

Rework overruns for building construction projects

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Abstract- Rework is defined as unnecessary process of re-doing a work activity that was incorrectly carried out the first time. Rework is a major contributor to time wastage and schedule overruns which eventually impact on cost, resources and quality. To carry out this research work we had considered two residential projects. The study has conducted for the area of Surat region of south Gujarat. This Study has been conducted for the Objective, to calculate total cost growth and schedule growth from rework. From this study we are able to say that cost growth for both projects are between 20-26% and schedule growth for both projects are between 11-34% from the original. From this Study we conclude that rework is generated due to inadequate practices and avoidance of the stakeholders so it's necessary to efficiently execute the work and must be follow all the necessary guidelines so that total amount of rework and overrun can mitigate. It's also clearly visible that cost and schedule growth effected due to rework in the construction project.

Keywords- Rework, Overruns, Cost growth, Schedule growth, Project performance

I. INTRODUCTION

Construction industry is faced with the significant problems of high cost of project delivery, bad financial performance and inability to deliver value to customers on time. A major factor contributing to this problem is rework. However, little is known about the background and consequently, rework remains an innate problem. The lack of attention to the root causes of rework seems to be a global phenomenon. Rework is defined as the unnecessary effort of re-doing an activity that was inaccurately done the first time or the process by which an item is made to conform to the original requirement by completion or correction. In another word rework defined as work that is made to conform to the original requirements by completion or correction at least one extra time due to non-conformance with requirements. Rework becomes essential when an element of building works fails to meet customer's requirement or when the completed work does not conform to the contract documentation. The lack of attention to the root causes of rework seems to be a global phenomenon. Rework can be obtained from various sources like errors, changes and omissions. Rework and the problem of rework has been largely ignored by the construction industry. The root causes of rework can be categorized into different groups such as client-related factors, design-related factors, and contractor-related factors including site management and subcontractor factor. In addition to the direct impacts (i.e. with respect to time, cost, and resources) on specific activities/ tasks, the rework occurrences will often have some indirect impacts subsequently (e.g. on several other related activities/ tasks).

II. OBJECTIVE

To calculate total cost growth and schedule growth for the Project of residential building.

III. LITERATURE REVIEW

Peter E .D. et al (2002) has determine the influence of different project types and procurement method on rework costs in construction project and also discussed and analysed the direct and indirect consequences of rework. For this study questionnaire survey was adopted. Total 420 questionnaires distributed in Australia and 161 respond they were received from Australian construction projects. In survey discussed and analysed on variety of project type like new build, renovation, fit out, new refurbishment and different procurement methods like traditional lump sum method, design and build, traditional cost plus, design and manage construction management. He concluded that cost and schedule growth for the project sampled were calculated and were 12.6% and 20.7% respectively and concluded that if performance and productivity of the project improve it is a great need to reduce rework cost. To reduce the design error Peter E. D, Purnendu, Jim, Heng et al (2010) has used to design and develop a system dynamics model. In literature discussed the factors that contributed to design errors are identified. To generate dynamics model the Powersim CONSTRUCTOR 2.5 package. In study found out factors affecting error proneness during design such as normal error, schedule pressure, design fee pressure and parallelism and as the identified the errors conformation of causes done and the process of re-designing tasks. The study is carried out in Hong Kong by Ekambaram, Peter E D, Jeong Tai et al in 2014 from their study they concluded that design audits has been effective mechanism for reducing errors and succeeding rework that can arise during the construction process. For study they have adopted triangulated research approach to examine how design audits can be effectively used to reduce error and rework. The rework is associated with discourse error during construction increase cost and schedule of projects. They concluded that design audit should be compulsory component for all construction projects as practised in Hong Kong.

IV. RESEARCH METHODOLOGY

For finding out cost and schedule growth of residential projects. We have consider two residential projects which are situated in Surat city. From the Original contract cost and by calculating Contract cost of practical completion we found out the cost growth of project. From the total Original construction period and by observing total actual construction period we found out the schedule growth of project

V. ANALYSIS AND DISCUSSION

Details of Case study 1:

