

A RESEARCH ON COST OVERRUNS DUE TO DELAY IN CONSTRUCTION PROJECTS AND RECOMMENDATIONS

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Abstract : Cost and time overruns are the key problems of any construction projects. These issues are causing the negative impact on the development of country economic growth and prosperity. To overcome these issues, the paper is aimed to discover the most influence factors causing the project delay and cost overruns and recommend the possible measures by investigating case studies of three different construction sites in India. Each project quantitative data from the past studies was selected to analyze and recommend the effective measures. A questionnaire survey was conducted in all three case studies adopting different data collection strategy. The reason of selecting three case studies is to outline the compare analysis of delay factors and to classify why different delay factors have different priority level of influence in project delay from construction site to another construction site. The findings from the case studies exposed that the most influential factors in Varanasi site was (1) planning and scheduling deficiencies, (2) methods of construction, (3) effective monitoring and feedback process, whereas in Delhi, (1) delay in payment certificates (2) underestimating of project cost, (3) complexity of projects are the most influential factors. However, in Bangalore (1) Contractor's improper planning, (2) poor site management, (3) inadequate contractor experience are the most influential factors. This paper has also analyzed the average and least impact of the delay factors causing project delay and cost overruns at all sites. The paper concludes that there are diverse groups of delay factors from one site to another site causing project delay and cost overruns. It also concludes that there are diverse measures according to the nature of delay factors to reduce the impact on project delay and cost overruns in construction industry.

IndexTerms - Delay, Cost, Duration, Planning, Comprehensive, Management, Methodologies

I. INTRODUCTION

Next to United States, India is rapidly increasing in the field of construction industry. It stretches about lakh of Kilometers in the year 2014 and also having a chance of increasing year by year. The Government of India takes initiatives to improve and increase the infrastructure facilities for better, smooth and modern transportation. It also increases the funds for investment for the growth and development of Infrastructure. Over the past few years the Indian economy has been in a phase of enhanced growth of about 8-10% per year. Indian construction industry is playing an important role in the economic growth of our Nation; it widely involves high risk due to its varying nature of its construction activities. The success of the construction projects mainly depend on their accomplishment of essential factors such as cost, time and quality. In case cost and time are not properly planned and utilized, the project will not accomplish its goals and will cause failure to the overall project. In most of the Indian construction activities, it was observed very few projects were completed in a planned manner within estimated cost. Due to the major problems and delays in construction, most of the projects were suffered from cost overrun issue due to many reasons such as ineffective planning, monitoring and execution of work. Better planning of cost and allocation of funds are to be achieved to complete the project task with high precision.

II. OBJECTIVE

Main objectives of this study are:

1. To identify the various factors which are mostly influencing the cost overruns in the construction phase of road projects.
2. To rank the factors based on their impact and significance.
3. To find out various critical factors which are mostly dominating the cost overruns.
4. To make recommendations to overcome or omit those critical factors in future road construction projects.
5. To identify the major causes of delays.

III. METHODOLOGY

The following section presents the research steps to achieve the mentioned objectives.

Various factors responsible for cost overruns were collected from literature study and they were sorted in a desired category.

A questionnaire was prepared with 30 items and a survey was conducted to gather the data from selected respondents to find out critical factors causing cost overruns.

Each factor was given a scale of 0 to 3, so that person could easily express the severity range or impact. i.e., 0 being the lowest and 3 being the highest.

The scale for impact is categorized into 3 types.

- 0 for No effect.
- 1 for Medium effect.
- 2 for High effect.

Questionnaires were administered to a sample of 50 people selected from various Govt. authorities, contractors, subcontractors, site engineers and supervisors, of which 30 questionnaires were returned with completed responses.

The scale value obtained for each factors were found out and ranked based on Relative Importance Index (RII) and Mean Values (MV) of the responses are computed for their impact and significance.

Findings of the study based on the statistical analysis, are given.

Finally suggestions and recommendations are given to avoid the cost overruns in future road construction activities.

IV. QUESTIONNAIRE SURVEY

The various factors of causes for cost overrun were collected from the literature study. Further, opinions were obtained from the various Govt. authorities, contractors, subcontractors, site engineers, supervisors, etc., were listed based on the category. Finally 30 factors were selected and considered for the questionnaire survey. The various factors are listed below.

