

Planning, Scheduling and Resource Allocation of a Nh-344 Using Primavera P6

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ABSTRACT

Transportation is one of biggest basic need for the society. The construction of road gives the better transportation facility around the country. For better development of the country in the construction assertive, the project management is necessary. Time and Cost are the two basic parameters to control work in the execution of the road construction. Flow of cost and its usage is very important aspect for beneficial point of view. It is necessary to develop the planning software to easy the works and risks arises in the projects. For the cost analysis of the road works, EVA technique is used to overcome the problems raised during execution. To understand the cost values in the road construction projects, Earned value analysis of any construction industry which gives the warning messages to the planning process as well as during the execution of the project whether the project is going on time and it is under budget or over budget. Primavera P6 software gives the accurate Earned value results.

The undertaken project was “Development of 6-lane Urban Extension Road (UER) – 2 - NH-344 M. Package -1 (From NH1 to Karala – Kanjhawala road, Km -0+700 to 15+000) in the state of Delhi on EPC mode” where the planning and scheduling is performed using Primavera P6 to presents its utility for resource allocation and cost optimization.

Keywords: Earned Value Analysis, Primavera P6, Project Management, Road Work, Cost, Time, EVA Parameters, Resources, Scheduling.

I. INTRODUCTION

Transportation is one of the biggest basic need for society. The construction of roads gives the better transportation facility around the country. For better development of the country in the construction industry, project management is necessary. Time and Cost are the two basic parameters to control work in the execution of the

road construction. Flow of cost and its usage is a very important aspect from a beneficial point of view. It is necessary to develop the planning software to ease the work and risks arising in the projects. For the cost analysis of the road works, EVA technique is used to overcome the problems raised during execution.

In olden days, the project budgeted total cost is determined by the difference, between the actual

cost, and planned cost. That means the project managers' focus was only for planned cost and expenditure cost as actual cost. Now in the modern days many schedule properties and cost parameters are considered. Because it is very important in every Construction project, losses are due to inadequate construction management and cost performances done by the contracts in the road construction projects. So it is necessary to develop the planning software to ease the work and risks arising in the projects. The mainly used software is MSP, Primavera P6 and some developed software. This software gives better scheduling methods and cost performances effectively.

Project Management

Primavera Systems, Inc. was a privately held company that developed Project Portfolio Management (PPM) software to assist project-intensive organisations in identifying, prioritising, and selecting project investments as well as planning, managing, and controlling projects and project portfolios of all sizes. Oracle Corporation became the legal owner of Primavera on January 1, 2009. Joel Koppelman and Dick Faris launched Primavera Systems, Inc. on May 1, 1983. It was a private corporation situated in Pennsylvania (USA) that developed Project Portfolio Management software. Primavera purchased Eagle Ray Software Systems in 1999, Evolve Technologies (a professional services automation provider) in 2003, Pro Sight (an IT portfolio management software vendor) in 2006, and Pert master in the same year to help expand its product capabilities (a project risk management software vendor).

Project Management Stages

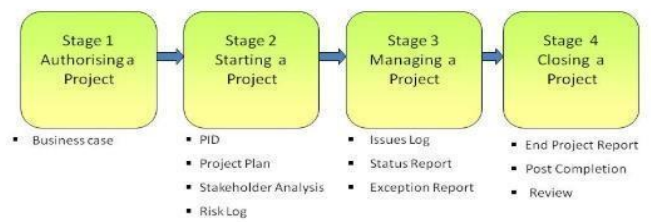


Fig 1. Stages of Project Management System

II. LITERATURE SURVEY

Pravin Namdev Pharne et.al (2022) research paper presented planning and scheduling of 1km length bitumen road using Primavera P6. It was observed that after planning and scheduling using Primavera the cost was reduced by 47,970 and with conventional planning the cost was 6,71,200. By using Primavera software the cost was 6,23,230. Hence cost reduced by 7-8%

Planning, monitoring and controlling, as well as the need and effectiveness of project management software like Primavera P6 in a construction project of this study was to understand the role of monitoring and control in the progress and timely completion of a construction project. Delays in construction projects was minimized by using primavera software. Effective handling of materials and resources was optimized by using Primavera. The study proved to be a guideline in understanding the progress of construction work and also to identify the specific problems arising during the process. Hence the study gives results about cost reduction and effective management of project. Results stated the drawbacks of the present project management system in running project. An efficient and cost effective new project management plan was brought to conclusion.

