Planning, scheduling, & allocation of resources for short-span bridge using Primavera P6

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Abstract. The paper states the advantages of web-based Primavera P6 for structural planning and scheduling Bridge building framing the problems and difficulties experienced in the construction schedule and resource availability. Only Bridge Design and Plannings taken for the project consideration. After the detail creation of Bill of Quantities of the proposed bridge. Here the Bridge consists of four spans only. Each Span is of 10.4 m length. Bridge is located at Yellareddy Tank Bund Portion, Nizamabad district (Hyderabad-Medak-Bodhan). The Resource Planning is the creation of Organization Breakdown Schedule (OBS) and Enterprise Project Structure (EPS) of the project and also to create Work Breakdown Schedule (WBS) and to insert the corresponding activities and schedule them on the basis of created calendar and need to level/smoothen the resources and make effective use of them. Organization Breakdown Schedule (OBS) and Enterprise Project Structure (EPS) of the project has been created Work Breakdown Schedule (WBS) and the corresponding activities are created and need to schedule their resources to activities on the basis of created calendar and need to level/smoothen the resources. Resource Scheduling involves the Scheduling of Project and Activity Network Diagram. Resource allocation enables you to allocate equipment, labor, and material expenditures to your timetable. The reports in Primavera P6 may be used to track resource allocation and potential over-allocation of labor resources.

1 Introduction

The Project Management module can be used independently to manage projects and resources. Project management is the practise of supervising the activities of a team in order to fulfil all project objectives within the defined constraints. Descriptions of this information are frequently included in project documentation created at the outset of the development process [1]. For enterprise-wide project management scalability, the Project Management

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module is a high-end, multi-project planning and control programme constructed on relational databases Oracle and Microsoft SQL Server. Budget, time, and scope constraints make up the three basic ones. The other issue is how to best distribute crucial inputs while using them to accomplish predetermined objectives [2].
The Project Management module allows your organization to centrally store and manage its projects. The module is compatible with WBS, OBS, field codes defined by user, Critical-Path Method (CPM) ,Scheduling are all examples of organizational breakdown structures. Management of a construction project requires overseeing and planning each phase of the undertaking from inception to conclusion. It is a thorough procedure with the aim of executing projects on schedule and within budget [3].
Primavera is enterprise project management software. Primavera offers functions like scheduling, analysis of risk, management of resource, and services of control, as well as interfaces with some business software such as Oracle and SAP's ERP systems. Primavera was created in 1983 year by Primavera Systems Incorporation, that was eventually purchased by Oracle Corporation [4].
Primavera is a software for project management that helps you to budget, prioritize, plan, oversee, and manage numerous projects; make the most of shared, limited resources; keep modifications under control; and continuously advance projects toward completion on time and under budget. It offers interfaces that may be customized, scalable and adaptable tools, and simple connection with project management tools like Microsoft Project and Primavera's Contract Manager Software. Microsoft Project and Primavera can share data in a straightforward manner 5].

2 Review of Literature

Simranjeet Singh and Sakshi Bhatia (2022) primary goal was to understand more about the functions of planning, scheduling, resource allocation, and project progress control. The first and most crucial thing we can say is the start and end dates of the project may be obtained through proper Primavera planning. The resource allocation for each activity can be seen, and resources may be modified and reallocated at any time. Each activity's numerous resources, whether material, machinery, or labour, can be allotted. Rasikh Riyaz et al. (2022) a survey discovered both Primavera and MS Projects are reputable project management tools that meet project objectives as well as organisational requirements. It is difficult to distinguish one tool from another tool since they employ different tactics and have diverse characteristics. In order to produce a high-quality CPM schedule, we should determine which software enables the specific project services to be fulfilled based on the project requirements [6]. Although each tool has a unique set of capabilities, they all attempt to deliver professional construction management services. Both MS Project and Primavera P6 were used to track the industrial project, and both software programmes assisted in the seamless tracking of construction work. Nidhi Raghuwanshi and Prof. M. C. Paliwal (2021) found that by allocating and overseeing each task in accordance with the project's running circumstances using the project management platform Primavera P6, time and money might be saved. In addition, additional water logging in excavation work caused by the environment (rain water) was examined, and the problem was rectified to avoid losing 5 days. Vishal Annappa Nimbal and Prof. Balasaheb Jamadar (2017) study's major purpose and mission were to learn about the function of project planning, scheduling, monitoring, and control in the timely completion of any construction project. This conclusion was reached with the use of literature references and unique approaches intertwined in Monitoring and Control using Primavera project management software [7]. The contractor anticipated the time of completion to perform the same job for 640 days, or roughly 21.5 months. However, the same project is scheduled to

be completed in 434 days with exact and timely planning, management, implementation, and monitoring of all activities using the Primavera application [8].

