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COST OVERRUN AND DELAYS IN CONSTRUCTION MANAGEMENT BY USING PRIMAVERA P6

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Abstract:-
In order to accomplish certain goals and meet specific success criteria within a defined time limit, project management is the process of organizing, planning, carrying out, supervising, and concluding a team's operations. Since every project is different, controlling it is essential to achieving the projects' higher productivity requirements. A number of challenges still need to be solved in order to increase the building process's speed, safety, cost, and accuracy, despite the industry's centuries-long evolution and researchers' decades-long hunt for breakthrough answers. A residential building construction project (G+5) is the subject of the study, which makes use of a program named Prima Vera p6, which is a tool for project planning and progress tracking.
With a total area of 1391 square meters, this project is a G+5-story residential structure with a rectangular shape and RCC framing. There has a 3-meter floor height. Primavera was utilized to determine project numbers, create a timeline, and estimate the project. We finished this project on schedule and on budget, using a Gantt chart and a network diagram. It collects all pertinent data from the appropriate agencies and keeps a careful eye on the working procedures. We've discovered a lot about the difficulties that companies face on a regular basis as a result of our work on it. Even though each project is different, as I've already demonstrated, we can still learn from our errors and avoid them in the future.
This study compares the original and actual time and cost using Primavera P6, a project management platform. The efficacy of the project monitoring process may be compromised by inadequate planning and rules, despite the best of intentions.

Keywords—
Cost Effectiveness, Time Control, Primavera P6, Construction projects, Commercial Building.

I. INTRODUCTION

In the engineering and construction sectors, delays and cost overruns in building projects have long been problems. increases in major public construction projects' duration and cost. It has been demonstrated that having too optimistic expectations for the schedule and budget will lower productivity and quality both during the building phase and in the finished product. The body of existing information tends to concentrate on critical success factors like time and cost as separate concepts of various project types and geographical areas with little context in an attempt to avoid such overruns. The ability to fulfill the timetable and budget requirements of the contract is what makes a project successful.
Comprehensive research concentrating on time, cost, and quality as interconnected concepts is thus required to establish major disparities between the three ideas in the "iron triangle" and to expand the current body of knowledge. This is because all three have been prominent in the building literature, sometimes known as the "iron triangle." However, in addition to earlier research, we must incorporate quality into the argument of time and cost as connected notions.
One potential solution to the critical success elements influencing building projects could be to increase pre-project planning efforts. Pre-project planning has the benefits of increased profit, less risk, and better quality. Greater construction planning enables the contractor to respond to important project-affecting factors more pro-actively than with a reactive approach. Improved project outcomes,

user satisfaction, and reduced project cost and duration are some of the advantages of realistic cost and time planning before design and during the building phase. Thus, it is vital to address the problems in the pre-project planning phase in order to guarantee the project outcome. This involves identifying and testing for significant variability in the impacts of the essential success variables on time, cost, and quality.

Projects that are completed on schedule provide as proof of an effective construction industry. Actually, if a project is completed on time, on budget, and to the required quality, it is considered "successful." When projects are delayed, they are frequently hastened or prolonged, which results in more expenses. To the dismay of owners, contractors, and consultants, many projects experience protracted delays, going over budget and taking longer than expected. The process of constructing is unpredictable and full of uncertainties. It takes more than just expecting to finish a job by the deadline to deliver it on time. Three factors need to be taken into account in order to successfully plan and carry out a project: money, time, and quality.

Most construction clients are worried about price, schedule, and quality. On the other hand, schedule and budget constraints account for the majority of construction project purchases.

Time overruns and cost increases are frequently linked to poor management practices. Consequently, the management tools are essential to successful project management. Managing resources include keeping an eye on employees, tools, money, supplies, and methods. Certain projects are economically and successfully managed, but others are mismanaged, leading to large delays and cost overruns that hurt the economy.