Pravinkumar Jagtap et.al (2022) in the research paper, author presented planning and scheduling of G+20 residential building and allocated the needed

resources and further estimated cost of the construction. Tracked the progress of the project at various intervals of time and explained how effective it was to plan, schedule, to estimate budget and tracked the progress of a G+20 residential building using Primavera P6 software.

The forecast of total duration of the project was expected to be 749 days. The required resources for the completion of the project were known and at which stage the particular resource was required to be known. This research proved as an interpreting the progress of Puranik's Hometown building, which helps to recognize the various problems aroused during or prior the execution process. The output results of the case study defined the usefulness of efficient planning, Scheduling, Monitoring and Controlling. Primavera helps the Project Manager to help him aware about the schedule with respect to the activities which are to be started or finished according to the schedule.

Veerabhadragouda P Patil et.al (2022) in the research paper, G+5 college Building Plan was drafted in AutoCAD and estimate the building material quantity and scheduling and controlling the project by primavera p6. The quantities of different elements like footing, beam, column etc can be estimated by using estimation methods like center line or long wall - short wall method and using excel format to tabulate estimated result efficiently. The planning, scheduling and monitoring of the start and end dates of activities can be done for the project using primavera. The duration for the completion of the project be from 5-sep-2021 to 1-mar-2023. Project management Technique helps in forecasting the project duration before starting any activity of the construction. Such that it helps to use the time efficiently and overcome any further delays in the project. Hence using modern tools like primavera over conventional method help in planning, scheduling,

tracking and monitoring the constructional activities efficiently.

Nidhi Raghuwanshi and M. C. Paliwal (2021) research paper dealt with presentation of AwasYojna project in New Market Bhopal comparing the two different blocks namely Block A and Block B. The project framed stated the advantage and added benefits of web based primavera P6 for planning and scheduling of structures under construction under the government scheme of "AwasYojna" framing the issues and complications faced in the time frame of construction and availability of resources. Construction sequence was prepared and comparative analysis was done in between two structure blocks and identification of reasons in delay and further conducted financial risk analysis using Gantt chart in Primavera P6 and assigned proper sequence and links between different activities for early finish.

Results concluded that using project management tool Primavera P6 assigning and monitoring each activity as per running conditions the project may be completed in time and cost may be saved. Besides, further water logging was analyzed in excavation activity due to the environment (rain water) which was resolved to save 5 days. Observations stated that the process of preconstruction was managed equally by linking all such activities namely preparing site office, Labour room, and laboratory setup. By linking the activities, the time lapse reduces simultaneously.

III. Objectives behind the research

- To determine the actual project cost of the road work.
- To determine the practical durations that are required to complete the activities.
- To determine the difference in estimated cost and actual cost of the project.

- To find out the various cost parameters and their values by software Primavera P6 and by formulae
- To identify the schedule of the project work with cost effective utilization of resources.

Table 1 Project Overview

1	Name of the Contract	Development of 6-lane Urban Extension Road (UER) – 2 - NH-344 M. Package -1 (From NH1 to Karala – Kanjhawala road, Km -0+700 to 15+000) in the state of Delhi on EPC mode.
2	Type of Contract	Engineering, Procurement & Construction
3	Authority	National Highways Authority of India
4	Authority’s Engineer	M/s URS Scott Wilson India Ltd in JV with CPCPL
5	EPC Contractor	M/s H G Infra Engineering Ltd.
6	Detailed Design Consultant	M/s FORCE Structural Engineers Pvt. Ltd.
7	Proof Consultant	M/s Ramboll India Pvt. Ltd.
8	Safety Consultant	M/s Roadlink Consultancy Services.
9	Date of LOA	23rd July 2021
10	Date of Agreement	08th Sep 2021
11	Appointed Date	28th Oct 2021
12	Completion Date	27th Oct 2023
13	Revised Completion Date	-
14	Construction Period	730 Days
15	Revised Construction Period	-
16	Defects liability / Maintenance Period	10 Years
17	Contract Value	INR 13,93,11,00,000/-

IV. Project Scheduling

Step-1: First step involves the creation of EPS (Enterprise Project Structure) for the structure of the organization and definition of their job roles.

The company profile is defined in WBS and the associated resources are presented in hierarchy as per tree structure, for example, manager, team leaders and other associates.

Step-2 The jobs roles are defined as per the organizational structure in company management.

