

Planning and Scheduling of Five Storied Apartment Using Primavera

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Abstract: Construction project management and scheduling are essential processes for the successful completion of a building project. Construction planning and Scheduling are key aspects in integrating all construction activities and phases needed to complete a given construction project at a given budget and time frame. Construction project management Involves planning, budgeting, coordinating, and supervising the project from start to finish. Construction Planning involves choosing policies, procedures, and processes to achieve project goals, while scheduling adapts those plans into a calendar. Construction scheduling Involves creating a detailed timeline for the project that outlines when tasks will be completed, and how resources and workers will be allocated. In the current project study, we implement the computer-based Project Management software tool Primavera P6 for the Planning and Scheduling for a five Storied residential apartment “JENO USHA APARTMENT” at Plot no. 37 & 38, Lakshmi Nagar, Puducherry.

Keywords: Construction Project management, Network Analysis, Work break down structure, Activities, Duration, Calendar Relationship, Critical path and Scheduling

1.Introduction

- Construction project management (CPM) is the process of managing a construction project from start to finish, ensuring it's delivered on time, within budget, and to the owner's satisfaction:

Planning: The project is planned and organized, with goals and plans specified

Execution: The project is executed, with tasks distributed and work mapped out

Monitoring:

- The project is monitored, with quality control and site inspections conducted

Closing: The project is closed out, with deliverables evaluated

Managing the project's schedule, cost, quality, safety, scope, and function.

About Primavera P6

Primavera P6 is a project portfolio management tool that helps users plan, manage, and execute projects.

Primavera P6 can be used for projects of any size, and in many different industries, including construction, government, healthcare, and manufacturing. It can be installed on a computer or accessed as an application online.

Objective

The purpose of project scheduling is to ensure that a project is completed on time and within budget.

A project schedule is a detailed plan that outlines the tasks, their duration, and the resources required to complete them.

It provides a roadmap for the project team to coordinate their efforts and make informed decisions.

Scope of the study:

The Scope of the study is as listed below:

In the study is limited to network analysis

A five storied residential apartment “JENO USHA APARTMENT” at Plot no.37 & 38, Lakshmi Nagar, Puducherry

The software used is Primavera P6

Research methods:

Construction planning and scheduling.

Construction project management practice

- The overall aim of the management in an enterprise is to create within the enterprise, an environment, which will facilitate the accomplishment of its objectives. In doing this, management has to perform certain functions.
- Project management is the art and science of converting the client's vision into reality working efficiently, effectively and safely. The British Standard BS 6079:2000, defines project management as the planning, monitoring and controlling of all aspects of a project and the motivation of all those involved in it to achieve the projective objectives on time and to the specified cost, quality and performance. Project management, according to ISO 10006: 1997(E), includes the planning, organizing, monitoring and controlling of all aspects of the project in a continuous process to achieve its objectives.

- The Planning, Scheduling and controlling methodology employed for managing scope, time, resources, costs and risks is loosely called Project Management Techniques.

Project network analysis:

- The term project networks analysis is a generic term covering all the network techniques used for planning, scheduling and controlling of projects. The three such commonly used techniques are:

Critical Path Method (CPM)

Program Evaluation and Review Technique (PERT) and

Precedence Diagramming Method (PDM) also called as Precedence Network Analysis (PNA).

Network critical path:

- The path of critical activities (including dummy activities) which links the start and end events is called critical path. In other words, it is the path of activities having zero float and events having zero slack. The sum of the duration of the critical activities along a critical path gives the duration of the project.

The various stages involved in the computation of critical path are;

1. Determining earliest event time (EET).

It is the earliest time an event can take place, assuming that all the events prior to it also occur at their earliest time.

2. Calculation latest event times (LET)

It is the latest time by which an event can occur, if the project is to be completed within the specified time.

3. Isolating critical events:

The slack of an event is equal to the difference between its LET and EET. The events having zero slack are termed critical events.

4. Identifying critical activities:

The critical activities are always joined by critical events, but an activity joining two critical events may not necessarily be a critical activity.

exception', thereby focusing its attention on the critical activities.

Project case study

Type of building

In the current project study, we implement the computer-based Project Management software tool Primavera P6 for the Planning and Scheduling for a five Storied residential apartment "JENO USHA APARTMENT" at Plot no.37 &

38, Lakshmi Nagar, Puducherry.

