

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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Vol. 7, Issue 5, May 2018

## Experimental Investigation on Preplanning of Road Construction by Using Primavera

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**ABSTRACT:** The infrastructure development plays an important role in development of country. Road transport has a major role in economic growth for a developing country like India. The construction of roads brings about a variety of benefits by all the sectors of economy. Highway constructions are the yardstick to measure the development of country. Project management is the main key role in the construction industry. Any construction project requires pre-planning and scheduling for its completion within time and budget. Pre-planning and scheduling helps, the construction projects for reducing and controlling delays of the project. Substantial amount of time, money, resources are wasted each year in a construction industry due to improper planning and scheduling. With globalization the construction projects have become vast and complex. Planning of such project requires huge amount of paper work, which can be reduced with the help of project planning software. Providing good planning, sufficient of flow of resources to a project can be automatically achieved desired result. In this thesis project management software Primavera P6 is used for preplanning a road project.

**KEYWORDS:** Preplanning, Scheduling, Budgeting, Road Construction, Primavera P6.

### I. INTRODUCTION

Projects are becoming increasingly complex. Economic uncertainty is putting a new level of pressure on teams and programs to execute well. Businesses are struggling to react quickly to fluctuating markets and changing business demands. Executives are demanding more project visibility. Distributed teams require around-the-clock collaboration and coordination, as well as the ability to successfully navigate change throughout the project lifecycle.

Today's project managers need to deliver the necessary project insight to maintain project schedule and budget commitments. And they need the ability to integrate project and program resources with other departments and at other locations to ensure project success. We get the project management, collaboration, and control capabilities you need to manage change and successfully deliver projects on time, within budget, and with the intended quality and design.

This study gives brief explanation for preplanning project management, Pre planning helps to schedule the working period in a proper manner and also purchase the goods at the right time. Advantages of using this software is Centralized Project Repository With all projects are in a centralized database, the robust security module protects project data and offers flexibility when determining who can access each project. CPM Scheduling provides Critical Path Method (CPM) Scheduling, which uses the activity durations, relationships between activities and calendars to calculate a schedule for the project. CPM identifies the critical path of activities, those activities that affect the completion date for the project or an intermediate deadline, and if delayed will delay the finish of the project.

### SCOPE OF THE PROJECT

- It would help in improving the efficiency and proper step by step planning of project implementation.
- Proper utilization of the work force which is to be utilized without wastage of men, material and machinery

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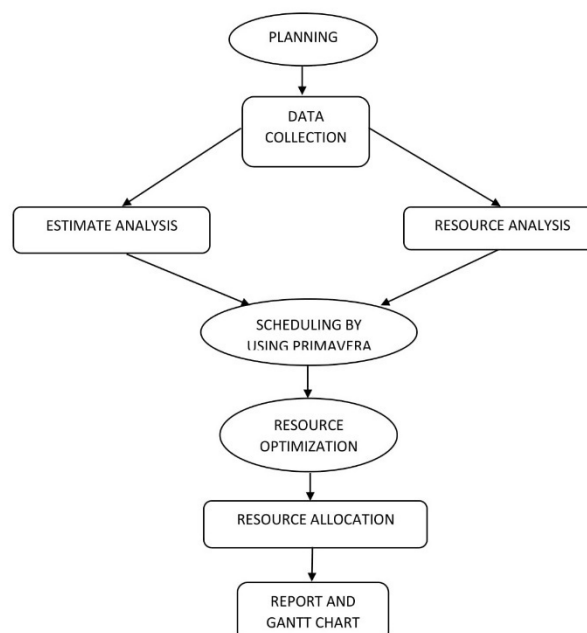
Vol. 7, Issue 5, May 2018

