

Study of Cost Overrun in Repair & Rehabilitation Projects in India

Mohtashim Ahmad Siddiqui^{1*}, Luke Judson², Sushil Kumar Solanki³

Abstract:

In broad sense, the word "rehabilitation" suggested putting a building back to how it was before. The specialized area of repair and rehabilitation engineering necessitates knowledge and skills that go beyond those needed for design and construction engineering. Repair and rehabilitation projects are significantly more challenging and more complicated than new construction projects. It is vital to take a methodical approach to structural deterioration, and technology management and economics should coexist in harmony. Inadequate early planning and analysis before beginning a repair activity can harm the project's success in terms of time, cost, and quality. Critical factors of cost overrun in repair & rehabilitation can be categorized into different category on the basis of their severity & importance. So, it is necessary to understand the cost impact of those cost overrun factors. Cost overruns leading to the financial crisis and hence these costs overrun factors must be identified and ranked so that they can be mitigated at very early stage. The goals of this study are to identify the critical factors that cause cost overrun in repair & rehabilitation projects through field study & expert interviews and analyze them through statistical tool (Cronbach's alpha & Friedman test) to check reliability and significance as well as solutions to mitigate the cost overrun in Repair & Rehabilitation projects. As repair and rehabilitation projects are more complex and complicated than standard construction projects, poor estimates, a lack of condition assessment or visual inspection, and contractor incompetence by providing a lower quote than the projected cost may result in cost overruns. Analyzing the productivity, schedule, and cost for certain tasks may be effectively done through early condition assessment and extensive description of the activities in the BOQ.

Keywords: Repair & Rehabilitation, Condition Survey, Bill of Quantities, Cost Overrun

INTRODUCTION

*Author for Correspondence

Mohtashim Ahmad Siddiqui
E-mail: ar.masiddiqui95@gmail.com

¹Student, Department of Building Engineering and Management, School of Planning and Architecture, New Delhi, India

²Assistant Professor, Department of Building Engineering and Management, School of Planning and Architecture, New Delhi, India.

³Associate Professor, Department of Building Engineering and Management, School of Planning and Architecture, New Delhi, India.

Received Date: December 20, 2022

Accepted Date: March 21, 2023

Published Date: March 27, 2023

Citation: Mohtashim Ahmad Siddiqui, Luke Judson, Sushil Kumar Solanki. Study of Cost Overrun in Repair & Rehabilitation Projects in India. International Journal of Architectural Design and Planning. 2023; 1(1): 35–40p.

For a variety of reasons, concrete repair and rehabilitation in India did not receive the attention it required until around ten years ago. However, recent years have seen positive changes in the situation. The picture has gradually changed as a result of rapid globalization, raising levels of awareness, and the growing significance of India as a nation that has started a big infrastructure development drive [1]. There must be a balance between technological management and economics, and a methodical response to the structural deterioration is required [2].

Even when norms and standards are followed while designing reinforced concrete structures, sometimes not enough attention is taken when building them. As a result, the structures begin to exhibit signs of degradation after 10 years of use,

necessitating early repair and rehabilitation work [3]. As the part of condition survey, structural audit is the first step in repair projects. By carrying out a health assessment or structural audit, someone can ascertain whether a structure's functionality is as desired and acceptable. The practice of repair and rehabilitation in civil engineering allows for the extension of a structure's useful life. The concrete industry's fastest-growing sub segment is repair, rehabilitation, and retrofitting. Each year, billions of dollars are allocated globally to fix and restore deteriorated concrete buildings. There is currently no established procedure, mandatory or not, for routinely inspecting buildings and structures and documenting structural flaws and symptoms, such as cracks, spalling, corrosion, and deformation of building, in a logical manner. Therefore, in recent years, civil engineers have begun to pay more and more attention to the selection and evaluation of repair materials and protective coatings. Repair & rehabilitation projects are more complex and require extensive and adequate early assessment of deterioration so that estimates of these projects can be prepared accordingly to avoid the further escalation in quantities and extent & quantum of work to be carried out. A developed nation like India is likewise experimenting with the new technology and repair materials that have been widely adopted by advanced nations.[4]

LITERATURE

Buildings built in India in the early 1970s and late 1980s are discovered to be in bad condition as a result of insufficient specifications and subpar construction techniques [5]. The building activities and quality of construction have major impact on the social condition and environment of the building and its users. In general, it is observed that there are cost overruns in 95% of the projects in construction industry & hardly 5% of the projects complete within the budget and cost under run this is applicable to new construction and repairs, rehabilitation work also. Barge into a repair activity without adequate early preparation and investigation hamper the project success in term of time, cost & quality. Therefore, in order to save time and money, it is necessary to prepare adequately before choosing the rehabilitation techniques, methods, materials, and the actual course of action [6].

