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# Construction Management of a Multi-Storey Building

Tushar Baranwal[1], Samar Tyagi[2], Suravi Chaudhary[3], Shubham Singh[4]
[1, 2, 3, 4]*Under Graduate Students, Department of Civil Engineering, KIET Group of Institutions, Ghaziabad, 201206, Uttar Pradesh, India*

***Abstract:*** ***For construction projects to reduce and control delays, proper planning and scheduling are critical. Each year, the construction sector wastes a significant amount of time, money, and resources owing to ineffective project management. Building projects have grown in size and complexity as a result of globalization. By decreasing the amount of paperwork you have to undertake, project planning software may help you save time and money. A project cannot accomplish the target outcome just by providing adequate planning, proper organization, and a sufficient flow of resources. A warning system must be present throughout the project to notify the organization about its potential success and failures. The primary purpose of this assignment is to evaluate the drawing in Auto CAD, produce an estimate in MS Excel, and plan, schedule, and track a construction project using Primavera software.***
***Keywords: Project Management, MS Project, planning and scheduling.***

## I. INTRODUCTION

Civil engineering is one of the oldest fields of engineering, with roots dating back to antiquity. With the advancement of modern science and technology, this stream has broadened its reach and is now known as "Construction Industry" in the modern world. Construction is a field that deals with building, modifying, renovating, and rehabilitating various structures. It has grown to be one of the most important sources of employment in our country. With the increase in infrastructure requirements to meet human needs, this industry has expanded in three dimensions and is now prepared to meet any modern-day problem. Modern machinery has also contributed in the expansion of the building industry.

With the advent of concepts like "Time Value of Money," the Civil Engineer understood the need of finishing the project in the shortest amount of time possible.

This opened the way for a new area in the Civil Engineering department called "Construction Project Management." Fast-track construction has grown increasingly common in the current environment, and it is currently used for the majority of building projects, due to the strong demand for new technology construction in a short length of time. Using this strategy, the length and cost of the entire structure may be reduced.

The length of time it takes to build multifamily housing depends on the total number of units. Any delays in the construction or execution of the project, on the other hand, would entail further delays in the project's completion job that requires estimation Cost and schedule overruns

plague the majority of building projects. Because the total project costs are so high, cost and time are the most important determinants in project success. Resource management is another important aspect of project success. The resources have an influence on the project from beginning to end, thus they must be managed properly. All resource-related problems, such as estimates, procurement, storage, supply, and transportation, should be addressed as quickly as possible to minimize a building delay.

## II. IMPORTANCE OF PROJECT MANAGEMENT

The project starts off to a good start, but as it progresses, it falls off course. As a result, it's crucial to manage activities properly, and project management plays a significant role in organizing the project's critical activities, also known as tasks, to ensure that they run smoothly. Project management helps the project offer services more efficiently.

In order to avoid sinking and scheming project delays, proper planning and scheduling are critical. Construction projects have grown limitless and complex as a result of globalization.

Project planning tools such as Primavera, Microsoft Project, and others can help to decrease the amount of documentation work required for such projects.

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## III. PHASES OF PROJECT MANAGEMENT

1) *Project Definition:* Establishing the project's goals, objectives, and important success elements.
2) *Project Initiation:* Before work could begin, everything had to be in place to get the project up and going.
3) *Project Planning:* Detailed plans for how the task will be done, including estimates for time, cost, and resources.
4) *Project Execution:* Performing the actions required to deliver the product, service, or intended outcome.
5) *Project Monitoring and Control:* Ensuring that a project stays on schedule and taking remedial action as necessary.
6) *Project Completion:* Written acceptance of deliverables and disbandment of all project-related organizations.

## IV. LITERATURE REVIEW

After carefully reviewing a number of research articles, we can see the relevance of project management in the construction sector, as well as the critical function it plays in cost analysis, reduction, and resource allocation. Primavera P6 and Microsoft Project Professional are two of the most often used project management softwares. Papers on the use of both of these softwares were also carefully examined.

From [1] *Study on Time and Resource Management in Construction Projects Using MS Project by T.Subramani[1*], T.M.Karthick[2]*, This building project investigates a high-stakes undertaking with a time-bound performance target. No operation can be accomplished according to a predetermined schedule unless combined resources are planned and secured. Under unusual schedule demands and in unknown scenarios, project managers must make difficult decisions that frequently extend past assignment intervals. Our project analysis includes resource scheduling for a fast-paced project with tight deadlines. The training was carried out in phases. In the first section, task time tables for various tasks for the creation of a commercial building are generated using MS PROJECT software. Finally, businesses that primarily use Standard Schedule Rates were assigned source requirements. It was determined that the data acquired from the prescribed drawings and triumphing site online conditions was necessary. The study used useable resource levelling for a range of activities, which required rapidly reducing resources to determine the time-cost repercussions.

