

ANALYZING AND VALIDATING OF CRITICAL FACTORS AFFECTING TIME OVERRUN AND COST OVERRUN OF PROJECT

Roshni Surti¹, Jaypalsinh Barad², Priyank Hirpara³, Naznin Dhanani⁴, Saurabh Jain⁵

1 Civil Uka tarsadia university,

2 Civil Uka tarsadia university,

3 Civil Uka tarsadia university,

4 Civil Uka tarsadia university,

5 Civil Uka tarsadia university

Abstract— Delay are one of the biggest issues in construction industries of India. It affects the economic growth of the country directly or indirectly. Hence it is necessary to identify cause of delay and variation in cost and time due to delay. The objective of the study is to validate the critical factors and also find out time overrun and cost overrun of the project through case study. We found out the top 10 critical factors affecting delay in construction of the residential building with the help of Relative Important Index(RII) method. Then these factors were validated by case study. Then for the same site time overrun and cost overrun is calculated with the help of Primavera P6 software. The validation of the critical factor is about 70%. Total time overrun is 27 months. Total cost overrun in direct cost is 3,51.014 Rs. and total cost, overrun in indirect cost is 27,93,000 Rs. It was analyzed that total cost overrun in indirect cost is much higher then cost overrun in direct cost. We carried out some recommendation to minimize the effect of delay in construction of residential building.

Keywords— Delay, Residential building, Validation, Time overrun, Cost overrun

I. INTRODUCTION

In construction project if the work is not complete on the date specified in the contract or if the work complete after the date mentioned in the contract, the time used after the date specified in the contract is known as the time overrun. Time overrun may occur due to so many reasons. During the work, detail study of the construction site is very important. Without studying and understanding the actual work on the site we cannot find the time overrun. For that here are only few reasons which are also included as the causes of time overrun such as delay in material delivery, shortage of labour, labour efficiency, payment by owner, payment by contractor, mistakes in planning, social and traditional festivals, equipment availability, natural disaster, rain, conflicts between two working parties, shortage of the material required at the time, delay in the government approval for the starting of work. When the estimated cost of the project increase due to any reason then the increased cost is known as cost overrun. Cost overrun is directly depended on the time overrun. As the estimated cost is based on the current rates, but when the time overrun occur the variation in the cost of calculation is noticeable in the case of large time overrun. Due to time overrun in the project work: fluctuation in rate of labour, rents of equipment, fluctuation in the rate of different materials, damage to the previously stored material will affect the cost of project.

II. LITERATURE REVIEW

Number of study has been done to identify the factors affecting delay. Number of surveys and studies are taken as reference of the study.

Delays are the unique problem in construction industry. Delays will result in several negative effects on project. Thus, comprehensive study on delays in construction project is important. This study is about identification and ranking of causes of delay in residential construction projects of Indian construction industry. Total 59 factors are identified and divided into 9 major groups. Total 50 feedbacks were received. For the ranking of each factor relative important index and importance index based on the degree of severity and degree of frequency is used. Based on the result total 10 critical

factors were identified and from them the 5 factors were determined as a common factor. They were original contract duration is too short, shortage of labours, delay in material delivery, low productivity level of labours, delay in progress payments by owner. Based on these factors the labour related factors ranked first by both methods and the external factors was least important. It is expected that the finding of this study will help the stakeholders to act on critical causes and further reduce delay of their projects, (Megha Desai and Rajiv Bhatt, 2013). [7]

In Indian construction projects time overrun and cost overrun has been a major issue. For the successful execution of project and keeping them within the prescribed time limit and cost is very important for effective time and cost performance. This study is determining the significant factors causing time and cost overrun in construction industry in India. From detail literature review a valid questionnaire is prepared having 12 categories for time overrun and 8 categories for cost overrun and distributed to the civil professionals. Relative importance index method was used to find out the most critical factors of time and cost overrun. The major causes for time overrun are material market rate, contract modification, and high level of quality requirement and the major causes for the cost overrun are high transportation cost, change in material specification, and escalation of materials price. Some recommendations are provided with study to reduce and control the cost overrun in Indian construction industry, (S. Shanmugapriya et al., 2013). [10]