The job roles are defined for the three different stages as per pre construction substructure and superstructure and proceed towards final work. Here the resources are allotted and defined for the project as per task allocation.

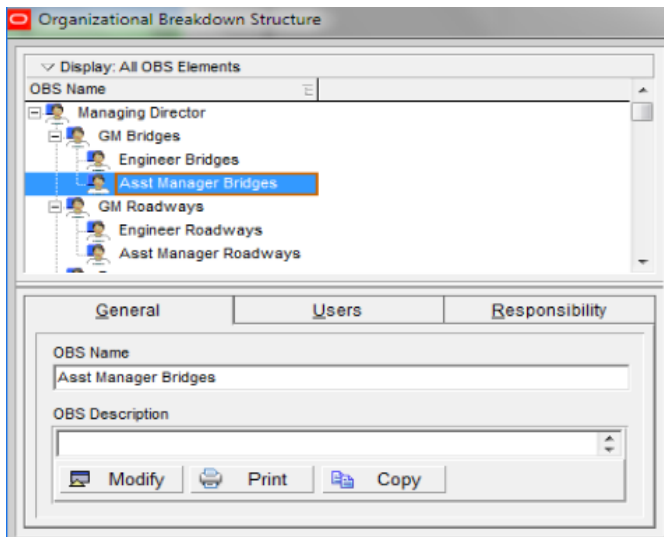


Fig 2 Assignment of Role

Step-3 The calendar is defined as per the working days and shift timings for the project:

The activity list is entered and the calendar is characterised and used to display the working time for each action in the task before the project begins. Calendars are also used to describe the working and occurrence design during the course of a project. Global, Venture, and Customized schedules are three different types of timetables. The working shift is 8 hours long, and there are six days in a week. The working hours for point to point are 8:00 a.m. to 5:00 p.m. From 12:00 p.m. to 1:00 p.m., there is a one-hour meal break.

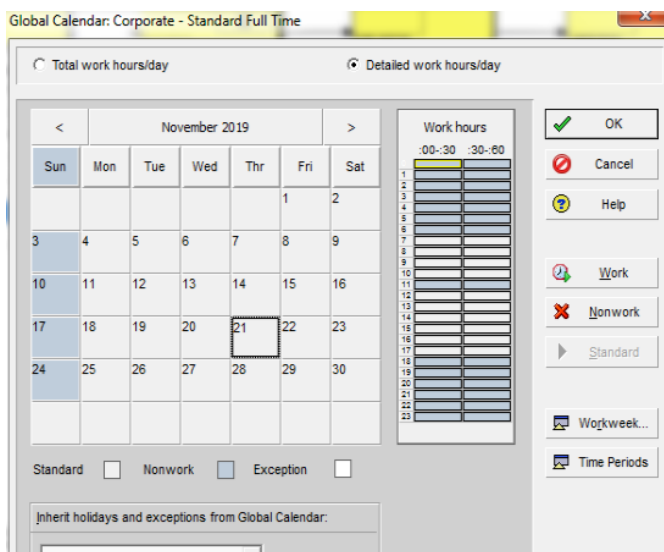


Fig 3 Global Calendar

In Primavera we have option to create calendar or schedule working a sper site requirement, it has options to assign working and non-working days, working hours, break time in between and non-working hours.

Step 4- Work Breakdown Structure Preparation

A work breakdown structure (WBS) is the sequence of tasks that must be completed in order to complete a project. WBS is divided into tiers of work, starting with the final task and progressing to the development of different forms into distinct work components. WBS is calculated depending on the individual sub-project, and the completed WBS is as follows:

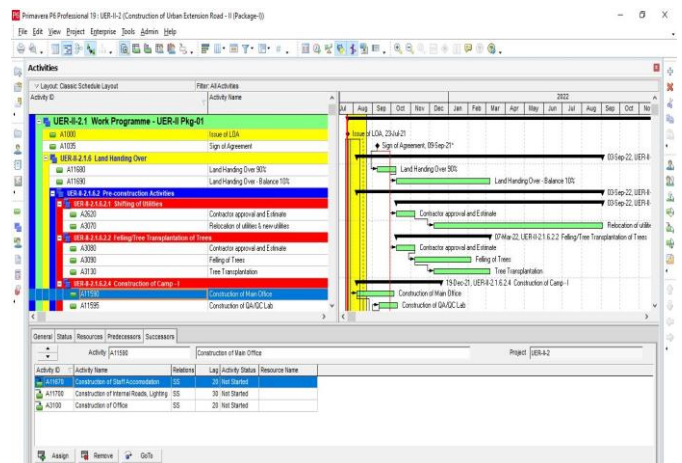


Fig 4 WBS Structure

Step 5- Assigning activities of each WBS as per scheduling data with links in between activities using Gantt chart.