The Proposed apartment is a five storied residential apartment.

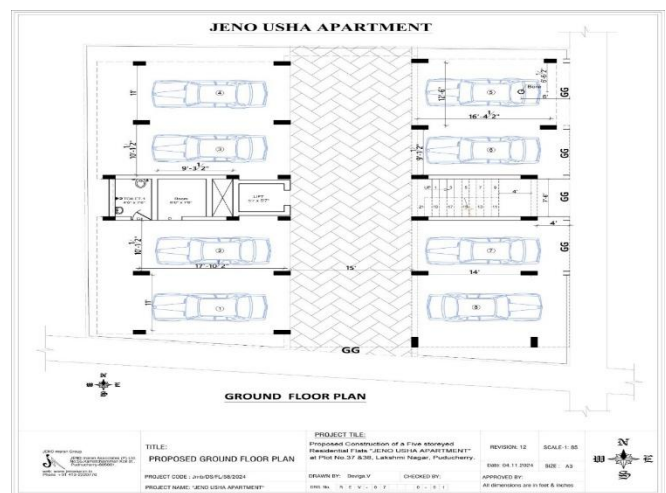
Ground Floor – is provided with parking facility, lift and staircase.

Typical Floor – First Floor, Second Floor, third and Fourth Floor, each consists of two unit – 3 BHK.

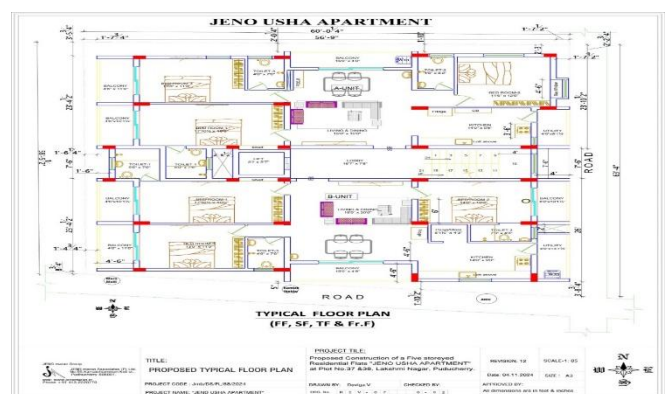
The current stage of the construction stage is at foundation level – Pile foundation and grade beam level completed.



Site Photo: Jeno Usha



Ground Floor Plan



Typical Floor Plan



Perspective View – Jeno Usha

2. Research and Discussion

Defining WBS

- A WBS is a hierarchical decomposition of a project's work into smaller components, starting with the overall project goal at the top.

WBS using Primavera

| Layout: WBS | | |
|-------------|--|------------------|
| WBS Code | WBS Name | Total Activities |
| JU FLAT | LAKSHMI NAGAR FLATS | 107 |
| JU FLAT.1 | PRE CONSTRUCTION | 3 |
| JU FLAT.1.1 | MOBILIZATION | 3 |
| JU FLAT.2 | CONSTRUCTION - SUB STRUCTURE | 23 |
| JU FLAT.2.1 | FOUNDATION | 9 |
| JU FLAT.2.2 | BASEMENT | 14 |
| JU FLAT.3 | CONSTRUCTION - SUPER STRUCTURE | 68 |
| JU FLAT.3.1 | SUPER STRUCTURE - 1st LEVEL - GROUND | 9 |
| JU FLAT.3.2 | SUPER STRUCTURE - 2nd LEVEL - FIRST FLOOR | 9 |
| JU FLAT.3.3 | SUPER STRUCTURE - 3rd LEVEL - SECOND FLOOR | 9 |
| JU FLAT.3.4 | SUPER STRUCTURE - 4th LEVEL - THIRD FLOOR | 9 |
| JU FLAT.3.5 | SUPER STRUCTURE - 5th LEVEL - FOURTH FLOOR | 9 |
| JU FLAT.3.6 | BRICK WORK, PLASTERING WITH SERVICE | 23 |
| JU FLAT.4 | CONSTRUCTION FINISHING | 13 |
| JU FLAT.4.1 | PAINTING & FLOORING IN ALL LEVELS | 6 |
| JU FLAT.4.2 | OUTER WORKS & FINAL FINISHING IN ALL | 7 |