## II. LITERATURE REVIEW

1. "Schedule and Resources Optimization Using Primavera In Metro Rail Project" T.ShivaNagaraju And Sri Lakshmana Kumar IRF International Conference 22nd May 2016 .The main objective was to understand the role of scheduling and proper usage resources to timely completion of a construction project. Results showed the drawbacks of the present project management system in station work project and the importance of efficient planning, as well as the need and effectiveness of project management software like Primavera P6 in a construction project.
2. "Preplanning And Scheduling Of Road Construction By Using PPM" T Subramani, M.Shekar International Journal Of Application Or Innovation In Engineering Management Volume 4 Issue 5, May 2015.Planning project management is required to give complete project management solution , helps to schedules the working period in a proper manner and also purchase the goods at the right time. Advantages of using this software are having flexibility to manage multiple projects in centralized location and determine who can access each project.
3. "A study on resource planning in highway construction projects" K Swarnakumari and J Yikranth international journal of engineering research and application volume 2, issue 4th july –august 2012.The present construction practices in India is still adopt the methodology of as and when required resource management. Which results in Lack of professionalism, training programs no real time records. Equipment cost for any project comprises of mainly 20-30% of project cost.

## III. METHODOLOGY

The methodology used in this project is divided into 3 main phases. By adopting planning and scheduling the activities critical path will be obtained by schedule reports by logical relationship which will be helpful in execution. Resource availability can be known and assigned, analysed and allocation will be done. The results obtained are concluded. The entire project is integrated with Primavera and reports are generated.



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Vol. 7, Issue 5, May 2018

## IV. PROGRAM OBJECTIVE

### 1. OBJECTIVES OF THE PROJECT

The objective of the project is to complete the construction project as indicated time period with specified date and proper usage of funding and number of resources. to accomplish the project successfully some of the objective goals set are:

- Preplanning and scheduling the activities of a project for acquiring budgeted cost.
- To adopt the proper activity sequencing by assigning proper relationship between activities.
- Identifying the activities which could be start parallel so that the duration could be reduced.
- To allocate the resources effectively for usage of available equipment's and material's.
- To know the Primavera is helpful in preplanning construction and execution of project.

### 2. PLANNING

The planning for the project involves collecting the data required and to identifying the construction tasks. The project which I have selected is Improvements to Moonnilavu - Kadapuzha - Mudikkunnu - Mechal - Thoranathumkunnu - Chakkikavu road ch.0/000 to 7/800km. in Kottayam district, Kerala.

### 3. DATA COLLECTION

- A Bill of Quantities or Schedule of the work is required for preplanning.
- The Moonnilavu - Chakkikavu road is an important link road connecting Moonnilavupanchayat and Melukavupanchayat at Kottayam district.
- The road lies in the eastern region of Meenachil taluk and will connect Erattupetta & Pala town in Kottayam district.
- Topography of this area is almost hilly. The materials for the raw construction can be obtained by nearby rock mining and metal crushers around 20 km.
- The machineries and equipment's can be mobilized to the work site.

### 4. CASE STUDY DETAILS

- The Contractor : KCA Constructions
- The Client : P.W.D
- Name of project : NABARD RIDF XIX -Improvements To Moonnilavu - Kadapuzha - Mudikkunnu - Mechal - Thoranathumkunnu - Chakkikavu Road @ Ch. 0/000 To 7/800km.
- Budget at Completion Rs.7, 66,77,537.50
- Project Actual Duration : 18 months

### 5. SCHEDULING

After collecting drawings and preparing quantities the activities are known. Now the scheduling is done in primavera software. The scheduling procedure in primavera is as follows:

- Techniques Used For Scheduling Projects
  - CPM – Critical Path Method

The method by which activity durations and the relationships between activities are used to mathematically calculate a schedule for the entire project. CPM focuses attention on the critical path of activities that affect the completion date for the project or an intermediate deadline. Early dates, the earliest possible dates each activity can start and finish, and late dates, the latest possible dates each activity can start and finish without delaying the project finish or an intermediate deadline (constraint) are also calculated.

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Vol. 7, Issue 5, May 2018

### ➤ PERT

The program evaluation and review technique (PERT) uses the same ideas as CPM; but instead of using just the most likely time estimate, it uses a probabilistic estimate of time for completion of an activity.

#### Structuring Projects

1. Setting-up and define EPS (Enterprise Project Structure).
2. Add a project to the EPS hierarchy.
3. Defining WBS (Work breakdown structure) to the Project.
4. Defining OBS (Organizational breakdown structure)
5. Defining Resources.
6. Create Calendar for Activities & Resources.
7. Add activities to WBS
8. Input activity details.
9. Schedule project.
10. Updating progress after project starts.
11. Preview / Print reports (Default / Custom made reports).