From [2] *Application of MS Project for Optimizing the Delay in Construction of Multistoried Building Caused Due to Uncertainties by Kratika J. Deshpande[1], Amey A. Kelkar[2]* , Construction is a field that deals with building, modifying, renovating, and rehabilitating various structures. Every project's success is determined by its completion date and cost. The goal of project management is to complete a project on schedule and within budget. Project cost overruns occur from delays in completion. This article addresses the difficulties that multi-story building construction faces, such as severe rain and pandemics. Covid -19. For the planning and scheduling of the building, a project management programme such as Microsoft Project is used. The work is separated into four stages for ease of execution, with each step requiring the use of a project management tool to plan and schedule the construction. Only the overall project is regarded in the first stage, with no effect of delay; in the second stage, the effect of heavy rain is considered; in the third stage, the effect of Pandemic Covid -19 is regarded; and in the fourth stage, planning and scheduling is made by considering both delays to minimize the total latency using enhanced project management methodology. We used the MS Project programme to try to reduce the delay by using tactics like asset improvement, project crashing, decreasing dependencies, and good critical path tracking.

From [3] *Construction Management Using Primavera by Fathima Zerin T[1] , Angela C. Joy[2]* , Construction managers encounter a variety of issues, some of which are new to the business and others which have existed for many years. Workforce considerations, safety, time restrictions, and the changing nature of work are among issues that construction company's face. Planning and scheduling are two critical aspects of effectively completing a project. The construction industry necessitates rigorous scheduling, planning, and resource management. Due to increased workloads and smaller business departments, new technology was discovered that aids in the administration and organization of work, allowing industries to develop quickly. Today, project management computer software programmes such as MSP, Primavera P6, and others are accessible. Appropriate project monitoring and implementation may be achieved with the help of this software. Primavera enables comparing the expected progress of construction activity to the existing project state a breeze. Primavera P6 is a project planning software that allows you to gather, analyze, evaluate, govern, and publish on project delivery. Controlling and monitoring may be done, as well as determining the reasons of delays.

From [4] *Planning, Scheduling and Tracking of Industrial Project Using Primavera P6 Software by Shah Harsh[1] , Prof Mamata Rajgor[2] , Dr. Jayeshkumar Pitroda[3]* , Planning and scheduling are critical components of construction projects for preventing and controlling project delays. Poor project management costs the construction industry a tremendous amount of time, money, and resources each year.

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As a result of globalization, construction projects have risen in scale and complexity. Such initiatives need a lot of paperwork and effort, which may be reduced by using project management software. Providing solid planning, effective organization, and sufficient resource flow to a project does not guarantee the desired outcome.

Throughout the project, a warning mechanism must be available to notify the organization about its potential success and failures. The major goals of this research are to use Primavera P6 software to plan, schedule, and track an industrial project, as well as to analyze the outcomes. Also, to make recommendations to the company for improving their project planning abilities in the future for comparable initiatives.

## V. THE PROJECT'S METHODOLOGY

### *A. Building Layout Preparation Using AutoCAD*

An architect designed, discussed, and approved the proposed building's plan. After that, AutoCAD was used to create the layout. The different layouts were created, and then the architect was consulted for error rectification**.**

### *B. Project Planning using Primavera*

Primavera P6 model gives a pretty included challenge portfolio management (PPM) answer that consists of role-precise skills to fulfill the needs, responsibilities, and abilities of every crew member. Standard Windows interfaces, client/server architecture, Web-enabled technologies, and stand-alone (SQL Server Express) or network-based (Oracle and Microsoft SQL-Server) databases are all used in this solution. Primavera provides us with the following software component, as well as a variety of superior options: Primavera P6 Professional was created to get us up and running with planning and scheduling as fast as possible. Thanks to a simple and uncomplicated navigation, we can start planning, scheduling, and controlling our project faster than anyone ever anticipates. Because many owners need it in their project requirements, this solution is the gold standard when it comes to project planning and administration. Whether the project is a sophisticated multi-billion dollar infrastructure project or a little house or business building, we demand P6 Professional.

### *C. Cost Estimation Using Microsoft Excel*

STAAD Pro estimates the overall steel and concrete need, saving time and effort. The calculations for walls, cement plaster, doors and windows, earthwork, and foundation remain to be completed. The computations are made using the centerline approach, which is rather simple.

