

ENHANCING CONSTRUCTION PRODUCTIVITY BY MICROSOFT PROJECT FOR PLANNING, SCHEDULING AND RESOURCE ALLOCATION

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ABSTRACT

A high-rise building's construction is a type of repetitive construction in which the same basic unit (typical poor of structure) is repeated multiple times. Delays and cost overruns can easily occur as a result of poor scheduling. Planning and scheduling a project should employ proper methodologies; management decisions should not be based solely on experience and intuition. The construction of a high-rise building is a sort of repetitive construction in which the same basic unit (typical poor of structure) is repeated numerous times. There is evidence that contractors avoid utilizing Gantt charts and network schedules in highly repetitious projects because they are resource and time restricted. Every building project is determined by two critical factors: cost and timing. The primary goal of project management is to finish the project on time, on budget, and with guaranteed quality. Adopting traditional execution techniques makes it difficult to consistently monitor work progress, review plans, track cost and time, and execute corrective actions as needed.

Keywords: - Planning, Scheduling, Gantt Chart, Cost, Time, Project Management.

1. INTRODUCTION

The word "construction" always refers to civil engineering terms and activities, which actually means creation or formation, or a process or action taken to make something reality/existence. Construction, like other industries, may face a variety of challenges that must be addressed wisely, most notably time, resource, and cost management. Because of poor project formulation, insufficient planning for implementation, a lack of best or good contractor planning and management, and poor plan management during project execution. Project planning is a more general and common term in construction management that refers to the achievement of desired goals and destinations. The key to completing a project is proper planning. As a result, the concept "project planning" has been employed on a variety of platforms to describe equal meanings of various things. In general, planning is breaking down the entire project into tiny, defined, recognizable, and quantifiable tasks, activities, or activity, and then determining the logical interdependencies between them. Scheduling is the process of allocating time by performing a complete and clear analysis of the planning term to each and every activity in order to determine the ultimate project duration and delivery date. To put it another way, it manages the time of each work activity indicated by the planning process prior to or during project execution. Resource allocation is the process of assigning the resource in proper manner in order to meet the goal. Resource is a physical variable such as men, material, money and machine required for completing various activities of the project. The main objective of resource allocation is to minimize or eliminate the wastage of the resource.

1.1 NEED OF STUDY

Planning is required to establish desired goals, limit risk, meet deadlines, and finally produce agreed-upon products, services, or outcomes. Construction planning and scheduling enhances job efficiency; having good material management and effectively allocating resources reduces costs and saves time. Planning construction projects helps to establish cost, scope, time and quality action plans in a detailed schedule.

1.2 OBJECTIVES

1. To study planning, scheduling and resource allocation method adopted by the organization.
2. To conduct planning, scheduling and resource allocation of construction activities using Microsoft Project.
3. Comparative study of conventional method with relation to advanced tools and software's of planning and scheduling (Microsoft project).
4. To find causes of delays in the construction phase.

1.3 SCOPE

1. The study of project is limited of planning of the project with respect to time only.
2. To complete the project with minimum cost and time.
3. With the help of work breakdown schedule to create various sub activities in order to develop a proper co-ordination of sub activities with cost and time
4. Schedules are used to communicate final deadline, milestone and to determine the resource need.

1.4 EXPECTED OUTCOME

1. It's helps to track the requirement of funds to be necessary at a particular time and helps to save the wastage of material due to proper allocation of a materials and thus low wastage of materials more the profit.
2. It also helps people to adopt Microsoft project software for high rise construction projects.

1.5 MICROSOFT PROJECT SOFTWARE

Microsoft Project is a Project Management software, established and sold by Microsoft. It is designed to assist the project manager to develop the plan, schedule the activities, assign resources to the activities, track the progress, manage the budget and analyses the workloads. Microsoft project can detect different classes of handlers. These multiple user classes have varying amounts of access to different project views, project levels, and other data. Software can be used to track a single project with various actions and resources. It includes a visual selection of resources based on the needs. Calendars, tables, filters, views, and other customization features in Microsoft Project are saved as an enterprise inclusive (global) database that may be accessed by all users. Microsoft Project makes use of teamwork and provides access to the outcomes. It is supposed to help a project manager create a schedule, assign resources to tasks, track progress, manage the budget, and analyzed workloads. Microsoft Project was the third Microsoft Windows-based application developed by the company. Although it is a member of the Microsoft Office family, it has not been included in any of the Office suites. The .mpp file format is specific to Microsoft Project.