### ➤ EPS (Enterprise Project Structure)

Projects are arranged in a hierarchy called “enterprise project structure”. The EPS can be subdivided into as many levels or nodes as needed to parallel work in the organization. Nodes at the highest or root level represent divisions within the agency, next level nodes represent Zones, then Regional Offices, then Construction Supervisors, then construction contracts; or by whom projects are delegated and tasked.

The EPS is made up of roots and nodes. Each root in the project structure can be subdivided into many nodes. All projects must be included in a node. Each node can contain an unlimited number of projects. Projects always represent the lowest level of the hierarchy. Placement of a project in the hierarchy determines the summary level in which it is included.

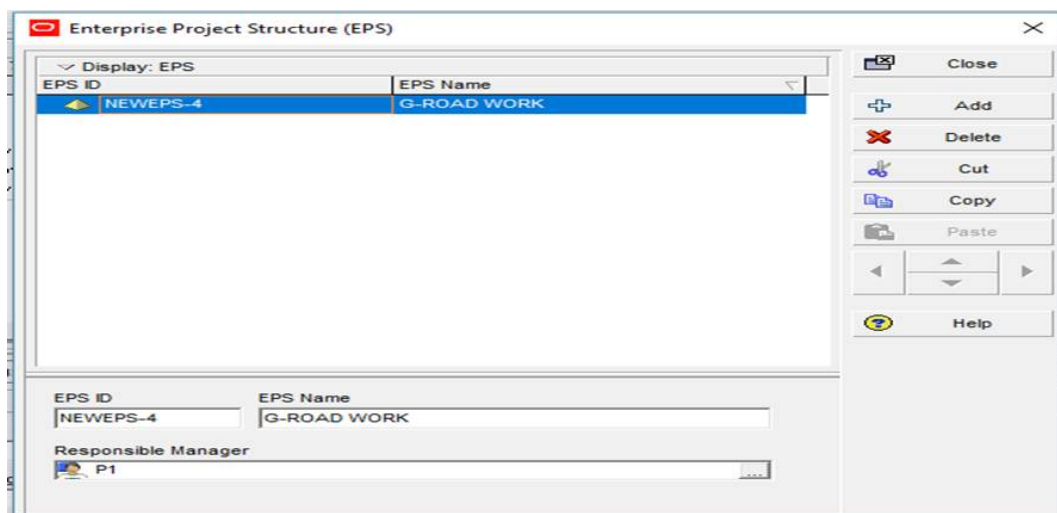


Fig.1 Window Shows Enterprise Project

### ➤ WBS (Work Breakdown Structure)

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Vol. 7, Issue 5, May 2018

A WBS is a hierarchy of work that must be accomplished to complete a project, which defines a product or service to be produced. The WBS is structured in levels of work detail, beginning with the deliverable itself, and is then separated into identifiable work elements. Work Breakdown Structure is a hierarchical arrangement of the products and services produced during and by the project. The project is the highest level while an individual activity (or an action item) to create a product or service is at the lowest level.

## ➤ OBS (Organizational Breakdown Structure)

The organizational breakdown structure (OBS) is a global hierarchy that represents the managers responsible for the projects in enterprise. The OBS usually reflects the management structure of organization, from top-level personnel down through the various levels constituting your business. Associate the responsible managers with their areas of the enterprise project structure (EPS) with either an EPS node or a project. When you associate a responsible manager with an EPS node, any projects you add to that branch of the EPS are assigned that manager element by default. An OBS supports large projects that involve several project managers with different areas of responsibility.

