Time Delay Analysis of Rajapeth Cross over Bridge

Shaunak Singh P. Monga¹, Sarang M. Dhawade²
¹,²Civil Engineering Department, SGBAU, Amravati

Abstract: Time is one of the main reason for which the construction is getting affected. The construction process is subject to many variables and unpredictable factors, which result from many sources such as availability of resources, external factors, etc which lead to loss of productivity.

The aim of this project is to examine the causes and effects of delay on building construction project during construction phase and to provide control measures for time overrun in the project. A study carried out on construction schedule delays and various delay analysis techniques and methods in order to evaluate the causes of delay and their impacts in the construction project. a questionnaire survey is done to find the major causes of delay faced by Client, Contractor, Consultant and Project manager. Population sample of 35 was used in which 30 was deployed. From the survey and study identified 63 causes of delay under 9 major groups such as Project team, Owner, Contractor, Consultant, Architect, material, labour, equipment and external factors. Then a ranking method is done based on relative importance index method to find major cause of delay. It is found that the most common factors of delay which is repeated in most of the project are lack of land acquisition, labour shortage, material shortage, lack of effective communication, lack of supervision. The outcome of the project is to provide recommendation to control delay in the project during construction phase.

Keywords: Time delay, time delay analysis techniques, factors affecting delay, evaluation of delay, delay control.

I. INTRODUCTION

In construction, delay could be defined as the time overrun either beyond completion date specified in a contract or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule. The delay in the project has an adverse effect on project success in terms of time, cost and quality. The objective of the project is

A. To identify delay factors in construction projects.
B. To rank the delay factors according to the importance level on delays in project.
C. To find the tools to analysis and evaluate the time delay factors in the construction building.
D. Recommendations to control delay during construction phase for construction project.

II. DELAY ANALYSIS TECHNIQUES

Delay analysis is a analytical process that should be employed with project documentation along with collected data from project site. The selection of delay analysis depends on the variety of factors and the available records. There are five commonly used delay techniques.

A. Impacted as-planned method

According to Trauner et al. (2009), in this method the analyst specifies the as planned schedule, and inserts into this schedule the changes which caused project delays. These changes are the only determined delays recorded during construction process which may have affected the project duration. Trauner et al. (2009) point out the major weaknesses of this method as it does not reflect the dynamic nature of construction project and the critical path.

B. Time impact analysis method

The analyst determines the amount of project delay resulted from each of the delaying activity successively by calculating the difference between the project completion date of the schedule after the addition of each delay and that prior to the addition (Ndekugri, Braimah, and Gameson, 2008).

C. Collapsed as-built or ‘but-for’ analysis method

In this method, the analyst studies all contemporaneous project documentation and prepares a detailed as-built schedule instead of an as-planned schedule as mentioned in the what-if method. The analyst subtracts or removes activities which affected the project from the as-built schedule (Trauner et al. 2009).
D. Windows analysis method

Window analysis method is also called the contemporaneous period analysis and snapshot method. In this method, the basic concept is that the total project duration of CP schedule is divided into digestible time periods or windows (e.g., monthly) and the delays that occurred in each windows of time are analyzed successively by focusing on the critical paths (Hegazy and Zhang, 2005).

E. As-planned versus as-built (Total time) method

Basically, the main concept is that the as-planned versus as-built method compares two schedules, which is why it is also called “the total time method or net impact method”. In this method the assumption is that one party (contractor) causes no delays and other party (owner) causes all delays.

III. QUESTIONNAIRE SURVEY

The Survey is designed based on the objective of the study to find out the causes of delays in construction projects and effect of the delays on overall project. The Survey is framed in such a way that the personal view of different people involved in different projects (Architect, Consultant, Owner, Project manager, Contractor) is collected and analyzed. This questionnaire consists of 63 causes of delay on which a detailed analysis will be carried out by using statistical concept. These causes are classified into nine groups according to the sources of delay: Factors related to Project, Owner, Contractor, Consultant, Architect/design-team, materials, equipment, manpower (labor), and external factors.

A. Questionnaire Format

Respondents are asked to fill What is the frequency of occurrence for this cause?. The frequency of occurrence was categorized as follows: always, often, sometimes and rarely (on 4 to 1 point scale). Respondents are required to fill the respective places with only scale points (1, 2, 3 and 4) of their opinion. Frequency of Occurrence Always (4): Generally occurs in all the projects (70% - 100%). Often (3): Occurs in 5 to 7 projects out of 10 projects (50% - 70%). Sometimes (2): Occurs in 1 to 5 projects out of 10 projects (10% - 50%). Rarely (1): Occurs only 1 time out of 10 projects (>10%).