2. LITERATURE REVIEW

Subramani & Karthick (2018), has empirically studied the optimization of the project period i.e., schedule by minimizing workforce and equipment so as to minimize the total cost of the project as well as to develop software used in this project to optimized scheduled with available construction workforce for other similar type of projects. This construction project investigated the useful resource scheduling for a fast-track project with limited intervals. The software tool used for this project is Microsoft project 2013 for scheduling, tracking of project, resource assignment, resource levelling and calculation of cost of project. Authors studied that the resource management is important feature that improve productivity in construction projects. If resources are not properly utilized on site, then implication leads to waste, shortage of materials, delays and lower in productivity. The methodology of the project study was executed in stages. In which data like resources (material and labors) are collected. All the activities are entered in Microsoft project software and scheduled is prepared. After that duration, quantity and the styles of sources required for completing activities are estimated. Resource levelling is done by the help of Microsoft software 2013 for minimal waste and resolve conflicts like over-allocation, delays, budget overruns and then task has been assigned to each activity. In this study the schedule is optimized by resource levelling i.e., use of all resources to complete the project in software Microsoft project 2013. Then author concluded that the effective method for time management was critical path method (CPM).

Joshi & Patil (2015), studied resource scheduling of construction project using Microsoft project 2013. Project management techniques like critical path method and program evaluation and review technique are useful in scheduling and coordinating various resources. The primary goal of this project is to examine various management strategies by scheduling various construction, resource allocation, and resource levelling using Microsoft Project 2013. Microsoft Project 2013 was utilised in this project to study resource constraints by resource levelling and comparing the time impact with scheduled and expected time. There are two phases to this project. In the first phase, data is collected on-site and quantities are calculated in accordance with the drawings. In addition, the amount of manpower required is calculated by taking into account the quantities of various activities. In the second phase, Microsoft Project 2013 is used to define various construction activities. The project schedule for identifying construction sequence is prepared in the form of a Gantt chart. These activities were given resources (manpower). The actual available resources on the construction site have been analyses and resource levelling has been performed. Resource levelling is performed for resource constrained analysis. Only manpower (labour) is considered a resource type for this project. The cost of the project increases day by day due to unexpected labour requirements or other unavoidable circumstances, which has an impact on the overall cost of the project. Because of the reduction in resource constraints, the duration has been increased. Masons, male coolies, and electricians are among the available resources. The increase in duration (% increase) is 10.38 %, resulting in a 0.94 % increase in project cost. Thus, resource scheduling reduces the risk of unexpected project losses caused by large variations in resource utilization.

Monish Kumar K et.al. (2017), found that traditional practices and poor planning have been reduce the efficiency of the construction industry. As a result, the project's duration is lengthened, resulting in higher overhead costs and lower quality work. To eliminate these flaws in construction projects, Microsoft Project 2013 software is introduced as an effective project management tool. The MK apartment residential construction project uses MS Project 2013 software for project scheduling,

estimation, and resource allocation. The allocation of resources results in the project's budgeted cost, time, and materials. Thus, project planning is done accurately using MSP 2013 as a construction project management tool, allowing management to effectively organize the resources required for the project.

Shubham Laddha et.al. (2017), evaluated a project's working and operating utilising a modern project management tool available on the market and then compared it to the traditional software (Excel) that is used. In order to gain an understanding of various project management approaches in the construction industry, we also conducted an online poll that included all stakeholders involved. Notably, traditional software Microsoft Excel is still used by 80% of India's construction industries for project planning, scheduling, and control, while 86 percent felt the need to adapt to new software. Then they went to a construction company in Pune, where Microsoft Excel is still the primary project management tool. They shared their views with a strong desire to work on one of their projects utilising Microsoft Project. They planned and scheduled the building using the Microsoft Project application. The results they achieved were far better than those obtained using traditional software.

3. METHODOLOGY

For planning and scheduling, we took an ongoing residential building construction Arihant Heights G+7 located in Bhiwandi. As it is like any ongoing projects, we have made a list of all the activities by doing meeting with the project manager. The study focuses mostly on cost, time, and resource management strategies used in the project's implementation. The traditional approach was determined and compared to the Microsoft project (MSP).