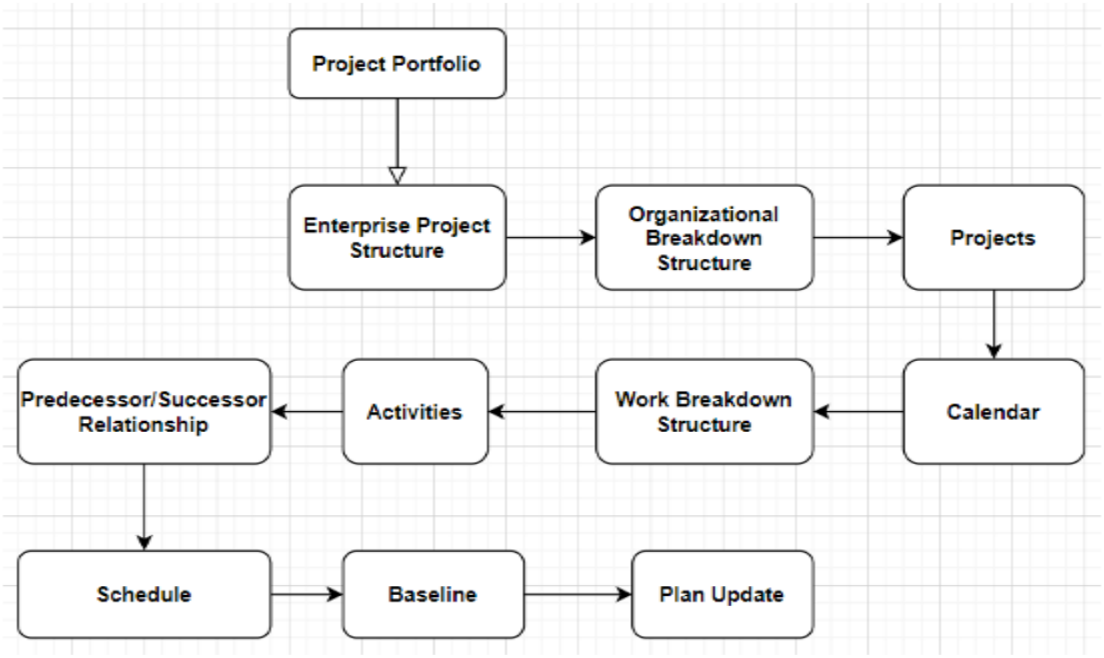

Fig.1. Project Flow Chart

II. OBJECTIVES OF STUDY

A. To emphasize the importance of monitoring construction activity and its intended outcome.
B. Analyzing techniques or tools for evaluating construction project management (Primavera P6).
C. To provide contractors with guidelines so they can make updates to the project.
D. To determine, initially from the client's point of view and subsequently more generally, which essential tasks are seriously impeding the project.
E. To monitor the planning, tactics, and resources being used in order to meet goals and complete a project on time and within budget.
F. To evaluate the effectiveness of the contractors' present cost monitoring and control methods.

G. Assessing whether the contractor's project management techniques are suitable for monitoring and managing expenses.
H. To give a comprehensive set of requirements, a system's structure, and related components for construction management evaluation.

III. METHODOLOGY

The following strategy has been carefully developed to achieve these goals after a review of the literature to ascertain how IT is utilized in civil engineering and to design goals that take software's PRIMAVERA into account.

1. **Collection of Literature:** I have read numerous publications relevant to my problem, done some research on them, and chosen the parts that are very important to my investigation to put in my study.
2. **Project Selection:** It is essential that I select a project that can start and be finished within the time frame of my research so that I can properly evaluate the activities and provide any necessary recommendations. An ongoing project at Golf City, Lucknow, is my choice.
3. **Data collection:** Due to the participants' disinterest in having their project examined, obtaining information for the project I have chosen will be challenging. But I was able to obtain the information I needed because of my relationships with the project staff.
4. **Prima Vera P6 planning:** A planning schedule with budgeted expenditures is prepared when data is gathered from multiple sources.
5. **Planning and monitoring:** Any increase in the amount of work could raise the actual cost of an activity because this is an item rate contract. As a result, keep track of the activities' values and quantities completed on a regular basis.
6. **Observation of the entire project:** Through analysis of the project, recommendations are made to avoid future occurrences of the same problems.

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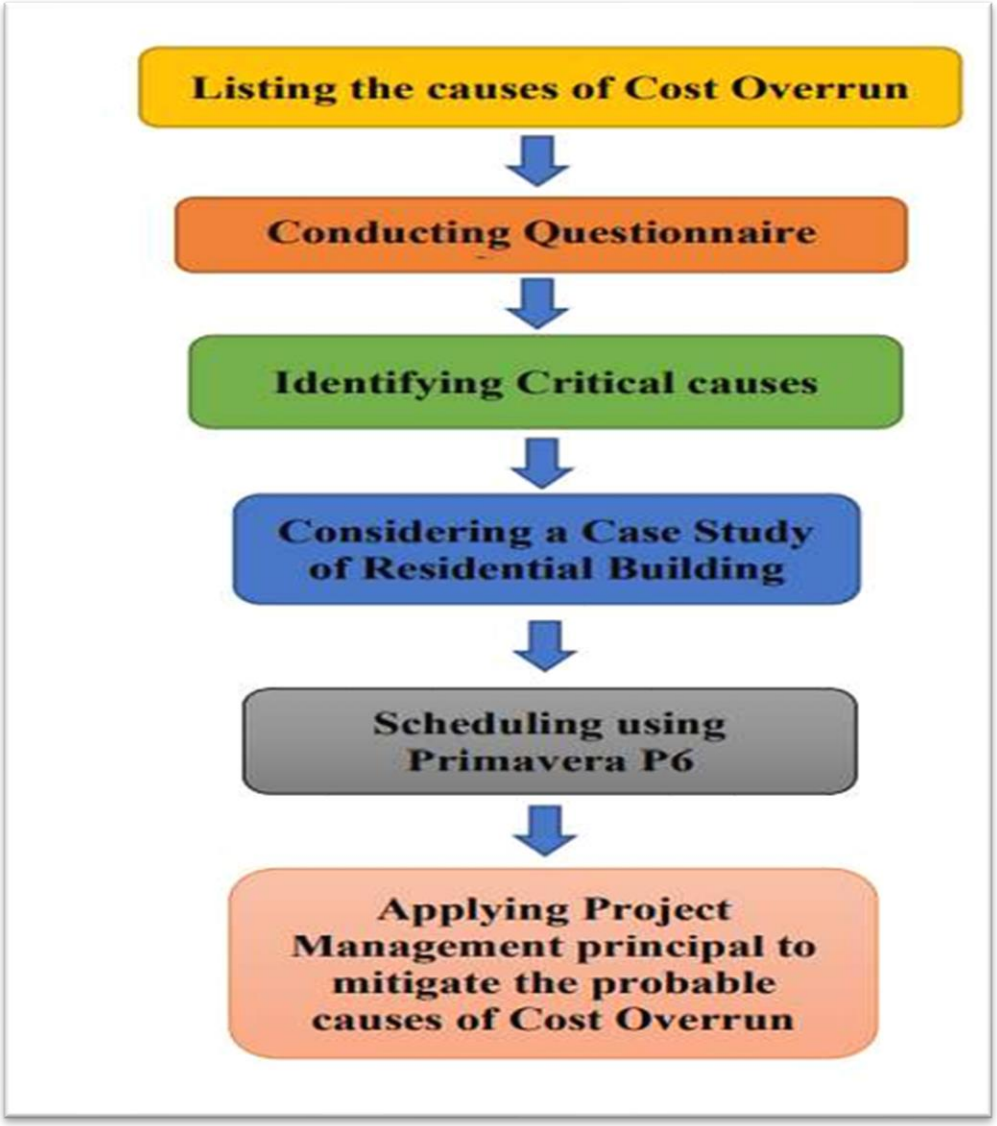