The project delays in construction industry is a common problem in Malaysia especially in case of housing project. The research of the paper is to evaluate and identify the cause of delay in private housing development project in Malaysia and also give remedial measure to minimize these delays. Top 10 factors for delays are 1. Weather conditions, 2. Poor site conditions, 3. Poor site management, 4. Incomplete documents, 5. Lack of experience, 6. Financial problems, 7. Contract modifications, 8. Delay in the approval of major variations, 9. Contractor coordination problems with other parties, and 10. Construction mistakes and defective works. Contractor related factors are the most important factor for delay in private housing development project. The effect because of delays are time overrun, cost overrun, differences in opinion, negotiations, legal actions and total abandonment, (M.A. Othuman Mydin et al. 2014). [5]

II. MOTIVATION AND OBJECTIVE

In construction industry delay could not be seen as a major problem, people consider it as a regular problem and not focus on the consequence of the delay which later on result in large amount of time and cost overrun.

Though our objective was, “to find out the Time Overrun and Cost Overrun for a particular Site” and “to suggest recommendation in order to minimize the delay”

III. METHODOLOGY

The methodology for the research work has been divided into 2 major parts. In the first part the study regarding to time overrun is taken and in the second part the cost overrun due to factors responsible for the time overrun is considered.

III.1 Time Overrun

In this phase of work, number of construction sites is visited and their opinion regarding to delay is collected. Their point of view is then ranked with the help of Likert scale and a questionnaire is used for this purpose.

The questionnaire is taken from the research paper [11].

The collected data were analyzed using Relative Importance Index Method (R.I.I.) [4]. RII method is used to find out the criticality of each factor leading to the time overrun. RII rank can be found out from the following equation,

$$\text{Relative Importance Index} = \frac{\Sigma(W)}{A * N}$$

.... (eqn. 1)

Where,

W = weight given to each factor

N = Number of respondent

A = Highest weight (Here it is 5)

After analyzing all the factors, they are compared with the critical factors taken from the research paper [11].

With the help of this comparison, criticality and validation of the delay factor on particular site is found out. Total 3 sites are taken into account for this work and following table shows the comparison of critical factors from the “site A”.

TABLE I
COMPARISON OF FACTORS

Top 10 Factors	Top Ten Factors of site A
Delay in material delivery	Contract modification by owner
Shortage of labour	Delay in material delivery
Change in design	Shortage of labour
Difficulties in coordination between various parties	Late payment by contractor
Contract modification by owner	Poor site management and supervision
Permit from related authorities	Corruption by authorities
An inadequate detail in drawings	Change in design
Ineffective planning and scheduling	Equipment maintenance and productivity
Poor site management and supervision	Conflict of labour
Late payment by contractor	Difficulties in coordination between various parties

From this comparison we have found that out of top ten critical factors obtain in from the research paper [11], seven factors were match with the top most critical factors of particular site A. so we can say that this seven factors are very much responsible for delay at site A. The validation of critical delay factors at site C is 70%

The same procedure is carried out for another two sites B & C and the comparison is done with the top ten critical factors. From the comparison it was observed that the validation of critical delay factors at site B is 80% and site C is 60%.

It can be analyze that the delay factors are varies site to site. So the average validity of the study is 70%. All the factors shown in the tables are in sequence as their RII value from high to low.

III.II Cost Overrun

As we have described earlier that, the cost overrun is find out based on the number of factors derived from the study of time overrun.

Here, the finding of cost overrun is again divided into two parts. In first part the time overrun of the residential building due to the delay in construction work is found out, and for that the data of building are required such as Scheduling, Planning, activity details and resources involved in each activity. For collection of respective data, datasheet is prepared. Following table shows the duration sheet prepared for the data.