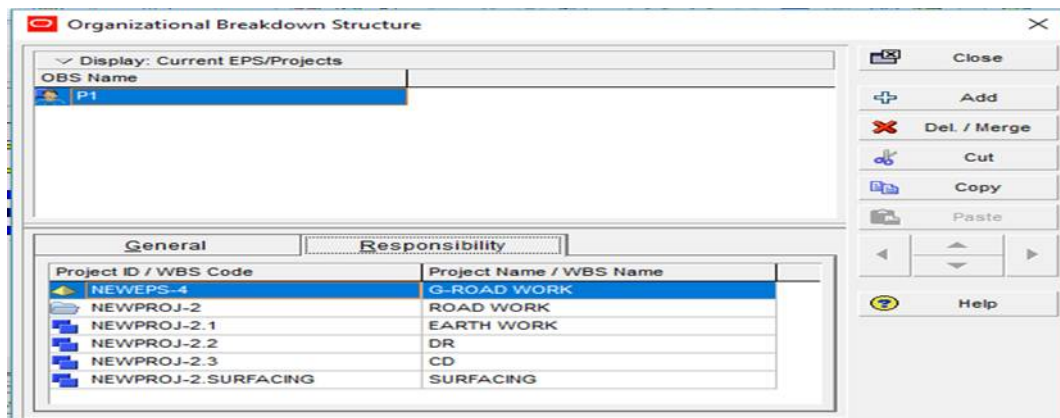


Fig.2 Shows Organizational Breakdown Structure

## ➤ Creating Calendars

Create and assign calendars to each resource and each activity. These calendars define the available work-hours in each calendar day (Figure.3). Also specify national holidays, organization's holidays, project-specific work/non-workdays, and resource vacation days. Calendar assignments are used for activity scheduling, tracking, and resource levelling.

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Vol. 7, Issue 5, May 2018

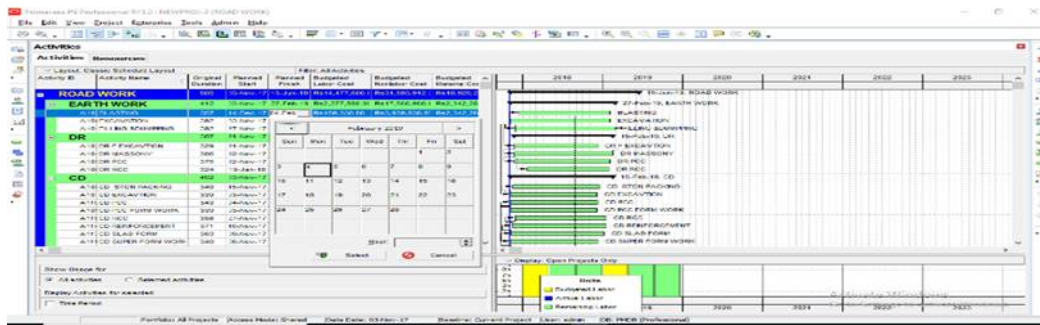


Fig.3 Window Shows Calendar Creation

## ➤ Activities

Also known as tasks, events, or work packages, activities are the lowest level manageable work elements in a project or WBS. Activities typically have expected durations, costs, and resource or role requirements. Milestone activities, however, have no duration or cost. Collectively, all activities form the foundation of the entire project, driving resource assignments, relationships, constraints, expenses, and durations. Activities are sometimes further divided into any number of discrete steps.

## ➤ Resources

A resource is any quantifiable item in limited supply and of sufficient value to justify tracking and assigning to specific activities for a project. Resources include general or specialized labor, non-labor items such as equipment, and material items such as bricks. Resources perform roles, if defined.. Resources are divided into three categories:

### 1. Labor (people, crews)

Measured in units of time, generally reused between activities/projects. Exception will be individual contractor's resources. Recorded in terms of days or hours (e.g. \$50.00/hour)

### 2. Non labor (Equipment)

Measured in units of time, Recorded in terms of days or hours

### 3. Material (contract pay items)

Measured in units other than time, meters, square meters, etc. Resource teams provide a convenient way for you to associate personnel into smaller, more meaningful groups within an organization.

## ➤ Role

Roles represent personnel job titles or skills needed to execute projects. Architect, general laborer, quality assurance tester, and engineer are all examples of possible roles. Create a standard set of roles that assign to labor and non-labor resources and activities for all projects in the organization. Establish an unlimited number of roles and organize them in a hierarchy for easier management and assignment. The set of roles to an activity defines the activity's skill requirements.

## ➤ Project Codes

Project codes help to track different projects based on characteristics they share. Use project codes to arrange projects hierarchically when EPS contains many projects within many levels. Many projects in the hierarchy, project codes help group and filter potentially vast amounts of information spanning different areas of the organization.