The ability to identify the activities required to complete the assignment, as well as forecast or evaluate the number of days required to complete the project, is a critical step in the project planning process. Meetings, research, estimating, and costing procedures are used to evaluate the duration of the activities. Every activity has a set of lengths that must be adhered to. Because the task is time-consuming, it is necessary to use CPM as a PP equipment to determine the strategy.

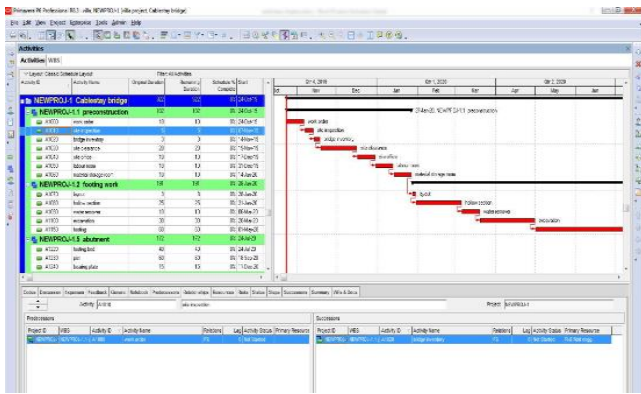


Fig 5 Activity List and Dates

Step 6- Gathering Materials (Manpower, Machinery and Material) The assets are created with the help of significant company assets, and users have the option of adding new assets. The cost of assets is determined by its unit, much as the cost of labour is determined by daily earnings, the cost of materials is determined by their weight, and the cost of machinery is determined by its working hours and maintenance.

Resource D	Resource Name	Resource Type	Unit of Measure	Primary Role	Default Units / Time
R-1	concrete	Material	cubic meter		8/d
R-2	job	Nonlabor			8/d
R-3	steel	Material	Tons		8/d
R-8	field engg.	Labor			8/d
	Field Engineer	Labor		Engineer	8/d
R	AAC BLOCK	Material	Each		8/d
R-6	labour	Labor			8/d