The inability to finish projects on schedule and under budget is a persistent issue that is getting worse across the globe. Due to some constraints, cost overrun in repairs industry is more than 20% of estimated values. Detailed estimation is very crucial to assess exact cost of work. Most effecting testing & adequate visual inspection can be done to increase the accuracy of the estimate. Proper assessment of quantum of work & accordingly specifications are required to avoid the cost overrun in repair & rehabilitation projects [7]. Repair & rehabilitation projects require adequate early preparation before deciding the rehabilitation strategies, methods, materials & execution of work to save the additional time & cost.

Early condition assessment & detailed breakdown of the activities in the BOQ can be effective in analyzing the productivity, schedule & cost for specific tasks. Poor estimation, lack of condition survey/ visual inspection and incompetency of contractor by quoting 15% than the estimated budget may lead to time and cost overrun in repair & rehabilitation projects.

Cost is indeed one of the key factors in determining a project's success. In general, the majority of the key variables affecting project costs are qualitative, such as the relevance of a client to construction time, the constructor's capacity for planning, locating techniques, and certain market conditions. One of the basic causes of cost overruns is when contractors quote costs based on their expected estimates. A project is effective if it can overcome the financial restrictions placed on it.[8]

Visual inspection limitations during condition survey, must be noted and taken into account when preparing the work specifications & methodology for repair and rehabilitation projects. . Adequate detailed investigation & selection of suitable techniques as per the project demand & cost are required to get the rehabilitation job done within stipulated time & cost. In repair & rehabilitation projects scope of work including demolition, selection of appropriate materials & methods, tests should be

properly select & quantify at early stage to avoid the additional work & cost during construction stage. Based on literature and personal interviews it was concluded that early adequate [9] condition assessment & detailed breakdown of the activities in the bill of quantities can be effective in analyzing the productivity, schedule & cost for specific tasks and thus estimation can be done more accurately to minimize the schedule & cost overrun in repair & rehabilitation project.

RESEARCH METHODOLOGY

The investigation began with a comprehensive study of the literature on challenges in repair rehabilitation and factors of cost overrun in repair & rehabilitation projects. (Figure 1) The study utilizes a self- created questionnaire for conducting expert interviews, field visits to assess the perspectives of various parties & experts associated with repair rehabilitation projects in order to identify & validate the cost overrun factors found from different literatures as well to evaluate the cost overrun in repair & rehabilitation projects. [10] A structured questionnaire was prepared to interview the experts, project manager, and project engineer & site supervisor for identifying the prominent factors that causes cost overrun as well as evaluation of cost overrun in these projects. Cost overrun factors are categorized and analyzed with respect to different stage of construction. Cronbach’s alpha test was used to check internal consistency and Friedman test is used to compare the mean ranks between the related variables/factors and indicates how the variables/factors differed. Root cause analysis is explained by fish bone diagram.

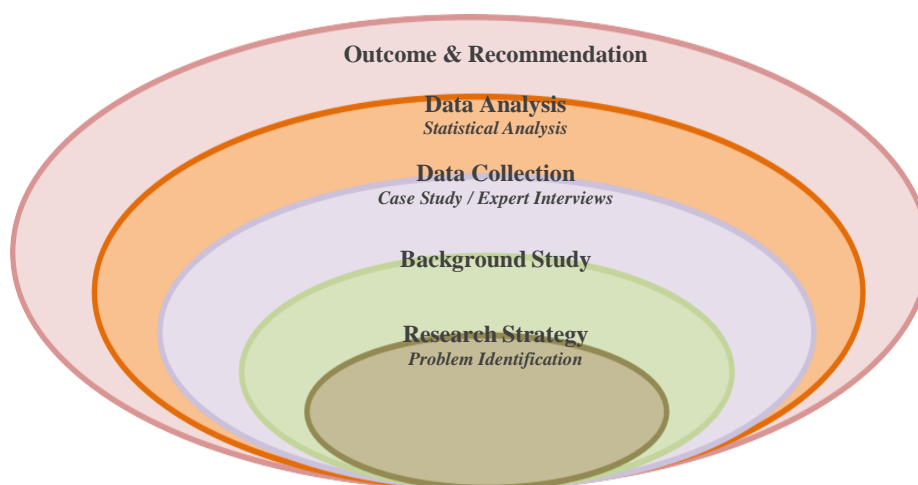


Figure 1. Research methodology.

