FACTORS AFFECTING REWORK COST IN CONSTRUCTION

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Abstract - *Rework, are activities in the field, which have been completed, but were required to be repeated or undertaken again as a result of some impeding correction that was necessary to be carried out during the project. This is regardless of source, or effecting a change, not due to change of scope by the owner. Fundamentally, rework becomes necessary either when an element of building works fails to meet customer requirements, or when the completed work does not conform to the contract documents. In either scenario, the product is altered so as to ensure conformity. At ascertain moment during construction, for example due to an error, rework is necessary. But the rework might not be discovered until some form of quality control check is done, after which it can be concluded as to what kind of rework needs to be done. Rework can also have internal or external origins. Changes in clients' expectations are an example of an external factor that might lead to rework. Rework can cause many costs to be higher than calculated at the start of the project. Rework can result from various sources such as errors, omissions and changes. While it is widely recognized that additional costs due to rework can have an adverse effect on project performance, limited empirical research has been done to investigate the influencing factors. The research presented in this paper aims to determine the influence of different project types and procurement methods on rework costs in construction projects.*

Keywords: *Rework, Rework Cost, Factors Affecting Rework*

1. INTRODUCTION

Rework is defined as the unnecessary effort of re-doing a process or activity that was incorrectly implemented at the first time Rework is also defined as the process by which an item is made to conform to the original requirement by completion or correction. It is also defined as doing something at least one extra time due to non-conformance to requirements. Rework is a silent consumer of time, resources and trust. It is the singular most potent destroyer of an excellently prepared works schedule as works are usually put on hold to attend to any rework that has arisen. Besides the failure of the schedules, it adds to the cost of the project, sometimes, significantly. This is because breaking down an already executed part of the structure is usually done so as to redo it and by this, new materials, labour and plant/machinery are mobilized afresh to get the activity done again, hence financial and time wastage. Looking at the causes of rework is very necessary so that project managers, designers, clients and contractors will take advantage of this to avoid their occurrence. This study highlights the causes, effects and remedies of rework so that it can be used as a guide to the aforementioned stakeholders of construction projects, so that rework can be reduced significantly, thereby adding to the contractor's profit margin and encourage the delivery of projects on schedule.

The challenge of rework costs which include labour, materials, equipment and sub-contractors can run from 2% to 20% of a projects' total contract amount Rework has been identified as a significant factor that contributes to cost increases and schedule delays on projects the adverse consequences of these difficulties include reduced profit, loss of market share and reputation, increased turnover of management and workforce, lower productivity, higher costs and all too frequently, costly litigation between participants over responsibility for over runs and delays. The major problems of costs overrun, which translates into reduced profit margin for the contractor and an eventual higher cost of executing the project considered as wastages and the delay in project delivery on schedule, are all caused by the menace called rework. The above highlighted problems are the reasons behind the desire to undertake this study hoping that it will translate into a solution for the problem..

1.1AIM

The aim of this research is to determine the underlying causes of rework during construction as well as the impact of rework on overall project performance so that effective prevention strategies can be developed.

1.2 OBJECTIVE

1. To identify factors affecting rework in building construction
2. To propose best practices to minimize rework in building construction
3. To develop checklists to minimize rework for selected trades

2. METHODOLOGY

The study sought to determine the causes of rework occurrences in the design and execution stage of building projects and best practices to minimize its effects on same due to organizational management practices, and project management practices. The purpose of Methodology was to identify and clarify rework in building construction projects and to develop rework reduction methodologies. On achieving this, rather than developing a questionnaire survey that sought respondents‟ general opinion about rework, this research was asked respondents to select a recently completed building projects most familiar to them and to subsequently answer questions about the perceived causes of rework associated with the environment and project management practices implemented.

Work categories comprised 10 of which were mostly common in building constructions identified to conduct this research both in identifying factors affecting rework and proposing best practices and developing checklists to minimize rework in the said trades.

Respondents, who were selected for the research, closely involved to the construction stage and actively participated to the projects representing either contractors‟ organization or project management organization.

3. CASE STUDY

Paranjape Broadway, is a sprawling luxury enclave of magnificent Apartments in Pune, elevating the contemporary lifestyle.

Paranjape Broadway offers 2 BHK and 3 BHK luxurious Apartments in Pune.