## VI. LAYOUT OF G+4 RESIDENTIAL BUILDING USING AUTOCAD

The plot size for the project was 10.10*12.70 mts, or 33'x41'. As a result, the structure has been located in the plot's centre, leaving ample space on both sides for landscaping and vehicular and pedestrian access.

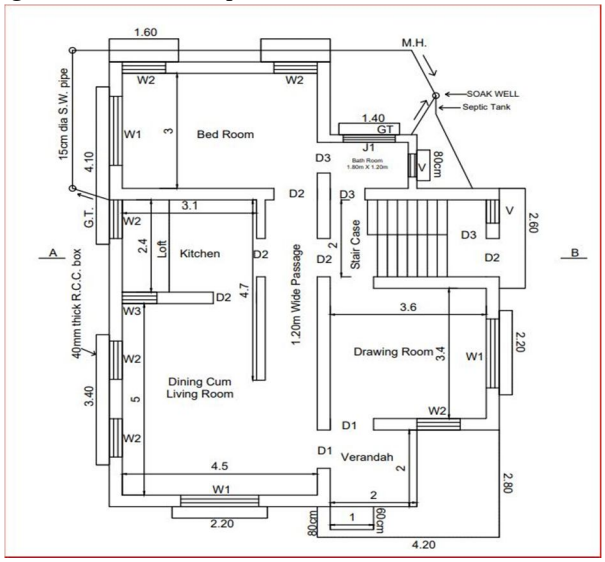



Fig 1. 1st, 2nd, 3rd, and 4th Floor, Floor Plans

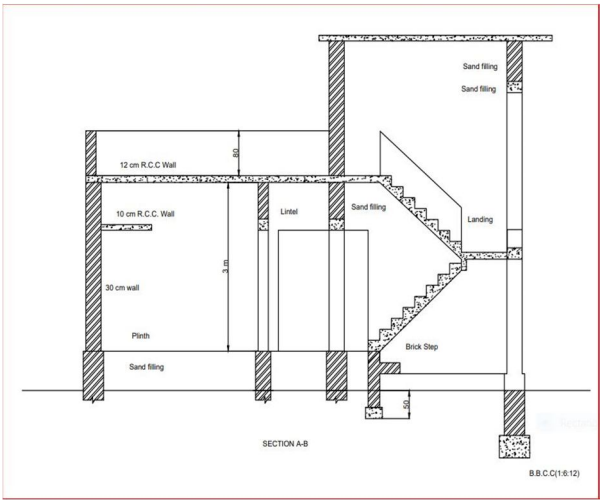
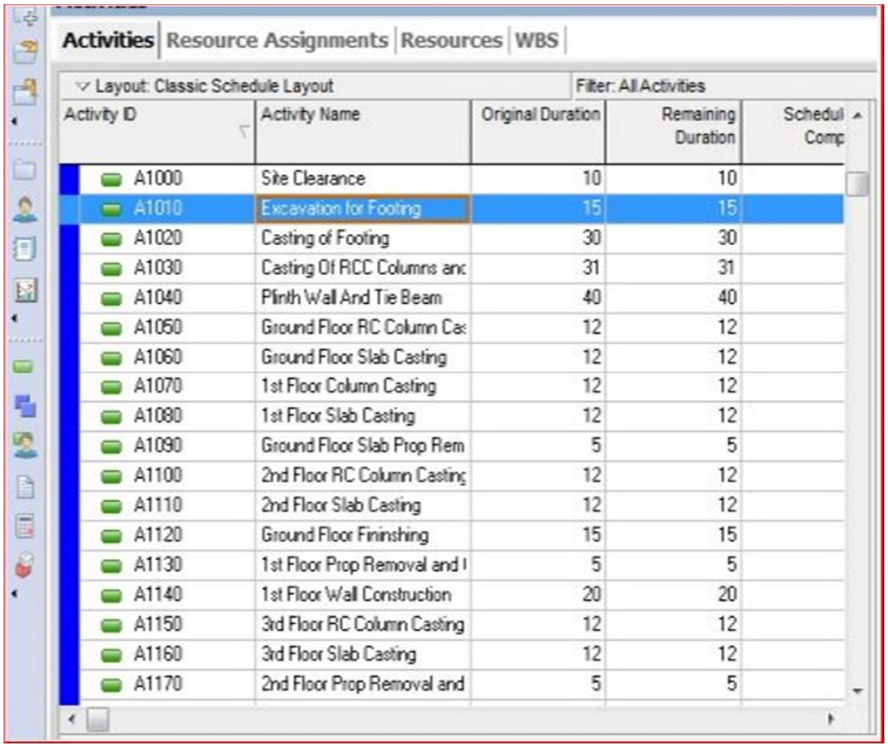



