

Delay Analysis of Flyover Bridge Construction Using Primavera

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Abstract

Delay is the most common problem in the construction industry. Project Scheduling and delay analysis became an important part of any project to complete the project among the planned time and cost. The application of the construction schedule to predict the project completion time. Delay in completion of the project can increase the price of the project. Small projects will be managed with efficiency manually, whereas massive projects aren't; therefore, massive projects will be better handled using computers. This junction multinumber of the software package is offered with the assistance of that project management. In bridge construction, different resources are needed for execution and also the risk is also added during this form of projects. So, planning and scheduling is an important task in massive projects. In our project, an attempt is created to schedule and delay analysis of varied activities concerned in flyover bridge construction in Salem district, Tamilnadu, using Primavera Software. The Flyover bridge is 8111m in length, and it's scheduled for 988 days. The construction unit's primary goal is to complete the work as specified on schedule with correct utilization of all the resources like man power, materials, cash, and machinery. To achieve the above goal is to execute the project most economically better in terms of money and time. This study's main objective is to analyse the delays in constructing flyover bridges and control the time loss and cost manipulation of the project.

Keywords: Delay analysis, Flyover Bridge, Primavera, Time and Cost

I. INTRODUCTION

A. General

In construction, the word delay refers to something happening later than planned, expected, and specified in a contract or beyond the date that the parties agreed upon for the delivery of a project. Delay is the slowing down of work without stopping construction entirely, and that can lead to time overrun either beyond

the contract date or beyond the date that the parties have agreed upon for the delivery of the project. Delays are classified into nonexcusable delays, excusable non-compensable delays, excusable compensable delays, and concurrent delays.

Delays in a construction project can be such a problem and a very serious issue for the parties involved, such as clients, consultants, and contractors. Many adverse effects can occur as a result of the delays. To reduce this problem from occurring, site management should be made carefully in our project conducted due to various problems and construction delays. There are different procedures to be observed by all parties so that unwanted things will not happen. Delays in construction projects are of the utmost priority.

B. Objective of the Study

This project's main objective is to analyze the delays in a construction project by detailed literature study, site activities, and observations made were as follows.

- Detailed literature study to define the various reasons for the delay in construction projects.
- Study on ongoing Project site to observe the activities and to identify delay factors.
- Determination of Critical Path using Primavera.
- The analysis also involves scheduling and tracking a construction project activity in software and related catch-up programs due to delays.



II. LITERATURE REVIEW

MuraliSambasivan and Yau wen soon (2007), in a research paper entitled "Causes and effect of delay in the Malaysian construction industry," reviewed an integrated approach and attempted to analyze the impact of specific causes and specific effects of project delays. They identified the main causes and effects of the delay in Malaysia's construction projects by conducting a properly designed questionnaire survey with clients, consultants, and contractors. Also, they identified the ten most important delay causes and six important effects of delays, and an empirical relation between them was established.

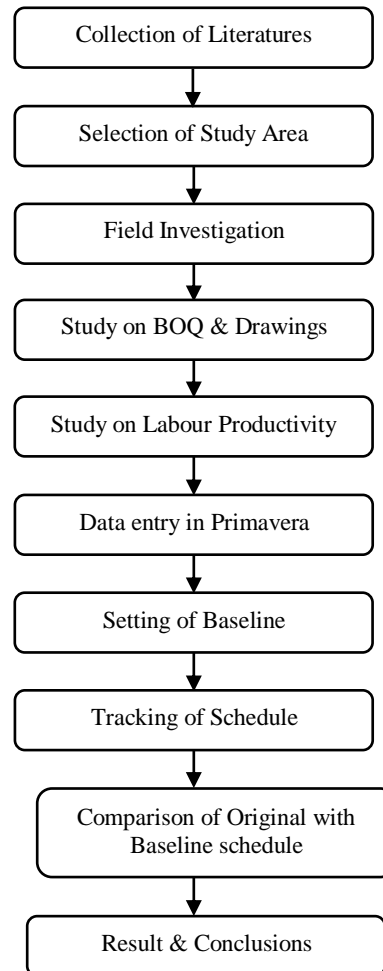
Abd El-Razek. et al. (2008), in their research entitled "Causes of delay in Building Construction Projects in Egypt, a questionnaire survey was conducted and identified the most important causes of delay in a construction project. They concluded that owners and contractor's parties do not agree on the relative importance of various delay factors, mostly blaming each other for delays using the importance index and spearman rank correlation. Survey results suggested that joint team effort is required to reduce delay.

