Study of Methods Used To Reduce Waste Due To Rework In Construction Projects & Checking Its Effectiveness By Cost-Time Analysis: Case Study At Hadapsar, Pune

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Abstract- *Rework in construction projects is mainly stated as the repetition of activity or wasting unnecessary efforts for redoing same process or activity, which was incorrectly implemented in first instance. Rework can adversely affect the performance, productivity and ultimately the profit margins. Construction projects are considered as continuous system which needs to be designed produced and delivered within specified time. In this continuous system, the repetition of work or activity causes delay of work and increase in cost.*

In proposed study approach included main study targeting purposively selected construction professionals i.e. Consultants, contractors. and also it includes opinion of labors working on construction site in the hadapsar area of pune city. First of all questionnaire was designed with the help of guide and experts in respective fields. Then responses are collected and respective objectives are obtained. The findings revealed the awareness of people regarding the rework waste reduction methods. this results into the giving idea about mostly used methods in hadapsar. then the case study is studied for cost and time analysis.

The study was motivated by several internal and local studies demonstrating lack of concern for root cause of rework. Also my own experience of site majorly motivated me for study. while working on site it becomes necessary to check the awareness of peoples working on site many times it is seen that the peoples don't give that much importance to the rework as they never focused on waste due to rework so it becomes necessary to make realize peoples about the waste due rework and give them solution to reduce that waste.

This study recommended that it's very important to increase awareness between contracting parties regarding rework in construction projects, rework causes and its impact on performance. It's recommended strongly that rework events should be documented and project managers should have a rework control system in their projects.

I. INTRODUCTION

Nowadays, the awareness of people regarding the construction is increasing day by day. The problems faced by construction companies are well known, it may include less production, poor safety, less profit insufficient quality etc. Solutions for these problems are given in many ways. as competition in market is increasing & profit is decreasing many contractors are worried about their business. they are finding many ways to increase the profit & reduce the waste. Numbers of approaches have been developed for that.

Contractors are getting aware about reducing waste. Waste may be in any form. Waste is nothing but the things which are wasted. It may be in the form of man, material, money & time. Rework is referred as unnecessary effort of redoing a process or activity that was incorrectly done in previous attempt. the rework may be occurred due to errors, omissions, failures; changes, poor coordination etc. rework affects on project directly & indirectly as it happens at different stages of project. the direct impact occurs on time, cost, material, manpower etc. while the indirect impact occurs on profit margin. it may also causes stress, motivation, relationship & reputation. so it is necessary to study the methods to reduce waste due rework and check its effectiveness.

1.1 Definition of rework

There are various interpretations and definitions about rework. Terms include: "quality deviations", "nonconformance", "defects" and "quality failures". Rework can be described as unneeded effort of redoing an activity or operation that was enforced in a wrong way from the beginning.

"The process by which an item is made to conform to the original requirement by completion or correction"

1.1 Nature of rework

The construction field plays important role in economic development of any nation especially in expanding economy. Construction industry is connected with many other manufacturing industries. it consumes a huge amount of money, time & energy. Nature of rework can be determined by referring definitions. Similar terms for rework include "quality deviation", nonconformance, defects & quality failures. Rework can be either positive or negative. Its positive when rework becomes necessary when an element of building works fails to meet customer's requirement (Simpeh EK,2012).construction industry is faced significant problems like high cost, late delivery & bad financial performance. Rework has negative impact on performance & productivity. Rework happens as demolishing & rebuilding. Sometimes it happens as requirement of extra work.

1.3 Rework as waste in construction projects

Waste means the thing which is wasted or which is not of any use. Nowadays there are many problems related to construction waste. Since last two decades the amount of waste is increased largely. it is because due to standard of living & increase in population mainly. Many reports and studies have concluded that generated waste leads to negative impact on environment, cost, productivity, time and economy. These waste generation activities consumes time and it causes loss of money, material and execution of unnecessary work. in rework due to repetition of work there is wastage of man, money, material etc. which are not refundable. So it is necessary to reduce waste due to rework.