Figure – WBS

Activities:

- In project management, an activity is a stage of a project plan that consists of tasks and subtasks that must be completed to move the project to the next stage:

Activities are characterized by:

A clear beginning and end

A corresponding timeframe

List of tasks or actions to be taken in a particular order.

| LAKSHMI NAGAR FLATS | | Pre |
|---|--|-----|
| Activity ID | Activity Name | |
| JU FLAT LAKSHMI NAGAR FLATS | | |
| JU FLAT.1 PRE CONSTRUCTION | | |
| JU FLAT.1.1 MOBILIZATION | | |
| A1020 | Site preliminary setting c | |
| A1030 | Bore work | |
| A1040 | Electricity Erection | |
| JU FLAT.2 CONSTRUCTION - SUB STRUCTURE | | |
| JU FLAT.2.1 FOUNDATION | | |
| A1050 | Column & pile marking | |
| A1060 | Pile drilling | |
| A1070 | Reinforcement pile foundation | |
| A1080 | RCC in pile foundation | |
| A1090 | Excavation of soil and pile breaking | |
| A1100 | PCC for pile cap and lift pit | |
| A1110 | Reinforcement pile cap and lift pit | |
| A1120 | Shuttering pile cap and lift pit | |
| A1130 | RCC in pile cap and lift pit | |
| JU FLAT.2.2 BASEMENT | | |
| A1140 | Excavation of soil for Grade beam | |
| A1150 | PCC below grade beam | |
| A1160 | Reinforcement for grade beam and lift | |
| A1170 | Shuttering for grade beam and lift | |
| A1180 | RCC for grade beam | |
| A1190 | RCC for column upto plinth beam bottom and lift wall | |
| A1200 | Brick work in basement | |
| A1210 | Reinforcement for plinth beam | |
| A1220 | Shuttering for plinth beam | |
| A1230 | RCC in plinth beam | |
| A1240 | Plastering the brick work | |

Figure – Activities Sample

Activity Duration

- Duration of an activity is defined as the expected economical transaction time required to perform an activity according to the specified execution method. The estimation of this time is based upon the specified practices carried out in an organized manner under the normal prevailing conditions, and its assessment is done preferably, by the person responsible for its performance.

| LAKSHMI NAGAR FLATS | | Predecessor/Successor A | |
|---|--|-------------------------|--------------------|
| Activity ID | Activity Name | Original Duration | Remaining Duration |
| JU FLAT LAKSHMI NAGAR FLATS | | | |
| JU FLAT.1 PRE CONSTRUCTION | | | |
| JU FLAT.1.1 MOBILIZATION | | | |
| A1020 | Site preliminary setting c | 7 | 7 |
| A1030 | Bore work | 2 | 2 |
| A1040 | Electricity Erection | 4 | 4 |
| JU FLAT.2 CONSTRUCTION - SUB STRUCTURE | | | |
| JU FLAT.2.1 FOUNDATION | | | |
| A1050 | Column & pile marking | 1 | 1 |
| A1060 | Pile drilling | 22 | 22 |
| A1070 | Reinforcement pile foundation | 10 | 10 |
| A1080 | RCC in pile foundation | 25 | 25 |
| A1090 | Excavation of soil and pile breaking | 3 | 3 |
| A1100 | PCC for pile cap and lift pit | 2 | 2 |
| A1110 | Reinforcement pile cap and lift pit | 4 | 4 |
| A1120 | Shuttering pile cap and lift pit | 2 | 2 |
| A1130 | RCC in pile cap and lift pit | 1 | 1 |
| JU FLAT.2.2 BASEMENT | | | |
| A1140 | Excavation of soil for Grade beam | 25 | 25 |
| A1150 | PCC below grade beam | 2 | 2 |
| A1160 | Reinforcement for grade beam and lift | 1 | 1 |
| A1170 | Shuttering for grade beam and lift | 2 | 2 |
| A1180 | RCC for grade beam | 1 | 1 |
| A1190 | RCC for column upto plinth beam bottom and lift wall | 3 | 3 |
| A1200 | Brick work in basement | 2 | 2 |
| A1210 | Reinforcement for plinth beam | 1 | 1 |
| A1220 | Shuttering for plinth beam | 1 | 1 |
| A1230 | RCC in plinth beam | 1 | 1 |
| A1240 | Plastering the brick work | 2 | 2 |

Figure – Duration Sample

Setting project calendar in P6

- In Primavera P6, a project calendar defines the standard workweek, holidays, and non-work hours for a specific project. It's crucial for accurately scheduling activities and resources, influencing task durations and cost calculations. Project calendars can be created by copying from existing global or resource calendars, or by creating a new calendar from scratch.