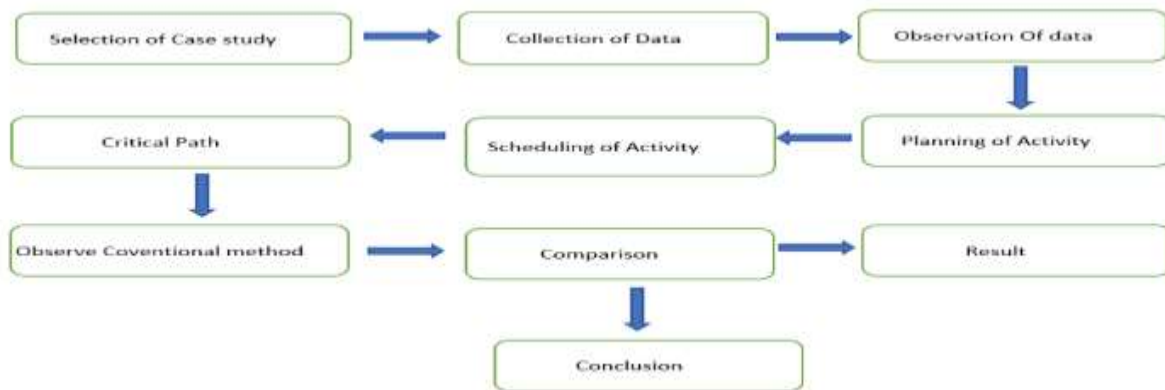


Fig. 3.1. Flowchart of Methodology

3.1 DATA COLLECTION & ANALYSIS

Data was collected from duration 8th February 2021 to 17th April 2021 from site Arihant Heights which includes materials, man power, machinery, other resources used, duration of each activity, the sequence of activities (dependent or independent) and any delay was occurred during the construction. Arihant Heights is still under construction. An analysis of planning and scheduling was again carried out for the Arihant heights with help of Microsoft Project software. After the analysis all the activity data is enter in the task column in their sequence of construction. All the activity required duration and activity linking was done in the Microsoft project software and then required resources are allocated to each activity to finish on time.

3.2 WORK BREAKDOWN STRUCTURE OF ARIHANT HEIGHTS: -

- | | |
|--|--|
| 1. SITE SET-UP WORK | 7.5. INTERNAL SAND FACE PLASTER (BEHIND DADO) |
| 2. SUBSTRUCTURE WORK | 7.6. EXTERNAL PLASTER |
| 2.1. EXCAVATION & ALLIED WORK IN FOUNDATION | 7.7. FLAT BALCONY & STAIRCASE RAILINGS |
| 2.2. FOOTING WORKS | 7.8. TILING WORK |
| 2.3. STUB COLUMN & BACKFILLING COMPACTION | 7.9. CARPENTARY WORKS |
| 2.4. PLINTH WORKS | 7.10. ALUMINIUM DOOR AND WINDOW WORK |
| 3. APPLY FOR PLINTH CERTIFICATE | 7.11. INTERNAL PAINTING |
| 4. APPROVAL OF PLINTH CERTIFICATE | 7.12. EXTERNAL PLUMBING |
| 5. RCC WORK 5.1. 1ST SLAB | 7.13. EXTERNAL PAINTING |
| 5.1.1. COLUMN AND RF SHUTTERING AND CASTING | 7.14. ELECTRIC WORKS (SWITCH BOXES) |
| 5.1.2. BEAM BOTTOM MARKING & FIXING (TOPI MARKING) | 7.15. SANITARY WORKS |
| 5.1.3. BEAM BOTTOM | 7.16. CP FITTING WORKS |
| 5.1.4. BEAM & SLAB REINFORCEMENT | 8. FIXTURES AND FURNISHING WORKS |
| 5.1.5. ELECTRIC CONDUIT WORK IN SLAB | 9. MEP WORKS |
| 5.1.6. ARCHITECT AND RCC CONSULTANT CHECKING | 9.1. DRAINAGE LINE WORKS |
| 5.1.7. CONCRETING | 9.2. ELECTRIC MAIN LINE CONNECTION WORKS |
| 5.2. UPTO 8TH SLAB | 9.3. PARKING FLOORING WORKS |
| 6. PARAPET & OTHER ELEVATION FEATURES | 9.4. TRANSFORMERS, HT-CABLES & PANELS |
| 7. FINISHING WORK | 9.5. LIFT WORKS |
| 7.1. BLOCK WORK | 9.6. PUMP WORK |
| 7.2. ELECTRIC WALL CHASING, PIPING & SAND PLASTER WORKS | 9.7. FIRE FIGHTING WORKS |
| 7.3. GYPSUM PLASTER | 9.8. SOLAR SYSTEM WORKS |
| 7.4. INTERNAL PLUMBBING AND WATERPROOFING (TOILET, KITCHEN & BALCONY) | 10. DEVELOPMENT AREA WORK (APPROACH ROAD, SIDE GUTTERS ETC) |
| | 11. MISCELLANEOUS WORKS |
| | 12. HOUSE KEEPING & CLEANING WORTKS |
| | 13. HANDOVER-POSSESSION |