Fig.2. Methodology Flow Chart

1. STEPS INVOLVED IN MONITORING AND CONTROLS OF PROJECT ARE*:* Setting up the ideal schedule Compiling all of the project's data is the first step in developing a schedule for any project. The subsequent phases can then be completed using Primavera.

1. Enterprise project structure (EPS) – The term "Enterprise Project Structure" (EPS) refers to the enterprise structure of the organization, including its branches, that manages the specific project.

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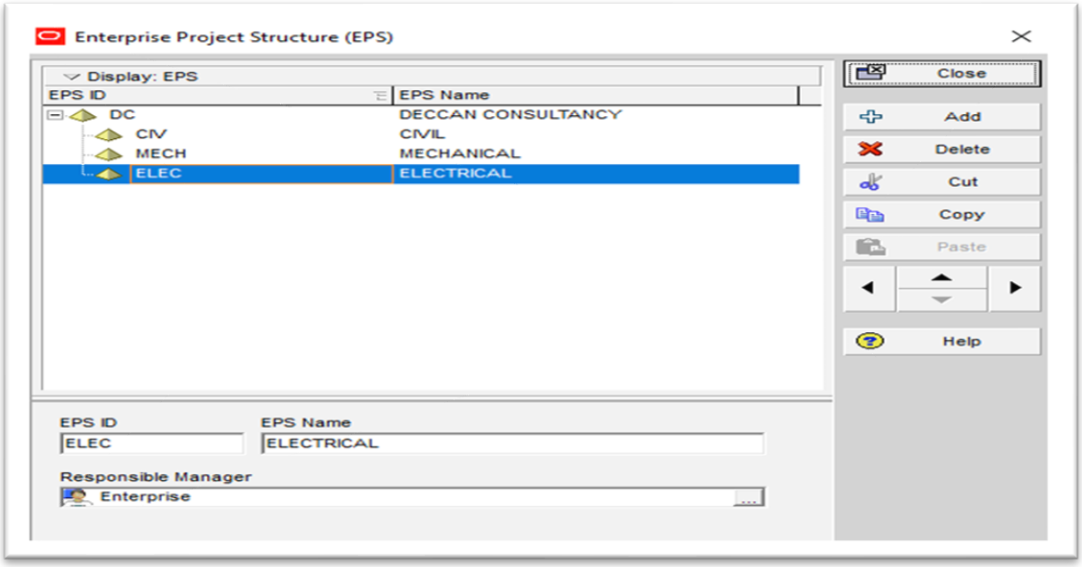

figure 3. Enterprise project structure

2. Organizational breakdown structure (OBS) – The enterprise structure, which is a hierarchy that represents the people in charge of the projects within the firm, is constructed before the organizational structure

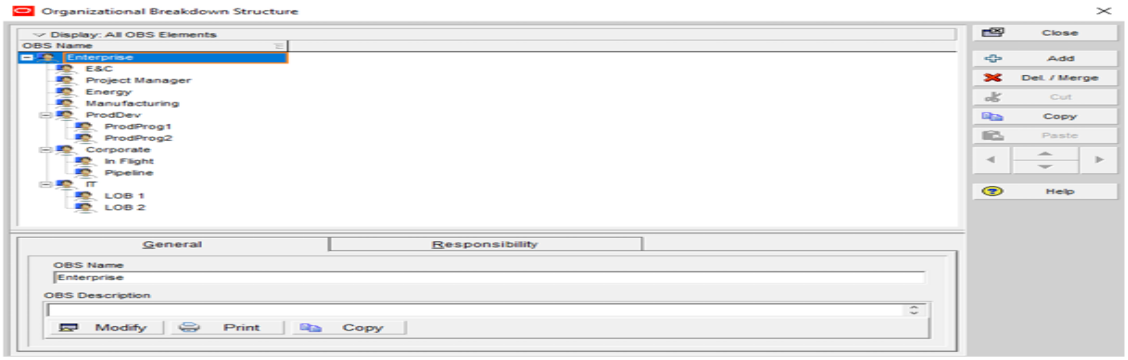

figure 4. Organizational Breakdown Structure

3. Creating new projects – Each project is unique and consists of a series of tasks and related data that together form a strategy for developing a good or service. The person in charge from the Organization Breakdown Structure is allocated to the project once it is developed under the specific divisions in EPS. There must be a scheduled start and end date for the project. The calendar, which might be a global, resource, or project calendar, should be selected at the time the project is assigned.

4. Work breakdown structure (WBS) - WBS is a list of tasks that need to be completed in order to finish a project. Every project has a unique WBS hierarchy, and the top level WBS element is the same for every project or EPS node. More thorough WBS levels, activities, or both, may be included in any given WBS element.

