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Performance Evaluation of Road Over Bridge Using Primavera

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Abstract: Most of the infrastructure projects suffer from cost and time overruns due to a multiplicity of factors. Construction industry requires proper planning and scheduling for reducing or controlling delays of the project. Improper planning and scheduling leads to the wastage of substantial amounts of time, money and resources each year. Performance evaluation of 2 ROB's in railway doubling work from Changanassery to Chingavanam (CH.77500-66950) is done using project planning software. Primavera is the ideal tool used for planning, monitoring and reporting the progress of any task, development or venture. The main objectives of this study are to plan, schedule and track the work by using Primavera software and study the results to suggest suitable measures for enhancing the project performance. Tracking the actual work and comparing it against original work is used to identify the difference in actual and planned schedule and cost of the project.

Key Words: Planning, Scheduling, Tracking, Project Planning Software, Primavera

I. INTRODUCTION

Construction industry plays a vital role in overall development of country. Project delay is the most common problem in construction industry. Most of the infrastructure projects suffer from cost and time overruns due to a multiplicity of factors. In construction projects proper planning and scheduling is very important for reducing and controlling delays of the project. Substantial amounts of time, money and resources are wasted each year in construction industry. It is difficult to get the exact progress of many construction projects by traditional process. Today's project demands are not satisfied with the traditional project management systems, as tremendous amount of information and data on a project are always changing. About 70% of project documentation is paper based and more time is spent for communication. These are the major problems faced by the project managers from construction industry. So more integrated method is needed to describe the true status of a project.

A. Planning and Scheduling

The desired results cannot achieve only by planning and scheduling. There must be some warning mechanism to alert the organization about its possible success and failures factors. Project monitoring is the process of collecting, recording, and reporting information concerning project performance.^[6] It involves watching the progress of the project and identifying lagging areas to bring actual performance to planned performance.

Time management can be broken down into two major categories: planning and implementation.^[5] Proper planning and scheduling of the project by effective use of resources for managing risks and delays are crucial to get a good results. Success of construction projects depends on the balance of resources, cost and schedule.

B. Study Area

Doubling of track between Chengannur to Chingavanam is a project undertaken by Southern Railway. It consists of three stretches, Chengannur - Thiruvalla, Thiruvalla - Changanassery and Changanassery - Chingavanam. Among this, first two stretches are completed and opened for public. The project was started in January 2015. Due to some technical, political and legal issues the project gets delayed. The land acquisition is the major problem faced by the authorities. The project restarted on 2015 October, and is undertaken by Rail Tech through bidding process. Site visits were carried out to gather further information regarding selected bridges as a part of the study.

Performance evaluation of 2 Road Over Bridges in railway doubling work from Changanassery to Chingavanam (CH.77500-66950) is done using project planning software. In this stretch the project includes 10 Road Over Bridges, 1 Road Under Bridge, 3 Bridges and 36 Culverts. Among this 2 ROB's (No. 225A, 241) were selected for study. The ROB 225A and ROB241 are single span bridges composed of 23.62 and 21.48m length respectively. They are located at the chainages 72800 and 74300 respectively. The total budgeted cost for the project is Rs.6, 65, 60,442.60 and the period of completion is 6 months.

II. OBJECTIVES

The study focuses on planning, scheduling, controlling and updating bridge construction work using primavera software. The main objectives of the study are as follows

- A. To identify construction sequence of the project
- B. To plan and schedule the project with help of Primavera software
- C. To track the actual work and comparing it against scheduled work
- D. To find out the reasons for variance of schedule and variance of cost
- E. To suggest suitable measures for enhancing the project performance

III. METHODOLOGY

The methodology for achieving the above objectives is

- A. Collect all information and data needed for the study from concerned authorities
- B. Note the work breakdown structure of the project
- C. Schedule the project, assign cost involved for each activity using Primavera P6
- D. Updting the project by tracking the actual work
- E. Identify and analyse the difference in actual and planned schedule and cost of the project
- F. Suggest suitable measures for enhancing the project performance

IV. SCHEDULING USING PRIMAVERA

This paper work makes use of a software method for computing the result faster with lesser chance of error. Primavera P6 is scheduling software which helps to keep an eye on the progress of the construction work from beginning till the end. Other functions such as resource allocation, role assigning, estimating budget and resource leveling are also available in this software.