Fig. WBS OF THE ARIHANT HEIGHTS**3.3 BAR CHART AND CRITICAL PATH**

A bar chart, as seen in the picture above, is a graphical representation of project activities in the form of a time-scaled bar line with no linkages between them. The x-axis of a bar chart is used to represent time, while the y-axis represents individual activities. Critical path indicates the sequence of project network activities that takes the most time overall. The red line shown in above fig. indicates the critical path which says it's a major or important task of the project which cannot be shuffle or can change it.

3.4 CASE STUDY DETAILS

Name of the Project: - Arihant Heights
 Location: -Bypass Bhiwandi, Thane-421302
 No of Floors: -G+7
 Type of Building: - Residential Building
 Type of Construction Method: -Conventional Method
 Plot Area: -381.38 sq.m
 Project Manager: - Manish Darekar
 Project Start Date: -22nd December 2020

4. RESULT & DESCUSSION

Arihant Heights is still under construction. An analysis of planning and scheduling was again carried out for the arihant heights with help of Microsoft Project software. After the analysis all the activity data is enter in the task column in their sequence of construction. All the activity required duration and activity linking was done in the Microsoft project 2019 software and then required resources are allocated to each activity to finish on time. All the calculations of time (duration), cost, labors and allocation of material has been clearly mentioned in given Microsoft Project 2019 with proper linking of an activity and resource Allocation.