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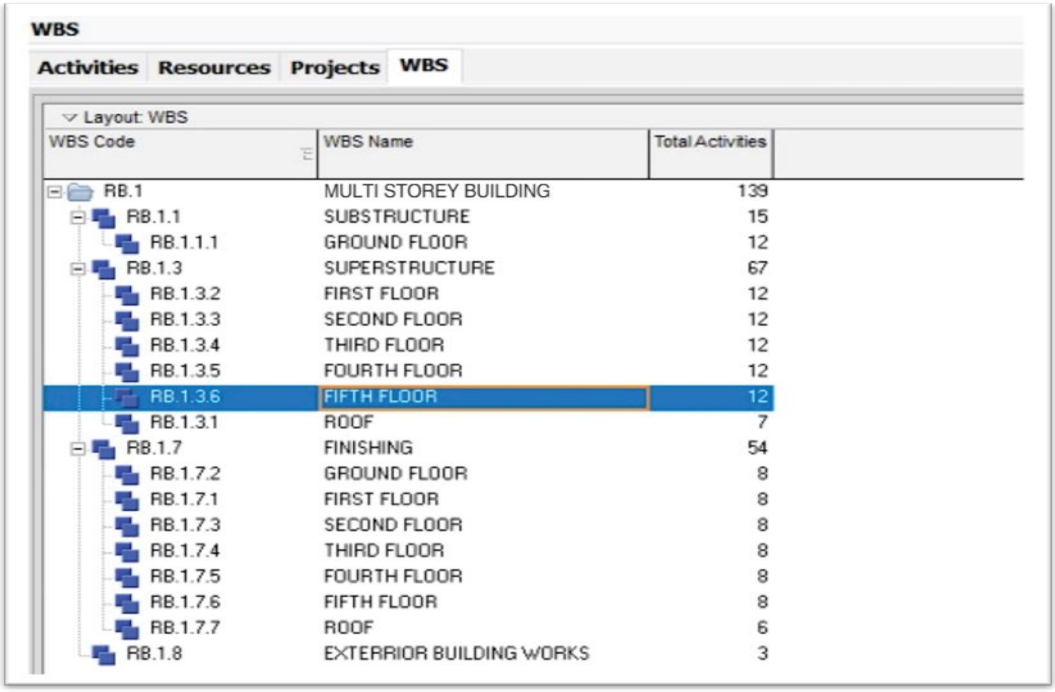

WBS Code	WBS Name	Total Activities
RB.1	MULTI STOREY BUILDING	139
RB.1.1	SUBSTRUCTURE	15
RB.1.1.1	GROUND FLOOR	12
RB.1.3	SUPERSTRUCTURE	67
RB.1.3.2	FIRST FLOOR	12
RB.1.3.3	SECOND FLOOR	12
RB.1.3.4	THIRD FLOOR	12
RB.1.3.5	FOURTH FLOOR	12
RB.1.3.6	FIFTH FLOOR	12
RB.1.3.1	ROOF	7
RB.1.7	FINISHING	54
RB.1.7.2	GROUND FLOOR	8
RB.1.7.1	FIRST FLOOR	8
RB.1.7.3	SECOND FLOOR	8
RB.1.7.4	THIRD FLOOR	8
RB.1.7.5	FOURTH FLOOR	8
RB.1.7.6	FIFTH FLOOR	8
RB.1.7.7	ROOF	6
RB.1.8	EXTERRIOR BUILDING WORKS	3

Fig.5: Details of Work breakdown structure

5. **Defining activities -** Activities are the basic work components of a project; they are the smallest subset of a project and are found at the lowest level of a WBS. Activities include things like activity ID, name, start and end dates, calendar, kind, and codes; they also have limits, costs, links between predecessors and successors, resources, responsibilities, and so on. 6. Connection between the various activities In order for activities to function as a network, they must be connected to one another. This is accomplished by assigning meaningful relationships to activities that come before and after them.

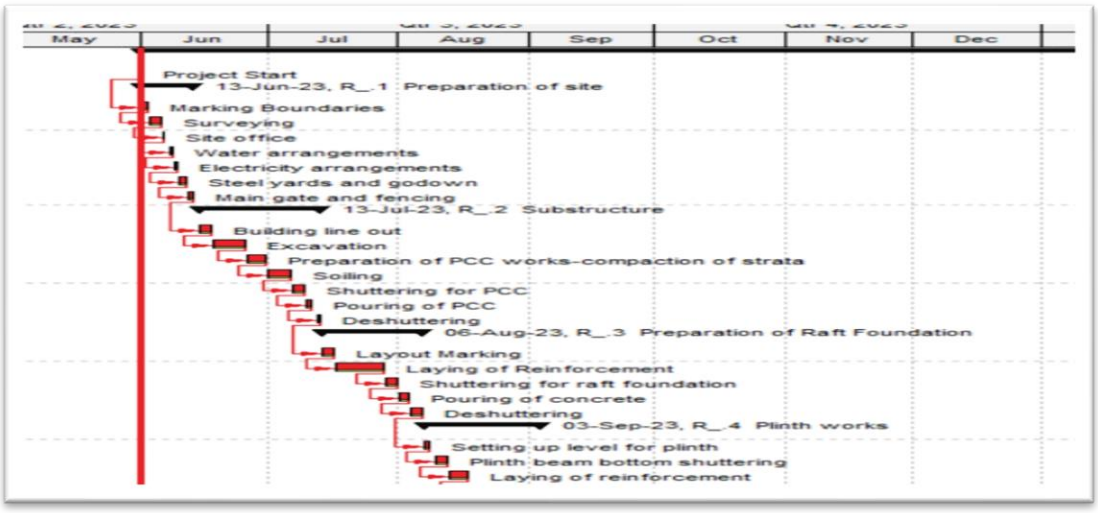

Fig.6: Gantt Chart- Monitoring activity Completed on time or delay

- **Finish to start (FS) relationship-** Finish to start relationships denote that an action will begin when the previous one concludes, and it can also be assumed that an activity cannot begin without the conclusion of the prior one.
- **Finish to Finish (FF) relationship-** A finish-to-finish relationship states that two subsequent activities cannot be completed before the completion of a predecessor action.
- **Start to start (SS) relationship-** According to the logical relationship known as "start to start," an activity can't begin until its predecessor has finished.