V. FACTORS

1. Change in policy / law (Govt. policy).
2. Cost escalation.
3. Design changes during construction phase.
4. Increase in construction time accordingly increase in overhead cost.
5. Inefficient estimation during tendering.
6. Increase in quantities due to actual site condition.
7. Inefficient resource utilization.
8. Delays in shifting existing utilities.
9. Improper scheduling.
10. Non availability of materials in the construction zone.
11. Act of god (Rain, earthquake, etc.).
12. Labour strikes.
13. Public agitation.
14. Improper procurement schedule.
15. Insufficient time to prepare bid.
16. Increase in land cost/ land acquisition.
17. Delay in design and approval of design.
18. Implementing new technologies. (For superior performance so that maintenance cost can be reduced. But initial cost is high).
19. Non-performance of subcontractors and nominated suppliers.
20. Conflict between project parties.
21. Improper interpretation of Contract and specification.
22. Financing and payment for completed works (Delays in payments).
23. Dependency on imported materials.
24. Unstable interest rate.
25. Excessive amendments of design and drawings.
26. The Contractual Failures.
27. Design errors.
28. Organizational or Institutional Failures.
29. Unrealistic work schedule.

30. Project key staff.

VI. DATA ANALYSIS

Relative Importance Index Technique (RII)

Relative Importance Index method to find out importance of the various causes of delay of the project. The same method is adopted in this study. A four-point scale ranged from 0 (No effect) to 3 (High effect) will be adopted. It will be converted in terms of relative importance indices (RII) for each factor from the received responses.

$$RII = \sum W/A * N$$

Where, W represents the weightage provided by the respondents to each factor (ranging from 0 to 3), A represents highest impact value (i.e. in this case, 3 is the highest weightage given to the scoring the factor), and N represents respondents in terms of number.

The value of RII ranges from 0 to 3, higher the range value of RII, more importance for the causes of delays. The RII was used to find out the rank (R) for the different causes. Each individual response should be used to find out RII, finally rankings are provided in order to give a clear view to the cost overrun in Road construction projects.

Mean Value Technique (MV)

Eng. S.B. Wijekoon. [5], used Mean value based technique to rank the factors based on responses received. The investigator adopted the same Mean Value technique to find out the rank, for checking the accuracy of results. Like Relative Importance Index, a four point scale was used, based on the Mean Value of the responses for each factors obtained from the respondents, the ranks were given using the formula.

$$\text{Mean Value} = \sum W/N$$

Where, W represents the weightage provided by the respondents to each factor (ranging from 0 to 3), and N represents the total number of respondents.

Mean values were calculated for verifying the ranks with relative importance index to give a clear idea for confirming the results obtained from RII technique.

VII. RESULTS AND INTERPRETATION OF DATA (RII TECHNIQUE)

The questionnaires prepared were given to various infrastructure organization professionals such as Govt. authorities, contractors, Engineers, site supervisors and other staffs involved in infrastructure projects in the southern part of India. The respondents were requested to readout the questionnaire and give scores from 0 to 3 based on the impact for each factor in the given handout. From the scores, Relative Importance Index for each factor was calculated, based on the RII, ranking was done and categorized in ascending order to find obtain the most critical factors. A total number of 50 questionnaires were distributed and a response of 30 numbers was received. The total percentages of response were calculated.

VIII. DISCUSSIONS

From the questionnaire received **land acquisition is ranked at top**. Most of the road projects are kept aside and are delayed due to objections from owners of the land. In the present scenario many projects are sanctioned by the Government, but after that it is not even started due to land issues at the initial phase of the project itself. The impact of land issues are getting serious now a days. It not only causes delay but also causes overrun of cost in the project. Therefore it is essential to formulate a strategy to overcome the issue in the initial stage itself. So introducing a national policy, widely in the country and also laws and amendment for land acquisitions are to be immediately implemented. Effective and timely plan and actions are needed to solve this problem in the earlier stages.

Second ranked cost overrun factor in road projects is **the cost escalation**. It means increase in price of money. It is caused due to price changes in the men (wages of labour), material, machinery and other construction related activity cost. This uncontrollable cost is mainly applicable for labour wages and material price escalation. It seems there is no solution for this problem, but effective planning at the procurement stage will reduce the price escalation, a little amount. For avoiding this issue, a standard cost escalation method is adopted in construction contracts in the contractual stage itself and provisions for contingencies are also to be included in the contract to avoid cost escalations.

Delays in payments, financing for completed works are ranked at three among the various factors. Almost 95% of road projects are funded by Government organizations and due to various Government policies and reasons, funds will not be given in time. This will reflect in the performance and progress of works. Due to the delays in payment, contractor will not able to circulate the money and his cash flow is mainly affected.

Force majeure is ranked at fourth, next to delays in payments. This is also referred as Acts of god, it includes unexpected rain, earthquake, natural calamities, political and economic instabilities. There is no preventive measure for such happenings. Usually the contractor is advised to insure against such events during the contractual stage itself to avoid the cost overruns.