B. Respondent’s Profile

The questionnaires were distributed to Owners, Project Manager, Architect, Consultants and Contractors of Indian construction industry. The respondents involved in the survey had several years of experience in handling various types of projects. The characteristics of the respondents participated in survey are summarized below. Population sample of 15 was used in this survey. A total sample of 30 was deployed.

| No | Cause Of Delay                                      | Points | Rank % | Group          |
|----|-----------------------------------------------------|--------|--------|----------------|
| 1  | Very short original contract duration               | 15     | 12     | Project team   |
| 2  | Legal disputes between parties                      | 20     | 16     |                |
| 3  | Inadequate definition of substantial completion     | 50     | 40     |                |
| 4  | Ineffective delay penalties                         | 30     | 24     |                |
| 5  | Types of construction contract                      | 40     | 32     |                |
| 6  | Types of project bidding                            | 45     | 36     |                |
| 7  | Payment delay                                       | 70     | 56     |                |
| 8  | Delay in delivering the site                        | 50     | 40     |                |
| 9  | Change order                                        | 30     | 24     |                |
| 10 | Late approval of design document                    | 50     | 40     |                |
| 11 | Late approval of sample material                    | 50     | 40     |                |
| 12 | Lack of communication                               | 80     | 64     |                |
| 13 | Late decision making                                | 40     | 32     |                |
| 14 | Conflicts between partners                          | 30     | 24     |                |
| 15 | Unavailability of incentives for contractor for finishing ahead of schedule | 50     | 40     | Owner          |
| 16 | Suspension of work                                  | 60     | 48     |                |
| 17 | Financing difficulty                                | 40     | 32     |                |
| Conflicts with sub-contractor | 30 | 24 |
|-------------------------------|----|----|
| Poor site management and supervision | 30 | 24 |
| Poor coordination with labor and subcontractor | 30 | 24 |
| Ineffective planning and scheduling | 20 | 16 |
| Improper construction method | 25 | 20 |
| Delay in sub-contractor work | 40 | 32 |
| Lack of knowledge | 30 | 24 |
| Frequent change of subcontractor | 25 | 25 |
| Poor qualification of technical staff | 30 | 24 |
| Site mobilization delay | 30 | 24 |
| Inspection and testing delays | 20 | 16 |
| Approval delay | 30 | 24 |
| Poor communication | 40 | 32 |
| Conflict between consultant & architect | 50 | 40 |
| Lack of experience | 20 | 16 |
| Errors in design document | 20 | 16 |
| Delay in producing design documents | 32 | 26 |
| Inadequate details in drawing | 18 | 15 |
| Insufficient data collection & survey | 28 | 23 |
| Misunderstanding of owners requirement | 19 | 15 |
| Unused advanced design software | 22 | 18 |
| Shortage of material | 16 | 13 |
| Change in specification | 32 | 26 |
| Late delivery | 26 | 21 |
| Damaged of required material | 32 | 26 |
| Delay in manufacturing | 22 | 18 |
| Late procurement | 36 | 29 |
| Lack of material availability | 55 | 44 |
| Shortage of equipment | 41 | 33 |
| Equipment break down | 24 | 19 |
| Poor operator skill | 28 | 22 |
| Low productivity & efficiency | 32 | 26 |
| Lack of high technology equipment | 56 | 45 |
| Shortage of labor | 46 | 37 |
| Personal conflicts | 13 | 11 |
| Lack of knowledge | 23 | 19 |
| Lack of communication | 18 | 15 |
| Lack of skilled labor | 15 | 12 |
| Poor soil condition | 37 | 30 |
| Delay in obtaining permits | 44 | 36 |
| Climatic factor | 22 | 18 |
| Unavailability of utilities | 26 | 21 |
| Accidents during construction | 12 | 10 |
| Changes in government regulation | 19 | 16 |
| Delay in final inspection | 23 | 19 |
C. Highest Percentage Of Delay Group

From the above finding and analysis using ranking method the group which is more responsible for the delay in the project is found out. According to the survey result it is found that resources are the main reason for the delay in the project along with external factors it is then followed by Contractor, then Owner and the others.