Rajani V.Akki et al. (2017) said that in today's economy, resource management is a crucial aspect of building project management. The cost and time aspects are entirely dependent on how the resources are employed successfully in the construction project. Due to the large-scale nature of building projects, project managers confront challenges such as resource allocation and resource planning. This programme will aid in the process of resource management. S. S. Deshmukh et al. (2016) This study presents a quantitative evaluation technique for project resource optimization in Primavera P6 software is utilised for resource levelling. The resource optimization and resource levelling problem is one of the most critical difficulties in project management. It is solved using Primavera P6 software and resource schedule optimization approaches. Time and cost should be controlled appropriately for resource optimization and resource levelling. T. Subramani and T.M.Karthick (2014) was undertaken to produce a project timeline and discover the optimal strategy to deploy all available resources. extensive research was done for the project about the usage of Microsoft Project and the scheduling, monitoring, and optimization of various construction tasks. The survey found that respondents believed the Critical Path Approach to be an efficient method of time management (CPM) [9-11].

3 Methodology

3.1 Procedure to begin the Primavera Project

This methodology provides a brief description of set of procedures employed in a certain field of this study or activity and also to choose the best among them for this project.

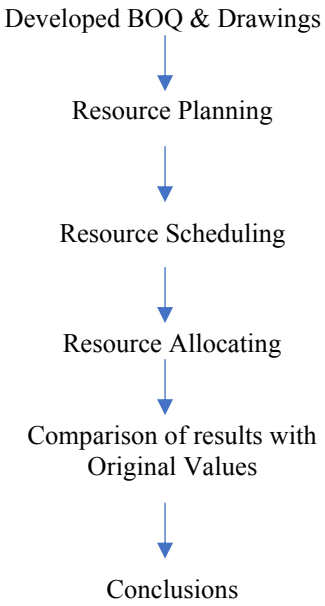


Fig. 1: Flow Chart for Resource Management

3.2 Details of the Project

Case study on Widening and Strengthening of Double Lane Road to Four Lane Road on Hyderabad-Medak-Bodhan from Km 117/9 to 119/0 (Yellareddy Tank Bund Portion) in Nizamabad District Including 117/9 & Construction of HLB at Km 118/8), is 47.835 kms. Including 184 nos. structure works in the state of Telangana.

