

Planning, Scheduling and Resource Optimization for Road Construction Using Primavera

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Abstract- The infrastructure development plays an important role in development of country. Road transport plays an important 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 proper planning and scheduling for its completion within time and cost. In this project the popular primavera tool/software is used. Planning and scheduling is very important in 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 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.

Index Terms- Highway Construction, Planning, Scheduling, Resources, Primavera

I. INTRODUCTION

1.1 GENERAL

The development of infrastructure plays a main role for the development of country. The important part of economic growth of the country depends on the road transportation. The construction projects like road construction needs a careful attention while planning as well it requires a very huge amount of resources. As it's known the road construction projects is different from one another as there will be changes in place, situation, weather condition by seeing all this it is very tedious in planning and allocating resources as the resources are repetitively used in the execution of the project. The time taken for the construction of road projects at the beginning of 19th century took a very long duration because of lack in techniques used which leads to wastage of money, time as well as the resources used for construction. As the days

passed their we saw the improvement in the construction technologies used which could complete the project with the appropriate usage of money, time and resources for this improvements their comes the proper project management tools which would help in planning, scheduling and resource allocating one such tool is Primavera P6.

1.2 PROJECT MANAGEMENT

Project management could play a very important role in the construction industry. By using these management tools it will be very helpful to execute the project in a very economical way as well with the limited duration with usage of optimum resources. This also enables to store the information and manage the project in a central location .The project management consist of balancing the needs which could be identifiable or unidentified expectation of the stake holders by giving the quality, scope, and time of the project.

The project management uses the information and turns it in a manner for execution in a skilled way with lot of strategies to satisfy the requirement of the construction projects. Every project has main goals to achieve that are

- On time completion of the project
- Optimum usage of the resources
- Within the minimum investment

The goal of project planning is to create a work chart with the activities which should be done on after another with a proper date of start and completion. By scheduling we could know the activities which are in a crucial position where it should be started and completed within the duration so that it will not affect the project completion duration. The allocation of the resources required for the project activities will cut down the wastage of materials which could affect the funds that are allocated for the resources in a project.

II. LITERATURE REVIEW

“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.

“Schedule and Resources Optimization Using Primavera In Metro Rail Project” T.Shiva Nagaraju And Sri Lakshmana Kumar IRF International Conferencend 22 May 2016The 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.

“A study on resource planning in highway construction projects” k swarna kumari and j vikranth international journal of engineering research and application volume 2, issue 4 july –august 2012The 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 .

man power planning is the process by which an organization ensures that it has the right number and right kind of people at the right place at right time. Which all should be controlled by proper allocation of resources so that effectively and efficiently works can be completed.

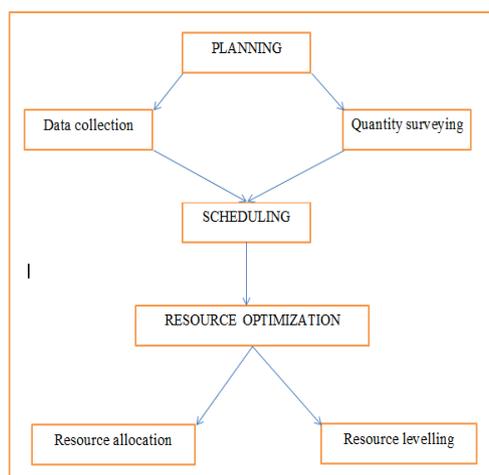
III. OBJECTIVES OF THE PROJECT

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

- Planning and scheduling of the activities of the project
- 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 the construction and execution of project.

IV. 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 levelling will be done. The results obtained are concluded. The entire project is integrated with Primavera and reports are generated. Following flow chart explains the phases.



Flow Chart 4.1 Showing the Phases of Methodology

4.1 PLANNING

Data collections for the project involves collecting the data required like drawings and for each the quantities are

calculated are shown in below tables. The project which I have selected is Improvements and widening to 4-lane of kotekar-pathuru road (MDR) from 12.76 to 14.35 in front

of Infosys campus at mudipi in bantwal taluk (kambalapadavu dwara to sambarthota) which also includes construction of culverts, retaining walls, CC drain and service road From India International infrastructure Engineers(IIIE) limited M.G.Road.

4.1.1 List Of Datas

1. Drawings

- Cross section in front of road
- Cross section in other location
- Cross section of retaining wall
- Cross section details of culvert with 600mm dia pipe
- Cross section details of culvert with 900mm dia pipe
- Cross section details of culvert with 1200mm dia pipe

2. Quantities of materials

- Quantities of main 4 lane road construction
- Quantities of culvert
- Quantities of retaining wall
- Quantities of road furnitures
- Quantities of CC drain
- Quantities of service road

3. Scheduling details

- Date of start
- Date of completion
- Duration of activities

4. List of resources used for the project

4.2 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

- Creating Enterprise Project Structure (EPS)
- Creating users and user preferences
- Creating Organisation Breakdown Structure (OBS)
- Creating Projects
- Creating Calendar's And Assigning
- Creating Work Breakdown Structure (WBS)
- Creating Activities Under WBS
- Creating activities
- Establishing Relationship Between Activities
- Scheduling of activities

- Knowing Grand Summary with Gantt chart

One of the methods used for scheduling is critical path method (CPM) that which defines the project activities, activity duration and relationship between activities. The schedule of activities connects the activities in a project to calculate the total duration required to complete. by scheduling we could identify the reasons for delay which occurs in a project. It also makes easy for tracking a particular project which gives a legal proof.

In a project scheduling is listing of milestones for project activities, milestones with intended start and finish dates which helps for the site engineers to execute the project easily by knowing the upcoming activity and requirements for the activity which makes the project to move on without any disturbance.

By adopting and executing proper scheduling predicting of the upcoming workloads can be known and handled accordingly to the situations. It's very useful in knowing the requirements of equipment's which are required for the upcoming activity

Primavera is a project management program which is designed to assist project managers in developing plans , assigning resources to tasks, managing budgets, tracking progress and analysing workloads . It also helps to effectively implement their strategies and can achieve the goal.