4.1 UPDATED SCHEDULED IN MICROSOFT PROJECT SOFTWARE

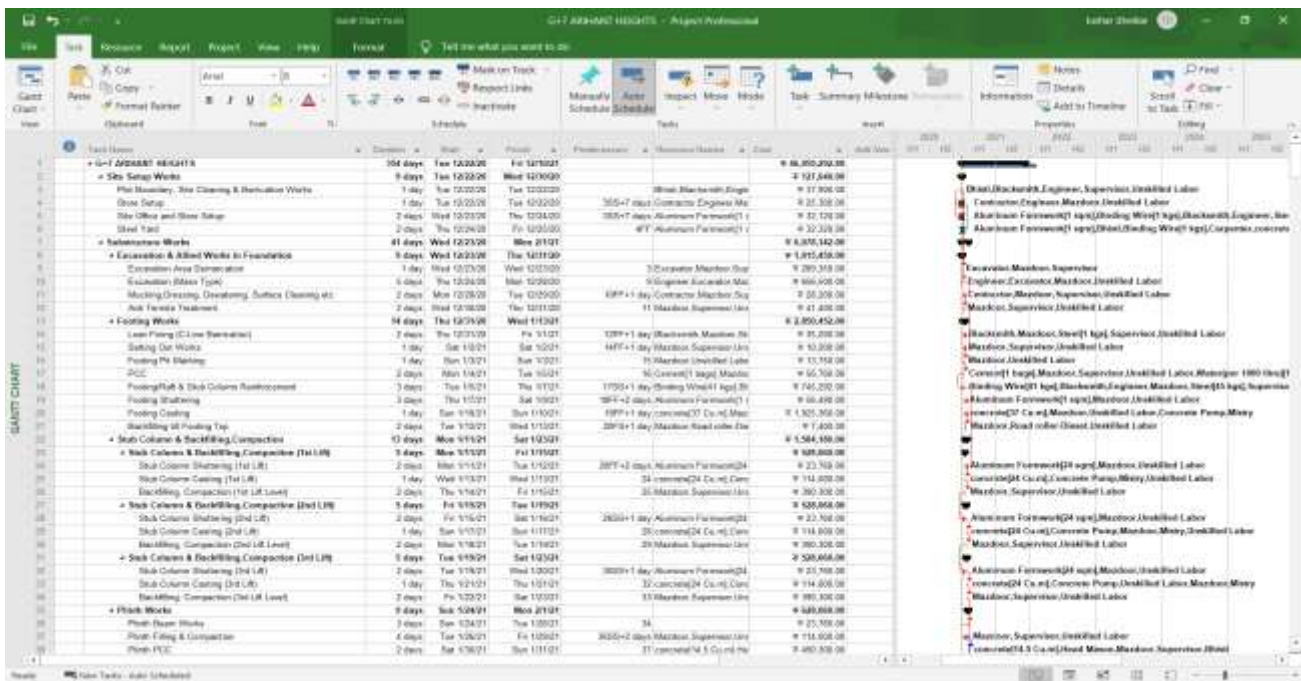


Fig.4.1.1 Bar chart till Plinth Work

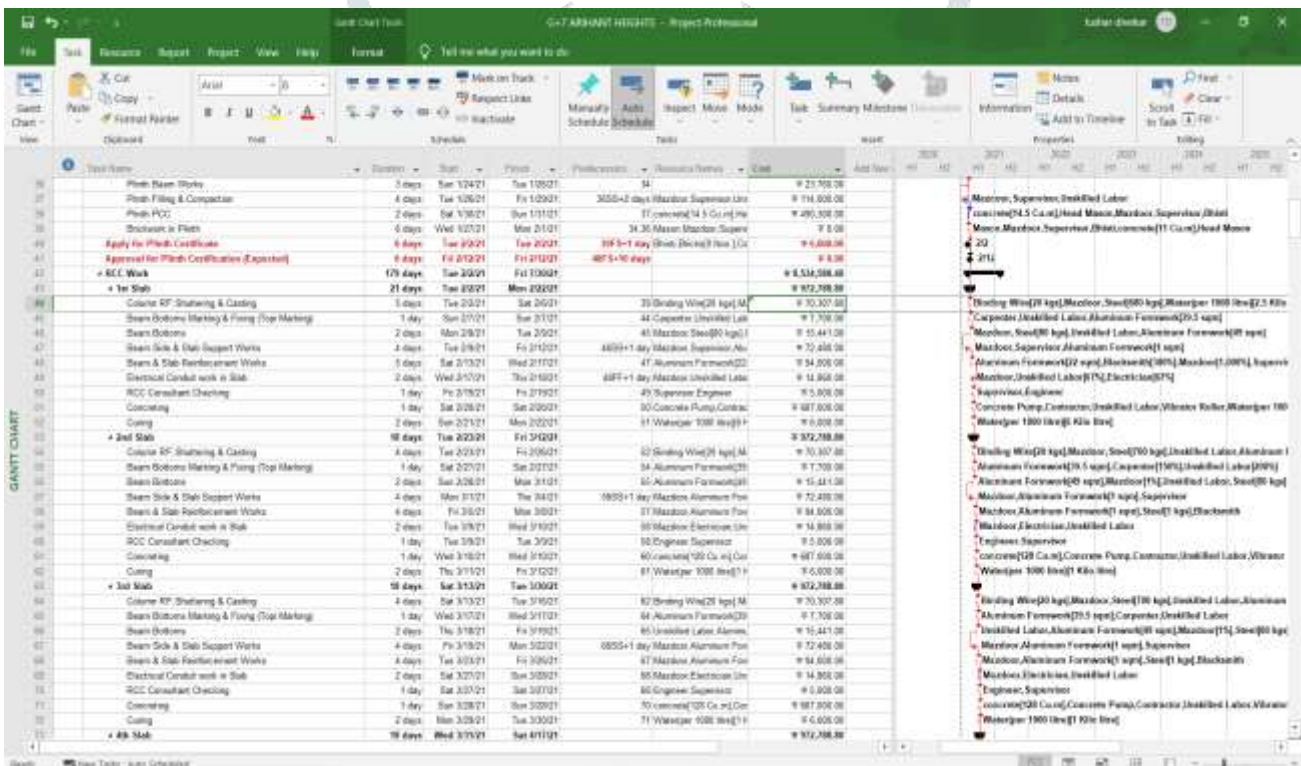


Fig.4.1.2. Bar chart till 3rd Slab work

The construction of Arihant Heights is still ongoing. The data is gathered from the construction of arihant heights up to the third slab. MSP creates additional planning and scheduling based on information gathered from their past construction sites.

