

# Study of Factors Affecting Cost Overrun in Road Construction Project

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**Abstract**— It is well known that most road construction projects in India exposed to cost and time overrun or both. This phenomenon may affect the progress of country as well as may expose many institutions of construction to be destroyed. Literatures of these studies were classified into two main parts which are: (1) Cost overruns of project; (2) Time overrun of projects. The aim of this paper is to study of road construction projects in view of cost and time overruns of road projects in Amravati region. The objectives of this study were achieved through two approaches the first one was to find critical cost overrun factors by questionnaire survey. The second by collect project related data from Amravati Municipal Corporation. The study clarified that change in cost of services, delay in payment, and design changes during construction, change in quantity due to actual site conditions, delay in design and approval of design, delays in shifting existing utilities, and poor communication between government bodies are the main reasons for cost overrun in road construction project. The study recommended government, contractors, and consultants to hold their responsibilities to avoid any cost and time overrun which could be achieved by good management of the project.

**Key words:** Design Changes; Road Construction Projects; Time Overrun; Cost Overruns

## I. INTRODUCTION

The Government of India takes initiatives to improve and increase the infrastructure facilities for better 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 road 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

Now a days, Indian road projects are facing a lot of problems and difficulties from the starting phase till the completion of the projects. Throughout the project cycle, a series of issues and challenges are to be tackled by the construction activities. Rather than any other developing country, growth of Indian road projects is seriously affected

by numerous issues. An immediate need for the future projects to avoid such problems is a good effective plan. It is essential to find out various critical factors which are mostly influencing the cost overruns, its origin, causes, and problems associated are also to be identified. Based on the study of the problems, remedies and recommendations to avoid such circumstances are to be suggested. There is no alternative to avoid the issue of cost overrun rather than above for future projects. Finding out the causes of cost overrun and rectification of the causes will be very useful to achieve the goals; scope of the project, to complete the project within actual budgeted cost and to minimize the wastage of funds, will avoid such critical instances to occur in future. Road construction projects in Amravati region is suffering from many problems which affect cost, time and quality, these factors related to political situation, techniques used and other issues in Amravati region, these problems are Summarized as following:

- Design changes during construction.
- Unavailability of fund.
- Continued increase in material prices.
- Different work approval not taken on time.
- Design of construction not ready on time.
- Unstable political situation.
- Poor communication between government bodies

These factors above and others contributed to large proportion in making many problems in road construction projects which usually related to cost and time overruns. Cost overrun and time overrun in India is one of most important problems at construction management field, also research and studies in this field in India are few compared to worthy expected results. Project finishing on time and absence of cost overruns are considered the most important factors of successful projects, which help to decrease problems for all parties and give new chances to construct other related projects. It also helps to increase the government benefits and transportation development in Amravati region and also full fill the road requirement. Most road construction projects in Amravati region are exposed to delay to the extent that it may extend to the double period of time specialized for that project, causing loss of project's benefits, increasing cost and leading to technical and managerial problems between project parties.

Despite the importance and the significance of the road sector in India. It is noted that the parties of project (government, consultant, and contractor) don't give the cost and time overruns the importance till the end of project. Cost overruns is big problem in road construction, which hinders project's progress, since it decreases the contractor profit leading to huge losses leaving the project in a big trouble. This problem is a result of lack of managerial skills, bad labor productivity, bad planning, increasing the prices of materials, poor communication between government bodies, type of project and others. For that it is of key importance to exert the

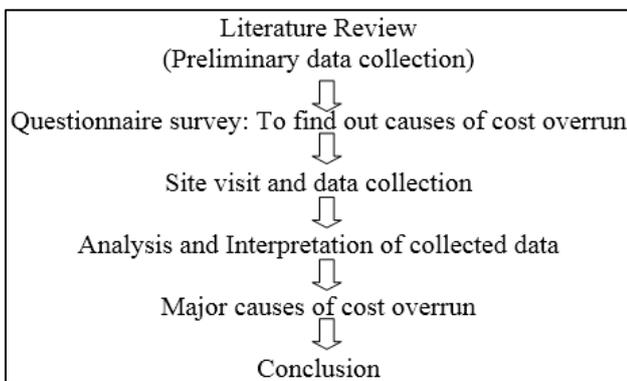
utmost effort to accomplish such study, to detect the previously mentioned factors and to treat all the weakness points and from all sides, and so giving specific priorities in order to avoid cost overruns in construction of road projects.

## II. OBJECTIVES

The main objectives of this study are:

- 1) To find factors responsible for cost overrun in road construction project
- 2) To find the most predominant factors influencing the cost overruns are to be sorted out from the literature survey and those factors are to be considered for preparing questionnaire survey.
- 3) To identify reasons for time delays and cost overrun by collecting, reviewing, processing, analyzing the available data.
- 4) To identify the factors that significantly influence cost overruns and time delays from the actual study.

## III. METHODOLOGY



## IV. DATA COLLECTION

Various factors responsible for the cost overrun were collected from literature survey. Questionnaire was prepared with 17 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 1 to 4, so that person could easily express the severity range or impact. 1 being the lowest and 4 being the highest. The scale for impact is categorized into 4 types.