Benefits of primavera software

- Plan, schedule and monitor the huge and complex construction projects
- Risk Analysing of projects
- Resource optimization for projects
- Delay analysis for the project
- Project activities relating
- Tracking the projects to know the current scenario
- Communication between the team members for the project is easy
- Helpful to know the further activities which has to be carried out
- Security level is well organised within the company



Fig 4.2.1 Window Staring Of Primavera P6 Software

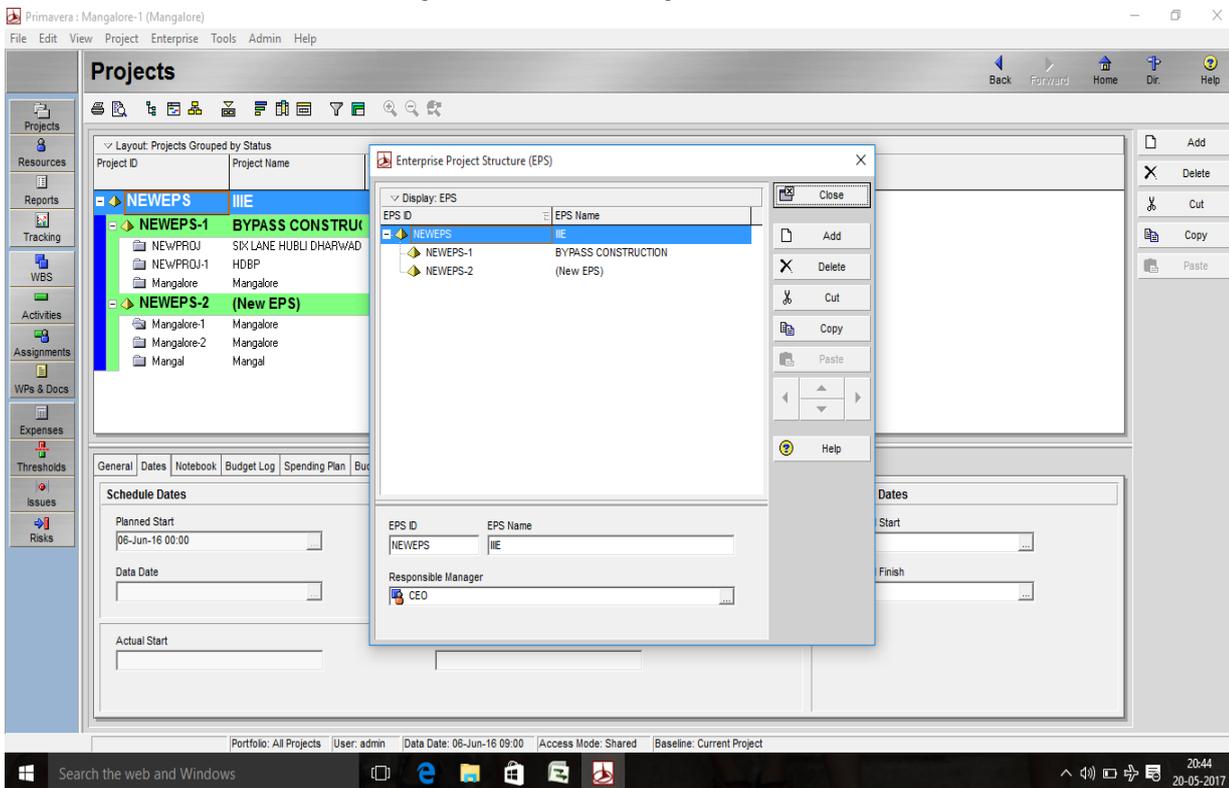


Fig 4.2.2 Window Showing the Entering Of Enterprises Project Structure

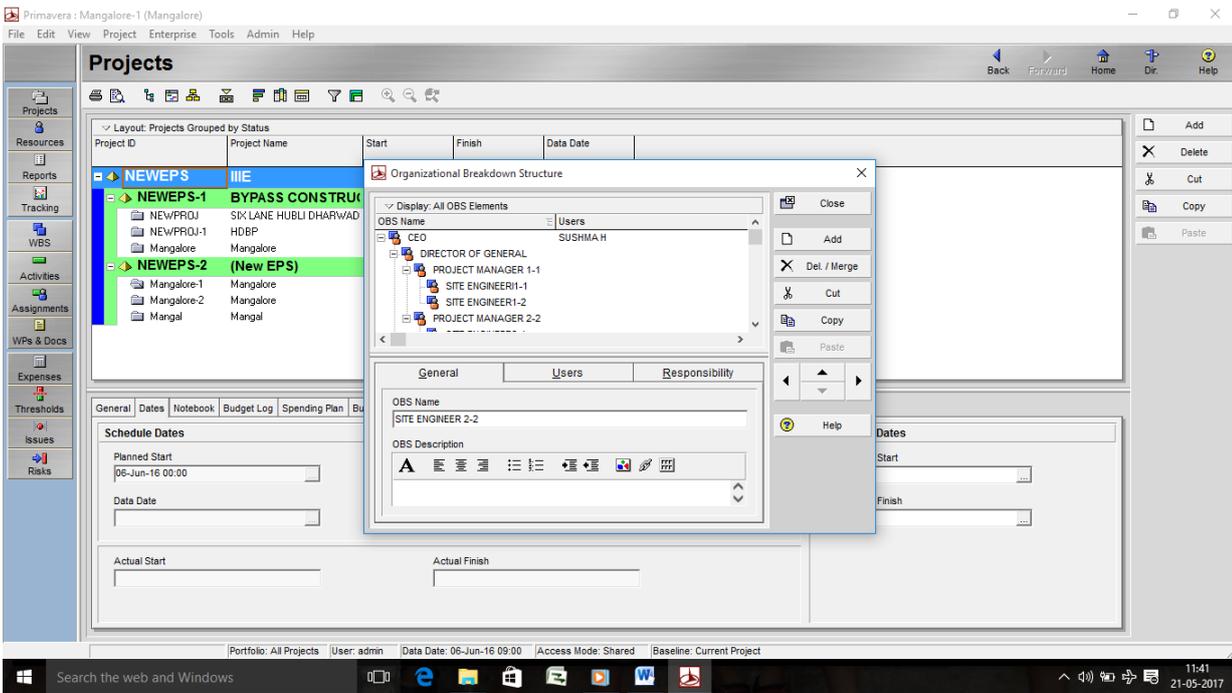


Fig 4.2.3 window showing the entering of Organization Breakdown Structure

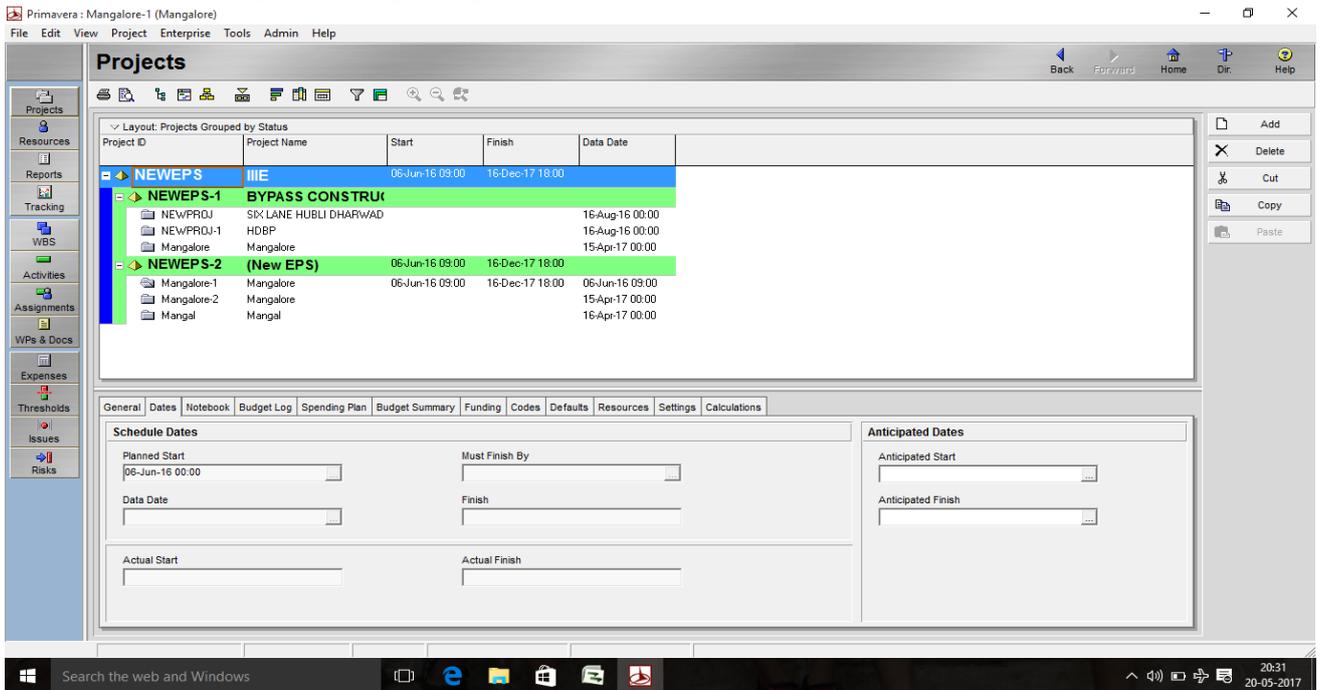


Fig 4.2.4 Window Showing the Entry of Projects with Location

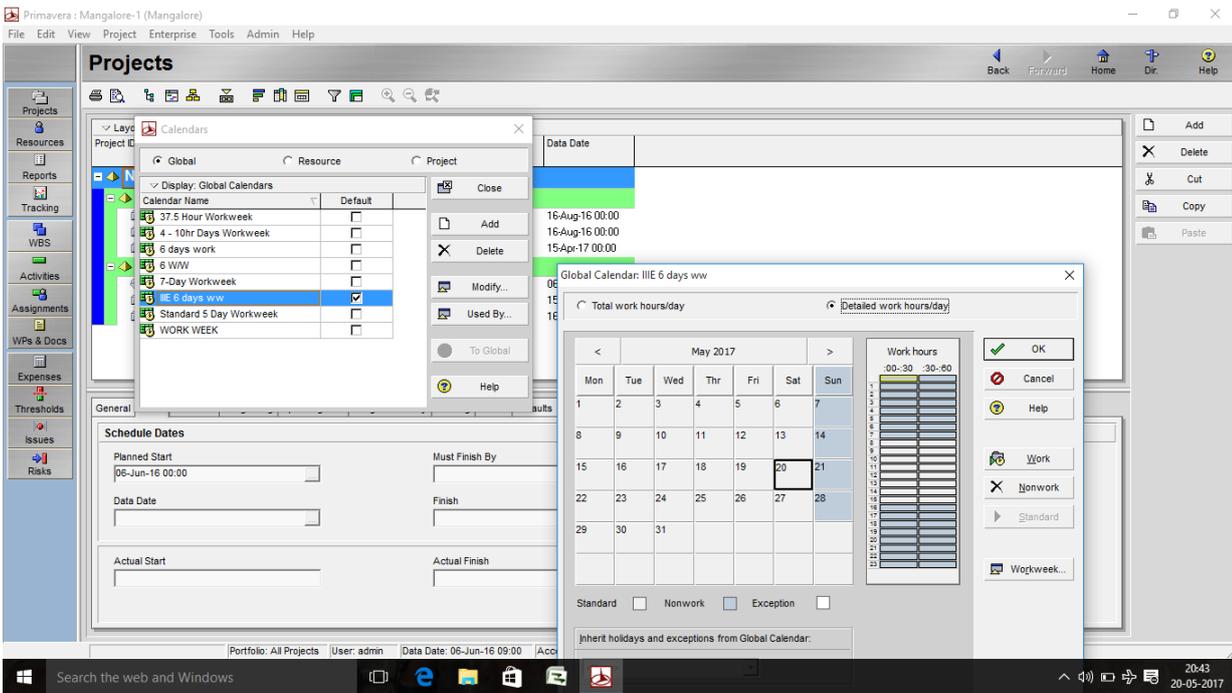


Fig 4.2.5 Window Showing the Creating Of Calendar as Per the Project Need