Fig 2. Sectional View

## VII. USE OF PRIMAVERA P6 FOR PROJECT PLANNING

Primavera P6 is professional project management software that has a set start and finish date. It is utilized in a variety of sectors where intensive monitoring and planning are required to complete work on schedule and achieve the intended outcomes. This programme features a very user-friendly layout that makes it easy for any project manager to keep track of what's going on and what's coming up next. The project manager must be able to demonstrate his customer the progress of his assignment in real time if the client is to be satisfied. An animated Gantt chart depicts the many activities and their timetables. The graphic also depicts the connections between various activities, which are linked to a range of resources to facilitate tracking. All progress may be monitored in real time, and required actions can be taken if the schedule is not adhered to. Primavera also allows users to maintain real-time track of expenditures, labor, and resources. This helps the project manager plan ahead and keeps costs under control. Primavera is preferable to conventional planning in that it lets the user to observe the project's status in real time, providing them more influence over the project.




| Activity ID | Activity Name | Original Duration | Remaining Duration | Schedul Comp |
|---|---|---|---|---|
| A1000 | Site Clearance | 10 | 10 | |
| A1010 | Excavation for Footing | 15 | 15 | |
| A1020 | Casting of Footing | 30 | 30 | |
| A1030 | Casting Of RCC Columns and | 31 | 31 | |
| A1040 | Plinth Wall And Tie Beam | 40 | 40 | |
| A1050 | Ground Floor RC Column Cas | 12 | 12 | |
| A1060 | Ground Floor Slab Casting | 12 | 12 | |
| A1070 | 1st Floor Column Casting | 12 | 12 | |
| A1080 | 1st Floor Slab Casting | 12 | 12 | |
| A1090 | Ground Floor Slab Prop Rem | 5 | 5 | |
| A1100 | 2nd Floor RC Column Casting | 12 | 12 | |
| A1110 | 2nd Floor Slab Casting | 12 | 12 | |
| A1120 | Ground Floor Fininshing | 15 | 15 | |
| A1130 | 1st Floor Prop Removal and I | 5 | 5 | |
| A1140 | 1st Floor Wall Construction | 20 | 20 | |
| A1150 | 3rd Floor RC Column Casting | 12 | 12 | |
| A1160 | 3rd Floor Slab Casting | 12 | 12 | |
| A1170 | 2nd Floor Prop Removal and | 5 | 5 | |

Fig 3. All Activities are entered into Primavera.

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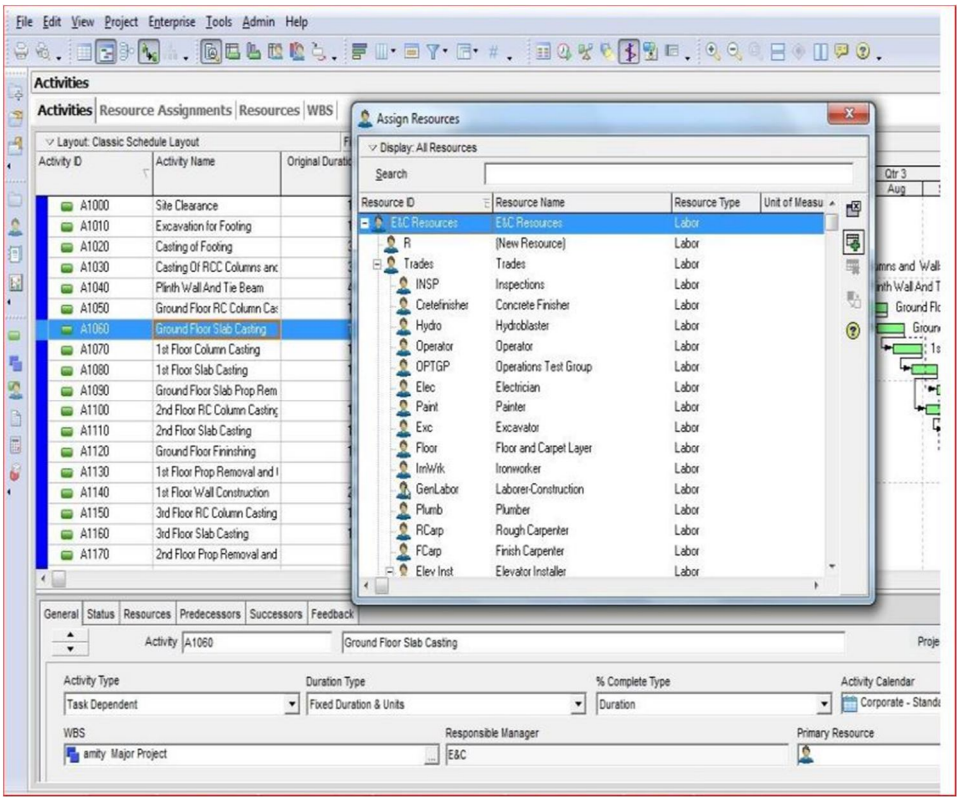



