# STUDY ON CRITICAL PATH METHODOF ANALYSIS &SCHEDULINGFORRESIDENTIAL BUILDING BY USING PRIMAVERA SOFTWARE

GUIDE:DR.K.VENKATALAKSHMI

SD.WALEED MUHAMMAD, CH.SRAVAN KUMAR, G.GEMINI KUMAR, D.PRAVEEN KUMAR M.THRINADH, U.ANJANEYULU

CIVILENGINEERING
NARAYANAENGINEERINGCOLLEGENELLORE,INDIA

***Abstract:****In every projecttime andcostare controlling factors.If wecancontrolthetimethenwecan optimize thecost of project. To control time requiredfor the project in a particular activity, we needto usecriticalpathmethod(CPM).Sothatwecanknowaboutactivityisdelayedornot.Ifitisdelayed,we needmoreresourcethanrequired.Inthis projectweareusingPRIMAVERAP6tofindthecriticalpath ofeachandeveryactivity.So,torectifythisweneed to takecareofthetimefactor,sowe proposedthis project.Inthisprojectwewillwritedowntheeachandeverytaskdurationtoknowaboutthecriticalpath method (CPM). We are visually representing activity sequences of a project in the form of network diagrams, in this process we are using deterministic approach. To find the critical path we need to analyse theschedulingandweneedtofollowsomesteps.Thisprocesswilldependsupondifferenttypesoffloats required to to calculate the critical path and also we need check for slack of an activity. critical path methodisassociated withactivity oriented.Itis usedfor repetitive projects (based on past experience). We are analysingandscheduling forresidential building by PRIMAVERA P6 software*

*IndexTerms–CPM,Primaverasoftware,time.*

## I. Introduction

**GENERAL:**

• The construction of buildings is expanding daily. Therefore, project control is becoming increasingly necessary for today's building projects.

• Nowadays many construction projects encounter events and that affect the original plan of executing a project. This delay in project completion happens due to various reasons such as shortage of labour, materials and also hikes in prices of the equipment’s. To overcome these types of errors we need to focus on project planning estimation and controlling techniques.

• Effective construction project planning, estimating, and scheduling has the following advantages: decreased construction time and cost overruns.

• Planningistheprocessofidentifyingeverytaskrequiredtocompletetheprojectsuccessfully andfocusesonthenextcourseofaction.

• An estimate is a calculation of the quantities needed and the expected costs associated with building a project.

• The process of assigning realistic durations to each activity, figuring out the start and finishdates of each activity, and figuring out the sequential order of the planned activities is called scheduling.

• Scheduleoutlinestheprojectworkprogram;itisatimetableofwork.

**PRIMAVERASOFTWARE:**

• The project, program, and portfolio management application Oracle Primavera P6 is used to organize, oversee, and carry out your project activity

**PLANNINGANDSCHEDULING:**

• The discipline of project planning deals with how to finish a project on schedule, typically with specified phases and allocated resources.

• Project schedulingis the process oforganizing and documenting the different tasks,deliverables and milestones that are part of a project.

• Itusuallyinvolvessettingstartandenddatesforeachactivity,determininghowlongeach activity will take to complete

**CRITICALPATHMETHOD:**

• In CPM, there is such a thing as a critical path. The definition of a critical path is an activity with a large amount of time and shows the shortest duration of completion time.

• This path is an important part of project scheduling because if implementation on the critical path is late, it will cause delays in other activities.

• CPM is a deterministic approach of network technique where duration of each activity involved in completion of project is known with

**FEATURESCOPEOFPRIMAVERA:**

• Primavera's future would be determined by Oracle's strategic approach to the product, market conditions, technology developments, and rivalry within the project management software industry.

• Project expenses grow when your schedule has inconsistencies, overrun issues, or errors, and to

compensate for the excess costs you have to remove more important parts of the project.Primavera in the course of managing, completing, and planning a project helps in identifying and mitigating risks.

• Organizationcankeepcontrolovermultipleprojectsorprogramswiththehelpof Primavera.

• Project Managers can copy information from the Oracledatabaseinseconds when anew project closely mirrors a previous project.

**ADVANTAGESOFPLANNINGANDSCHEDULING:**

• GoalsBecomeMoreAchievable.It'seasytosaythatyouwantyourrevenuetodouble.

• ItKeepsYourCostsDown.Planningandschedulingallowyoutostickwithinabudget.