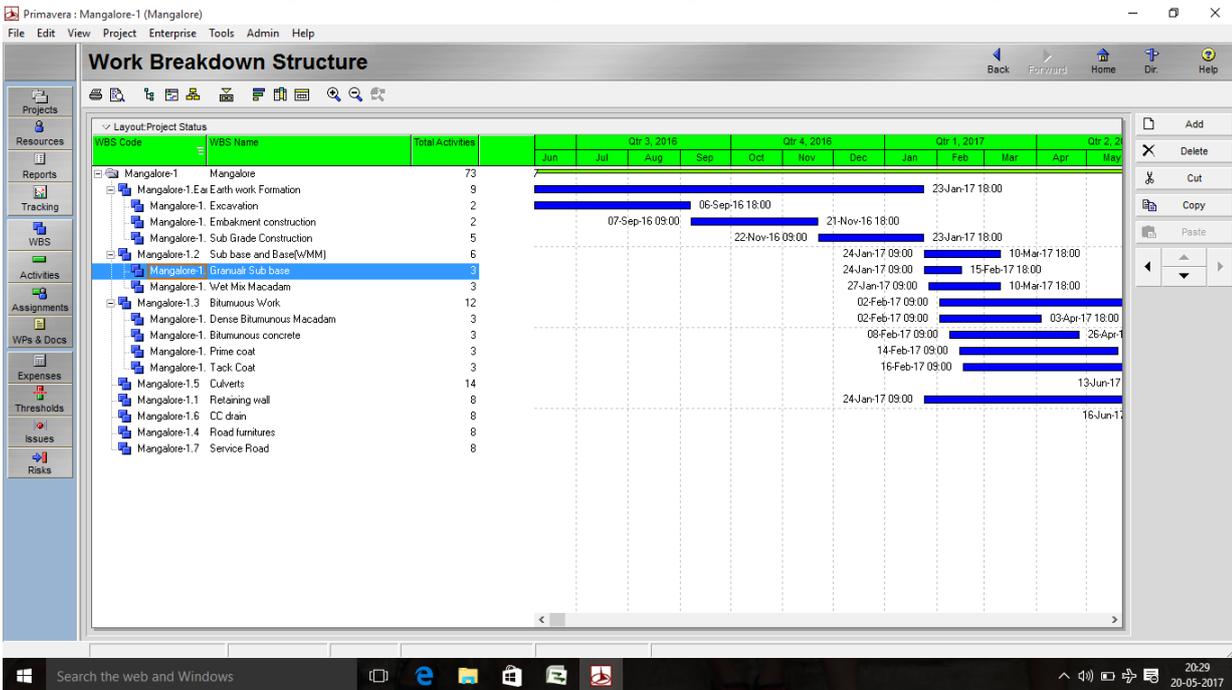


Fig 4.2.6 Window Showing the Work Breakdown Structure

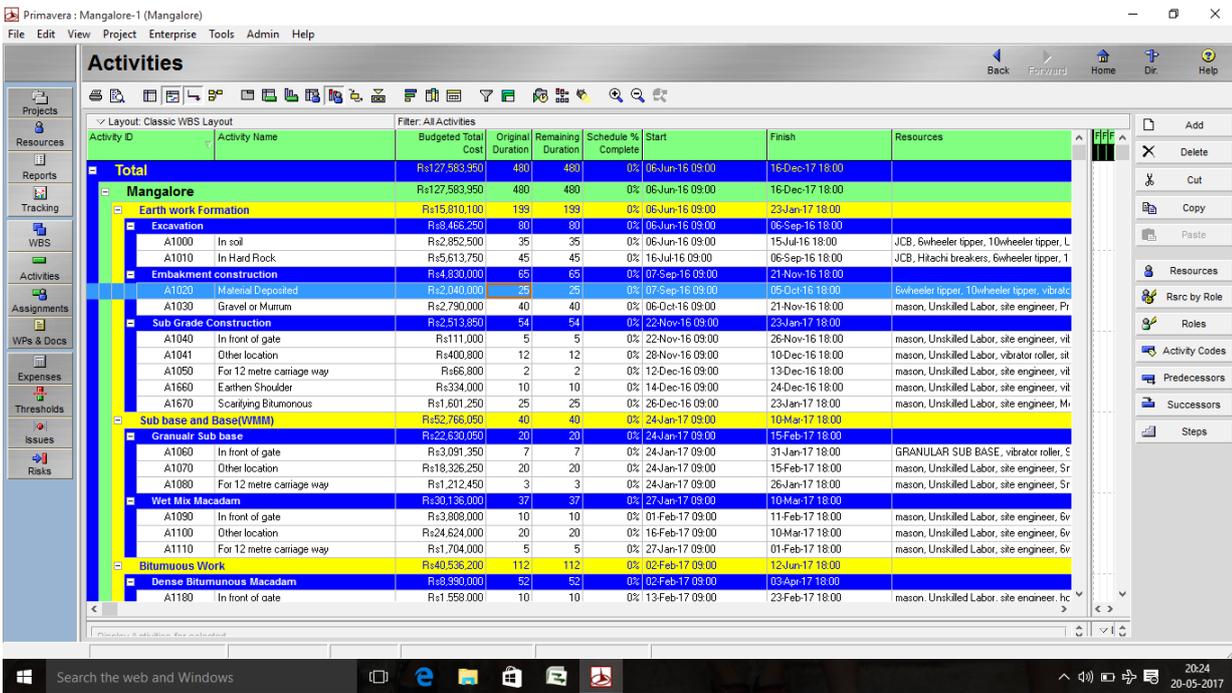


Fig 4.2.7 Window Showing the Activities of the Project

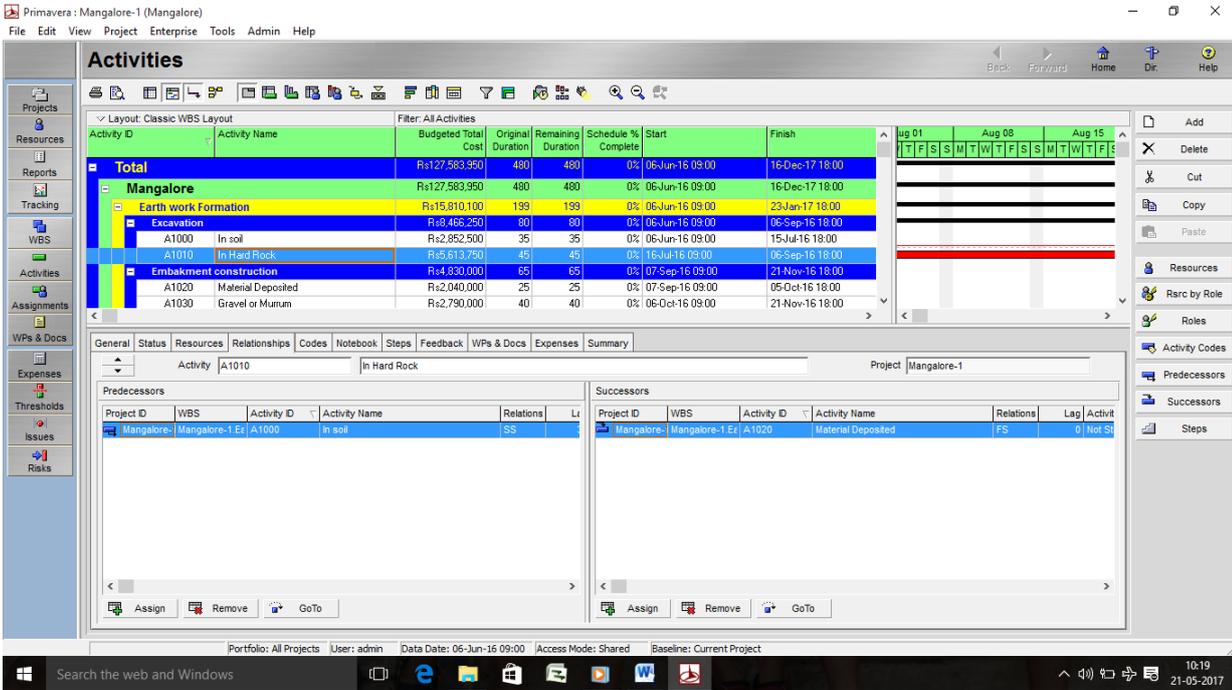


Fig 4.2.8 Window Showing the Assigning Of Relationship

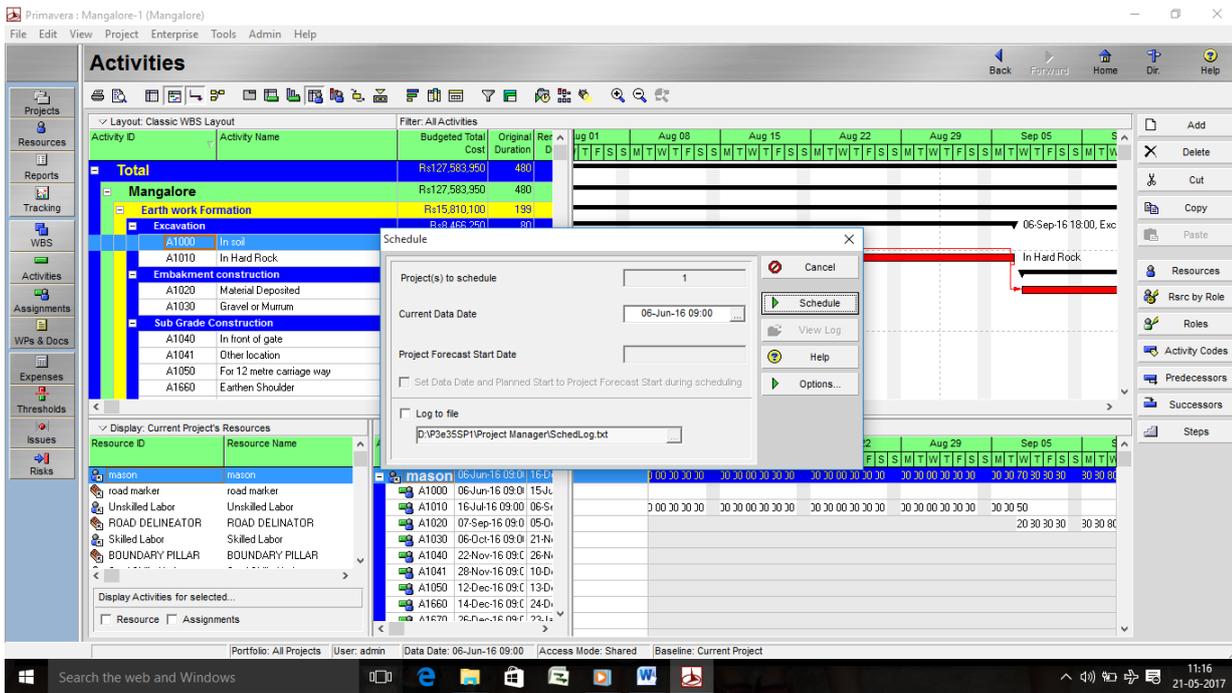


Fig 4.2.9 Window Showing the Starting Of Scheduling

4.3 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. The resources can be groped based on the categories so which helps to find easily while assigning to the activity.