Fig 4. Allocating Resources to Different Activities

When assigning resources, Primavera provides the user a variety of options. Primavera includes almost all of the resources necessary to finish a project, such as earthwork labor, field engineers, electricians, and plumbers. Any resource that is currently missing from the database can be manually added. This provides the user with a great deal of freedom in managing such a large and complex project.

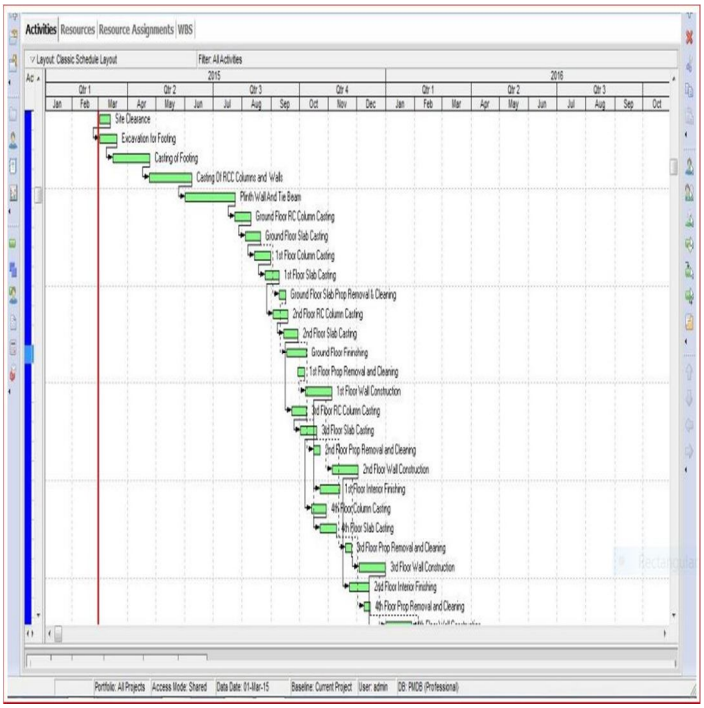



Fig 5. Gantt Chart depicting time scale and link between activities.

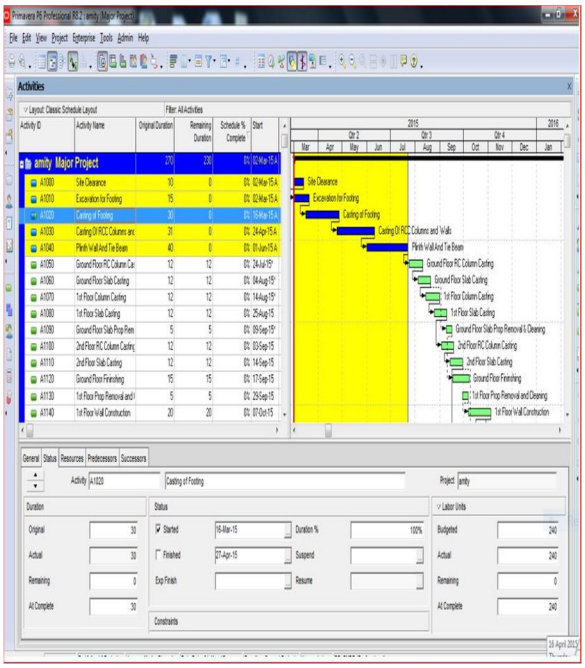


Fig 6. Completed Activities are highlighted in yellow.

The yellow highlighted part indicates that the blue bars have been completed. Green indicates activities that have not been performed.

Each day begins with an 8-hour working shift for each laborer, which can be altered as needed. The project manager monitors all operations in real time, and any delays are adjusted properly so that the work plan is not disrupted.