## ➤ Resource Codes

With potentially hundreds of resources in use across the enterprise, resource codes provide an efficient means for tracking and sorting resources for reporting or analysis. Use this procedure to assign resource codes to resources. Once assigned, categorize resources using codes.



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Vol. 7, Issue 5, May 2018

## ➤ Activity Codes

Activity codes enable to categorize activities into logical groups based on organization's criteria. An activity code can be one of three types: Global, EPS, or Project. Global activity codes organize activities across all projects in an organization. EPS activity codes organize activities within a specific branch or node of the enterprise project structure (EPS Use activity codes to view and roll up activities in the activity table; build reports in the Report Wizard or Report Editor; organize a layout by grouping activities into specific categories; and select and summarize activities.

- 1) Activity codes can be global:
- 2) Organize within a project or across the entire organization
- 3) The Department can create an unlimited number of global activity codes Activity codes can be project specific:
- 4) The Contractor can create up to 500 project-specific activity codes
- 5) Each activity code (global, EPS, and project) may contain an unlimited number of activity code values. Activity codes can be organized in a hierarchy.

## ➤ Risks

Risks are any uncertain events or conditions that, if they occur, have a positive or negative effect on project objectives. Risks are also known as threats, warnings, imperatives, escalation notices, or jeopardies. Positive risks are often classified as opportunities which, if they occur, are realized as rewards. Thorough documentation and analysis of risks over multiple projects offer lessons, and potentially cost and time savings, for all future projects.

## ➤ Gantt chart

A Gantt chart is a graphical representation of the duration and sequence of activities or projects. It is useful for planning, scheduling, and monitoring progress against a timeline. Easily update dates and durations by resizing or moving Gantt chart bars. When you change bar positions in a Gantt chart, the start and finish date columns update automatically to reflect the new bar position. After moving a Gantt bar, when save changes, the remaining duration is recalculated based on the new dates and the activity or project calendar. Because this calendar is applied when save, if move but do not resize a Gantt bar, the duration might shorten or lengthen based on the calendar's non work time.

## 6. RESOURCE OPTIMAIZATION

Resource includes personnel as well as equipment that work on an activity across the project. Resources can be created according to the organization resource structure which helps for assigning the resources for each activity. This enables to schedule as well as plan the cost by role at the planning level of the project.

## 7. RESOURCE ALLOCATION

The resources can be groped based on the categories so which helps to find easily while assigning to the activity. The resource calendars can also be assigned and define contact information, price over time for resources and roles. Unlimited resource coding can be done. Team leaders, resource manager and project managers of teams in and enterprise should jointly establish the resources required for the project. The units for the resources can be set by adding the required units in admin categories which appears with a tab when clicked on admin column. By selecting each activity the required resources are added with the quantity required for each activity.

## 8. REPORT

Generating reports in Oracle P6 is an amazing, efficient way of maintaining control and oversight in your project. The potential report combinations in Oracle P6 can easily compile into the hundreds, if not more when considering custom reports. To help make these decisions and increase your productivity, try to stick with the most common reports in Oracle Primavera P6.

- 1) Functional Group Summary Report.
- 2) Baseline Gantt chart Layout.
- 3) Program Review Report.

## 9. BENEFITS OF PRIMAVERA SOFTWARE

- a) Plan, Schedule and Monitor the huge and complex construction projects
- b) Risk Analyzing of projects

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- c) Resource optimization for projects Delay analysis for the project
- d) Project activities relating
- e) Tracking the projects to know the current scenario
- f) Communication between the team members for the project is easy
- g) Helpful to know the further activities which has to be carried out
- h) Security level is well organized within the company.