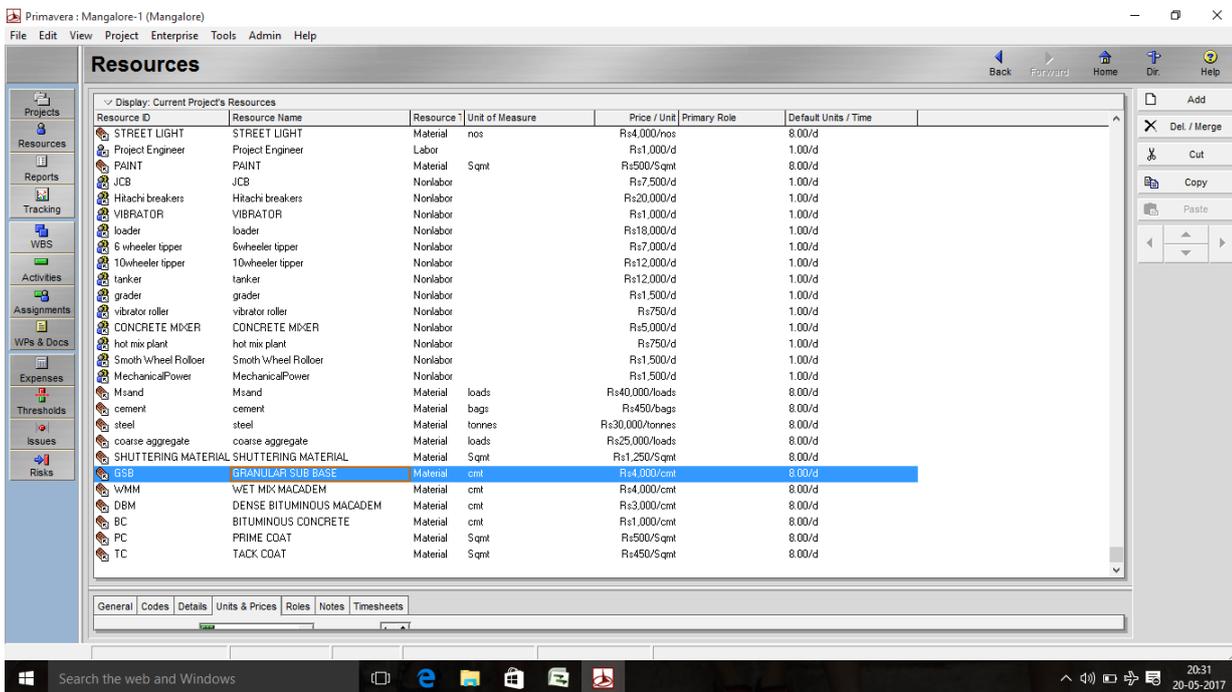


Fig 4.3.1 Window Showing the Resource Sheet

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 project control co coordinator needs to participate in the process to make sure resources are distributed accordingly based on the availability. The

resources window can also be opened at global level without opening any project to know the availability of resources in company.