Creating a Project Calendar:

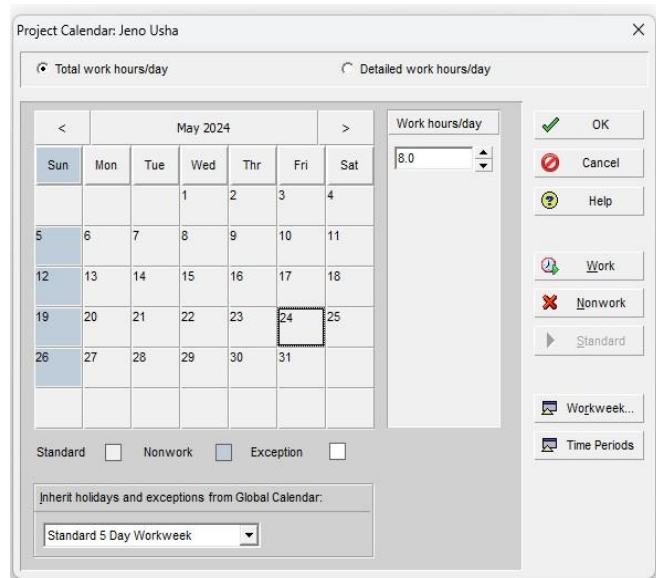


Figure - Calendar Sample

Activity relationship in project

In Primavera P6, a relationship refers to a link between two activities. This link describes the flow of work between tasks, as shown below.

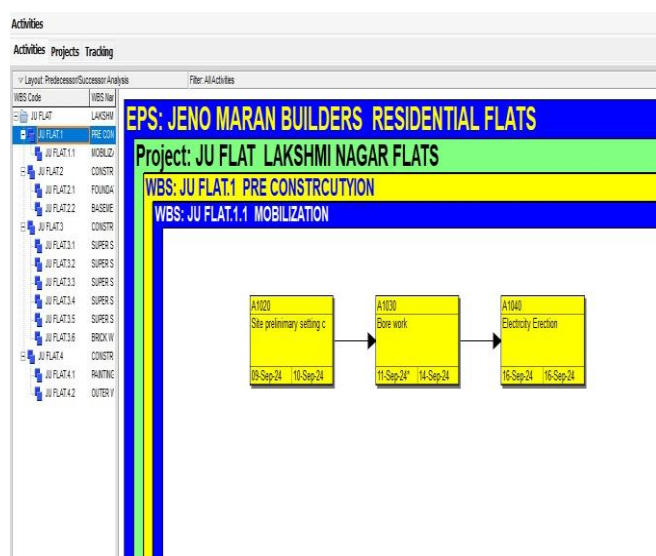
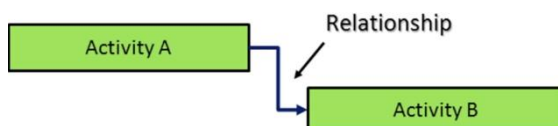


Figure - Activity Relationship Sample

Network Analysis – Critical Path

The Critical path method (CPM) is a project management technique that's used by project managers to create an accurate project schedule.

The two basic elements used in a network are activity and event.

Activity:

A project can be broken down into various activities necessary for its completion. An activity is an identifiable, quantifiable, measurable and constable, discrete lowest level element of work, which must be performed during the course of a project for achieving the project mission.

Event:

It is the state that marks the completion of a preceding activity and the beginning of the succeeding one. It has no duration; it represents only a point in time.

The path of critical activities (including dummy activities) which links the start and end events is called critical path. In other words, it is the path of activities having zero float and events having zero slack. The sum of the duration of the critical activities along a critical path gives the duration of the project.

The various stages involved in the computation of critical path are:

Determining earliest event time (EET).

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Isolating critical events:

The slack of an event is equal to the difference between its LET and EET. The events having zero slack are termed critical events.