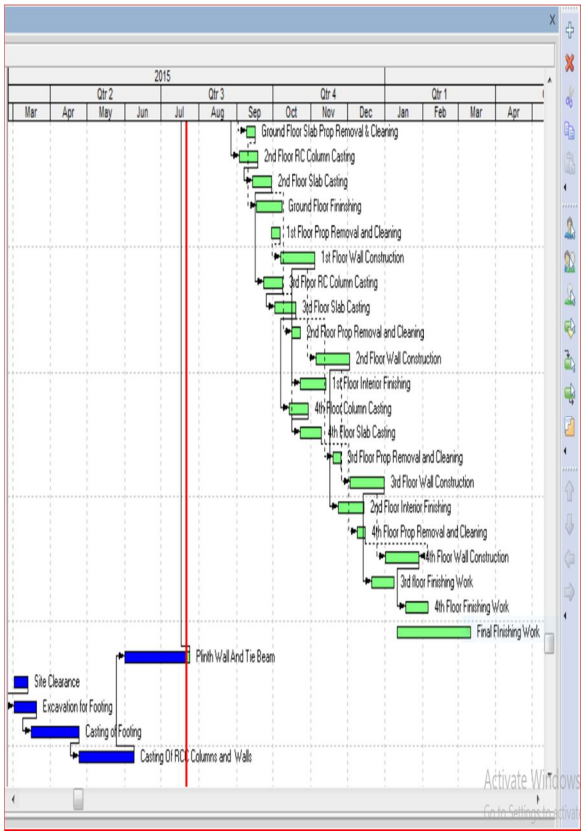



Fig 7. After updating the progress, Gantt chart.

## VIII. G+4 RESIDENTIAL BUILDING COST ESTIMATION

The building's Abstract Cost is included in the cost estimate. The CPWD Schedule of Rates for New Delhi was utilized in the abstract.

The following is the G+4 Residential building's Complete Cost Estimate, which includes a quantity estimate and an abstract cost.

**ABSTRACT**

| No. | Item | Qty. | Per | Rate | Amount |
|---|---|---|---|---|---|
| 1 | Excavation | 48.64 | cu m | Rs. 95.00 | Rs. 4620.80 |
| 2 | B.B.C.C. (1:6:12) in Foundation | 16.34 | cu m | Rs. 1410.00 | Rs. 23039.40 |
| 3 | Sand filling in Plinth | 37.56 | cu m | Rs. 290.00 | Rs. 10892.40 |
| 4 | 1st Quality Brick Masonary upto plinth in c.m. (1:6) | 40.65 | cu m | Rs. 1920.00 | Rs. 78048.00 |
| 5 | 1st Quality Brick Masonary in superstructure in c.m. (1:6) | 57.36 | cu m | Rs. 1950.00 | Rs. 111852.00 |
| 6 | 10 cm thick brick partition wall in c.m. (1:4) | 1.7 | sq m | Rs. 285.00 | Rs. 484.50 |
| 7 | Wooden doors and windows with brass fixtures and fittings | 23.8 | sq m | Rs. 7820.00 | Rs. 186116.00 |
| 8 | Fully glazed wooden windows with brass fixtures and fittings | 14.64 | sq m | Rs. 6945.00 | Rs. 101674.80 |
| 9 | Fully glazed wooden ventilators | 0.6 | sq m | Rs. 7075.00 | Rs. 4245.00 |
| 10 | Steel Grillwork | 10.2 | sq m | Rs. 800.00 | Rs. 8160.00 |
| 11 | Cement Concrete Jali | 2.04 | sq m | Rs. 330.00 | Rs. 673.20 |
| 12 | R.C.C. Lintels proportion (1:1.5:3) | 2.23 | cu m | Rs. 7710.00 | Rs. 17193.30 |
| 13 | R.C.C. Beams proportion (1:1.5:3) | 0.39 | cu m | Rs. 10855.00 | Rs. 4233.45 |
| 14 | R.C.C. Footing proportion (1:1.5:3) | 0.08 | cu m | Rs. 5145.00 | Rs. 411.60 |
| 15 | R.C.C. Column Proportion (1:1.5:3) | 0.16 | cu m | Rs. 9770.00 | Rs. 1563.20 |
| 16 | 40 mm R.C.C. Box Proportion (1:1.5:3) | 13.59 | sq m | Rs. 550.00 | Rs. 7474.50 |
| 17 | 75 mm thick R.C.C. Weathershed proprotion (1:1.5:3) | 4.14 | sq m | Rs. 550.00 | Rs. 2277.00 |
| 18 | 10 cm R.C.C. Slab proportion (1:1.5:3) | 18.36 | sq m | Rs. 690.00 | Rs. 12668.40 |
| 19 | 12 cm R.C.C. Slab proportion (1:1.5:3) | 91.68 | sq m | Rs. 845.00 | Rs. 77469.60 |
| 20 | R.C.C. Stair steps proportion (1:1.5:3) width 1m and polished kotah stone on tread and riser. | 21 | no | Rs. 730.00 | Rs. 15330.00 |
| 21 | 10 cm B.B.C.C. (1:6:12) floor concrete | 6.58 | cu m | Rs. 1410.00 | Rs. 9277.80 |
| 22 | Paving of Mosiac tiles | 57.42 | sq m | Rs. 395.00 | Rs. 22680.90 |
| 23 | 75 mm high mosiac tiles skirting | 50.4 | r m | Rs. 50.00 | Rs. 2520.00 |
| 24 | Paving of polished kotah stone | 17.26 | sq m | Rs. 600.00 | Rs. 10356.00 |
| 25 | 75 mm high polished kotah stone skirting | 15.4 | r m | Rs. 88.00 | Rs. 1355.20 |
| 26 | Paving of 150 mm * 150 mm size white glazed tiles in flooring | 0.81 | sq m | Rs. 575.00 | Rs. 465.75 |
| 27 | ...do... But in dado | 5.76 | sq m | Rs. 595.00 | Rs. 3427.20 |
| 28 | R.C.C. Cooking platform with sink and polished kotah stone finish | 3.8 | r m | Rs. 1900.00 | Rs. 7220.00 |