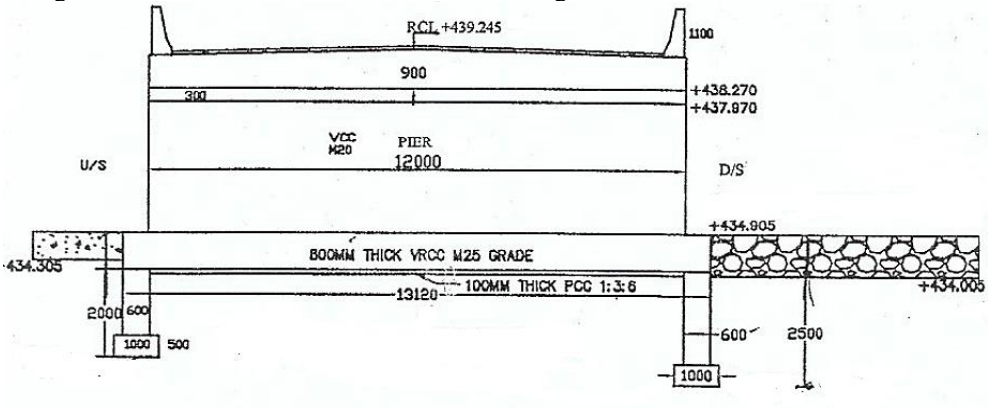


Fig. 2: Section of Bridge

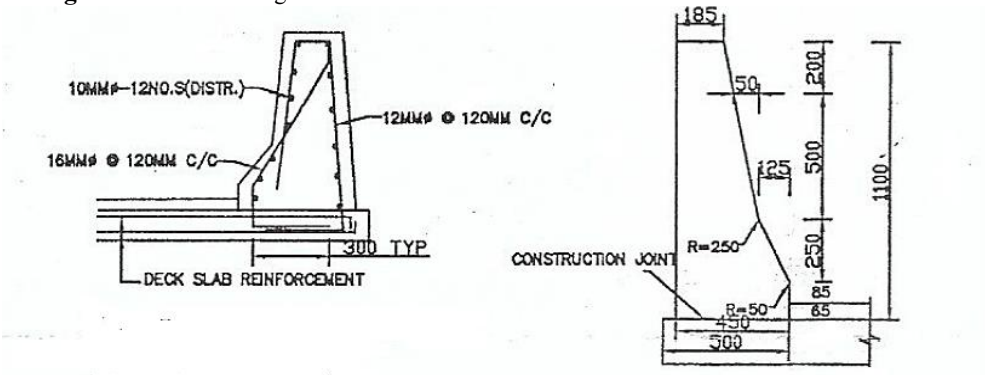


Fig. 3: Crash Barriers Details of Bridge

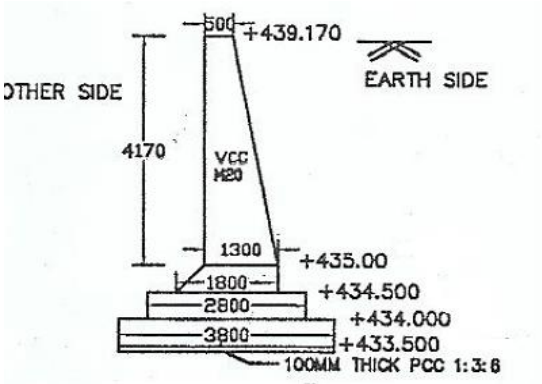


Fig. 4: Wing Wall of Bridge

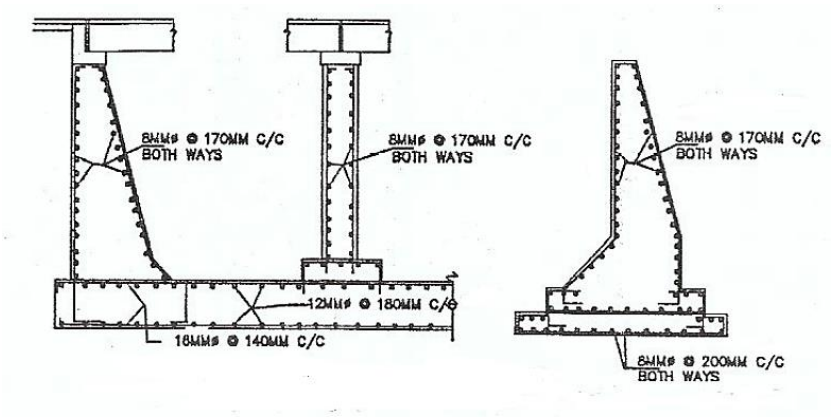


Fig. 5: Renforcement Details of Bridge

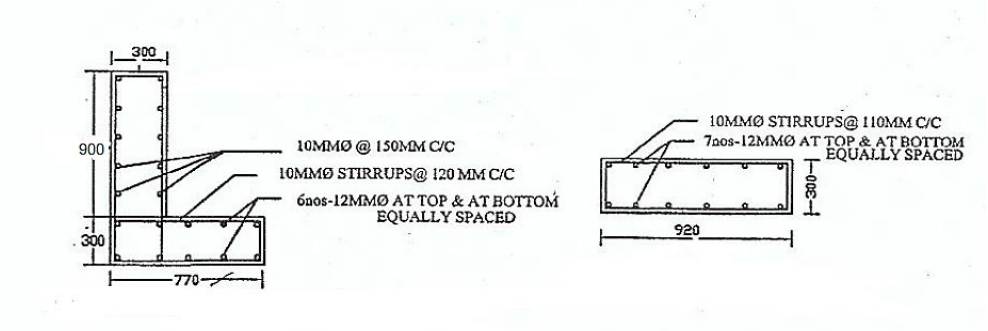


Fig. 6: Bed Blocks of Bridge

3.3 Resource Planning

It is a crucial and difficult task for both managing and completing projects. The selection of a technology, the determination of an effort-intensive activity, and the estimates the time and resources needed for each activity, and it shows the relationships between the various job activities. A plan serves as the foundation for adjusting the timetable, and creating a construction plan is a difficult undertaking in construction management. A planner must first maintain an objective that must be accomplished.