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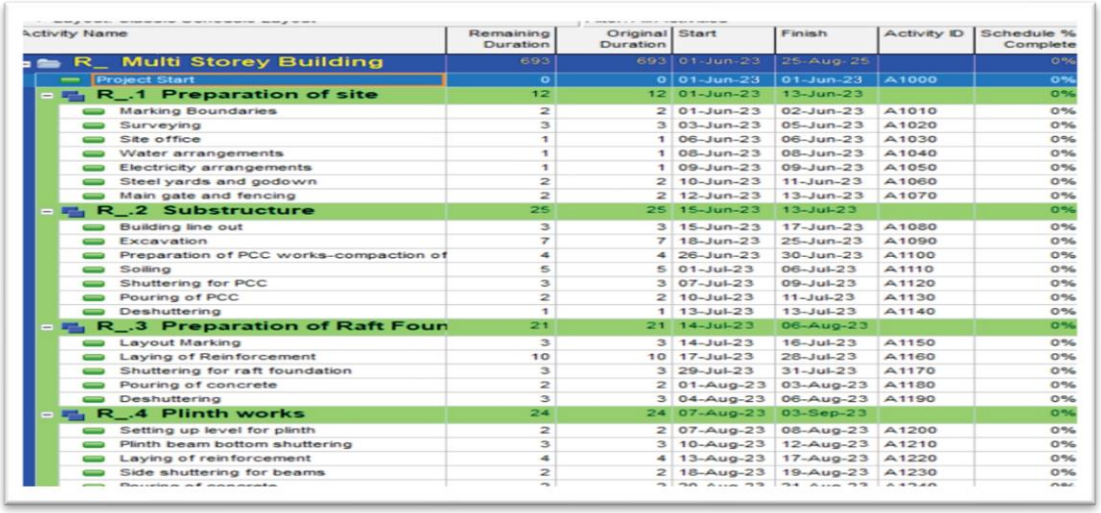
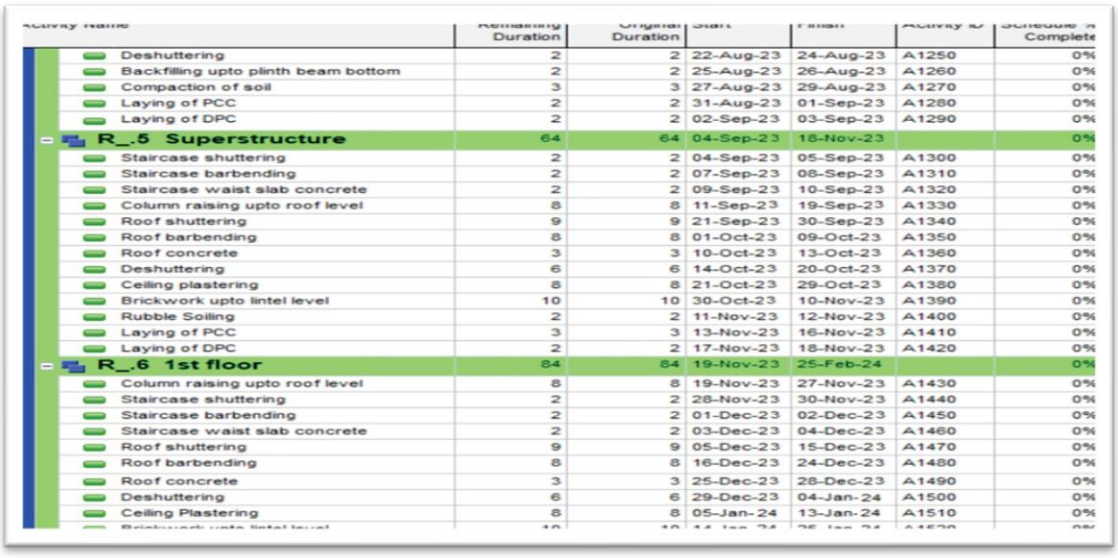
- **Start to finish (SF) relationship-** A logical relationship known as "start to finish" states that an activity can't begin until its predecessor has begun.

7. Determining activity duration - The initial duration field is where the duration is entered while planning the work. Only actions that have been finished can have their exact duration input.