D. Recommendations

From the survey it is found that contractor has the highest percentage of cause of delay followed by owner and then consultant. So recommendation to control major causes of delay are listed below:

| Causes of delay                  | Recommendations                                                                 |
|----------------------------------|----------------------------------------------------------------------------------|
| Weather condition                | Conducting detailed and perfect surveys towards the field condition and previous weather data |
| External factors                 | Monitor the work done by the earlier contractors to make sure that delays outside your control are recognized and documented. |
| Lack of funds                    | Optimize cash flow in accordance with the requirements and make sure fund needed for project is available to execute the project |
| Deviation of scheduling          | Develop detailed and accurate schedule to facilitate easy and controlled scheduled execution |
| Lack of communication            | Planning and applying Management Information System(MIS)                          |
| Poor decision making process     | Conduct routine/regular coordination meeting and develop a procedure regarding decision making. |
| Lack of coordination / Wrong delegation of authority | Develop a good, simple and easy to understand system to regulate coordination procedures and responsibility of units. Make organization chart with detail job description which includes responsibilities and roles of each function |
| Lack of inspection               | Provide separate technical staff or site manager for periodic inspection and monitoring work process which includes starting late, late submission of drawings, mistakes or errors, resource availability, etc. then proper record has to be maintained to detect risk and mitigate. |
| Improper planning                | Understand the level of supply and demand to produce detail planning and schedule. Implement automatic machine work to avoid shortage of labor such as automatic plastering machine, wall painting, precast concrete wall, etc. |
| Lack of knowledge                | Contractor needs to aware of new technology and techniques to reduce time duration for activity or labor force |
| Lack of facilities at site       | Site management should be properly done to ensure proper resource; basic facilities for worker are available to increase productivity by doing detail study in site condition. |
| Poor selection of vendors        | Consider supplier daily capacity and material quality for selecting vendors to avoid delay and conflicts. |
| Labor shortage                   | Early workforce planning is essential for owners and contractors to effectively manage project labor risks. Then providing incentives/awards for workers like best employer of the year/month so that productivity and quality of work will be increased. |
| Skilled labor shortage           | Providing training and upgrade skills to use new technology and techniques for unskilled labors to increase productivity and efficiency of the worker. |
IV. CONCLUSIONS

The major causes of delay which is found repeating in almost every project are external factors, financial difficulties, shortage of labor, insufficient labor productivity, owner interference and improper planning. After analyzing the data it is clear that the contribution of Contractor in delay of the construction project is high then followed by client then consultant side and others. Resource allocation is the main criteria for doing schedule planning to allocate duration for each activity included in the project so that delay in the construction project can be reduced.

REFERENCES

[1] Ar.Meena V "Study on Time Delay Analysis for Construction Project Delay Analysis". IJERT Vol.4, 03 March 2015.
[2] Aditi Dinakar “Delay Analysis in Construction Project”, IJETAE, Vol. 4, No. 5, May 2014
[3] Aftab Hameed Memon, “Contractor Perspective On Time Overrun Factors In Malaysian Construction Projects”, IJSET, Vol. 3, No. 3, 2014
[4] Ashwini Arun Salunkhe & Rahul S. Patil, “Effect of Construction Delays on Project Time Overrun: Indian Scenario”, IJRET, eISSN: 2319-1163 | pISSN: 2321-7308
[5] “Construction Delay Analysis Methods”, http://www.forensisgroup.com/expert-articles/construction-delay-analysis-methods, 2013
[6] Roger Gibson “Construction delays: Extension of time and prolongation claims”
[7] Desai Megha & Dr Bhatt Rajiv, “A Methodology For Ranking of Causes of Delay For Residential Construction Projects In Indian Context “, IJETAE, Vol. 3, No. 3, March 2013
[8] Enas Fathi Taher & R.K. Pandey. “Study of Delay in Project Planning and Design Stage of Civil Engineering Projects”, IJEAT, Vol. 2, No.3, February 2013
[9] Owolabi James D & *Amusan Lekan M. Oloke C., “Causes And Effect of Delay on Project Construction Delivery Time” IJER, Vol. 2 No. 4 April 2014
[10] P. J. Keane & A. F. Caletka, “Delay Analysis in Construction Contracts”, A John Wiley & Sons, Ltd., Publication 2008, United Kingdom
[11] Songül Dayı “Schedule Delay Analysis In Construction Projects: A Case Study Using Time Impact Analysis Method”, The Graduate School Of Natural And Applied Sciences of middle East Technical University, December 2010
[12] Theodore J. Trauner Jr., “Construction Delays: Understanding Them Clearly, Analyzing Them Correctly”, 2009