• TheywillPrepareforUnexpectedProblems.

• Progresswillbeeasiertotrack.

**STEPSINCPMPROJECTPLANNING:**

• Specifytheindividualactivities.

• Determinethesequenceofthoseactivities.

• Drawanetworkdiagram.

• Estimatethecompletiontimeforeachactivity.

• Identifythecriticalpath.

• UpdatetheCPMdiagramastheprojectprogresses

## II. METHODOLOGY

**PLANNING:**

Planning of a project means that the taking consideration of aim of the project that the which the owners get accomplished by that in civil field we generally plan for the buildings, structures, bridges, roads,etc for all these we will use the planning .so currently we are working for a residential building to accomplish the early handover and making it economically considerate .so for the planning of the residential building we will consider the clients requirements and make it possible .so in few words planning is like the start and end of the project .

**DEFINEACTIVITIESOFPROJECT:**

Definingactivitiesmeansactivitiesdoneduringtheprocess ofachievingcompletionoftheproject

.so for the following task we are preparing for the residential building so generally we know the activities involved in the construction of the residential building so if you don't know let me tell youthe activities involved inthe processof theconstruction of the projectare given below

1.SitePreparation:Thefirststepistoclearthelandofanyobstaclesliketreesorrocks,gradethe siteforproperdrainage,andbringinutilitieslikewaterandelectricity.

2. Foundation Construction: Excavation is done to make space for the foundation, which is then built using materials like concrete or treated lumber for stability.

3. FrameworkConstruction:Walls,floors,androofstructuresareassembledaccordingto architectural plans usingmaterials like wood, steel, or engineered wood products.

**IDENTIFICATIONOFDEPENDENCIES:**

1. TaskDependencies:DirectDependencies:Thesearethedependenciesthatapparentlystated in the project plan or management software. For example, Task B cannot start until Task A is complete. Indirect Dependencies: Sometimes, dependencies are not immediately obvious. For instance, Task C might depend on Task B, which in turn depends on Task A. Identifying these indirect dependencies ensures thorough planning.

2. Types of Dependencies: Finish to Start (FS): This is the most common type of dependency where Task B cannot start until Task A isfinished. For example, you can't paint a wall until it has been plastered. Start to start (SS): Task B depends on Task A to start. For instance, setting up equipment can start at the same time as preparing the workspace. Finish to Finish (FF): Task B depends on Task A to finish. An example could be two teams waiting to merge their work until both have completed their respective tasks. StarttoFinish (SF): Task B depends on Task A to start. Thisistheleastcommontypeandmightbeseeninscenarioslikewaitingforatrainingsession to begin before ending a previous task.

3. Project Constraints: Resource Availability: Some tasks may depend on the availability of specific resources, such as equipment, personnel, or materials. Identifying these dependencies helps with resource allocation. Technology Dependencies:If a task relies on specific technologyor tools, any delay or issue with those tools can impact the tasks that depend on it. External Dependencies: Projects often rely on factors outside of the team's control, such as regulatory approvals, client feedback, or supplier deliveries. Understanding these dependencies helps in managing expectations and mitigating risks.

**SEQUENCINGOFACTIVITIES:**

a). Evaluate and Modify: After initially setting up the sequence of activities in Primavera, it's crucial to carefully evaluate the relationships and dependencies between tasks. This evaluation

guarantees that the sequencingaccurately representsthe logical progressionofworkinthe project. It's important to pay special attention to the order of critical path activities, as any errors here can have a significant impact on the project timeline. Project managers and schedulers should work closely together during the evaluation process to spot any inconsistencies or missingdependencies. Once identified, changes can be made in Primavera to finetune the sequencing and

ensureitmeetstheproject'sneedsandlimitations.

b). Confirm Order: Confirmingtheorderofactivitiesisakeystepinmaintaining theintegrity and reliability of the schedule. Primavera includes a schedule logic checker that automatically reviews the sequencing of activities forany inconsistencies, conflicts,or errors. Runningthis logic check helps to pinpoint any issues that could compromise the accuracy of the schedule. Common problems detected by the logic checker include circular dependencies, missing relationships, or conflicting constraints on activities. Project teams should carefully examine the results of the logic check and promptly address any identified issues. By resolving discrepancies early on, they can avoid potential delays or disruptions during project implementation and ensure that the schedule serves as a dependable tool for project management

**DOVELOPSCHEDULEINPRIMAVERA:**

So developing schedule in Primavera is a process which is done by Scheduling work using Primavera p6 by taking consideration of time cost and management. So I want to tell you in a procedure steps so you can easily understand

**1. SettinguptheProject:**

To start a new project in Primavera P6, open the software and create a new project file. Enter important project details like the project name, start date, end date, and other relevant information such as the project manager, client details, and project location.