Fifth rank is given to the design changes during construction. Improper planning, inadequate site investigation, misinterpretation of data, unaware of future needs are some of the causes for design changes. So proper planning, adequate investigation of site and accurate design procedure are needed to execute the project with high precision. If the design stage is not carefully examined and properly monitored, it will make additional cost to rectify the errors.

Delays in shifting existing utilities are sixth highest ranked critical factor. Most of the road construction projects are started, before the utilities are relocated from the site. So it is necessary to plan the relocation process and schedule the projects according to that. It is the prime solution to avoid the cost overruns in the road projects.

Seventh highest ranked factor is, increase in quantity of materials due to actual site conditions. It occurs due to unexpected ground and terrain conditions. Because of improper assessment of ground conditions and nature of soil strata during preliminary survey, the actual quantity varies. Unexpected sub surface condition will also affect the quantities (i.e. increase). Changes in ground conditions may lead to several issues in moving machineries, in undertaking excavation, and in foundation laying. To avoid these problems, additional care is provided at preliminary and reconnaissance survey, if not, this leads to increase in total cost and time also.

Non availability of construction materials is ranked at eighth position. During the periods when the levels of activity developments are unusually high in particular region, there might be chance shortage of materials used in the construction activities. If this is not anticipated in the planning stage itself, it will lead to increase in cost due to transportation of materials from far away areas. So provisions are given at contract at the stage of original cost estimate for avoiding the delays.

The ninth ranked cost overrun factor is design errors, it is caused due to designer's misinterpretation of data, carelessness, lack of technical knowledge, unaware of site Comparison of Results

Relative Importance method and Mean Value method were applied separately and compared with each other for checking the accuracy of results.

From it is observed that both methods (RII and MV) used for analysis shows similar results. And therefore it is concluded that the methods used for analyzing data are acceptable.

CONCLUSION AND RECOMMENDATION

Conclusion

Cost overrun are the most common factor and predominant in road construction projects in India. And during these study efforts was taken to find out the most critical factor which was mostly influencing the Indian Construction projects. So a questionnaire survey was made across various Government and private organizations. From the study it was observed that many respondents mainly focused on completing the project within the budget to control the cost overrun. The most predominant factors from the study are based on respondents perspective which includes the issues in land acquisition, cost escalation of workers' wages and material, financing and payments for completed works (delays in payments), Force majeure (act of god), design changes during construction phase, delays in shifting existing utilities, increase in quantities of materials due to actual site conditions, non-availability of construction materials, design errors, unstable or increase in interest rates.

To verify the accuracy of results made from the questionnaire survey, two different methods for analysis were used during the analysis of study. And those methods are relative importance index method (RII), and mean value method (MV).

Recommendations

Early identification of lands to be acquired is the best solution to avoid the land acquisition of the project. Because, about 70% of lands are acquired before the work gets started, balance 30% is acquired periodically after the commencement of work. This is the major

reason for land acquisition issues. By forming a new team especially for land acquisition and providing training for key staff will avoid this issue.

A realistic cost escalation factor should be considered on project estimates and early predictions of escalation cost based on future value of money in project estimates are the best solution to avoid cost escalation problems.

In order to avoid funding problems and payment delays, a realistic time period is mentioned in the contract, clearly indicating about time for the parties to prepare the claim and certification. Financial plan is also to be made that consist of date of disbursement and amount to be settled.

Force majeure is an unavoidable situation which cannot be determined earlier. It seems there is no solution for that. But there is a possibility of making provisions in the contract document, indicating about this issue. So that it will resolve the problem too much. Extra payments and extra time are calculated for tackling these types of disasters are also to be mentioned in the conditions of contract.

To avoid the design changes in construction stage, final approval of design is made before starting the work and getting authorization is also to be implemented.

After acquisition of land, the utilities removal plan is to be adopted at the pre-construction stage itself. Identify the scope of relocation with the help of support of utility authority is to be implemented to avoid this issue. Forming a committee inclusive of members from all departments in project is one of the solutions.

Sufficient time is to be given for preparing the tender and work out the quantities accurately after studying the tender document carefully, these are the powerful tool for avoiding the quantity increase in construction stages. Detailed work out of materials is carried out based on the initial and reconnaissance survey will avoid this critical issue.

Non availability of construction material issue can be avoided by preplanned purchase strategy. It includes purchasing of unique and rarely available raw materials and stored it in site earlier, before the task starts. It is the prime solution for the cost overrun issue.

Design errors can be omitted by appointing an experienced person for the role of designer and gave sufficient time to prepare the design. A separate panel comprising of design professionals is to be made for cross checking and verifying of designs made by the designer.

Unstable interest rates cannot be avoided fully but can be reduced. By providing a provision clearly in contract condition adjusted with floating rate of interest, will avoid the loss of money for the contractor.

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