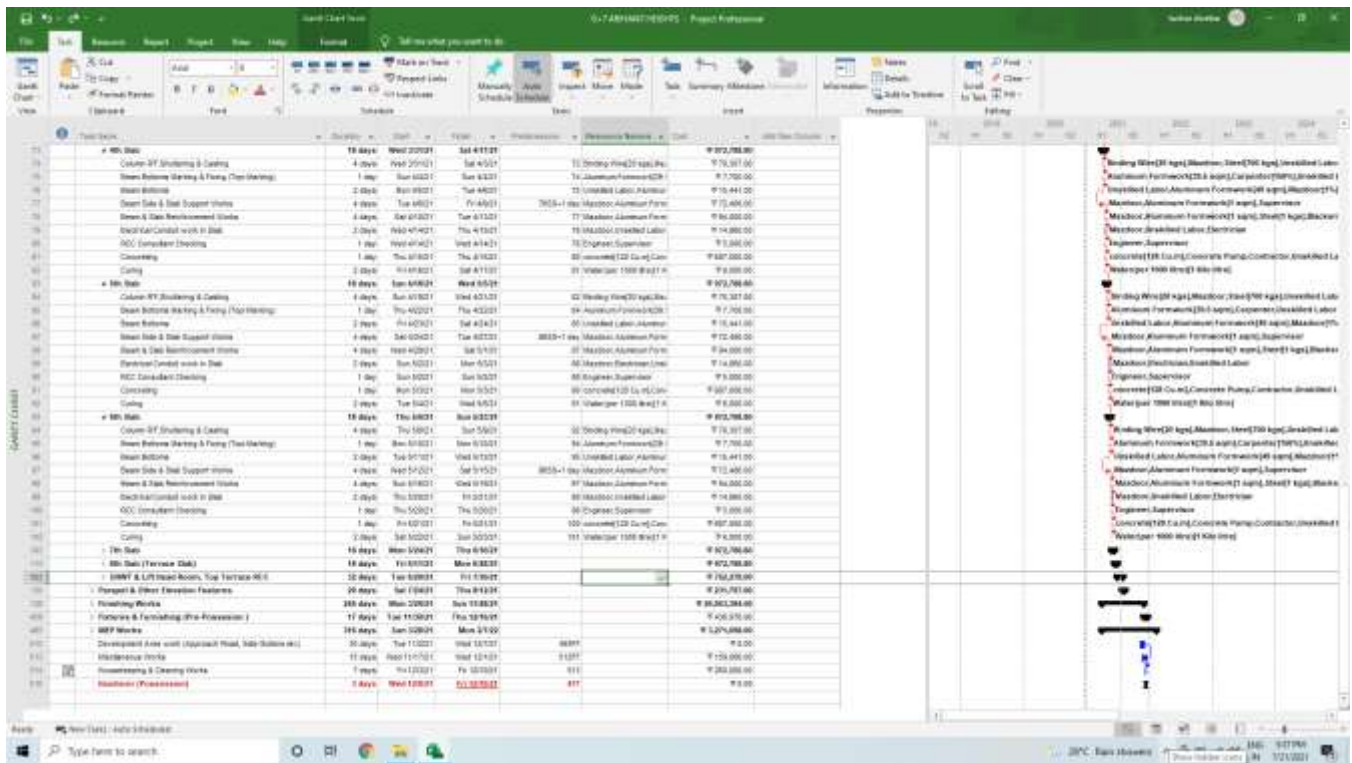


Fig.4.1.3. Bar chart till Possession Handover

The screenshot shows a Resource Sheet for the same project. The table lists resources with their types, units, and rates. The resources are categorized into Work, Material, and Labor. The 'Engineer' resource is highlighted in red. The table includes columns for Resource Name, Type, Material, Units, Group, Max, Util. Rate, Cost Rate, Comp/Use, Avail., Rate, and Code.