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| | | | | | |
|---|---|---|---|---|---|
| 29 | Av. 65 mm thick brickbat coba concrete in proportion (1:6:12) on terrace | 73.39 | sq m | Rs. 120.00 | Rs. 8806.80 |
| 30 | Paving of mosaic tiles on terrace | 73.39 | sq m | Rs. 310.00 | Rs. 22750.90 |
| 31 | Cement grit vata in proportion (1:2:4) | 44.2 | r m | Rs. 35.00 | Rs. 1547.00 |
| 32 | 12 mm thick sagol finish cement plaster in c.m.(1:4) | 634.82 | sq m | Rs. 81.00 | Rs. 51420.42 |
| 33 | Three coats of colour-washing | 634.82 | sq m | Rs. 15.00 | Rs. 9522.30 |
| 34 | 100 mm diameter S.W. Pipe | 4 | r m | Rs. 130.00 | Rs. 520.00 |
| 35 | 150 mm diameter S.W. Pipe | 13 | r m | Rs. 175.00 | Rs. 2275.00 |
| 36 | 75 mm diameter C.I. Pipes (Open) | 19.6 | r m | Rs. 310.00 | Rs. 6076.00 |
| 37 | 100 mm diameter C.I. Soil Pipes (Concealed) | 5 | r m | Rs. 550.00 | Rs. 2750.00 |
| 38 | 75 mm diameter C.I. Vent cowl | 1 | no | Rs. 140.00 | Rs. 140.00 |
| 39 | 100 mm diameter C.I. Vent Cowl | 1 | no | Rs. 160.00 | Rs. 160.00 |
| 40 | Indian W.C. Pans with a pair of foot rests | 1 | no | Rs. 1370.00 | Rs. 1370.00 |
| 41 | P.V.C. Flushing cistern for W.C. | 1 | no | Rs. 2200.00 | Rs. 2200.00 |
| 42 | White wash basin with stop cock, pillar cock etc. | 1 | no | Rs. 2465.00 | Rs. 2465.00 |
| 43 | Nahni Traps | 2 | no | Rs. 200.00 | Rs. 400.00 |
| 44 | Gully Traps | 3 | no | Rs. 320.00 | Rs. 960.00 |
| 45 | Inspection Chambers | 1 | no | Rs. 2600.00 | Rs. 2600.00 |
| 46 | Manholes | 2 | no | Rs. 3200.00 | Rs. 6400.00 |
| 47 | Intercepting S.W. Sewer trap | 1 | no | Rs. 450.00 | Rs. 450.00 |
| 48 | Mica Flap Valve | 1 | no | Rs. 900.00 | Rs. 900.00 |
| 49 | 12 mm diameter G.I. Pipe concealed | 20 | r m | Rs. 190.00 | Rs. 3800.00 |
| 50 | Stop cocks | 2 | no | Rs. 340.00 | Rs. 680.00 |
| 51 | Bib Cocks | 3 | no | Rs. 280.00 | Rs. 840.00 |
| 52 | Manhole Cover | 2 | no | Rs. 450.00 | Rs. 900.00 |
| 53 | Septic tank and soak well | 1 | pair | Rs. 80000.00 | Rs. 80000.00 |
| | | | | Total | Rs. 935663.42 |
| | | | | Add 5% Contingencies | Rs. 46783.17 |
| | | | | Grand Total | Rs. 982446.59 |
| | | | | **Approximate Total** | **Rs. 982500.00** |

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## IX. CONCLUSION

This project entails designing a G+4 residential building with AutoCAD, planning with Primavera P6, and calculating the overall project cost.