DATA ANALYSIS

Cronbach’s Alpha Test

In this study Cronbach’s Alpha test is used to check internal consistency. (Table 1) The Cronbach’s coefficient alpha was related with the factors that causes of cost overruns in repairs and rehabilitations of buildings. Reliability Test for overall feedbacks received is 0.851 [11] which shows good reliability in internal consistency. Further group wise significance is shown in table below wherein construction & miscellaneous factors shows acceptable reliability and pre-construction & condition survey factors very high reliability.

Table 1. Cronbach’s Alpha Coefficient.

S.no.	Group	No. of Variables/ Factors	Cronbach's Alpha Coefficient	Significance
1	Condition Survey Stage	7	0.813	Good
2	Pre-Construction Stage	4	0.824	Good
3	Construction Stage	6	0.736	Acceptable
4	Miscellaneous	3	0.708	Acceptable

Friedman Test

The non-parametric substitute for the one-way ANOVA with repeated measures is the Friedman test. In situations when the dependent variable being measured is ordinal, [12] it is utilized to examine differences across independent variables. (Table 2) The Friedman test compares the mean ranks between the related independent variables and indicates how the independent variables differed, and it is included for this reason. Here factors are independent variables and there are total 20 independent variables and cost overrun is dependent variable.

Table 2. Overall mean & rank of variables.

Cost Overrun Factors (Friedman Test)					
Factors	Group	Variable	Mean Rank	Weightage	Rank
Lack of Visual Inspection	Condition Survey	V1	11.48	1.093	11
Poor Documentation		V2	6.68	0.636	16
Lack of expertise in client's team		V3	8.2	0.781	14
Lack of Structure Audit (NDTs)		V4	13.55	1.290	6
Inadequacy in Identification of Damage		V5	11.7	1.114	10
Inadequacy in Extent of Damage		V6	14.55	1.385	3
Unavailability of Drawings & Documents		V7	6.1	0.581	17
Improper Estimation	Pre- Construction Stage	V8	14.98	1.426	1
Discrepancy in BOQ		V9	14.5	1.381	4
Improper Project Scheduling		V10	10.06	0.958	12
Improper Quantum of Work		V11	14.93	1.422	2
Additional Work	Construction Stage	V12	14.23	1.355	5
Job Site Surprises		V13	13.43	1.279	7
Onsite Uncontrollable Damages		V14	9.13	0.869	13
Change in Scope of Work		V15	12.75	1.214	8
Procurement Issues due to Uncertainties & scope of work		V16	12.63	1.203	9
Decision Changes by Client		V17	7.6	0.724	15
Temporary Rent	Miscellaneous	V18	6.05	0.576	18
Hidden Litigation		V19	4.1	0.390	19
Local Vandalism		V20	3.4	0.324	20

Root Cause Analysis of Cost Overrun Factors (Fish Bone Diagram)

Root cause analysis is a problem-solving method that allows stakeholders to identify the factors that are causing the issue. When there are issues with a project, especially those that have a negative impact on its success, root cause analysis is used. (Figure 2) A project's problems are not caused by a single factor. That's why a root cause analysis is carried out to identify the many reasons of the problem.

Proper estimation and actual quantum of work are essential aspects to avoid the cost overrun and due to discrepancy in earlier stage of condition survey which includes lack of structure audit, lack of visual inspection which leads to inadequacy in identification & extent of damages and due to these reasons problems arise in actual quantification of work that to be demolished & executed. As repair & rehabilitation projects are more complex in nature than new construction projects. So due to improper condition survey issues like additional work, change in scope, job site surprises arise at construction stage which leads to cost overrun in repair & rehabilitation projects.

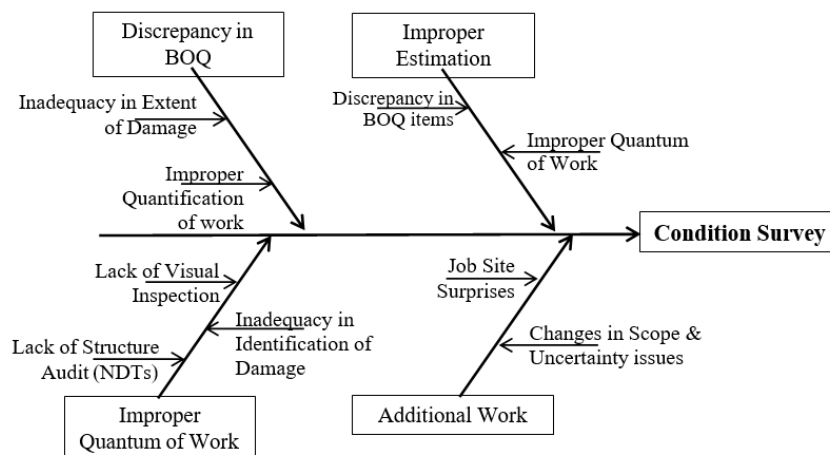


Figure 2. Root cause analysis.