B. Indhu, P. Ajai (May 2014), in the case study entitled "Study of delay management in a construction project - A case study," identified the most important factors causing delay and the effect of delay on the project duration. Some of the factors causing delays are weather, no proper, timely supply of budgets and resources, contractor and client-related and also changes in design and drawing. The major effects of delay are time and cost impact, reduced labor productivity, postponement in work, change in labor allocation, etc.

Keval J. Shah, Prof. M. R. Apte (2015) in the case study entitled "Causes of Delay in Construction of Bridge Girders," Frequent site visits were carried out in an ongoing bridge girders construction project and collected the data from the site for each activity of construction of bridge girder and compared with its planned duration and actual duration. Identified the important causes of delay and the effect of these in the project duration. Causes of delay have a direct effect on time overrun and cost overrun for the whole project. Most of the

reasons for delays are related to the contractor. Some of the causes are beyond all the project parties' control, such as differing site conditions, unforeseen weather, etc. In the overall responsibility of delay, the contractor possesses near about most responsibility.

III. METHODOLOGY



IV. ABOUT THE STUDY

The case study on a Flyover bridge construction project consisting of 213 spans and a bridge length is 8111m, including 9 approach ramps.

A. Project Specification

a). Structures

Reinforced Concrete Structure

b). Concrete

M15 grade - Levelling course / P.C.C. below foundations and approach slabs.

M30 grade - Approach slabs.

M35 grade - Foundations, Piles, Pile caps, Abutments, Piers, Pier caps, Dirt wall and Bracket.

M40 grade - Crash Barriers and Centre median.

M50 grade - PSC Segmental and Cast in-situ Box Girders.

c). Prestressing

Post Tensioning with High Tensile Steel Wires/Strands

d). Steel

High Yield Strength Deformed Bars Fe-500D

e). Expansion joint

40mm Strip Seal expansion joint system.

f). Bearings

POT/PTEF bearings

g). Wearing Course

Mastic Asphalt 25mm thick

Bituminous Concrete 40mm thick

h). Painting

Providing and applying 2 coats of water-based cement paint to unplaster concrete surface

- a. Budget
- b. Estimate
- c. Schedule
- d. The sequence of completion of each part of work
- e. Cash flow budget
- f. Manpower planning
- g. Equipment and material planning.

A. Steps involved in Project Planning

Project planning involves the following steps:

- a. Define the scope of work
- b. Preparing a list of activities to be performed
- c. Preparing network diagram or logic to establish the relationship among different activities
- d. Analyzing the network diagram to work out project period, vital and noncritical activities during a project
- e. Determine the critical path with the assistance of critical activities Establish standards for the resources (material, men, machinery, and money)
- f. Resources allocation
- g. Forecasting budget allocation to achieve the target
- h. Organization of project information
- i. Recording the status report of every activity
- j. Comparing the recorded report with the original plan

V. PROJECT PLANNING

Project planning is a very fundamental and challenging activity to execute work in all construction projects. Planning involves listing activities or tasks in a project, manpower, listing the requirement of materials, types of machinery, and money to accomplish the tasks. Also, cost estimation is done through the planning process.

A good planning process helps in budgeting and in preparing the schedule for the work. The main objective of project planning is to identify the various tasks and activities required to accomplish work and estimate the proper time to accomplish that particular activity considering interrelationship with other sequential activities involved in that work.

Developing a proper plan in any project is a very critical task. Proper logic, time analysis, and scheduling are included in project planning. For a planning process, inputs will be taken from estimating departments, project managers, field engineers, foremen, and contractors. Proper planning helps in providing adequate resources and time to accomplish the activities. A plan includes the following terms:

B. About Primavera

Primavera Systems, Inc was a private company providing Project Portfolio Management (PPM) software to help project-intensive organizations identify, prioritize, and select project investments and plan, manage, and control projects and project portfolios of all the management team, including project manager, planning manager, construction manager, quality and safety in charges work as a whole for all the activities. In other words, It is a tool that helps you build a Program consisting of Activities with Resources (Materials, Manpower, Machinery, Money) against Time. It also helps analyze Critical Path, perform Earned Value analysis (when project is under progress), and generate reports such as Manpower Histogram, Monthly Budget, and Overall Budget.