To create an ideal schedule for any project, first step is to collect data available for the project. Sample data for conducting the proposed study was taken from the concerned authorities. The following steps can be used for scheduling using Primavera.

A. *Creating OBS*

Organizational Breakdown Structure determines how people within a company are organized and what rights or access they have to various projects. OBS for the Doubling project is constructed in the hierarchical order of Southern Railway. Fig. 1 shows the hierarchal structure for doubling work.

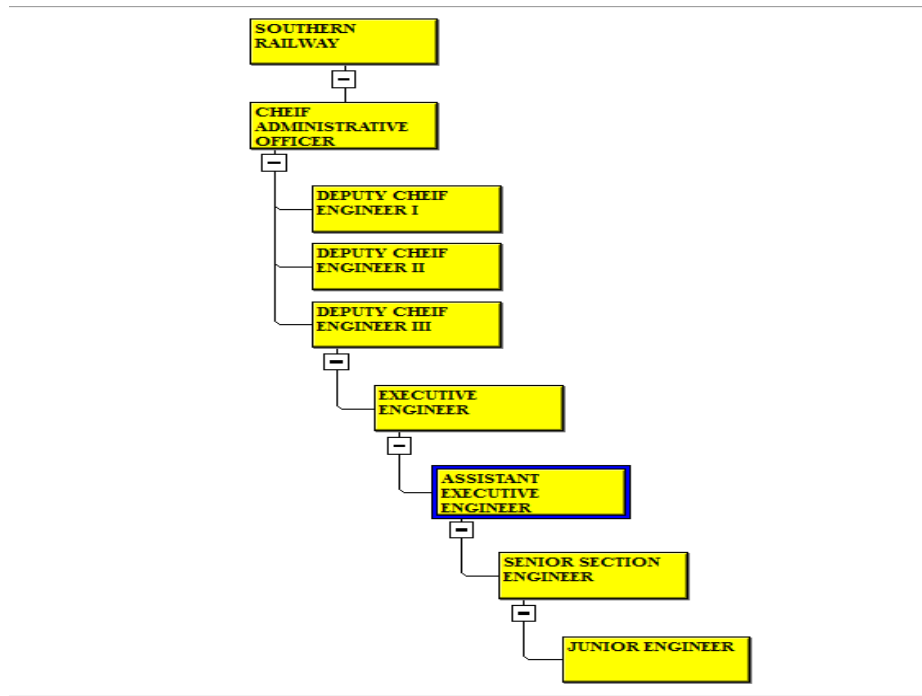


Fig. 1 Organizational Breakdown Structure

B. Creating EPS

Enterprise project structure is created by dividing the project into three stretches such as Chengannur - Thiruvalla, Thiruvalla - Changanasserry and Changanasserry - Chingavanam. The project is created under the respective division in the EPS and assigned in the person charged form OBS to it. The project can be given planned start and must finish dates. The project is assigned a calendar. Fig. 2 shows the EPS and projects for doubling work.

Project ID	Project Name
DOUBLING	DOUBLING OF TRACK BETWEEN CHENGANNUR AND CHINGAVANAM
CNGR-TRVL	CHENGANNUR- THIRUVALLA REACH
TRVL-CNGY	THIRUVALLA - CHANGANASSERRY REACH
CNGY-CHGV	CHANGANASSERRY CHINGAVANAM REACH
BR	BRIDGE
REACH	REACH WORK
ROB	ROAD OVER BRIDGE
225 A	ROB 225 A
237	ROB 237
241	ROB 241

Fig. 2 Enterprise Project Structure

C. Creating WBS

The bridge is breakdown into preliminary activities, substructure and superstructure. And the associated works like retaining wall, RR masonry and road works are also included for both ROB.

