil, A. R. and Pataskar, S.V. (2013). Analysing Material Management Techniques on Construction Project, *International Journal of Engineering and Innovative Technology*, 3, 96–100.
xii. Ayegba, C. (2013). An Assessment of Material Management on Building Construction Sites, *Civil and Environmental Research(IISTE)*, 3, 18-22.
xiii. Patil, D. P., Bhangale, P. P. and Kulkarini, S. S. (2014). Study of cost control on construction project, *International Journal of Advanced Engineering Research and Studies*, 3, 1-2.