- a) 1 for No effect.
- b) 2 for Less effect.
- c) 3 for Moderate effect.
- d) 4 for Strong effect.

Questionnaires were administered to a sample of 50 people selected from various Govt. departments, contractors, subcontractors, site engineers and supervisors, of which 30 questionnaires were returned with completed responses. The various factors of causes for cost overrun were collected from the literature study are as follows:

- 1) Design changes during construction
- 2) Act of god
- 3) Labour strike
- 4) Public agitation
- 5) Land acquisition and increase in land cost
- 6) Delay in payment
- 7) Change in cost of services

- 8) Non availability of construction materials
- 9) Design errors
- 10) Delay in shifting existing utilities
- 11) Increase in quantities due to actual site conditions
- 12) Delay in design and approval of design
- 13) Organizational or institutional failure
- 14) Project staff
- 15) Improper scheduling
- 16) Dependency on imported materials
- 17) Poor communication between government bodies

Also, the data was collected regarding the road construction from Amravati Municipal Corporation for the actual study. The data of 15 roads were collected for the actual study and to find out the causes of cost overrun.

## V. RESULT & DISCUSSIONS

The collected responses are analyzed and their ranking is find out by the Relative Important Index Method (RII) and Mean Value Method (MV).

### A. Relative Index Important Method (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 1 (No effect) to 4 (Strong effect) will be adopted. It will be converted in terms of relative importance indices (RII) for each factor from the received responses.

The RII was computed as follow:

$$RII = (\Sigma W)/A * N$$

Where, W represents the weightage provided by the respondents to each factor (ranging from 1 to 4), A represents highest impact value (in this case, 4 is the highest weightage given to the scoring the factor), and N represents respondents in terms of number.

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.

### B. Mean Value Technique (MV)

Mean value based method used 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.

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

Where, W represents the weightage provided by the respondents to each factor (ranging from 1 to 4), 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.

| Item no | Critical cost overrun factor | RII   | Rank |
|---------|------------------------------|-------|------|
| 1       | Change in cost of services   | 0.858 | 1    |
| 2       | Delay in payment             | 0.725 | 2    |

|   |   |       |   |
|---|---|-------|---|
| 3 | Design changes during construction                  | 0.675 | 3 |
| 4 | Increase in quantities due to actual site condition | 0.650 | 4 |
| 5 | Delay and approval of design                        | 0.591 | 5 |
| 6 | Delays in shifting existing utilities               | 0.566 | 6 |
| 7 | Poor communication between government bodies        | 0.516 | 7 |

Table 1: Relative Index Important Method

| Item no | Critical cost overrun factor                        | MV    | Rank |
|---------|---|-------|------|
| 1       | Change in cost of services                          | 3.433 | 1    |
| 2       | Delay in payment                                    | 2.900 | 2    |
| 3       | Design changes during construction                  | 2.7   | 3    |
| 4       | Increase in quantities due to actual site condition | 2.6   | 4    |
| 5       | Delay and approval of design                        | 2.366 | 5    |
| 6       | Delays in shifting existing utilities               | 2.666 | 6    |
| 7       | Poor communication between government bodies        | 2.066 | 7    |

Table 2: Mean Value Method

Ranking of the critical cost overrun factor is calculated by both Relative index and mean value method. Higher the range value of RII, more importance for the causes of overrun. 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 values were calculated for verifying the ranks with relative importance index to give a clear idea for confirming the results obtained from RII technique. From the 17 factors we find 7 critical cost overrun factors from the questionnaire survey.

#### 1) Change in Cost of Services

First ranked cost overrun factor in road projects is the change in cost of services. It means increase in price of money. It is caused due to price changes in the men, material, machinery and other construction related activity cost. This price change is mainly due to inflation and it is one of the predominant factors for the cost overrun in road projects. This uncontrollable cost is mainly applicable for labour wages and material price change. 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 change in cost.

#### 2) Delay in Payment

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.

#### 3) Design changes during construction

Third 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.

#### 4) Increase in quantities due to actual site conditions

Fourth 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. 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.

#### 5) Delay and approval of design

It contains the delay for the start of actual work because of the government bodies which gives permission for the design and sanctioning of the design and it results in delay for the start of the project and also affects the cost of the project.

#### 6) Delays in shifting existing utilities

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. This is one of the unavoidable situations that cause delays in construction, which finally leads to overrun of cost. 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.