Activity Name	Remaining Duration	Original Duration	Start	Finish	Activity ID	Schedule % Complete
R_ Multi Storey Building	693	693	01-Jun-23	25-Aug-25		0%
Project Start	0	0	01-Jun-23	01-Jun-23	A1000	0%
R_.1 Preparation of site	12	12	01-Jun-23	13-Jun-23		0%
Marking Boundaries	2	2	01-Jun-23	02-Jun-23	A1010	0%
Surveying	3	3	03-Jun-23	05-Jun-23	A1020	0%
Site office	1	1	06-Jun-23	06-Jun-23	A1030	0%
Water arrangements	1	1	08-Jun-23	08-Jun-23	A1040	0%
Electricity arrangements	1	1	09-Jun-23	09-Jun-23	A1050	0%
Steel yards and godown	2	2	10-Jun-23	11-Jun-23	A1060	0%
Main gate and fencing	2	2	12-Jun-23	13-Jun-23	A1070	0%
R_.2 Substructure	25	25	15-Jun-23	13-Jul-23		0%
Building line out	3	3	15-Jun-23	17-Jun-23	A1080	0%
Excavation	7	7	18-Jun-23	25-Jun-23	A1090	0%
Preparation of PCC works-compaction of	4	4	26-Jun-23	30-Jun-23	A1100	0%
Soiling	5	5	01-Jul-23	06-Jul-23	A1110	0%
Shuttering for PCC	3	3	07-Jul-23	09-Jul-23	A1120	0%
Pouring of PCC	2	2	10-Jul-23	11-Jul-23	A1130	0%
Deshuttering	1	1	13-Jul-23	13-Jul-23	A1140	0%
R_.3 Preparation of Raft Foun	21	21	14-Jul-23	06-Aug-23		0%
Layout Marking	3	3	14-Jul-23	16-Jul-23	A1150	0%
Laying of Reinforcement	10	10	17-Jul-23	28-Jul-23	A1160	0%
Shuttering for raft foundation	3	3	29-Jul-23	31-Jul-23	A1170	0%
Pouring of concrete	2	2	01-Aug-23	03-Aug-23	A1180	0%
Deshuttering	3	3	04-Aug-23	06-Aug-23	A1190	0%
R_.4 Plinth works	24	24	07-Aug-23	03-Sep-23		0%
Setting up level for plinth	2	2	07-Aug-23	08-Aug-23	A1200	0%
Plinth beam bottom shuttering	3	3	10-Aug-23	12-Aug-23	A1210	0%
Laying of reinforcement	4	4	13-Aug-23	17-Aug-23	A1220	0%
Side shuttering for beams	2	2	18-Aug-23	19-Aug-23	A1230	0%

Fig.7: Activity details for substructure



Activity Name	Remaining Duration	Original Duration	Start	Finish	Activity ID	Schedule % Complete
Deshuttering	2	2	22-Aug-23	24-Aug-23	A1250	0%
Backfilling upto plinth beam bottom	2	2	25-Aug-23	26-Aug-23	A1260	0%
Compaction of soil	3	3	27-Aug-23	29-Aug-23	A1270	0%
Laying of PCC	2	2	31-Aug-23	01-Sep-23	A1280	0%
Laying of DPC	2	2	02-Sep-23	03-Sep-23	A1290	0%
R_.5 Superstructure	64	64	04-Sep-23	18-Nov-23		0%
Staircase shuttering	2	2	04-Sep-23	05-Sep-23	A1300	0%
Staircase barbending	2	2	07-Sep-23	08-Sep-23	A1310	0%
Staircase waist slab concrete	2	2	09-Sep-23	10-Sep-23	A1320	0%
Column raising upto roof level	8	8	11-Sep-23	19-Sep-23	A1330	0%
Roof shuttering	9	9	21-Sep-23	30-Sep-23	A1340	0%
Roof barbending	8	8	01-Oct-23	09-Oct-23	A1350	0%
Roof concrete	3	3	10-Oct-23	13-Oct-23	A1360	0%
Deshuttering	6	6	14-Oct-23	20-Oct-23	A1370	0%
Ceiling plastering	8	8	21-Oct-23	29-Oct-23	A1380	0%
Brickwork upto lintel level	10	10	30-Oct-23	10-Nov-23	A1390	0%
Rubble Soiling	2	2	11-Nov-23	12-Nov-23	A1400	0%
Laying of PCC	3	3	13-Nov-23	16-Nov-23	A1410	0%
Laying of DPC	2	2	17-Nov-23	18-Nov-23	A1420	0%
R_.6 1st floor	84	84	19-Nov-23	25-Feb-24		0%
Column raising upto roof level	8	8	19-Nov-23	27-Nov-23	A1430	0%
Staircase shuttering	2	2	28-Nov-23	30-Nov-23	A1440	0%
Staircase barbending	2	2	01-Dec-23	02-Dec-23	A1450	0%
Staircase waist slab concrete	2	2	03-Dec-23	04-Dec-23	A1460	0%
Roof shuttering	9	9	05-Dec-23	15-Dec-23	A1470	0%
Roof barbending	8	8	16-Dec-23	24-Dec-23	A1480	0%
Roof concrete	3	3	25-Dec-23	28-Dec-23	A1490	0%
Deshuttering	6	6	29-Dec-23	04-Jan-24	A1500	0%
Ceiling Plastering	8	8	05-Jan-24	13-Jan-24	A1510	0%

Fig.8: Activity details for Superstructure

8. Activity dates - The activity dates that are offered in Primavera are as follows: real start, actual finish, planned start, and planned finish.