Using unit and piece tab we can specify available quantities for the resource for the work. Setting up the limits helps you quickly identify the area where the resources are overloaded and can be handled easily

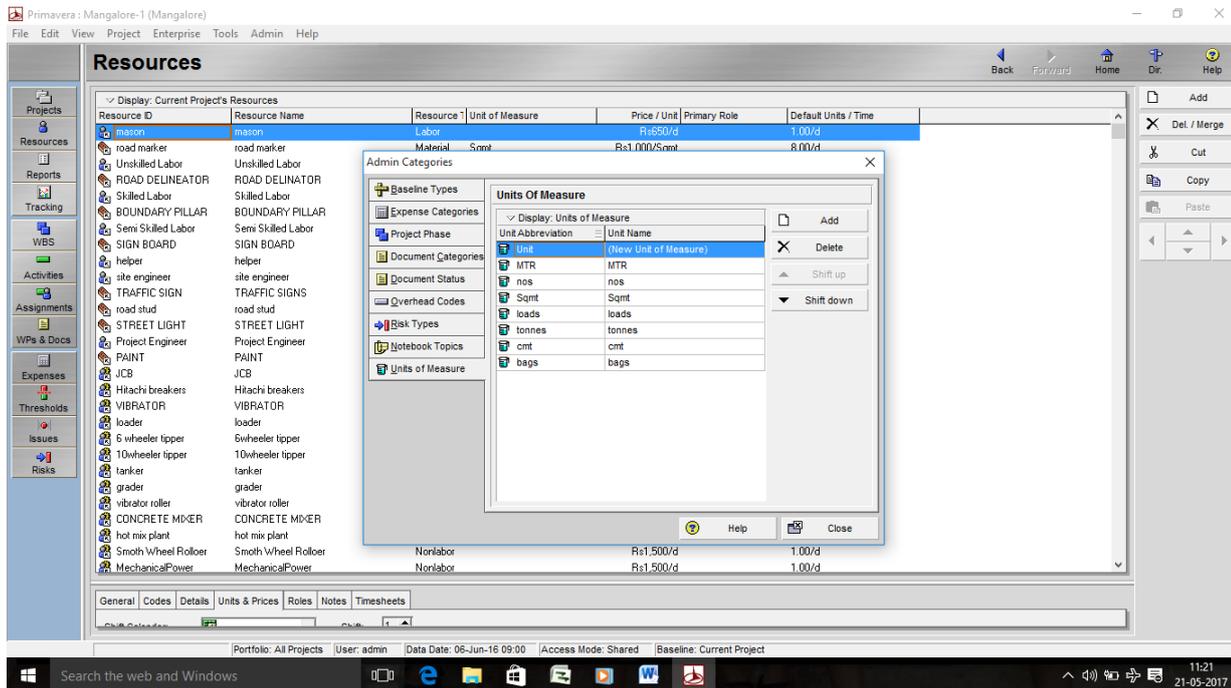


Fig 4.3.2 Window Showing the Entry of the Units for Resources

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.

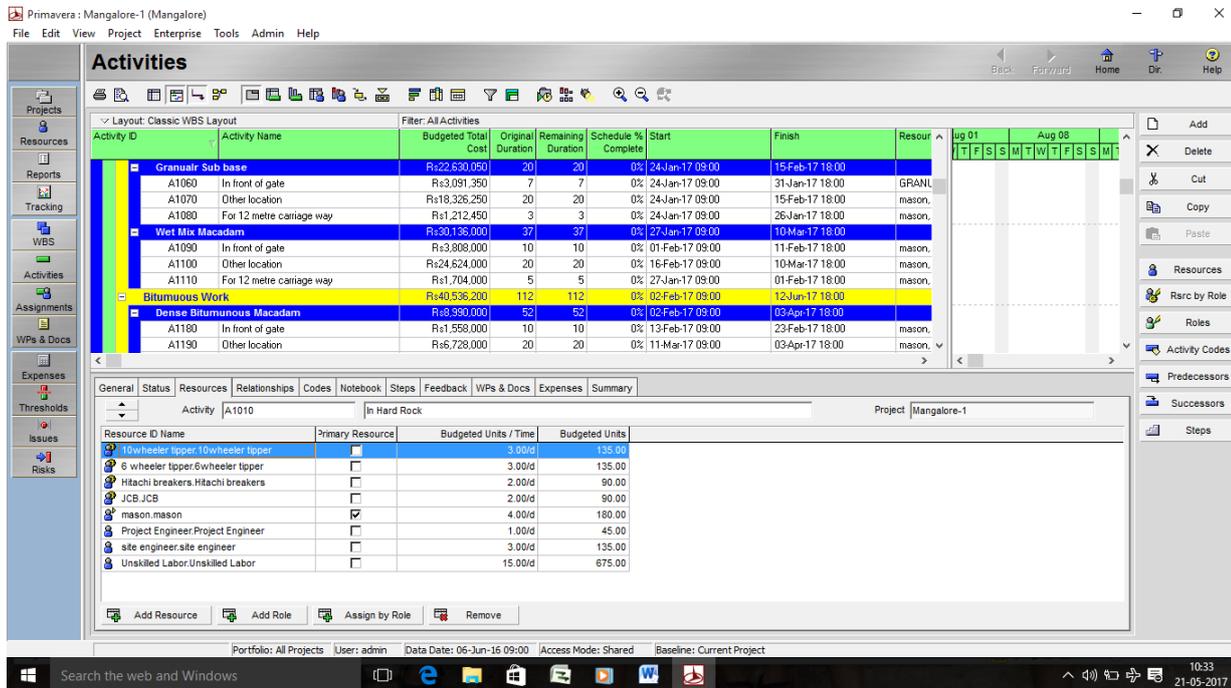


Fig 4.3.3 Window Showing the Assigning Of Resources for Each Activity

After assigning the required resources the resources should be levelled to know the requirement and the resources which are over allocated. It helps to manage the resources while execution of activity.