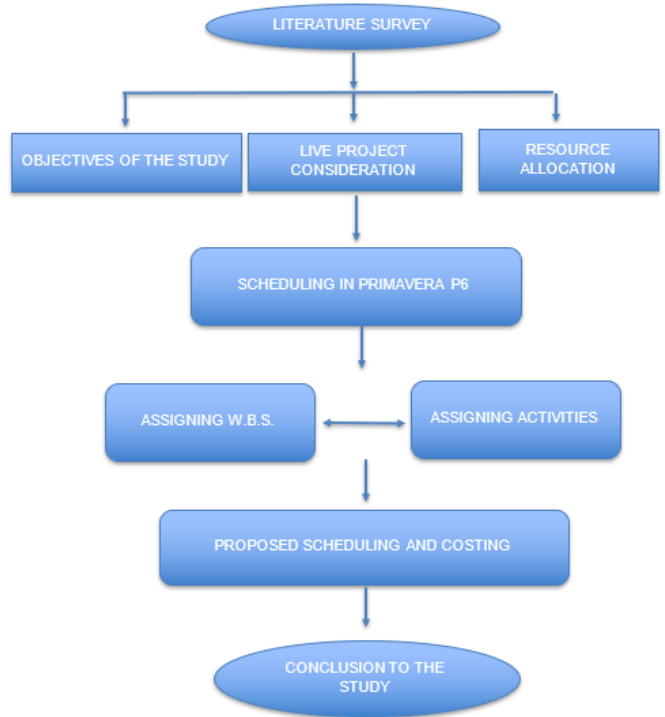
Fig 6 Resource Analysis

Step 7- Assigning Resources in each activity as per IS. 7272

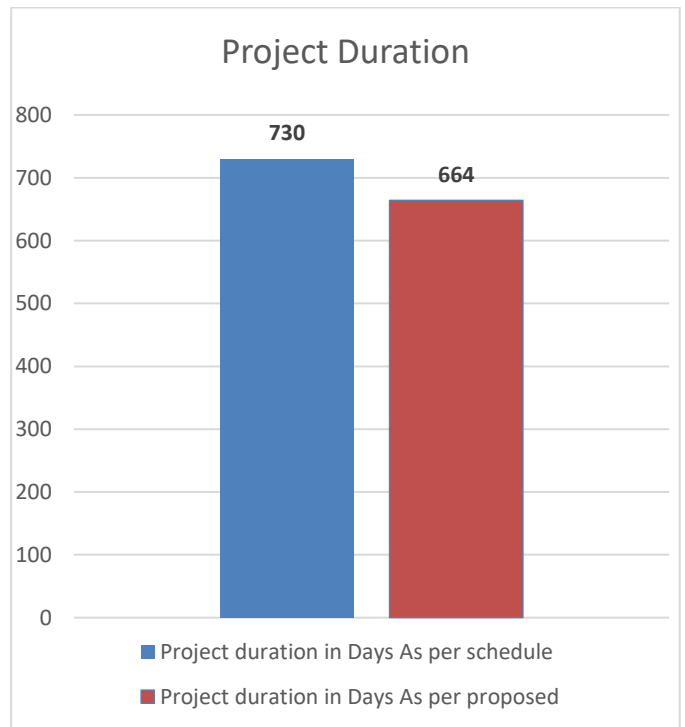
IS 7272 establishes an inexact labour requirement based on the assigned activity. It provides consistent working labour based on the type of work; this code is based on the requirement of work for exercises based on the jobs required for usage.

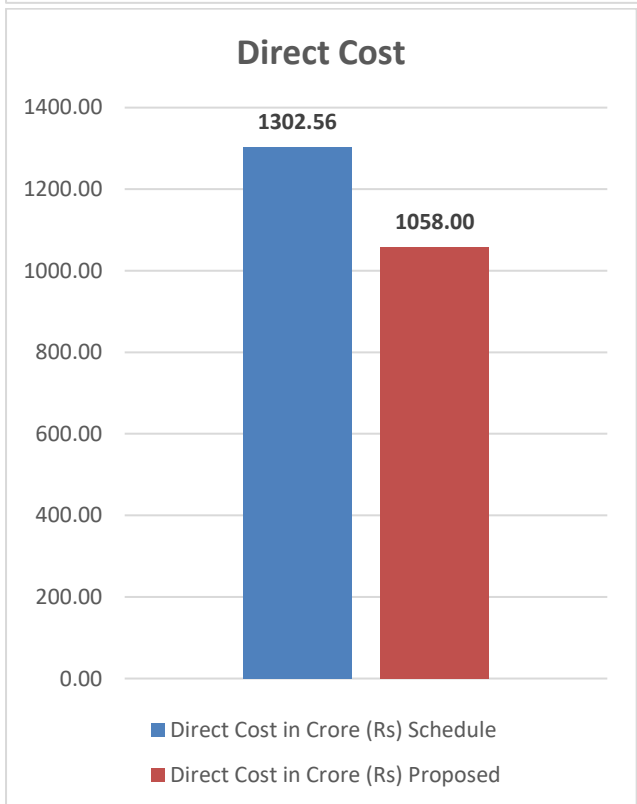
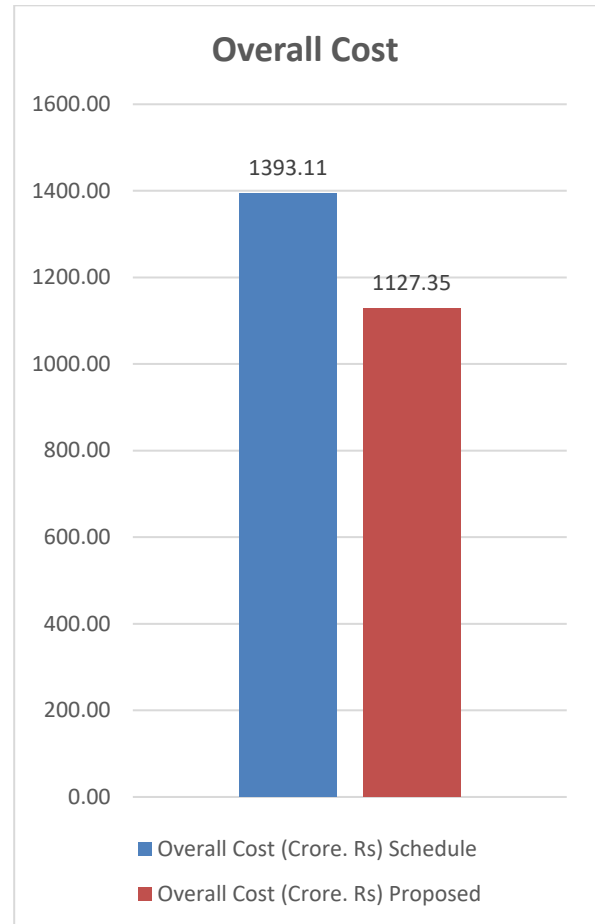
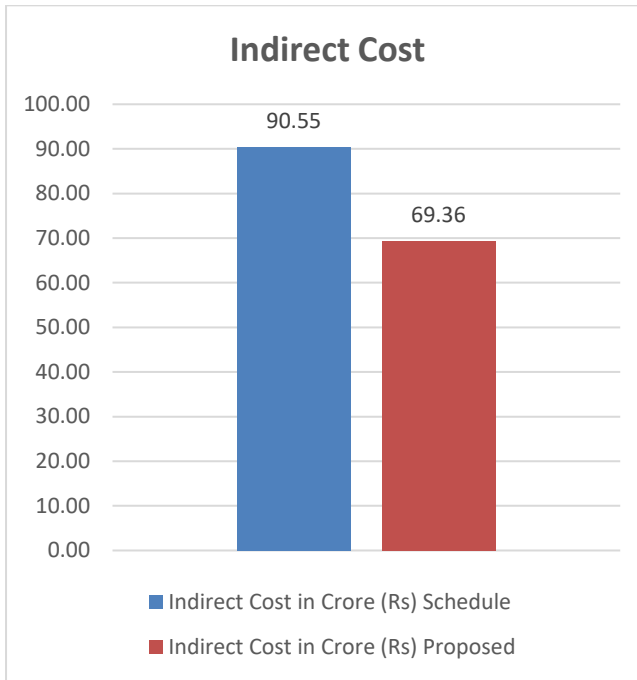
Step 8- Comparison of scheduling proposed as per site scheduling using Primavera P6. Primavera also has a tool called Project Scheduling that may be used to compare standard and current work progress. It provides legal booking and checking of all last-minute exercises, as well as managing and examining several aspects.