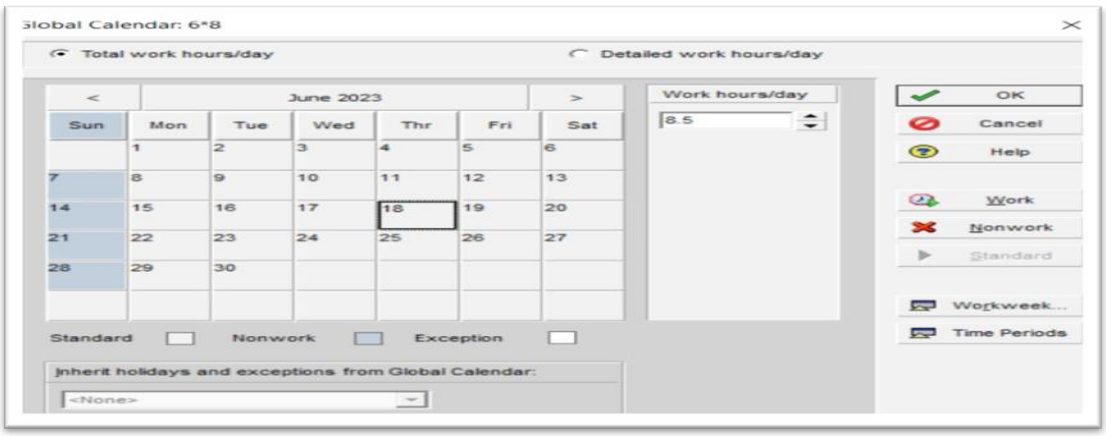


Fig.9: Calendar

9. Activity cost - The total amount of expenses incurred to finish the task is the activity cost. It might consist of the following: labor + material costs equals total cost.

10. Creating baselines - A basic baseline plan, which serves as a benchmark for monitoring the advancement of a task, is a perfect duplicate of the initial timeline.

11. Updating schedule

- All that is needed, if all goes as planned, is an estimate of progress.
- If the project is not going as expected, a lot of activities are starting out of order and actual resource consumption is higher than anticipated. In these cases, updates for each activity and resource should be made separately.
- The majority of initiatives involve both scheduled and unplanned operations. The best course of action in this situation is to combine the two updating strategies.

12. Tracking - A tracking window is used to track a project's progress utilizing several layouts, including labor expenses, project costs, resource forecasting, and cost- and unit-wise resource allocation.

13. Earned value - A method for gauging project performance based on schedule and cost is called earned value. The method contrasts the work's estimated and actual costs.

14. Project issues - Project challenges are the difficulties that a site engineer or site manager has while carrying out project tasks. By being punctual and figuring out the solution, one can solve problems.

IV. FACTORS THAT AFFECT COST AND TIME IN CONSTRUCTION PROJECT

FACTORS - The amount of money spent on two identical infrastructure projects will never be the same, even if they are similar. Variations will still happen because of the large range of client and economic preferences, even in the case of technical variables. The project's final cost is determined by the cost of the actual materials, the cost of the equipment used in construction, the cost of labor, and—most importantly—the cost of the land in the location where the project is being done. The building timeline may vary based on the client's wants and how well his notion is implemented in his vision. These costs and timings are subject to change in light of the following listed factors:

a) **The Project Specification-** The project's specification details its physical status and design. For residential buildings, variables such room height, floor plan size, internal and external design, floor loadings, heating and lighting requirements, and room specification will determine the required number of rooms and expected occupancy rate. The cost of completion increases with the project's scale and level of detail in the specification. For example, there are significant differences in the design and features of a hospital, business center, institution, and hotel.

b) **Location of the Building Project-** Geographic reality and the site's location may also have an effect on the project. For instance, the cost of exporting sand dust and coarse aggregates will be less if the project is being completed in a location with easy access to these raw materials. Land prices, building material costs, and design requirements vary greatly from location to location due to general market conditions and delays in material availability. If a project has a difficult entry point and is located far from the local market, it will cost more to transport labor and goods.

c) **Repairing or New Buildings:** Building new infrastructure typically entails greater costs than sustaining pre-existing ones. It is occasionally mentioned, nevertheless, that replacing infrastructure will cost more money than mending what already exists. This is the initial state of affairs since the price of maintaining and modifying already-existing structures does not account for the expenses related to land unrationing, service provision, etc. Even though repairs will be made, it is advised to develop new infrastructure if the existing infrastructure is seriously damaged.

d) **Project Timescale:** Generally speaking, a project's cost will increase with duration. The project durations are determined by the nature of the project and its requirements. When an undertaking grows in size, it takes longer to complete. But it might stop sooner if a site is watched over. Each task in a

project usually depends on the others, so when one is delayed, it will definitely affect the others. The budget of a project will also be impacted by its duration.

e) **Characteristics of Site :** A site's geography, soil profile, and ground water level may have an impact on the initial cost and estimated time of construction. The amount of excavation and foundation work required is particularly impacted by poor ground conditions. Without initially performing a soil evaluation, it is hard to generate accurate project cost estimates in scenarios where ground conditions are unclear.

f) **Inflation of project costs:** Depending on the area of the country, labor, material, and equipment costs may go up or down. Additionally, contracts between suppliers and subcontractors may have different clauses that provide for inflation protection and are negotiated with the client. Overbudgeting brought on by inflation in commodity prices results in an increase in interest rates.

g) **Price fluctuation of raw materials:** It is difficult to pinpoint the precise cost of resources in developing countries when prices are prone to fluctuations.

h) **Underestimating the cost of construction:** Construction parties might secure contracts at a lower real cost than projected after receiving project clearance; thus, they face financial challenges as the project advances.It's an improper procedure that drives up project expenses over budget.

i) **Change in exchange rates:** In the event that foreign supplies or other project components need to be purchased, fluctuations in exchange rates will have a major effect. If the foreign exchange rate rises more than anticipated, the project's cost could increase and cost overruns would unavoidably occur.