Resource Name	Type	Material	Units	Group	Max	Util. Rate	Cost Rate	Comp/Use	Avail.	Rate	Code
1 Engineer	Work		E			100%	₹ 2,000.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
2 Contractor	Work		C			50,000%	₹ 900.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
3 Supervisor	Work		S			10,000%	₹ 450.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
4 Excavator	Work		E			10,000%	₹ 450.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
5 Hole Driller	Work		H			10,000%	₹ 750.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
6 Head Mason	Work		H			10,000%	₹ 600.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
7 Mason	Work		M			50,000%	₹ 450.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
8 Mazdoor	Work		M			50,000%	₹ 450.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
9 Bhisti	Work		B			50,000%	₹ 600.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
10 Carpenter	Work		C			50,000%	₹ 600.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
11 Painter	Work		P			50,000%	₹ 600.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
12 Blacksmith	Work		B			50,000%	₹ 600.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
13 Electrician	Work		E			50,000%	₹ 600.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
14 Polisher	Work		P			50,000%	₹ 500.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
20 Windows	Material		W				₹ 7,000.00		₹ 0.00	₹ 0.00	Prorated Standard
27 Beldar	Work		Be			3,300%	₹ 368.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
38 DPC	Work					100%	₹ 0.00/hr	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
39 Unskilled Labor	Work		UL			12,000%	₹ 300.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
37 Doors	Material		D				₹ 5,000.00		₹ 0.00	₹ 0.00	Prorated Standard
37 Plumber	Work		P			100%	₹ 0.00/hr	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
38 Vibrator Roller	Work		VR			100%	₹ 3,000.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
40 Fitter	Work		F			2,100%	₹ 487.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard
41 Labor for plumbing	Work		PL			2,700%	₹ 485.00/day	₹ 0.00/hr	₹ 0.00	₹ 0.00	Prorated Standard

Fig.4.1.4. Resource Sheet 1

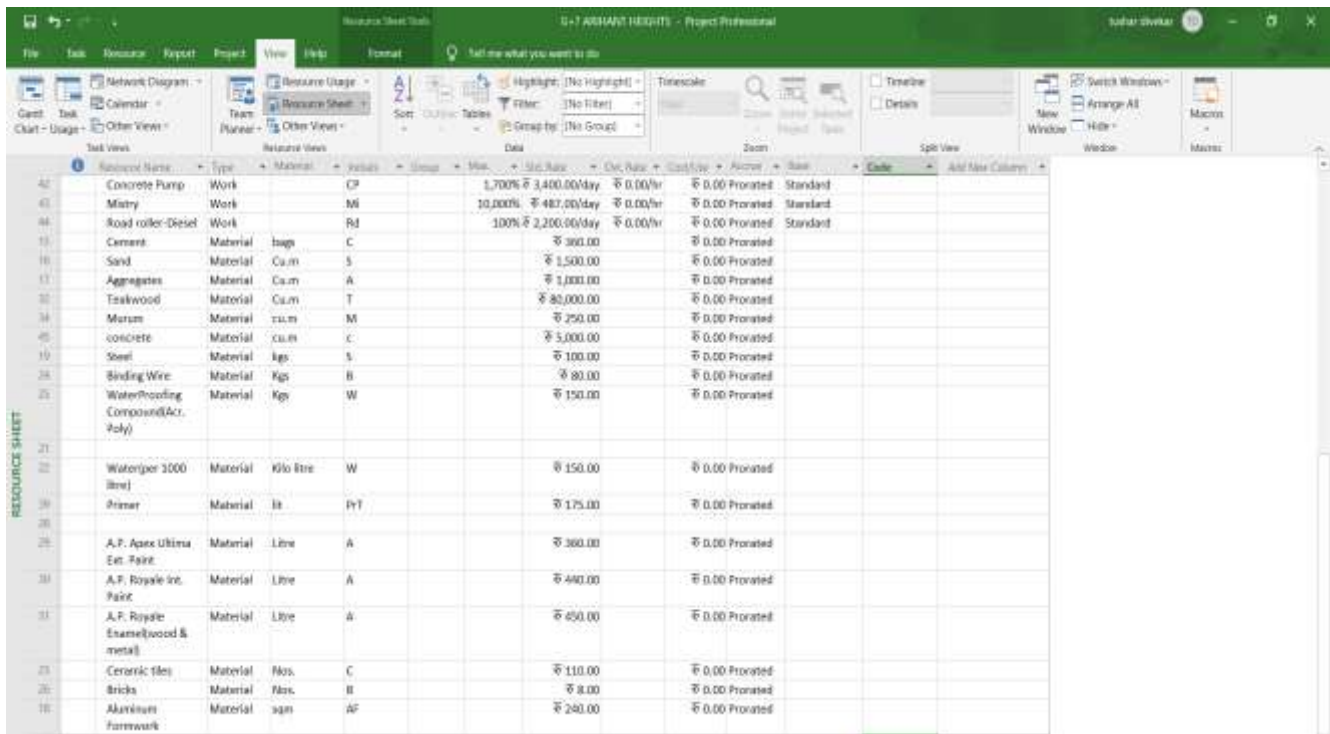


Fig.4.1.6. Resource Sheet 2

Activity	Duration of Delay (days)	Reasons of Delay
Footing work	5	1. Equipment's are not available on time 2. Shortage of labors for shuttering and backfilling work
Stub column, backfilling and compaction	3	1. Unavailability of labors