1.4 Rework impact on construction projects:-

In large construction projects there are many activities like supplying of material, installation etc. takes place simultaneously due to poor communication and co-ordination there is occurrence of errors, omissions and poor management practices which results into rework. There are many direct impacts on construction projects. Rework directly impacts on time schedule, cost etc. the direct impacts are easily identifiable. in addition to the direct impacts there are some indirect impacts which affect the projects. They are like morale level, conflict, absenteeism, fatigue and communication. love studied that rework can seriously affect an individual, an organization and a projects performance indirectly.

1.5 Rework activities causing rework in construction projects:-

In construction projects it is observed that there are many repeating activities or events causing the rework. If that activities got reduced by any method that will help to reduce the total cost and time of project. Summary of all the activities or events from starting to end of project in the area of hadapsar is given in below table

Table 1 activities/events causing rework:-

Rework event	Main causes of rework	Responsible person
Excavated soil is dumped into projected area	Lack of involvement of owner, Poor workmanship.	owner
Building out of alignment i.e. **Failure of centerline**	Poor workmanship ,Personnel attitude (personnel issues) the contractor concentrated on there was no failure ,Poor quality system from contactor ,Poor communication system specially between contractor and consultant	contractor
Cutting of extra beam i.e. take a overhang	Poor workmanship, Insufficient design specification, Poor communication system between contractor and consultant	consultant
Change in position of wall ,pop	Changes because of change in owner officials, Inadequate briefing from owner	owner
Change in tile	Unskilled labour , Poor workmanship, Poor communication system between contractor and labor	labour
Change in electrification	Bad supervision, Insufficient design specification, Poor communication between consultant and contractor	consultant
Change in plumbing	Changes because of change in owner officials, Inadequate briefing from owner, Insufficient design specification	consultant
Change in waterproofing and terrace slope	Bad supervision, Unskilled labour	contactor
Change in color, rebaring.	Inadequate briefing from owner, Poor communication between consultant and owner, Wrong selection from consultant.	consultant

II. METHODOLOGY

Research design selected for study purpose is descriptive in nature and includes the questionnaire survey. Secondary data is collected by reviewing the past literature of well-known authors. it includes reading and evaluating other people's idea or completed work and analyzed results. Primary data is collected with help of questionnaire survey. The deliberate sampling is used for study purpose. The area selected for study is Hadapsar, pune. Questionnaire is designed with the help of guide of this project study and

experts having experience of more than 10 years, in the field of rework. Closed ended type questionnaire is designed. Then the respective questionnaires are distributed among the contractors, consultants/designers, and labors. Responses of all respondents are collected in five types i.e. strongly agree, agree, undecided, disagree and strongly disagree. Some questionnaires are collected directly, some are collected by phone and few of them are collected through mails. Total 30 contractors, 30 designers and 30 labors are involved in this survey. This helps to find out the methods used in this area for reduction of waste due to rework. out of 30, 21 contactors are aware about these methods. out of 30, 18 designers are aware about these methods. total 15 labors are aware about the rework.

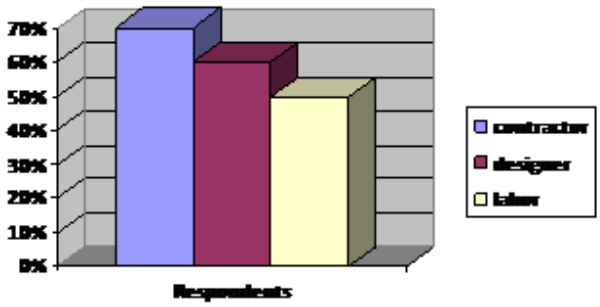

Fig 1 awareness of respondents regarding rework waste reducing methods:-

then available methods are studied. the methods used in the area of hadapsar are traditional method, non traditional method, lean method, supply chain system method, lesson learned method. the peoples who are actually aware about these methods have chosen the method they use for their work the results of survey are displayed in below graph.