The duration of each activity is given top priority in this project, which means that all construction-related events must adhere to strict time constraints. Based on the productivity of the available resources, the necessary resources (labour and non-labour) are estimated and allocated to specific activities. Resource planning is a sophisticated process that identifies current and prospective resources as well as their requirements. It entails surveying, mapping, and qualitative and quantitative resource estimation.

It is critical to arrange your resources for the following reasons: It assists in recognising the various resources accessible in various sections of the country. It helps to preserve some non-renewable/extinct resources. It helps to reduce resource waste.

3.3.1 Work Breakdown Structure for the Project

The word Work Breakdown Structure is abbreviated as WBS. WBS is a project deconstruction that is visual, hierarchical, and focused on deliverables. It is a helpful diagram

for project managers because it enables them to envision all of the actions required to carry out their projects and deconstruct the scope of their projects. It is practise of gathering various. The project aspects are concerned with a specific product and it organises or impinges on the broader goal of the project.

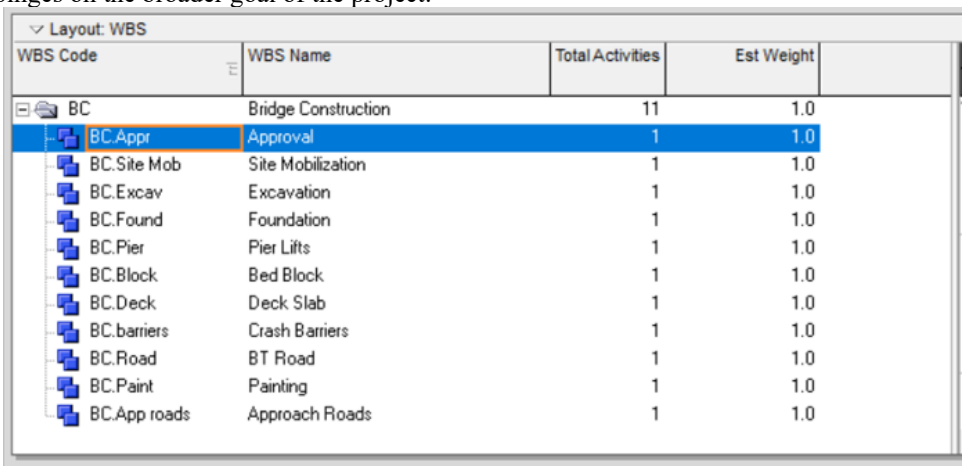


Fig. 7: WBS layout of the Project

3.3.2 *Process of creating a Project Calendar*

Project calendars are a minor component of project schedules. The project calendars show the progress of when utilised effectively, days can include holidays, non-working days, exceptions, suspensions, and any other days pertinent to that project. Calendars allow you to specify available workdays and work hours on a given day. It helps to choose public holidays, acknowledged holidays, RDOs for your firm, and project-specific work/non-workdays. You may create an infinite number of calendars to accommodate diverse work schedules.

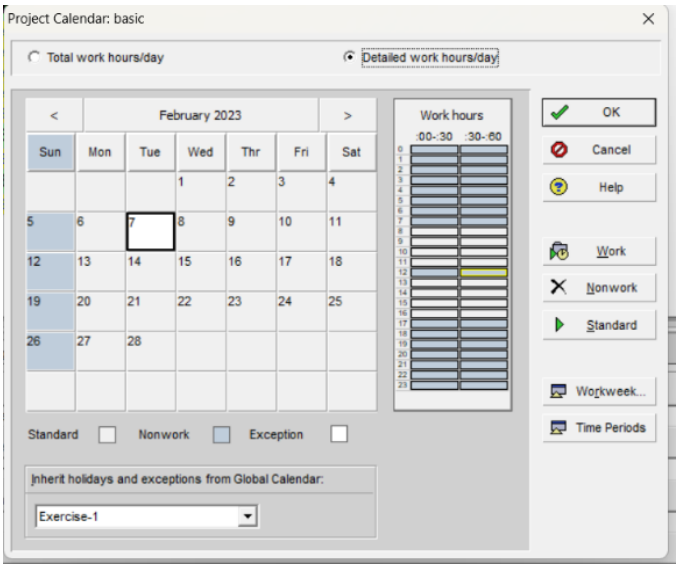


Fig. 8: Calendar of the Project

3.3.3 Project Activities

An activity is a component of every project and its schedule; the total number of such diverse activities creates a whole project or its schedule. The job or event that helps the project be completed might be referred to as the activity. Every unique activity contains details regarding its length, start date, completion date, and one or more logical linkages or ties.