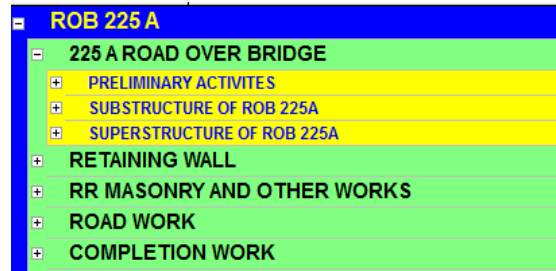


Fig. 3 Work Breakdown Structure

D. Creating Calendar

A project should follow specific working days and time. According to the timing, project duration can be scheduled and analyzed. Calendars are used to set in project for scheduling and tracking activities. Fig. 4 shows 6x8 global calendar used for the project. Calendars once made in Primavera can directly be made global and can be used in multiple projects without creating new ones again and again.

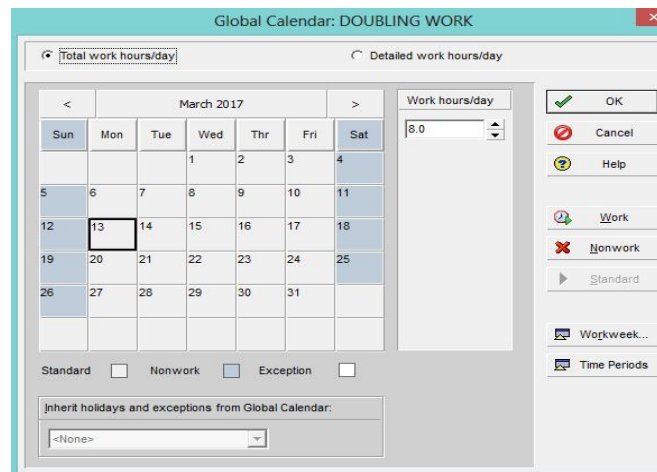


Fig. 4 Proposed calendar for the project

E. Scheduling and Cost Assignment

The scheduling data includes the activities with their original duration, start date, finish date, predecessor and successor, budgeted cost and actual cost. Schedule was generated automatically after feeding the required data. The scheduled data shows the actual cost and the planned cost which helps in calculating the variances. Activities are the fundamental work elements of a project. An activity has the following characteristics like Activity ID, name, start and finish dates, activity calendar, activity type, activity codes, constrains, expense, successor and predecessor relationships, resources etc.

Activity ID	Activity Name	Original Duration	Start	Finish	Predecessors	Successors	Budgeted Total Cost	Actual Total Cost
ROB 225 A								
225 A ROAD OVER BRIDGE								
PRELIMINARY ACTIVITIES								
A1000	Site and Topographic Survey	1d	05-Oct-15	05-Oct-15		A1010	Rs0.00	Rs0.00
A1010	Conducting SPT	1d	06-Oct-15	06-Oct-15	A1000	A1020, A1030	Rs600.75	Rs600.75
A1020	Design and detailing of structural drawing	5d	07-Oct-15	12-Oct-15	A1010	A1050	Rs90,000.00	Rs90,000.00
A1030	Temporary Barricade of 2m height	1d	07-Oct-15	07-Oct-15	A1010	A1040	Rs34,000.00	Rs34,000.00
A1040	Erection of Railway caution boards and speed indicators	1d	08-Oct-15	08-Oct-15	A1030	A1050	Rs1,500.00	Rs1,500.00
A1050	Removing cables	1d	13-Oct-15	13-Oct-15	A1020, A1040	A1060	Rs75,000.00	Rs120,000.00
SUBSTRUCTURE OF ROB 225A								
A1060	Earthwork excavation in cutting	1d	14-Oct-15	14-Oct-15	A1050	A1070	Rs22,676.70	Rs37,330.38
A1070	Shoring for protecting existing track	1d	15-Oct-15	15-Oct-15	A1060	A1080	Rs160,000.00	Rs160,000.00
A1080	Vertical load testing of single pile	1d	16-Oct-15	16-Oct-15	A1070	A1090, A1100, A1110	Rs250,000.00	Rs250,000.00
A1090	Casing pipe for pile-A/PI	2d	17-Oct-15	19-Oct-15	A1080		Rs124,057.00	Rs124,057.00
A1100	Boring for pile-A/PI	2d	17-Oct-15	19-Oct-15	A1080	A1150, A1160, A1331	Rs0.00	Rs0.00

Fig. 5 Scheduling details screen shot for preliminary activities and substructure for ROB 225A

F. Activity Network Diagram

Network diagrams display the activities and its relationships according to its WBS. To form a network the activities should be connected to each other, which is done by assigning preceding and succeeding activities with significant relation to the activities.