Flow Chart:



SCHEDULING OUTPUTS





V. CONCLUSION

The project is considered for Development of 6-lane Urban Extension Road (UER) – 2 - NH-344 M. Package -1 (From NH1 to Karala – Kanjhawala road, Km -0+700 to 15+000) in the state of Delhi on EPC mode. The costing of the project is divided into four areas of Bituminous work, CC pavement, Culvert and Bridges. Maximum cost is involved with earthwork and granular work. This entire project is management using Primavera to peek into the activities and monitor the project work from 2021.

- The activity list for the scheduled work for the road construction were listed in this section after the LOA (Letter of Agreement) as on 08th Sep 2021 and completion date is planned as on 27th Oct 2023. The construction period is considered to be 730 days.

- Resources include the labor and equipment that are used to perform activities within a project. Resources are time-based and they are often used between activities. Creating a resource pool may be useful to define the organization's resource structure and supports the allocation of resources to the relevant activities. The resources were managed for all the departments as Plant and machinery, security, Accounts, HR and Admin, Survey, Project Management and Planning Team.
- The project duration is defined as per proposed and as per the scheduled data set. The time duration is compared for the actual data and the data set as per Primavera P6. As per the chart it seems that the human resources are not used efficiently and not assigned tasks in an effective manner. Hence, the progress of project isn't up to mark.
- The direct costs of a project are the costs of labour, materials, and equipment, among other things. These construction project prices are estimated based on a thorough examination of the contract activities, construction method, site circumstances, and resources. The direct cost is 28 % higher in the scheduled cycle when compared to the proposed time lapse. Here the recommendation states use of raw materials on site in order to reduce the time and transportation associated charges.
- Indirect costs might be constant or variable. Personnel costs, security costs, and administrative costs are the three main categories of indirect costs. These expenses have nothing to do with the construction project. Due to delay in project, the salary of the project managers and site workers are running in delays which is increasing the costing of the project ultimately hampering the profits of the project. As the project is directly proportional to indirect cost. Here it was found that blocking of machinery has further added the cost which even includes the annual depreciation on the machinery.

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