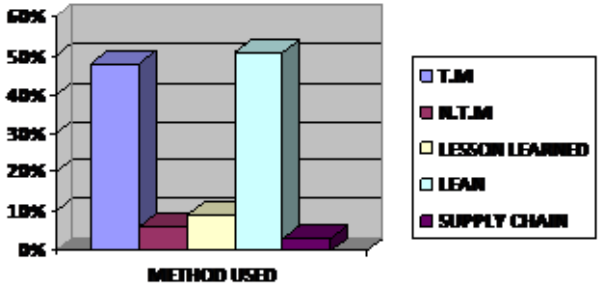

Fig 2 mostly used method for rework waste reducing methods:-

after the survey results got are lean and traditional method are the mostly used methods in the area of hadapsar. so their effectiveness is checked by comparing time and cost by using case study method.

2.1 case study

One residential project is selected and investigated. this case studied the occurrence of rework events/activities and its impact on project performance in terms of time and cost. it is also determined that who is responsible for rework in each rework event/activity. for that purpose all project documents and reports are studied and many site visits are arranged. Then all rework events, its main causes and its cost & time are recorded.

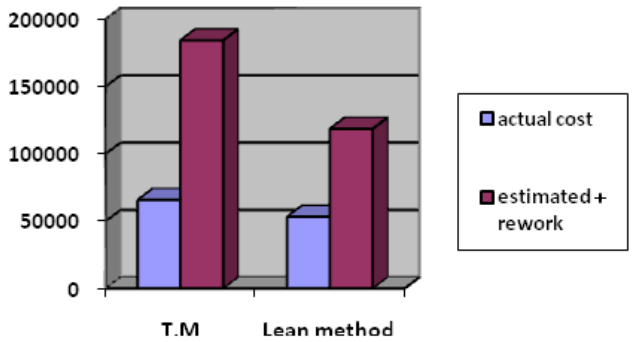

Fig 3 comparison of cost of project using traditional and lean method.

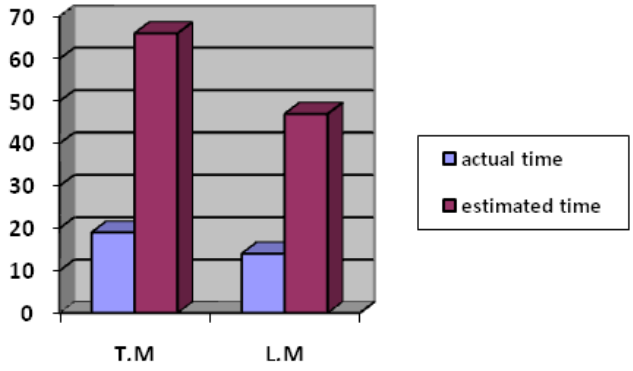

Fig 4 comparison of time of project using traditional and lean method

III. SUMMARY/CONCLUSION.

Based on the previous results obtained from questionnaire survey and case study the recommendations were made to help hadapsar area construction professional in order to optimize the project performance for individuals, the wellness of the construction contractor firms, and ultimately,

the benefits of the entire construction industry in hadapsar. This study concluded that availability of qualified consultant, qualified contractor, well trained and skilled labors and knowledgeable owner & in addition to ensuring supplier qualification per supplying under suitable and enough owner involvement in the construction project under effective teamwork environment will contribute to reduce rework effectively in the hadapsar area.

1) Using lean construction improvement is a very effective technique to reduce rework in construction projects. as illustrated from results of case study the cost of rework in lean method are less as compare to the traditional methods and also it saves the time.
2) It's very important to increase awareness between contracting parties regarding rework in construction projects, its causes and impact, to qualify them to avoid it as possible.
3) Its recommended strongly that rework events should be documented during projects, and it should be reported to the project manager. so that it can be used for future projects.
4) To reduce rework in the construction project, it can be concluded that better understanding of causes of rework will assist project managers to identify the best methods to improve the performance to minimize rework. So PM should be well aware about that in hadapsar area.

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