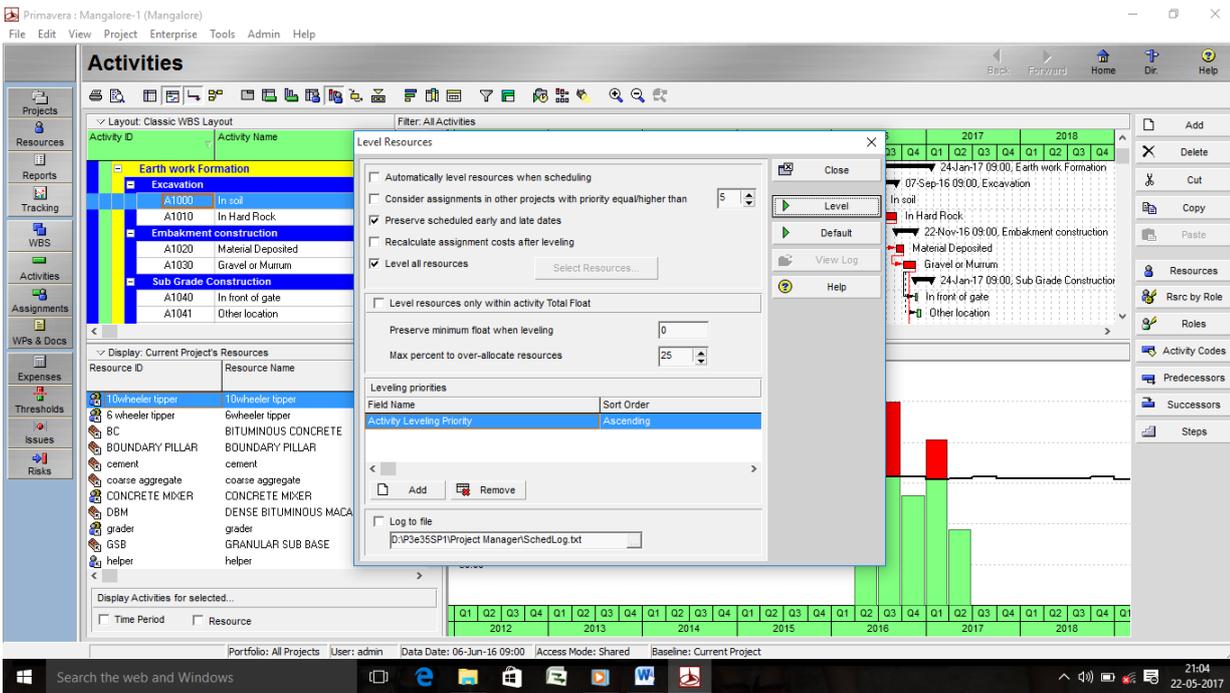


Fig 4.3.4 Window Showing the Starting Of Resource Levelling

Once the levelling is done recalculation should be done. If activity is not progressed the planned cost, remaining cost and completion cost all will be equal. Recalculating cost option will be used when resources costing increases during execution.

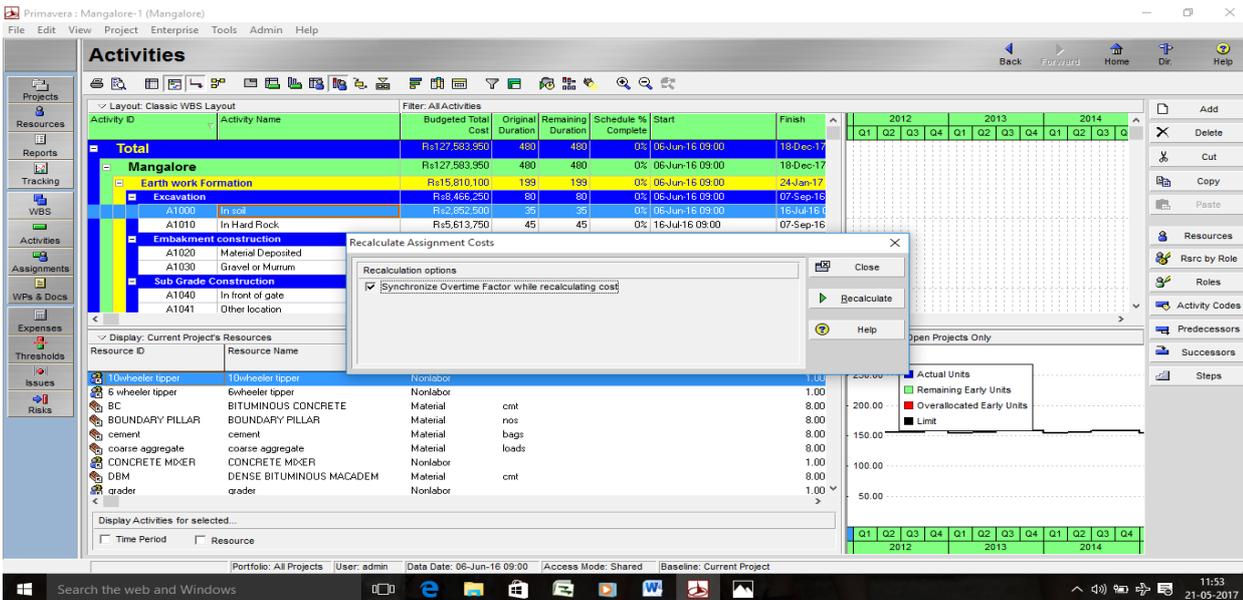


Fig 4.3.5 Window Showing the Recalculation after Resource Levelling

V. RESULT AND DISCUSSION

5.1 GENEREAL

In this road construction project some of the results obtained from the software are listed below.

- Gantt chart
- Resource graph
- Reports

5.2 GANTT CHART

Gantt chart can be said as the graphical representation of the activities with duration which shows the inter

relationship between each other. It is very helpful in planning, scheduling and monitoring progress in a project. Detailed Gantt chart view represents the schedule that which is done in proper planning and co-ordination in between the activities. Mainly in this we could know the activities which are critical which can be taken care in the stage of execution. In this the highlighted red colour shows the activities which shows critical path and which should be taken extra care while execution so that it doesn't delay the project by providing the resources required so that it does not affect the project completion.

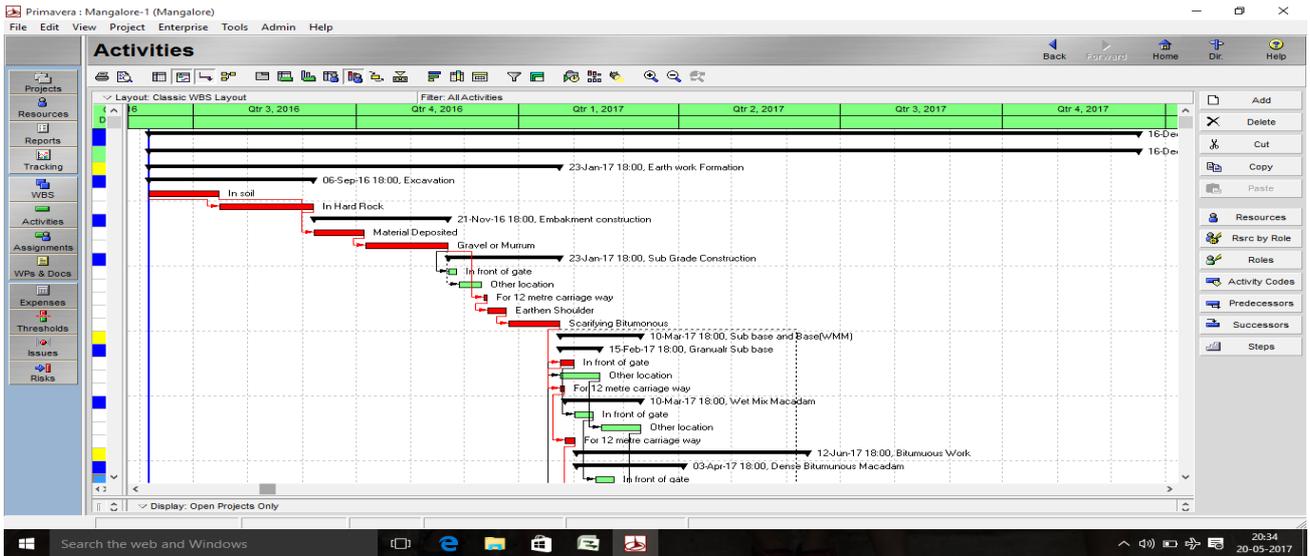


Fig 5.2 Gantt chart view of the current project in primavera

5.3 RESOURCE GRAPH

Resource graph represents the resource usage level can be known the peak and low demand of the resource for the activities can be known. The over allocated of resources can also be known after levelling the resource.