Site detail	13 STOREY RESIDENTIAL BUILDING
Type of Contract	Item rate contract
RCC (Item)	30X20 sq. ft. slab size 0.3773 ft. thick size five slab
Reason of rework	Due to deviated quality of construction material rework has been done.
Demolition quantity	30X20 sq. ft. slab size 0.3773 ft. thick size five slab
Rework quantity	30X20 sq. ft. slab size 0.3773 ft. thick size five slab
Demolition cost	Material cost = 96150Rs Labour cost = 9600Rs Breaker cost=30000Rs Total demolition cost =135750Rs
Rework cost	Steel cost = 200000Rs RMC cost=108970Rs SBR Chemical=75000Rs Vibrator cost=1600Rs Rebar charges (labour)=110000Rs RMC 1 day cost feeling =10500Rs Total Rework cost =5,06,070Rs
Total original contract cost	33,00,000Rs
Total Contract cost of practical completion	39,41,820Rs
Total original construction period	72 Week
Rework period	8 Week
Total actual construction period	80 Week
Schedule growth	11.11%
Cost growth	19.45%

The cost and schedule growth for both project calculated by using the following formula:

$$1) \text{ Cost growth } P_{CG} = \frac{\sum CCP - \sum OCC}{\sum OCC} \quad (\text{Source: Zeitoun and Obrelander 1993})$$

Where,

P_{CG} = Percentage cost growth

CCP=Contract cost of practical completion

OCC=Original contract cost

$$\begin{aligned} \text{Cost growth } P_{CG} &= \frac{39,41,820 - 33,00,000}{33,00,000} \\ &= 0.1945 \times 100 \\ &= 19.45 \% \end{aligned}$$

$$2) \text{ Schedule growth } P_{SG} = \frac{\sum ACP - \sum OCP}{\sum OCP} \quad (\text{Source: Zeitoun and Obrelander 1993})$$

Where,

P_{SG} = Percentage schedule growth

ACP = Actual Construction Period in Weeks

OCP = Original Construction Period in Weeks

$$\begin{aligned} \text{Schedule growth } P_{SG} &= \frac{80 - 72}{72} \\ &= 0.11111 \times 100 \\ &= 11.11 \% \end{aligned}$$

Details of Case study 2:

Site detail	24 STOREY RESIDENTIAL BUILDING
Type of Contract	Item rate contract
RCC (Item)	162 m3 (M40)
Reason of rework	Due to Level Difference
Demolition quantity	173 m3 (M25)
Rework quantity	162 m3 (M40)
Demolition cost	Material Cost = 8,30,400Rs Labour Cost = 1,80,000Rs Machinery Cost =10,800Rs Total Demolition Cost = 10,21,200Rs
Rework cost	Material Cost = 10,53,000Rs Labour Cost = 81,000Rs Machinery Cost =18,000Rs Total Rework cost =11,52,000Rs
Total original contract cost	85,00,000Rs
Total Contract cost of practical completion	1,06,73200Rs
Total original construction period	12 week
Rework period	4 week

Total actual construction period	16 week
Schedule growth	33.33%
Cost growth	25.67%

$$1) \text{ Cost growth } P_{CG} = \frac{\sum CCP - \sum OCC}{\sum OCC}$$

Where,

P_{CG} = Percentage cost growth

CCP=Contract cost of practical completion

OCC=Original contract cost

$$\begin{aligned} \text{Cost growth } P_{CG} &= \frac{1,06,73200 - 8500000}{8500000} \\ &= 0.25567 \times 100 \\ &= 25.567 \% \end{aligned}$$

$$2) \text{ Schedule growth } P_{SG} = \frac{\sum ACP - \sum OCP}{\sum OCP}$$

Where,

P_{SG} = Percentage schedule growth

ACP = Actual Construction Period in Weeks

OCP = Original Construction Period in Weeks

$$\begin{aligned} \text{Schedule growth } P_{SG} &= \frac{16 - 12}{12} \\ &= 0.3333 \times 100 \\ &= 33.33 \% \end{aligned}$$

VI. CONCLUSION

After carried out the detail case study of Rework for residential building construction projects. It's also clearly visible that cost and schedule growth effected due to rework in the construction project. We are able to calculate the cost growth and schedule growth of the study. We have found cost growth and schedule growth of case project 1 are 19.45% and 11.11% respectively. For project 2 cost growth and schedule growth are 25.67% and 33.33% respectively. We can say total overrun for project 1 is 6, 81,420 Rs and for project 2 is 21,73,200 Rs which is very large amount so rework is needed to be minimize. From this Study we conclude that rework is generated due to inadequate practices and avoidance of the stakeholders so it's necessary to efficiently execute the work and must be follow all the necessary guidelines so that total amount of rework and overrun can mitigate.

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