2. DevelopingtheWorkBreakdownStructure(WBS):

The WBS breaks down the project scope into smaller, more manageable components. Begin by identifying the major phases or stages of the project, like Design, Construction, and Commissioning. Further break down each phase into sub phases or deliverables, such as Site Preparation, Foundation, Structural Work, MEP Installation, Interior Finishing, and Exterior Finishing. Use Primavera WBS feature to create these hierarchical levels and organize activities under each WBS element.

3. DefiningActivities:

Activities represent the specific tasks or actions needed to complete each element of the WBS. Define activities by giving them a name, duration, resource requirements, and any constraints or

dependencies. Activities should be specific, measurable, achievable, relevant, and time bound (SMART). For example, an activity could be “Excavation for Foundation,” with a duration of 10 days and requiring labor and equipment resources.

**ANALYSIS:**

1. When analyzing activities in Primavera, a powerful project management software, there are several key aspects to consider for successful project planning and execution. Initially, it involves carefully examining activity durations, where project managers estimate the time needed for each task's completion. This sets the foundation for creating realistic timelines and milestones duringthe project lifecycle. Understanding the dependencies between activities is also crucial.

2. Primavera enables users to establish different relationships between tasks, like finish-to-start, start-to-start, finish-to-finish, and start-to-finish. By mapping out these dependencies thoroughly, project managers can understand how different project components interact, allowing them to sequence tasks logically and efficiently. Identifying the critical path is another essential part of Primavera's analysis capabilities.

3. The critical path is the longest sequence of tasks that determine the project's overall duration. Tasks on this path have zero float or slack, meaning any delays will impact the project's timeline directly. By focusing on critical path activities, project managers can prioritize efforts to ensure timely project delivery. Resource allocation is also critical in Primavera analysis.

**REDUCINGFLOATDURATIONS:**

Reducing float durations in Primavera requires a detailed approach that involves analyzing different aspects of the project schedule to find opportunities for optimization. The key to this process is examining task dependencies. Tasks are often connected, and their order is determined by these dependencies. By reviewing these dependencies, project managers can identify unnecessary constraints or excessive lag time between tasks that contribute to longer float durations. Another important step is conducting critical path analysis. The critical path is the sequence of tasks that determines the shortest possible duration for the project. Tasks on thecritical path have zero float, meaning any delay in these tasks will directly impact the overall project timeline. By focusing on optimizing tasks on the critical path, project managers can minimize float durations and ensure efficient project execution.

**MONITORINGANDCONTROL:**

It is crucial to closely monitor and review the changes in the total float of project activitiesbetween

updates.Someactivities may have extrafloat that can beused by theproject management team to focus on other tasks and reduce the overall resources needed for thoseactivities.Significant changes in the float could indicate problems in the project, which should be brought to the attention of management to determine the best course of action, as mentionedearlier.

On the other hand, there arespecific situations like “Project Pacing” that require utilizing the float and following certain contractual procedures.

Total float is a valuable asset in a construction project, almost like a gold mine. Most project management experts view total float as an asset that belongs to the project as a whole, rather than justoneparty.

**DISCUSSION:**

The Critical Path Method (CPM) in Primavera is an essential tool for managing projects,especially those that are complex and have many interconnected activities. With Primavera'sCPM, project managers can carefully plan and carry out projects by identifying critical tasks and their order. By examining the relationships between tasks and their durations, Primavera helps determine the critical path, which shows the longest sequence of activities needed for project completion. This critical path assists project managers in efficiently allocating resources, optimizing schedules, and reducing risks. Additionally, Primavera's CPM supports betterdecision-making by offering insights into potential delays and their consequences, allowing proactive steps to ensure project success.