- 1) Finish to Start (FS) relationship
- 2) Finish to Finish (FF) relationship
- 3) Start to Start (SS) relationship
- 4) Start to Finish (SF) relationship

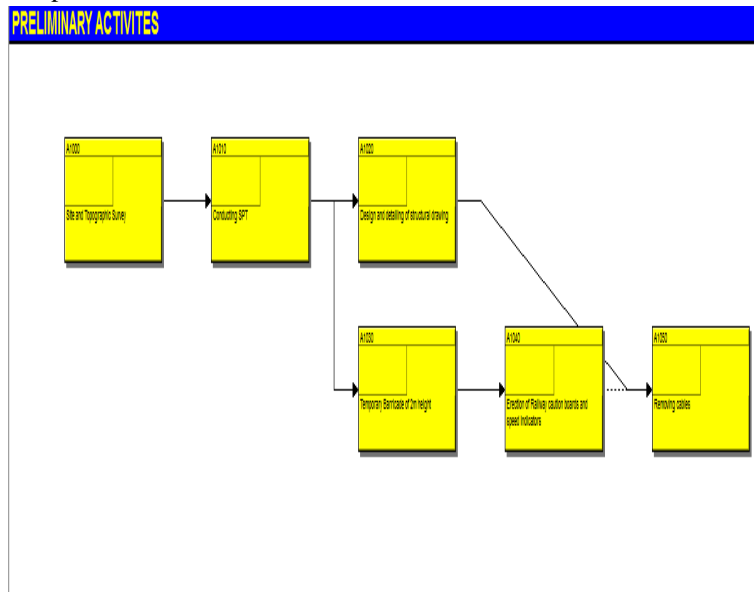


Fig. 6 Network diagram for preliminary activities of ROB 225 A

G. Gantt Chart

Gantt charts are a way to graphically show the progress of a project. Gantt charts are plotted for each project from their schedule using primavera. It shows the duration, required units and quantities of resources assigned into the activities.

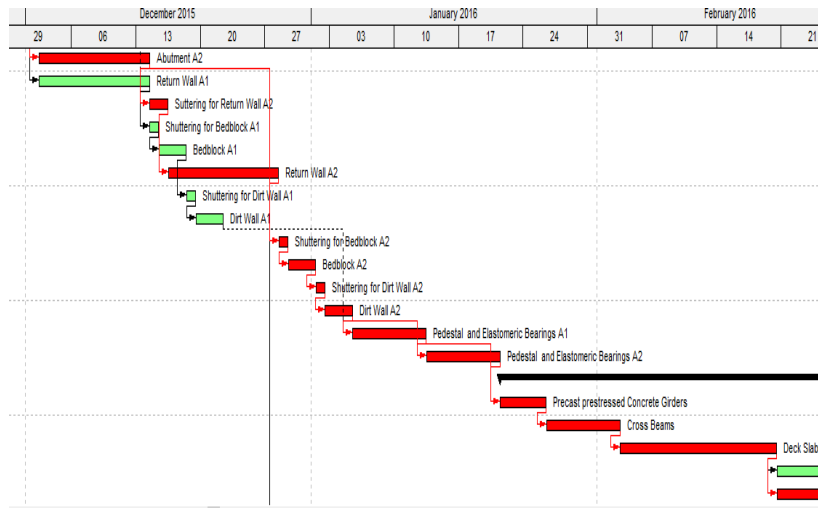


Fig. 7 Gantt chart screen shot for substructure and superstructure for ROB 225A

V. PERFORMANCE EVALUATION

Conduct direct interview with the project manager and site engineers to obtain the present activity status. Change in completion time and budget was then observed and schedule was updated and Gantt charts are plotted by considering the collected information from site.

Tracking of the project can be done so as to check whether the project is running on time or not. If the project is behind schedule, necessary actions need to be taken so as to pick up the construction speed without affecting the project cost to a great extent. A baseline is created on the day the tracking is done on the site and the percentage completion of work is found out. Tracking cannot be done without creating a baseline.