## V. RESULTS AND DISCUSSIONS

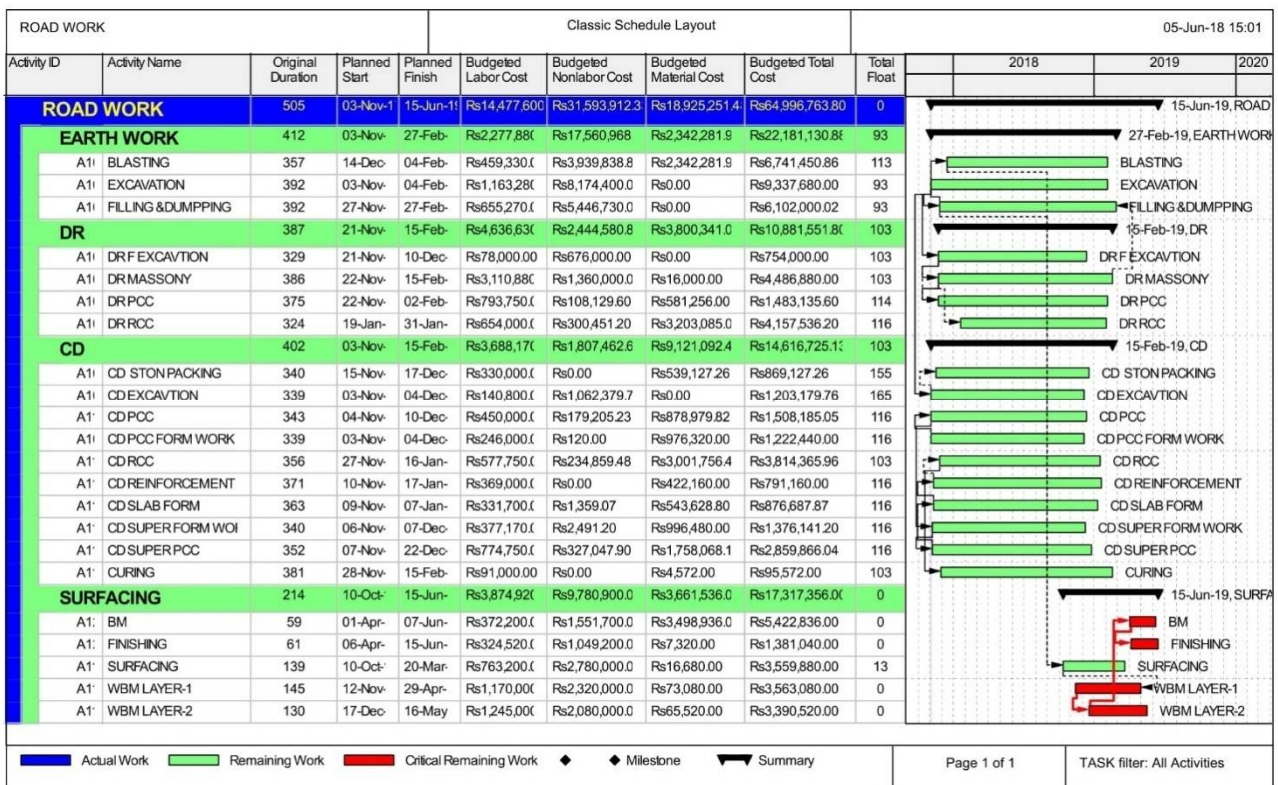


Fig.4 Shows Gantt Chart of the project.

The actual duration of the project as per original schedule is 18 months i.e. 540 days .As per preplanning and scheduling the project by using primavera the project can be completed by 505 days , which gives 35 days earlier than the actual duration.

The Earth work can be completed within 412 days and have a total float of 93 days with a budgeted cost of Rs.2218130.88.

The D.R (Retaining Wall) work can be completed within 387 days and have a total float of 103 days with a budgeted cost of Rs.10881551.8

The C.D (Cross -Drainage) work can be completed within 402 days and have a total float of 103 days with a budgeted cost of Rs.14616725.13

Surface work come in a critical activity which have zero total float value, the activity should be completed within 214 days with a budgeted cost of Rs.17317356.00



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Hence the Contractor or the management could get a profit of 15.2% of project budget at the time of completion i.e. Rs.11680773.70

## VI. CONCLUSION

The preplanning and scheduling by using Primavera P6 helps in understanding the variation original schedule and the pre-planned schedule. This help the project managers to identify the critical activity plan accordingly while executing the project.

The current construction practice in our country is still adopting the policy of as and when required in managing the resource of project. This policy of management may cause a huge impact in achieving the budgeted expenses and the actual expenses. Hence using construction management software in the vast and complex projects reduce the uncertainty and achieve a better result.

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