Table.4.1.1. Activity delays and their Reason

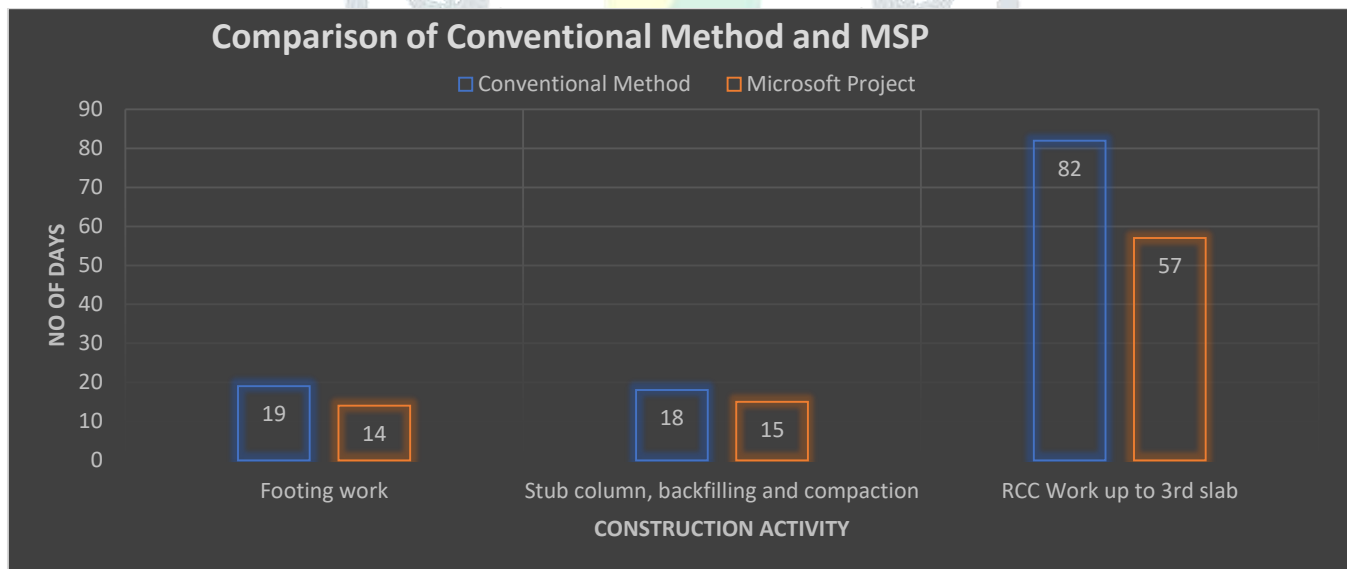


Fig.4.1.6. Comparison of Conventional Method and MSP

Result: -

Project Starting Date: -22nd December 2020

Project Completion Date: -14th January 2022 (Conventional Method)

Project Completion Date: -10th December 2021 (Microsoft Project Software)

5. CONCLUSION

Planning and scheduling- Proper planning and scheduling are very important to ensure that the project should be completed within a given period duration. The time calculated for the construction of Arihant Heights with the help of MS-Project 2019 is 354 days. MSP helps for the optimum and effective organization of activities which helps to give the vision to complete the project in planned duration and within the Economy. As per conventional method, the project commenced on 22nd December 2020 and was scheduled to be completed on 14th January 2022, but was delayed by 33 days. After updating, the scheduled in the Microsoft project the project was completed to be on 10th December 2021.

Activities that caused delays to the project were identified and rescheduled appropriately. The traditional way of construction shows to be uneconomical and needs more time with several complications and large errors that actual project execution. By observation of the updated schedule, it was evident construction activity of RCC 1st slab and 2nd slab which concreting and reinforcement was the most time-consuming activity. Microsoft project software is work on the Gantt chart concept. This allows for a clear understanding of the work's progress in relation to the time schedule. Finally, we can conclude that using Microsoft project as compared to Conventional Method the time is optimize by 33 days which improves the construction productivity.

6. REFERENCE

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