TABLE II
DURATION SHEET

Sr.no	Activity	Start Date	Finish Date	Quantities	Unit	Cause

For finding the time overrun and cos overrun it is very essential to study the planning, scheduling, work break down structure, material market information, rate of the material and labour, rent of equipment, transportation facilities for material and labour are necessary to be known.

For finding of the cost overrun of selected site, actual data are required to collect. For the data collection this three data sheets were prepared and data was collected with the help of civil professional of the particular site.

The prepared data sheets are as shown below.

1. Material sheet
2. Labour sheet
3. Equipment sheet

1. Material sheet

The material delivery on the project site is critical factor from the top ten critical factors. Hence, the data regarding to material used and the cost fluctuation during the delay is also included in the computation of delay and cost overrun. The sheet prepared for the material is shown in the table below.

TABLE III
MATERIAL SHEET

Activity	Type Of Material	Materials Quantities	Unit	Rate of Material per Unit	Actual Cost

2. Labour sheet

Labour availability is the most critical factor found out during the questionnaire survey. The requirement of labour is varies at every stage of the project (i.e. skilled labour, unskilled labour, labour for bar bending etc.), also the number of labour in every activity is different. So, the requirement of type of labour, the rate of labour, and number of labour required in each activity is found out. The labour sheet is as follows in table.

TABLE IV
LABOUR SHEET

Sr.no	Activity	Type of Labor	Rate of Labour	Total Coat

3. Equipment sheet

For saving the overall cost and time of the project the use of equipment is essential. Before using the equipment for any activity, to find out the best equipment for that particular work, the efficiency of the machine and output of machine per unit hour is very important. Keeping in view the above objective, the equipment sheet is prepared as follows in table.

TABLE V
EQUIPMENT SHEET

Activity			Equipment		Rate of Equipment	Total Cost
activity	Start date	Finish date	Name of equipment	Required No.		

IV. RESULT & DISCUSSION

After preparing the data sheets we have distributed these sheets to the civil professionals of the particular site A. We have collected that sheets from them, as well as we have also collect some other documents like Auto-CAD Drawings, expenses of indirect cost, no. of resources used in their project for construction of residential building. After the receiving data from them we have studied the data carefully.

First of all, we have computed all the quantity of individual activity carried out at site from the auto-cad drawings.

After computation of quantity in each activity of site, different items such as: brick, cement, sand, aggregate, steel quantity of different activity like, masonry, plaster, RCC works etc, were found out. Based on the quantity of material and items required amount of resources like number of labour, types of labour, type of equipment, numbers of equipment are calculated.

After obtained the above details, the planning with proper dates and resources are prepared on the software **Primavera P6**.

From the planning of the project, the planned duration and planned cost of the particular project is obtained. After the calculation of these data, the comparison between the actual and planned duration was carried out. The comparison of the duration and cost shows the clear difference between the increased cost and increased time of the project.

- ✚ **Direct cost:** From the data sheets, activity, duration and cost involved in the project was analyzed and determine that the total time overrun in the project is 21 months and total cost overrun is 3,51,014 Rs.
- ✚ **Indirect cost:** This cost is not directly calculated in construction of residential building but, if delay occurred in project then, it is majorly affect then the direct cost in the overall cost of project.

Calculation of indirect cost shown in table.

TABLE VI
INDIRECT COST SHEET

Content	Cost per month	Total month	Total cost
Engineer's Salary	75,000	21	15,75,000
Superwiser	31,,000	21	6,51,000
Light bill	25000	21	5,25,000
Other	20,000	21	42,000
Overall indirect cost of the project			27.93.000

From the above table it was analyzed and determine that the total time overrun in the project is 21 months and total cost overrun is 27,93,000 Rs.

In external and other factor, permits from related authorities is the top factor. Delay in passing any information from the higher authority and to the higher authority will affect the duration of project.

V. CONCLUSION & RECOMMANDATION

From the analysis through RII method top ten most critical delay factors were identified. The first most critical delay factor is Delay in material delivery with RII value, similarly second and third delay factors are shortage of labour and change in design. Validation of the critical factors is 70%.