VI. CONSTRUCTION DELAY

Time is money, and that is particularly true on a construction project. When construction projects don't run on time - the contractor suffers because his overhead and expenses increase (eating into profits), and the owner suffers because he cannot open his new business on time, which causes lost profits that he could have been gaining. So, keeping projects on their critical path schedules is very important.

Nevertheless, delays on massive construction projects are common due to construction projects being difficult and involving plenty of various players. Everyone has to be working together seamlessly to avoid delays. When a project is delayed, the question that is inevitably asked is who is responsible, if anybody, for the costs associated with the delay. This will, of course, rely fully on the language within the contract governing the project.

A. DELAY ANALYSIS RESULTS

The following reasons were determined throughout this project work, which may be controlled accountable for delays,

- ❖ Lack of information regarding advanced construction techniques.
- ❖ Lack of trained workers.
- ❖ Lack of fund flow throughout the project progress.
- ❖ A major portion of working labor is from Andhra Pradesh and Bihar. Regional festivals in these areas cause fast delays in work progress.
- ❖ Sudden extension of monsoon rain caused a delay in a project's progress.
- ❖ Sand nonavailability because of legal restrictions.
- ❖ Late delivery of resources.
- ❖ Improper planning of construction activities.
- ❖ Unforeseen underground utilities and overhead utilities are shifting/diversion delay.
- ❖ Improper utilization of available resources.

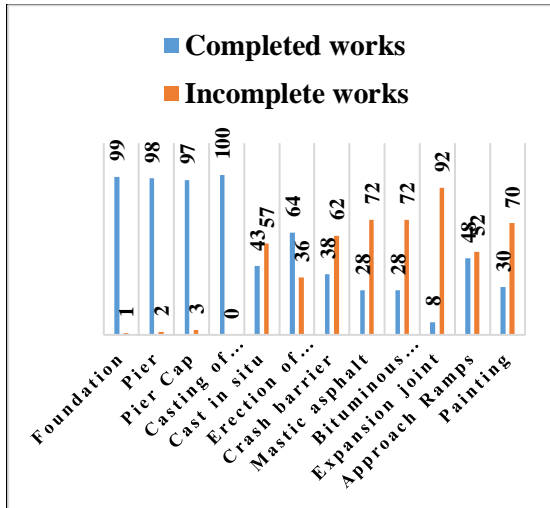
From this project study, the causes of the delay reasons can be listed as below table 1

S.No.	Reason for delay	Delay in days
1	Traffic permission / diversion delay	32
2	Design issue	28
3	Shortage of skilled labor	23
4	Shortage of Materials	13
5	Shortage of machinery	16
6	Weather condition (Rain)	34
7	Utility issues	14
8	Cash flow issues	18
9	Land acquisition	26
	Total	204

Table: 1 Reason for delay in our project

S.No.	Item of Works	% Complete	% Incomplete
1	Foundation	99	1
2	Pier	98	2
3	Pier Cap	97	3
4	Casting of Segments	100	0
5	Cast In Situ	43	57
6	Erection of Segments	64	36
7	Crash Barriers	38	62
8	Mastic Asphalt	28	72
9	Bituminous Concrete	28	72
10	Expansion Joint	8	92
11	Approach Ramps	48	52
12	Painting	30	70

Table: 2 Work Completion Details as on Date



VII. CONCLUSION

Based on our case study, the Construction started in February 2016, and the duration of the Project as per the baseline Schedule is 988 days. Tracking till April 2019 revealed 99% completion of foundation and substructure work and 100% casting of precast segments, and 64% erection of segments, overall completion of the project is 58%. Causes of delay in our project are identified by a direct site visit and predict the project's approximate date. In our case study, the most important causes of delays in our bridge project are Traffic permission/diversion delay because this project is located at five road junction to bus stand, delay in utility shifting/diversion, delay in design works, shortage of resources, and land acquisition delay.

RECOMMENDATIONS FOR FUTURE STUDY

In this research, we have studied the causes of delay in Flyover bridge construction. It

is recommended to study further and analyze the cost of delay in this project.

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