Activities are the fundamental components of a project's work. A task, item, or event is another name for an action. Typically, activities have projected resources, expenditures, and durations. Milestone activities, on the other hand, have no time or expense. Activities may often be broken down into a series of logical steps.

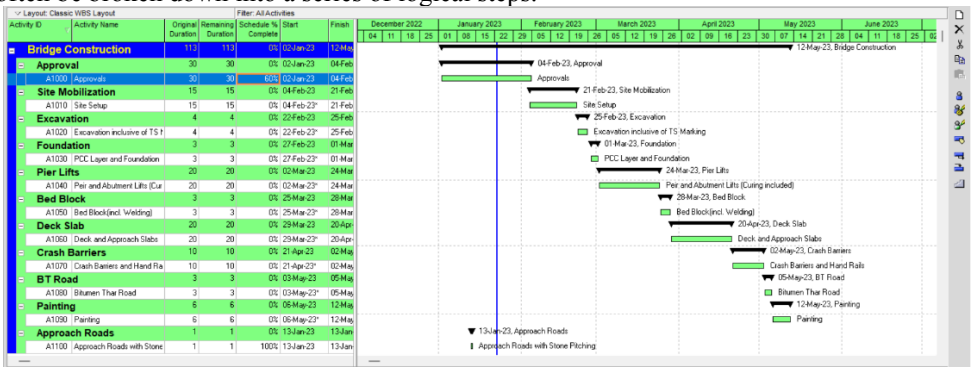


Fig. 9: Activities of the Project

3.3.4 Network Diagram of the Project

A network diagram illustrates the job logic and fundamental activity succession of a project plan in detail. Due to the simplicity of it is utilised in most scheduling software, in part because it includes the four main activity linkages. These Network diagrams offer a potent visual representation of the position, status, and link between multiple project tasks. These are the fundamental tools for project planners and observers to communicate with one another.

A network diagram makes it possible for a project manager to monitor each project's component and inform others about its condition. Other benefits include: Stakeholders are given a visual representation of progress. workflows for projects. Network diagrams have a number of benefits, such as project tracking help, Project activities are carried out in a sequential manner to provide better planning and scheduling.

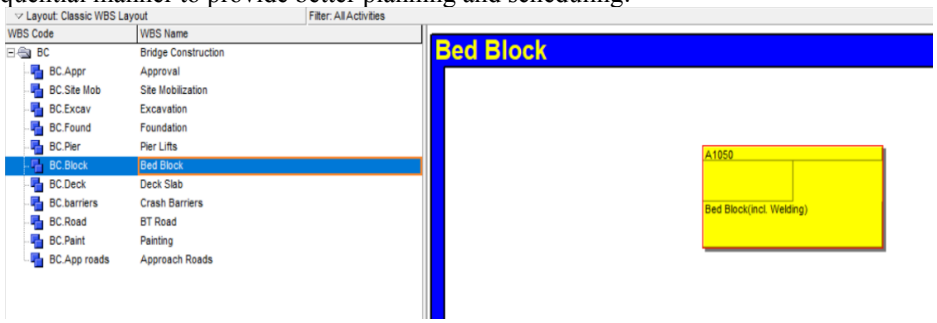


Fig. 10: Network Diagram of the Project

3.4 Resource Scheduling

Along with specified sequencing and scheduling, a construction schedule also specifies means and procedures for a project. It is the organisation of the project's operations in a timetable with start and completion dates allocated to each activity. The relationships between these events must be shown via logic and common sense, with an appropriate lag of length if necessary. It shows the timing and sequence of various bridge tasks. Scheduling is also properly described as a detailed time-based map of all project job assignments.