The Critical Path Method (CPM) Is a widely used technique in project management to plan and schedule projects. In Primavera, a popular project management software, CPM is a crucial tool to ensure projects are completed within the designated time frame and budget. The Critical Path Method (CPM) in Primavera is a fundamental tool for project management. It provides astructured approach to scheduling and resource allocation, with the main goal of identifying the critical path. This critical path consists of the longest sequence of dependent tasks that determine the project's duration. By identifying these critical activities, project managers can prioritize their efforts and allocate resources effectively to meet deadlines. CPM also helps teams streamline processes, optimize resource utilization, and stay within budget throughout the project's lifecycle. Furthermore, CPM in Primavera empowers project teams to anticipate potential bottlenecks and risks, enabling them to proactively implement mitigation strategies. By focusing on critical activities, managers can make informed decisions to keep the project on track and quickly address any deviations from the schedule. Ultimately, CPM enhances project visibility, promotes collaborationamongteam members, and facilitates effective communication with allstakeholders.

In summary, CPMin Primavera serves as a comprehensive framework for achieving project success through efficient scheduling, resource management, and risk mitigation.

## III. RESULT

Using the Critical Path Method (CPM) in constructing a residential building has been incredibly helpful in carefully planning and executing the project. By using CPM, we have gained athorough understanding of the sequence of critical activities needed to finish on time. Through careful analysis and task sequencing, we have identified important milestones and dependencies crucial to the project's success. Our main focus is on the critical path, which highlights activities like backfilling that have a significant impact on the overall projectduration. This strategic focus allows us to allocate resources wisely, ensuring efficiency and smooth operations throughoutthe construction process.Additionally,bycloselymonitoringthecriticalpath,we can quickly identify any potential bottlenecks or delays, giving us the ability to take proactive measures to mitigate risks and stay on schedule. CPM serves as our guiding framework, helping us navigate the complexities of construction projects with precision and confidence. ByfollowingtheinsightsprovidedbyCPM,wearepreparedtotacklechallenges,adaptto changing circumstances, and ultimately deliver the residential building project successfully and on time, meeting or even exceeding stakeholders' expectations.

In the construction of residential buildings, it is crucial to identify critical activities and take necessary measures to address them. This helps improve the accuracy of the project. By carefully analyzingtheprocess,wecanidentifykeytasksthatmaycausedelaysandtakeproactivesteps to mitigate risks and keep the project on track. This approach not only ensures a smoother workflow but also allows us to allocate resources efficiently for maximum productivity.

The integration of network diagrams and Primavera software has revolutionized project management. It provides a visual representation of task dependencies and critical paths, giving project managers a better understanding of the project's dynamics. This enables better planningand decision-making. By utilizing the advanced features of Primavera, such as schedule optimization and resource leveling, project accuracy is further enhanced, leading to more accurate forecasting and execution.

Moreover, the use of network diagrams improves communication among project stakeholders, creating a collaborative environment that promotes success. With this comprehensive approach, project managers are empowered to confidently navigate challenges, adapt to changing

circumstances, and ensure the timely and successful completion of residential building projects. Hereare the references to authors andtheir worksmentioned inthe literature review section:

## IV. REFERENCES

1. PawelZielinski(2000)-"Criticalpathanalysisinthenetworkwithfuzzyactivitytimes"

2. Heru Nur Yaqin, Hanie Teki Tjendani, Budi Witjaksana (2015) - "Analysis of the acceleration of time and cost of implementing building construction projects using the critical path method (cpm) method"

3. Nándor Vincze, Zsolt Ercsey, Tamás Kovács, József Tick, Zoltán Kovács (2016) - "Process Network Solution of Extended CPM Problems with Alternatives"

4. Ming lu, Heng Li (August 2003) - "Resource-Activity Critical-Path Method for Construction Planning"

5. Orumie Ukamaka Cynthia (February 2020) - "Implementation of Project Evaluation and Review Technique (PERT) and Critical Path Method (CPM): AComparative Study"

6. Wallace Agyei (August 2015) - "Project Planning And Scheduling Using PERT And CPM Techniques With Linear Programming: Case Study"

7. Vipin jain, puneet sethi, sathyendra Arya, chanchal chawla (December 2020) - "Project Evaluation using Critical Path Method & Project Evaluation Review Technique"

8. Ahmad Aliyu Maidamisa (December 2017) - "Comparative Analysis of Activity Duration in Project Management"

9. Engr. Muhammad Tayyib, Engr. Ghufran Ullah, Engr. Mohib Ur Rahman, Engr. NayabKaleem and Engr. Faisal Zaman (July 2019) - "Construction Project Scheduling With The HelpOf Primavera P6"

10. Win G Li, David J Carter (February 2005) - "Construction baseline schedule review and submittal timeframe"