RESULTS & DISCUSSION

The table above shows that there is an overall statistically significant difference between the mean ranks of the related variables. After conducting the site visits & expert interviews and analyzing the data with the help of statistical tool, Friedman test was performed between independent variable & dependent variable to check the differences across independent variables and it was found that due to inadequate condition survey which includes primary investigation, visual inspection, structure audit (NDTs), extent and identification of damages which results in poor estimation of project, discrepancies in BOQ items, additional work, change in scope of work procurement issues due to change in scope of work & these factors ultimately contribute to the cost overrun in repair & rehabilitation projects. Therefore, based on primary & secondary data collection & assessment these critical cost overrun factors has to be mitigated before & thereafter their occurrence & severity on repair & rehabilitation construction sites. Mitigation strategies should be followed if these identified critical cost overrun factors occur.

CONCLUSION

Early forecasting and problem detection are essential for repair and rehabilitation projects in order to calculate project costs and apply the best solutions. The study demonstrates that proper estimation and actual quantum of work are essential aspects to avoid the cost overrun and due to discrepancy in earlier stage of condition survey which includes lack of structure audit, lack of visual inspection which leads to inadequacy in identification & extent of damages and due to these reasons problems arises in actual quantification of work that to be demolished & executed. To improve the estimations' accuracy, more efficient testing can be carried out before they are used. This will result in thorough testing rather than insufficiently flawed testing on important structural components. As repair & rehabilitation projects are more complex in nature than new construction projects. So due to improper condition survey issues like additional work, change in scope, job site surprises arise at construction stage which leads to cost overrun in repair & rehabilitation projects. In this study, the causes of cost overruns and their effects are discussed in depth and these critical costs overrun factors has to be mitigated before & thereafter their occurrence & severity on repair & rehabilitation construction sites.

REFERENCES

1. Abdussalam Shibani, K. A. (2015). Avoiding Cost Overruns in Construction Projects in India. *Management Studies*, August 2015, Vol. 3, No. 7-8, 192-202, pp. 192-202.
2. Bhattacharjee, J. (2016). Repair, rehabilitation & retrofitting of RCC for sustainable development. *Civil Engineering and Urban Planning: An International Journal (CiVEJ)* Vol.3, No.2.
3. Chajlani Jeetendra, K. S. (2015). Analysis of repairs and rehabilitation of R.C.C Structures. *International Journal of Engineering Associates*, Volume 4, Issue8 .

4. Chander, S. (2014). Rehabilitation of Buildings. *International Journal of Civil Engineering Research*, Volume 5, pp. 333-338.
5. CPWD. (2011). *Handbook on Repair & Rehabilitation of RCC Buildings*. New Delhi: CPWD.
6. Pankaj Lipte, A. G. (2020). Structural Audit, Repair and Rehabilitation Techniques. *International Research Journal of Engineering and Technology (IRJET)*, Volume 7. Issue 9, pp. 2809-2814.
7. Shweta M. Kadam, S. C. (2016). SOME STUDIES ON COST OVERRUN FACTORS AFFECTING REPAIRS AND REHABILITATION OF BUILDINGS. *International Journal of Civil Engineering (IJCE)*, Volume 5, Issue 6, pp. 51-56.
8. Singh, P. (2021). *Techno Managerial Challenges in Repair & Rehabilitation of Tall RCC Building Structure*. New Delhi.
9. Sreekumar, A., Paul, D. V., Solanki, S. K., & Dua, S. (April 2022). Sustainable Retrofit for Adaptive Building Reuse—A Facility Management Approach for Highlighting and Cataloguing Deficiencies for Retrofit Decision Making. *International Journal of Multidisciplinary Innovative Research*, ISSN: 2583-0228 Volume 2, Number 2, pp-21-37.
10. Suresh Kumar S, M. M. (2019). AN EXPERIMENTAL STUDY OF REPAIR AND REHABILITATION OF STRUCTURE. *International Journal of Scientific & Engineering Research* Volume 10, Issue 3.
11. Sushil Kumar Solanki, V. P. (May 2022). Comparison between service life prediction methods for building rehabilitation: application on a case study. *Journal of Building Pathology and Rehabilitation* (2022) 7:51.
12. Varinder K Singh. (2013). Structural Repair and Rehabilitation of 3 no. (G+8) multi-Story residential building. *Procedia Engineering* (pp. 55-64).