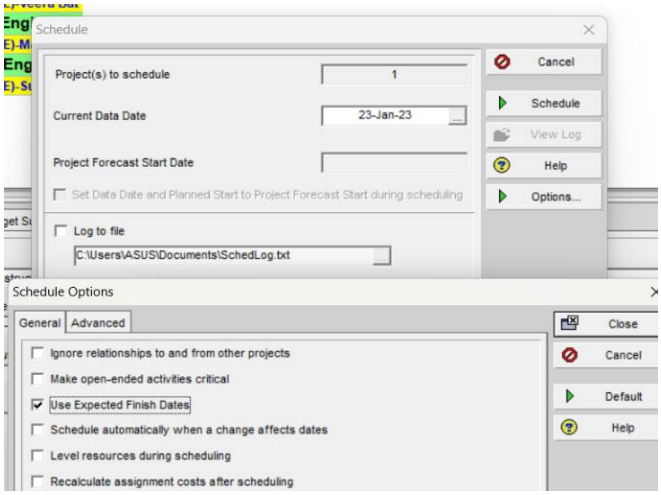
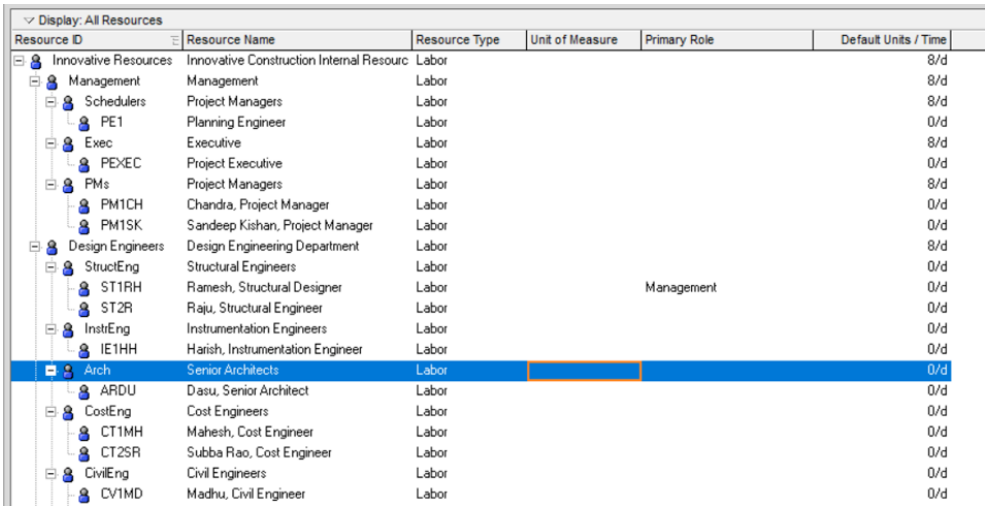


Fig. 11: Scheduling of the Project

3.5 Resource Allocation

Resources are the people, tools, and supplies required to do the task. Although not all activities require resources, the majority of them do require a variety of resources. For instance, the action of healing seldom uses any resources. Successful construction projects depend on the efficient use of resources, which might include people, supplies, and equipment



Display: All Resources

Resource ID	Resource Name	Resource Type	Unit of Measure	Primary Role	Default Units / Time
Innovative Resources	Innovative Construction Internal Resourc	Labor			8/d
Management	Management	Labor			8/d
Schedulers	Project Managers	Labor			8/d
PE1	Planning Engineer	Labor			0/d
Exec	Executive	Labor			8/d
PEXEC	Project Executive	Labor			0/d
PMs	Project Managers	Labor			8/d
PM1CH	Chandra, Project Manager	Labor			0/d
PM1SK	Sandeep Kishan, Project Manager	Labor			0/d
Design Engineers	Design Engineering Department	Labor			8/d
StructEng	Structural Engineers	Labor			0/d
ST1RH	Ramesh, Structural Designer	Labor		Management	0/d
ST2R	Raju, Structural Engineer	Labor			0/d
InstrEng	Instrumentation Engineers	Labor			0/d
IE1HH	Harish, Instrumentation Engineer	Labor			0/d
Arch	Senior Architects	Labor			0/d
ARDU	Dasu, Senior Architect	Labor			0/d
CostEng	Cost Engineers	Labor			0/d
CT1MH	Mahesh, Cost Engineer	Labor			0/d
CT2SR	Subba Rao, Cost Engineer	Labor			0/d
CivilEng	Civil Engineers	Labor			0/d
CV1MD	Madhu, Civil Engineer	Labor			0/d

Fig. 12: Activities Resource Allocation of the Project

4 Results

A summary of the current study's findings leads to the following conclusions:
1) The project is scheduled to be completed on June 3, 2023.
2) The project's progress and expected total time must be reported and updated.
3) This project involves a total of 55 actions from project inception to project completion with various milestones.
4) Planned float at the start or completion of various operations has been observed to ensure that the activity operates smoothly without exceeding the budget and resources.
5) If the start date and completion date threshold variances are appropriately monitored, variation concerns with respect to the project's start date or finish date cannot be reported.