For the calculation of time overrun and cost overrun, site is selected and the delay factor for that particular site is determined. For cost overrun, the ideal schedule is prepared as per the quantity of the building and then it is compare with the actual completion of work on site.

The total time overrun is determined as 27 months and the total cost overrun in direct cost is 3,51,014 Rs. The total cost overrun in indirect cost is 27, 93,000 Rs.

It was also analyzed the total cost overrun run in indirect cost is much higher than the total direct cost involved in project and the reason for the time overrun the particular is given by: shortage of labour, contract modification by owner, change in design, ineffective planning and scheduling and so on.

Some of the recommendations to minimize the effect of delay are as follows:

- ◆ Do proper planning and scheduling for the proper execution of work on the time and also update the schedule as per completion of work using appropriate software such as MS Project, PRIMAVERA.
- ◆ The availability of materials should be ensured in time because most of the construction work in Surat city is delayed due to unavailability. This can be achieved by pre-procurement of materials at the site if the source of the materials is far away from site. If possible, the source of material should not be far from the site.1
- ◆ With use of the proper planning and scheduling of work we know the labour requirement at different stages, so we can minimize the delay due to shortage of labour.
- ◆ Quality of the work should be maintained during executing.

- ◆ Extra fund for the execution should be collected or saved from the starting, which can be used during the financial difficulty.
- ◆ Designs and plans should be properly checked and Conformed by the owner and related authorities before the execution of work to not change the plan or design later.
- ◆ Progress report should be maintained by the contractor or any other staff, and it will have to be studied at some intervals for required change to complete the work with more accuracy and less time.
- ◆ 1/3 material of the total required material should have to be on the site from the starting for not delay due to late material delivery.

VI. REFERENCES

- [1]. Anita Rauzana, (2016) “Analysis of Causes of Delay and Time Performance in Construction Projects “, IOSR-JMCE, Vol. 13, ISSN: 2278-1684 (Oct.-2016), 116-121.
- [2]. Augustine Uche Elinwa & Mangyvat Joshua, “Time-overrun factors in Nigerian construction industry”, JCEM (Oct.-2001), 419-425.
- [3]. Desai Mathura.c. et.al, “Study factors affecting of delay in residential construction project for Nashik city”, IJLTET, vol.2, ISSN: 2278-621x (May-2013), 115-124.
- [4]. Ghulam Abbas Niazia, Noel Paintingb,” Significant Factors Causing Cost Overrun in the Construction Industry in Afghanistan”, ELSEVIER, 2017, 510 – 517.
- [5]. M.A. Othuman Mydin, N.Md Sani, M.Taib N. Mohd Alis, “Imperative Causes of Delays in Construction Project from Developers’ Outlook”,MATEC Web of Conference 10,06005(2014).
- [6]. M. E. Abd El-razek, H. A. Bassioni, A. M. Mobarak, “Causes of delay in building construction projects in Egypt”, From Journal of construction engineering and Management, (ASCE / NOVEMBER 2008), 831-841.
- [7]. Megha Desai & Rajiv Bhatt, “Critical causes of delay in residential construction project: case study of central Gujarat region of India”, IJETT, Vol. 4, ISSN: 2231-5381 (April-2013), 762-768.
- [8]. Nabil Al-Hazim, Zaydoun Abu Salem, Hesham Ahmad, “Delay and cost overrun in infrastructure project in Jordan”, ELSEVEIR (2017), 18-24.
- [9]. Saurabh Thorat, Prof. M.A.Khandare, Prof. and A.K.Kanase, “Identifying the causes and effect of delay in residential project”, IRJET, VOL. 4, ISSN: 2395 -0056,(April-2017).
- [10]. S.Shanmugapriya, DR. K. Subramanian, “Investigation of significant factor influencing time and cost overrun in indian construction project”, IJETAE, Vol. 3, ISSN: 2250-2459 (Oct.-2013), 734-740.
- [11]. Priyank Hirpara “Evaluating factor affecting delay in residential building” proceeding 6th world conference on applied science, engineering and technology at goa on 2nd – 3rd January 2018.