The planned G+4 residential building's layout is based on a 33' x 41' plot. AutoCAD was used for all of the drafting.

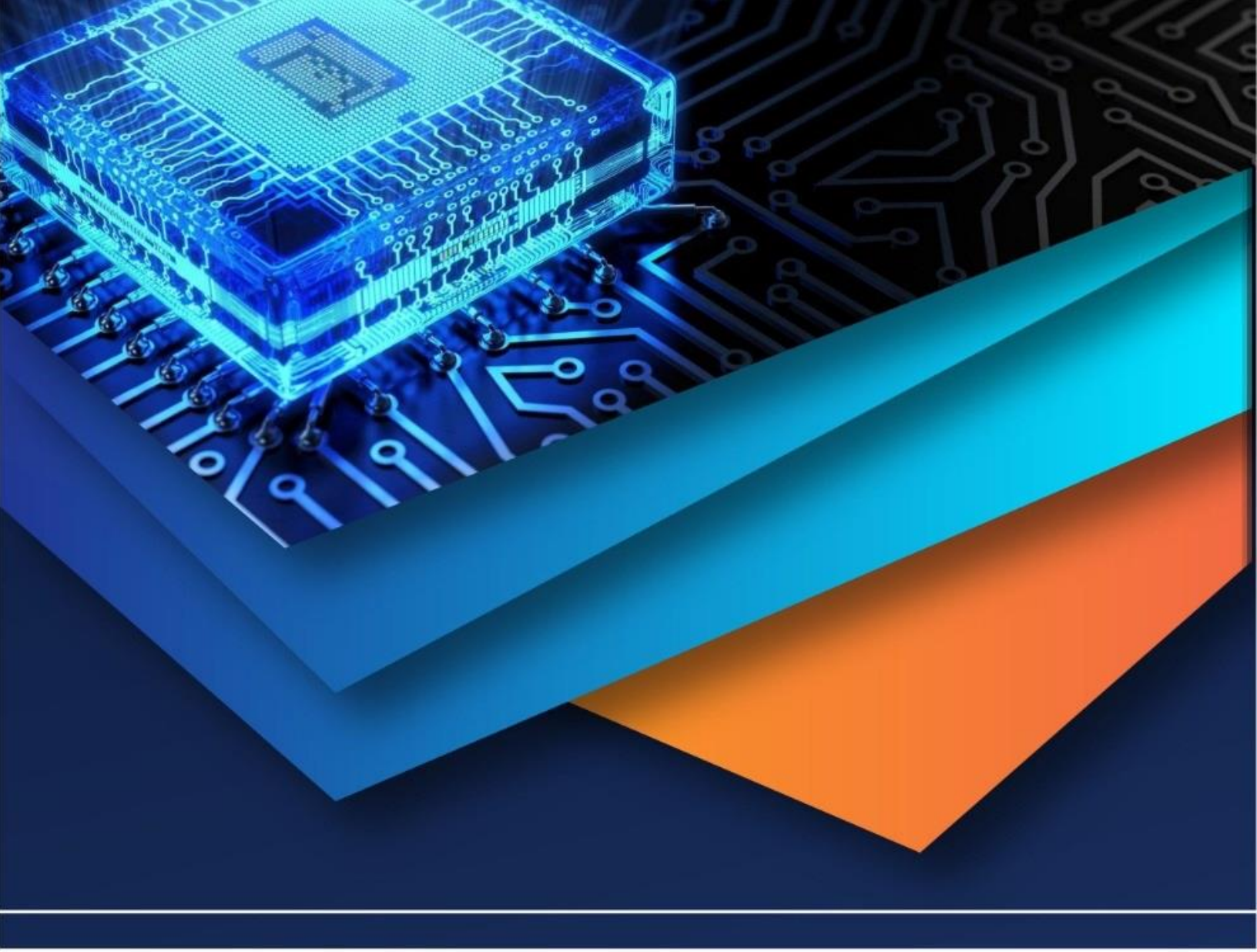
Primavera P6 was used to plan the many operations that surround a building's development. Using Primavera, we were able to build a work plan and a progress indicator for ongoing project monitoring. Using Primavera, we were able to assign different resources and responsibilities to different people who were involved in different stages of the project, which boosted accountability. The length of the Primavera project has been estimated to be roughly 374 days, including vacations. An animated Gantt chart was used to highlight the progress and relationships between the various activities. This chart also aids the Project Manager in explaining the project's many features and progress to his clients.

The project's cost estimate was determined in Microsoft Excel using the Centre Line Method. The CPWD Schedule of Rates was used for the Abstract cost, and a total cost of Rs 982500/- was determined.

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