• The master plan of Paranjape Broadway comprises of unique design that affirms a world-class lifestyle and a prestigious accommodation in Apartments in Pune.
• Amenities: The amenities in Paranjape Broadway comprises of Landscaped Garden, Swimming Pool and Play Area.
• Location Advantage: Location of Paranjape Broadway is a major plus for buyers looking to invest in property in Pune. It is one of the most prestigious address of Pune with many facilities and utilities nearby Wakad.
• Address: The address of Paranjape Broadway is Wakad, Pune, and Maharashtra, INDIA.

4. RESULTS AND DISCUSSION

4.1 SCHEDULING OF PROJECT

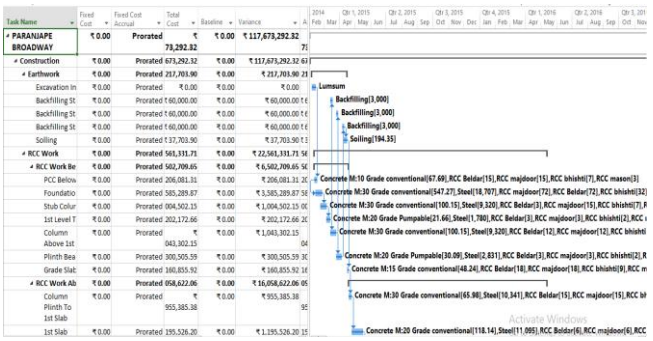

FIG -1: SCHEDULING OF PROJECT

DATA ANALYSIS: -

The relative importance of main group and there sub groups is determined by analytical hierarchy process

Table -1: Main Group ranking

Factors	weight	Rank
Design related factors	.085	4
Client related factors	.512	1
Contractor related factors	.292	2
Extraneous environment factors	.111	3

Table -2: Ranking of design related factors

Factors	weight	Rank
Poor used of advanced engineering	.260	2
Inadequate details collection before preparing design	.077	5
Poor communication between members of design team	.172	3
Design mistake due to numerous design	.099	4
Insufficiency of attention on design details	.393	1

The ranking of the factors under the influence of design related factors

Table -3: Ranking of client related factors

Factors	weight	Rank
Monet and time spent on preparation work	0.163	3
Poor coordination with design consultants	0.2	2
Insufficiency of experience and understanding of design	0.467	1
Shortage of funding for site investigation	0.096	4
Lack of client participation	0.075	5

Therankingofthefactorsundertheinfluenceofextraneousenvironmentfactors

4.2 Rework cost calculation

In this research study Calculate the rework amount and rework cost, take an example for calculation of rework amountandreworkcost.ActivityA,B,C,D,E,andthereduration andnormalcostareshowinexample.Andthenetworkdiagram ofthese activity is alsoshown

Table -4: Rework cost calculation

Activity	Duration (days)	Normal cost (₹)
A	**120**	**12,000/-**
B	**20**	**1,800/-**
C	**40**	**16,000/-**
D	**30**	**1,400/-**
E	**40**	**3,600/-**
F	**60**	**13,500/-**

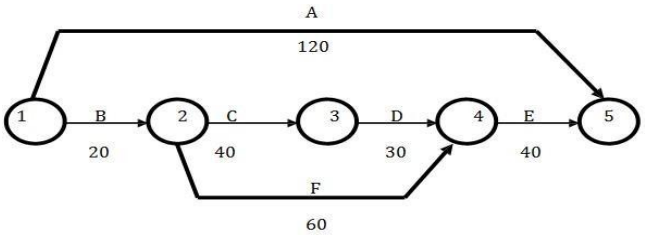

Fig -2: Activity Network Diag

Table -5: cost calculation for critical activity B

FACTORS	DURATION (DAYS)	COST	WEIGHTAGE	REWORK AMOUNT	REWORK COST (₹)
Lack of experience and knowledge of design and construction process.	**20 DAYS**	**1800**	**.288**	**5.76**	**103.68**
Poor quality of construction technique			**.266**	**5.32**	**95.76**
Poor use of advanced engineering			**.133**	**2.66**	**47.88**
Adverse natural condition			**.111**	**2.22**	**39.96**
Lack of use of advanced mechanical equipment's			**.100**	**2**	**36.00**

5. CONCLUSIONS

1. The important conclusion withdraw from this research study is the client and contractor related factors are most responsible for rework in construction projects. And the ranking of four main groups respectively are client related factors, contractor related factors, extraneous environment factors and design related factors.
2. Lack of experience and knowledge of design and construction process, poor quality of construction technique and poor used of advanced engineering are more responsible for rework in construction process.
3. The total rework cost is approximately 15-20% of the total project cost in construction work based on the probabilistic approach.

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