4.1. Delays

Delay was one of the most frequent outcomes of cost overruns, as the aforementioned analysis showed. There are several reasons why projects take longer to finish than expected. These include:

i.**Payment delays brought on by interim documentation** Most of the contractors working on this project struggle to get paid for their completed work. The multiple departments engaged in the complex and time-consuming bureaucratic processes that confirm and double-check every project-related documentation to avoid any financial harm to the company.It typically has a negative impact on the contractor's cash flow. Consequently, the contractor is compelled to wrap up the project and move forward. This negatively affects how long it takes to complete the project.

ii.**Modification Orders** When the project is being built, most variety occurs. It takes time to adjust to changes in the directives from the client officials for this project. Delays, rework, and job extensions result from its influence on the construction schedule, length, and pace.

iii.**Cash Flow** The most crucial prerequisite for completing a project and starting a new one is cash flow. Delays in cash flow have a higher chance of leading to the project's termination, which affects the contractors' cash flow as well. All of the project's stakeholders and the project itself are impacted by improper cash flow. For instance, the client regularly pays the main contractor in this project, but the main contractor neglects to pay their subcontractor, who is in charge of a sizable amount of the work.

4.2. Additional Costs

1) **Additional Works**

Added Works First As a result of design modifications, extra work becomes necessary during the building phase. The additional cost will be required in order to finish a certain project. For this, more money and manpower are required, as well as planned alterations that must be made in between project phases.

2) **Fluctuations Indian construction projects**

Elevated rates of inflation result in rising costs for labor and services, as well as materials. This leads to variations. Throughout its period, oscillations are quite common. There is also fluctuation as a result of the implementation of additional taxes, such the GST. Given that India is not as developed as the US dollar, British pound, etc., material prices will shift significantly in response to fluctuations in exchange rates. It is anticipated that there will be volatility in tenders quoted in India.

3) **Inaccurate Estimates / Provisional Sums**

Inaccurate project cost estimates could have detrimental effects on the client. The true costs of these work items are found out during the building process when not enough research is done and not all work items are fairly priced in the Bills of Quantities (BOQ) before construction begins. These costs are usually higher than the approximate amounts allowed in the BOQ and are added to the tender price, which leads to notable cost overruns.

4) **Adversarial Relationship among Parties**

Cost overruns may lead to issues with the parties' relationships under the Contract. Excessive expenses can lead to a precipitous decrease in building operations, harm an individual's standing, and complicate future project funding acquisition. Other repercussions of cost overruns should also be considered:

- A contractor affected by insufficient cash flow from the client.
- Equitable and just allocation of resources.
- The level of craftsmanship is quite low.

- The contractor is chosen for this research based on item rates and quantities; the architectural team determines how much of each component is needed. The contract is an item rate contract.
- I decided to use Primavera P 6 for this project after selecting this topic for my study because I wanted to find out how the current approach and the layperson technique would reduce project costs and time.
- They have created a timeline for the project's completion using Microsoft Excel using the layman's method.
- This software also displays our project's beginning point, our progress to date, and the remaining costs and time.
- Because this is an item rate contract, the contractor needs to make sure that he will increase his time savings in order to lower his indirect expenses.
- Any contractor's main objective is to finish the job in the allocated time frame since happy clients will recommend you to their friends and relatives.

V. RESULT AND DISCUSSION

The main reasons for cost and schedule overruns—which can have many different origins and vary depending on the project chosen—are discussed in this section. Due to poor planning and budgetary restrictions, the project under inquiry is running behind schedule. The inquiries made to the project managers, subcontractors, and site engineers served as the basis for the results collection. It is imperative to verify that the site personnel and the architecture firm, from whom the example data was obtained, were cognizant of the research definitions. The site engineers, project managers, subcontractors, and client representatives offer their comments from the conversation, which are then reviewed.

The respondents supplied some information on the company, which was verified by internet research. A single project management software file, which is updated every day and verified against the previously set timeline, is used to track ongoing construction. Interviewees four acknowledged having relatively organized meetings. The four meetings that the organization's two task administrators reported, as well as the members' post-event reviews, thereby formed the core of this thesis's complete study design. We went over two different tasks with each of the project managers; one was executed really well, and the other was not so well. The current case study is used to determine the following outcomes. The following table lists the different factors. This shows how the data should be represented to get the desired outcome.

Activities	Actual Cost	Predicted Cost	Difference
Foundation	15,00,000	20,00,000	5,00,000
Ground floor	12,00,000	15,00,000	3,00,000

First floor	12,00,000	15,00,000	3,00,000
Second floor	12,00,000	15,00,000	3,00,000
Third floor	12,00,000	15,00,000	3,00,000
Fourth floor	12,00,000	15,00,000	3,00,000
Fifth floor	12,00,000	15,00,000	3,00,000
Roof	7,00,000	8,00,000	1,00,000
Finishing	42,56,130	50,00,000	7,43,870
Total amount	1,25,76,365	1,68,00,000	31,43,870

We were informed by the contractor that the project would actually take 365 days to complete and would cost approximately Rs. 2 crores in total. However, the same project might be finished in just 265 days, as indicated in the anticipated timeline, if it were effectively planned using Primavera software. The estimated total project cost would be up to Rs. 1 crore. Thus, it is determined that a project might save Rs. 31, 43,870 and be finished 79 days sooner. Thus, we were able to accomplish our project's goals of completing it within the allotted time with the fewest possible resources and making the most use of the available equipment and materials.

VI. CONCLUSION

- In order to save money, we must ensure that the project is completed on time. Sufficient planning is necessary to finish a job on schedule.
- Contractors need to have a track record of on-time completion in order to land the most projects on the market.
- Why The contractor for a project might save Rs. 31, 43,870 and finish 79 days sooner by employing a simple planning tool.
- We have achieved our project's goals, which included finishing it within the allotted time with the fewest resources possible and making the most use of the available materials and equipment.
- The contractor bears the responsibility of ensuring the timely availability of the teams needed to complete a given work.
- Never choose a subcontractor whose bid is too cheap or too costly compared to the overall cost of finishing the project.

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