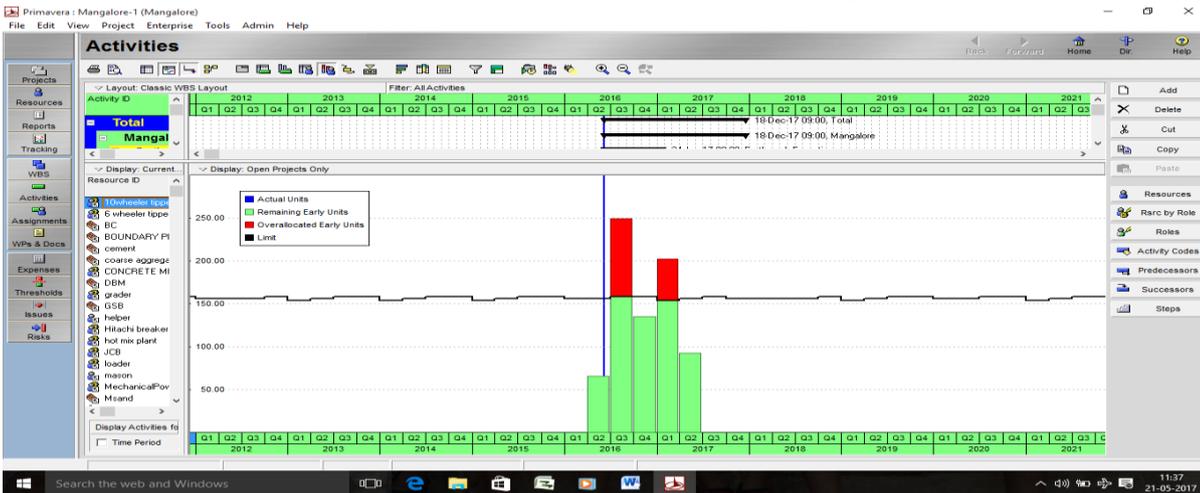


Fig 5.3 Resource bar graph view of the current project in primavera

5.4 REPORTS

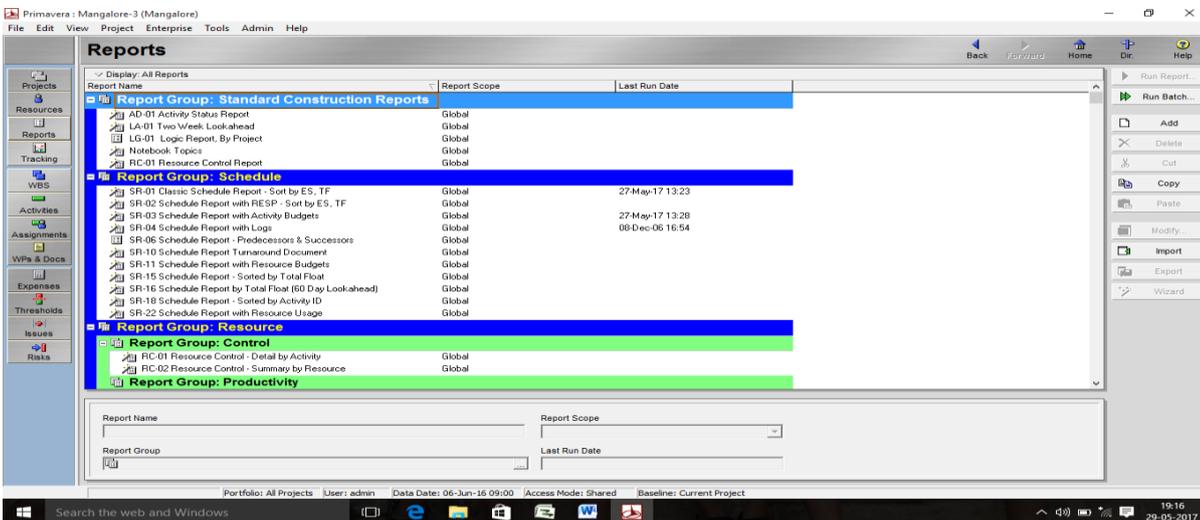


Fig 5.4 List of Reports Which Could Be Taken In Primavera

The purpose of report documentation of the project is to provide a monitoring guidance for the project manager and site engineers for easy execution. Each report in the software generated will have the overall view of the project with the requirements needed. Reports are grouped so that it helps to view and take the print of the required report document. By collecting all the reports it will be easy to maintain the documents of the project and helps for execution.

VI. CONCLUSION

In the present scenario there is an immensely increase in demand for the road construction projects due to the rate of development in India which is increasing day by day .in India as we have observed there are many underperforming projects which is effecting on time and cost.to overcome all the facts that are effecting the construction of project with poor performance there we should include proper planning and scheduling techniques to have a good and effective performance of the construction economically. So to include the best planning and scheduling techniques we can use Primavera P6 for the minimum duration construction of road construction. Primavera P6 gives a proper project management solution for the planning and scheduling team of the enterprise. Some of the points for the conclusion are following

- The calendar's will help for setting the targets to the contractor which plays a vital role in execution of project
- By activity sequencing and proper planned interrelationship between the activities the project duration can be managed without any delay.
- The Gantt charts will be a clear picture for the site engineers for the easy execution of activity and have a prepared for the upcoming activities.
- Line of balance is a graphical based representation whereas CPM is chart based representation which gives easy representation of critical activities
- CPM is very simplest and easiest method for scheduling
- The security levels in this software for the projects are very high.
- By allocating the resources as needed for the activity wastages of resources can be avoided.
- The resource graph which is obtained for the materials will help the contractor to manage the material requirements for the activities.

VII. FUTURE SCOPE

- Planning, scheduling and resource optimizations can be used for all construction work which helps for the economical and proper execution.
- The control over resource wastage and loss in budgets could be identified.

- By using Primavera software tracking, cost management and much other helpful management can be adopted.
- By using primavera multi projects could be handled in a centralized location by developing security passwords.
- This also helps in analysing the risks in the projects

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