Identifying critical activities:

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Critical path in P6

- In Primavera P6, the critical path can be determined by either defining critical activities based on Total Float (activities with zero or negative float) or by defining them based on the Longest Path
- Here's a breakdown of how to determine the critical path in Primavera P6:

1. Understanding Critical Path Definition:

Total Float:

- By default, Primavera P6 defines critical activities as those with a total float of zero or less. These activities are identified as critical because any delay in their completion will directly impact the overall project completion date.

Longest Path:

Define critical activities as the longest path in the project network, regardless of their total float. This ensures that all activities on the longest path are considered critical.

2. Displaying the Critical Path:

Gantt Chart:

- The Gantt chart can be used to visually identify the critical path by highlighting critical activities (usually in red) and the longest path.

Activities Table:

- The Activities table can be used to display columns like "Total Float" and "Critical" to identify critical activities and their impact on the project schedule.

Filters:

- Filters to isolate and display only the critical activities or the longest path.

3. Identifying Critical Activities:

Total Float:

- Activities with a total float of zero or negative are considered critical.

Longest Path:

- Activities that belong to the longest path in the project network are considered critical.

4. Adjusting Critical Path Definition:

Scheduling Options:

- Adjust the definition of critical activities in the Scheduling Options by selecting "Longest Path" or setting a specific tolerance for Total Float.
- Critical Path Methodology scheduling assigns dates to project activities, calculates project's finish date and also reveals the project's critical path.

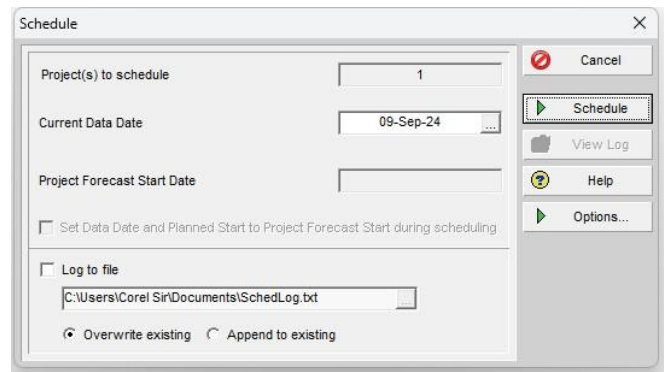
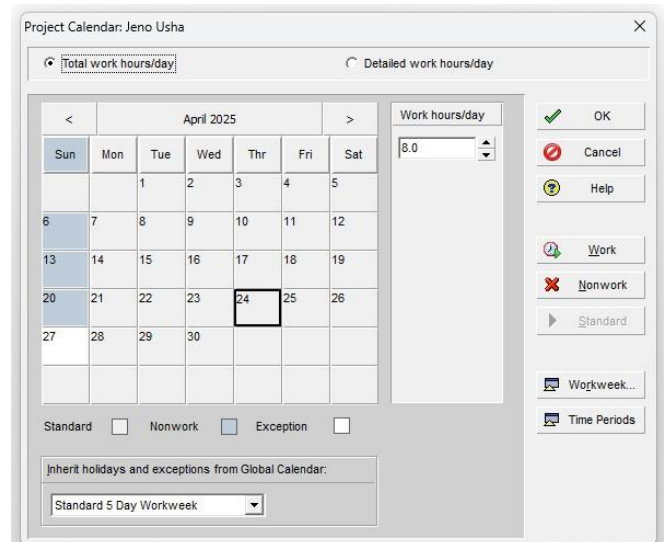


Figure: Schedule



Before Schedule:

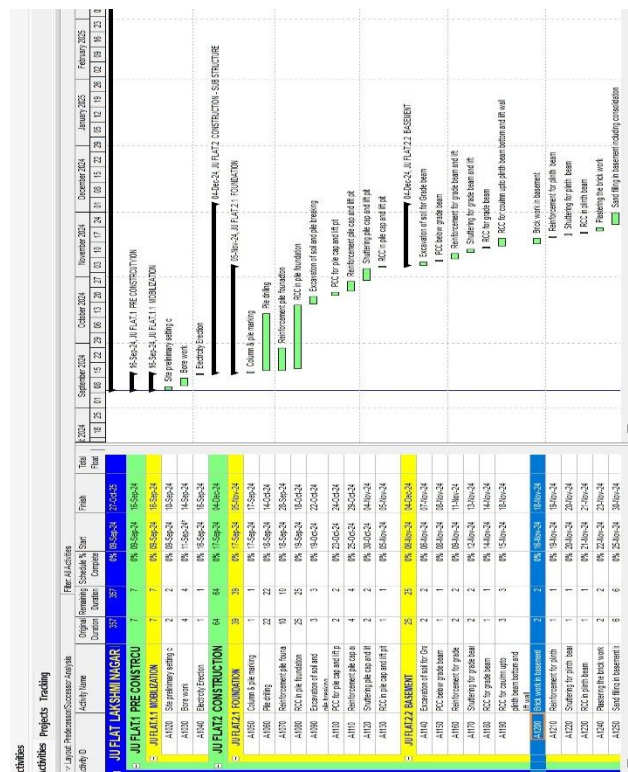


Figure: Before Schedule Sample

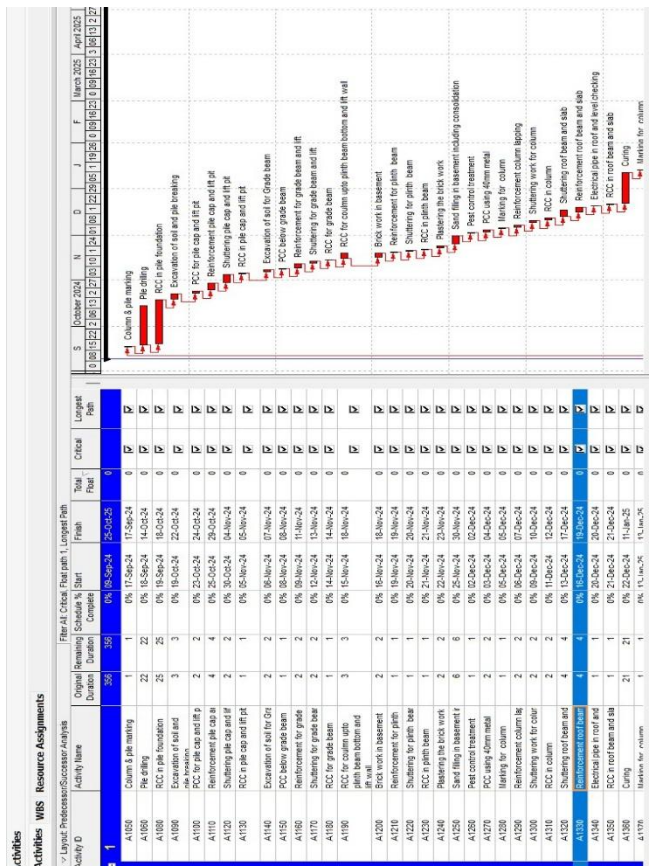


Figure: After Schedule-Critical Path

3. Conclusion

- The primary purpose of the research was to determine how the scheduling, planning, tracking, control and oversight impact to the efficient finish of any building venture. With the use of literature citations, original strategies, and Monitoring and Control with Primavera project management software, this conclusion was obtained. In this thesis, the research acted as a cicerone in analysing the JENO USHA apartment at Lakshmi Nagar, Puducherry
- With the help of Primavera, the user can effectively:
 - Link all the activities involved in the construction of the project.
 - Determine the total duration required for the project construction.
 - Determine the Critical Path for the project schedule.
 - Keep a track of the scheduled and the on-site construction.
 - Assign the resources in a way that helps in reducing the time duration and cost of the project that makes it economical.

4. Future Scope and Enhancements

- In the future, research could explore the possibility of integrating other knowledge areas into the development of project schedules, such as risk management and procurement management. MCPSA can be adapted to solve scheduling problems in multiple projects, thereby reducing delays and improving the completion rates of all

projects in an organization.

- Companies are always looking for improvements in equipment features, communication tools, efficient management techniques, and training human resources. The benefits of effective planning, scheduling and control of construction projects are reduced construction time, reduced cost overruns and the minimization of disputes. It helps to avoid the construction interruption, keep the continuity of crew work, and avoid the delay of construction and cost overruns. 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.
- The study proved to be a guideline in understanding the progress of construction work. Results of this study show the drawbacks of the present project management system in running project and the importance efficient. An efficient and cost-effective new project management plan is brought to conclusion.

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