Updating is very essential in project. Updating helps in analyzing project status and gives a clear idea about the project efficiency. Activity which is completed is shown as blue colored bars and the activities behind the schedule are shown automatically as red colored bars.

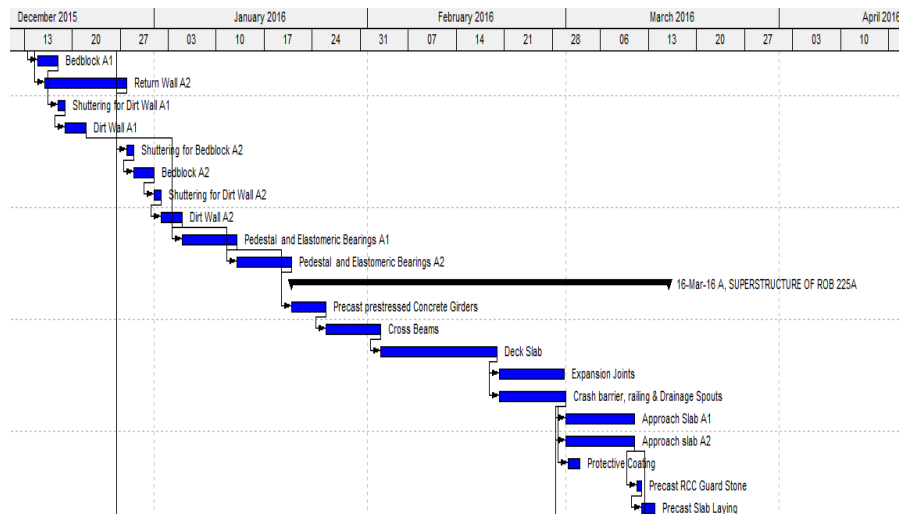


Fig. 8 Updated Gantt chart screen shot for substructure and superstructure for ROB 225 A

VI. RESULTS AND DISCUSSIONS

While comparing the actual work with the schedule generated from the software, some major delays are detected. From the updated schedule, it was identified that the project is behind schedule. The originally estimated completion time for the project was 6 months but now it taken 18 months and the work is not completed till now. If the work continues at the current rate, 1.5 months extra will take to complete the project. Some of the major reasons for the delays have been noted down.

- A. Land acquisition problem
- B. Cash flow and financial difficulties faced by contractors due to delay in payment for work done
- C. Poor site management and ineffective planning and scheduling
- D. Due to unavailability of material for earthwork excavation in filling
- E. As it is difficult to erect precast member, cast in situ pre stressed girders are used
- F. Unfavorable weather condition
- G. Lack of coordination between different parties
- H. Lack of knowledge about advanced tracking methods and software's

Also the project had a cost overrun of Rs.1, 32,160.82 and identified the causes of cost overruns which affect the cost performance of construction projects. The major causes are planning and scheduling deficiencies, poor site management, delay in site mobilization, extra work without approvals, frequent changes during execution, improper control over site resource allocations, funding and payment and limited access to job sites.

A. Remedial Measures

- 1) Better formulation and appraisal of project
- 2) Proper planning, scheduling and monitoring
- 3) Assurance of fund resource
- 4) Proper control over material allocation
- 5) Provide night shift works
- 6) Better contract management, penalties

VII. CONCLUSION

Construction projects following traditional methods prove to be uneconomical and consume more time. These leads to the increases in complexity of project and thereby enormous error may occur with actual execution of the project. Primavera is the modern tool of project management that helps to overcome the difficulties due to traditional way of planning and management. It helps for the optimum and effective organization of activities which helps to give the vision to complete the project in planned duration and within the economy. Activities on the site with respect to execution of the project are thoroughly observed and comparison is made between planned and actual executed schedule. The problems such as delay in getting clearances and other problems listed above makes it more difficult to complete the project on time and within planned budget. Better project management techniques are implemented to improve the situation and this can lead to achievement of more growth and development to the economy as a whole. Results of this study show the drawbacks of the present project management system in doubling work project and show the importance of efficient planning, as well as the need for adopting effectiveness project management software like Primavera P6 in a construction project.

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