5 Conclusions

It can be concluded that:
The study's major purpose and mission were to learn about the function of project planning, scheduling, monitoring, and control in the timely completion of any construction project. This conclusion was reached with the use of literature references and unique approaches intertwined in Monitoring and Control using Primavera project management software. In this thesis, the study served as a cicerone in analyzing the Yellareddy Tank Bund Portion Bridge construction, assisting in identifying the many difficulties that arose during or prior to the execution process. The current case study's production findings defy the importance of effective planning, scheduling, monitoring, and controlling.
For the same task, the contractor estimated it would take 120 days to complete it, or about 4 months. With precise and timely planning, management, execution, and monitoring of all operations using the Primavera P6, the same project is still expected to be finished in 104 days. The project manager in charge should be well informed of the schedule's timetable, including the activities that must begin or end on time.
It is feasible to draw conclusions as a consequence of this study:
1) The scheduled schedule activities for the present project are fruitful.
2) The execution of massive surveillance procedures might be closely monitored.

3) A methodical priority has been assigned to the different tasks of timetable fulfilment.
4) The utilization of diverse resources throughout the project's duration would be optimal.
5) The software Primavera P6 proven to be an excellent and effective tool for monitoring and coordinating diverse building projects. The unique layout will significantly save the time required for upgrading efforts.

References

1. Satinder Chopra, Arvind Dewangan, International Journal of Innovative Research in Science, Engineeringand Technology(An ISO 3297: 2007 Certified Organization) **Vol. 3**, Issue 7, (2014)
2. V.dhanalakshmi, International conference onengineering innovations and solutions(ICEIS – 2016)
3. J. Srinivas Rao, Suresh Kumar Tummala, Narasimha Raju Kuthuri, Indonesian Journal of Electrical Engineering and Computer Science, 21(2), pp: 723-734, (2020)
4. P. Esakki Thangam, R. Magdalene Benila, IJSTE – International Journal of Science Technology & Engineering | **Volume 2 | Issue 11** | (2016)
5. Tummala, S.K., Kosaraju, S. & Bobba, P.B. Applied Nanoscience 12, 1537–1543 (2022).
6. Unmesh. Y. Polekar, Rohit. R. Salgude, International Journal of Advance Research in Computer Science and Management Studies, **Volume 3, Issue 5**, (2015)
7. T. Subramani, A. Sarkunam, J. Jayalakshmi, Int. Journal of Engineering Research and Applications www.ijera.com ISSN : 2248-9622, **Vol. 4, Issue 6** (Version 5), June 2014, pp.134-144 (2014)
8. Davu, S.R., Tejavathu, R. & Tummala, S.K. EDAX analysis of poly crystalline solar cell with silicon nitride coating. Int J Interact Des Manuf (2022).
9. Srinivasa Reddy, V., Seshagiri Rao, M.V., Shrihari, S., International Journal of Engineering and Advanced Technology, **8(6),** pp. 1661–1665 (2019)
10. Srinivasa Reddy, V., Seshagiri Rao, M.V., Shrihari, S., International Journal of Recent Technology and Engineering, **8(2)**, pp. 2125–2130 (2019)
11. Tummala, S.K., Indira Priyadarshini, T., Indian Journal of Engineering and Materials Sciences, 2022, 29(6), pp. 794–798.
12. Kumar, K.S.J., Seshagiri Rao, M.V., Reddy, V.S., Shrihari, S.. E3S Web of Conferences, **184**, 01076 (2020)
13. Srinivasa Reddy, V., Krishna, K.V., Rao, M.V.S., Shrihari,. E3S Web of Conferences, **309**, 01058 (2021)
14. Reddy, V.M., Hamsalekha, S., Reddy, V.S.. AIP Conference Proceedings, **2358**, 080018 (2021)
15. Suresh Kumar Tummala, Phaneendra Babu Bobba & Kosaraju Satyanarayana (2022) SEM & EDAX analysis of super capacitor, Advances in Materials and Processing Technologies, 8:sup4, 2398-2409,
16. Reddy, V.S., Satya Sai Trimurty Naidu, K., Seshagiri Rao, M.V., Shrihari, S..E3S Web of Conferences, **184,** 01082 (2020)