#### 7) Poor communication between government bodies

Poor communication or miscommunication of the government bodies regarding sanctioning, payment, completion, etc.

| Sr No. | Name of project   | Cost Overrun | Time Overrun |
|--------|---|--------------|--------------|
| 1      | construction of cement concrete road in front of maharana pratap garden | 2,13,785     | 30 days      |
| 2      | Cement concrete road in front of Grace inn                              | 1,30,294     | 15 days      |
| 3      | Cement concrete road in front of sudha classes                          | 1,15,880     | 10 days      |
| 4      | Construction of cement concrete road at shyam nagar                     | 60,487       | 10 days      |
| 5      | Construction of cement concrete road at savta colony                    | 2,61,650     | 17 days      |
| 6      | Construction of cement concrete road at rukhmini nagar                  | 5,00,160     | 32 days      |
| 7      | Cement concrete road at varsha colony                                   | 90,556       | 10 days      |

|    |  |          |         |
|----|--|----------|---------|
| 8  | Cement concrete road at kolhatkar colony               | 2,74,846 | 15 days |
| 9  | Construction of cement concrete road at Kharkar colony | 1,59,778 | 10 days |
| 10 | Cement concrete road at Deshpandewadi                  | 1,60,075 | 10 days |
| 11 | Ravi nagar chowk tar road                              | 4,74,488 | 45 days |
| 12 | Tar road in front of Court                             | 2,92,622 | 30 days |
| 13 | Dastur nagar tar road                                  | 1,13,848 | 20 days |
| 14 | Narsamma college tar road                              | 2,57,541 | 30 days |
| 15 | Tar road malviya chowk                                 | 1,43,263 | 40 days |

Table 3: Cost & Time Overrun In Road Construction Project for Amravati Region

There are various reasons for cost and time overrun, but from the actual data it is clear that maximum cost and time overrun in road construction project is due to the change in cost of services, delay in payment, design changes during construction, change in quantity due to actual site conditions, delay in design and approval of design, delays in shifting existing utilities, poor communication between government bodies. For each project different factors of cost overrun is affect the time and cost of the project. Sometime reasons for the overrun is different from the above factor and each projects involves different factors other than the above major factors.

The main reasons of cost overrun is unavailability of funds in corporation, delay in approvals, public agitation in some projects, contractors lack of experience, unavailability of machineries, wrong preliminary surveys, increase in material due to actual site condition, poor or miscommunications between government departments.

To minimize the cost overrun in road construction project following points should be consider:

– Use of Project Management Techniques

Management is the heart of organization and is the integral part any construction project. They include planning, coordination of subcontractors, contractor, resource scheduling, cost control, labor, billing, purchasing, and other related to the project. In Construction Company, project manager plays an important role to track these functions and has the responsibility to successfully deliver the project. The project management techniques should be used to have proper coordination and make efficient use of labor, skills, materials, and equipment's which are used in construction and need daily application of proper project management techniques. Computers have multiple applications in the construction industry which includes cost estimation, planning and scheduling, accounting, and calculations. All these applications can help the contractor to get the work done easily, quickly and accurately. To optimize the utilization of resources, resource smoothing and resource leveling technique can be used.

– Proper Project Planning & Scheduling

The project cannot be successfully executed and delivered on time if it is not properly planed and implemented according to the schedule. It ensures that the resources (labor, material, equipment) are used efficiently with no wastage and by following the schedule there will be no shortage of resources.

The most important factor time and money can be best efficiently utilized. If the project tasks are not performed in its duration then, additional resources should be deployed to avoid delay.

– Client, Consultant & Contractor

The approval of the tender should not be done just on the basis of low bid but should also consider their experience, effectiveness and technical knowledge of the contractor and availability of enough resources to complete the project on time. The clients and contractors should not delay the progress payment. Thus they should have good financial capability to make the payment on schedule. The consultants should make on time project drawings and plans and get them approved by the respective authority. The progress of the project should be checked by the consultant by inspecting at regular intervals on the site and the paper work. The contractor should have well experienced and qualified project managers and supervisors, skilled labor to run the activities smoothly. Contractor should have sound financial capability. There should be regular scheduled meetings among the three to keep the updates and check the problems and resolve them.

– Use of Fishbone Diagram

Fishbone diagram, also called a cause and effect diagram or Ishikawa diagram is a visualization tool for categorizing the potential causes of a problem in order to identify its root causes. Fishbone diagrams are typically worked right to left, with each large "bone" of the fish branching out to include smaller bones containing more detail. The left side of the diagram is where the causes are listed. The causes are broken out into major cause categories. The causes identified will be placed in the appropriate cause categories as to build the diagram. The right side of the diagram lists the effect. The effect is written as the problem statement to identify the causes. Thus, Fishbone diagrams are an excellent way to explore and visually depict the causes of a problem. They enable the root causes of a problem to be determined. This helps to be more effective by focusing the actions on the true causes of a problem and not on its symptoms.

## VI. CONCLUSION

Change in cost of services, delay in payment, design changes during construction, change in quantity due to actual site conditions, delay in design and approval of design, delays in shifting existing utilities, poor communication between governments bodies are the top seven factors responsible for the cost overrun in road construction project find out by the questionnaire survey. From the actual study of road construction in Amravati region it is clear that, cost overrun and time overrun is not depend on size of the project, it also occurs in the small size project. Inaccurate estimates and design changes at the time of construction may directly affect the cost found initially. From the actual study Delay in payment, Act of god, Poor communication between government bodies, Change in quantities due to actual site condition, Public agitation is major reasons for cost overrun. Proper use of project management techniques, Proper project planning and scheduling, monitoring and taking corrective action results in minimizing the cost overrun in road construction project.

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