Study On Time And Resource Management In Construction Projects Using MS Project

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Abstract— *Construction resources usually constitute a major portion of the total cost in a building project. Most of the construction projects suffer from maintaining time, labour, materials and equipments. This is due to improper planning and subsequent monitoring of the schedule and of CPM charts. To use these resources effectively an optimized schedule is needed. For this purpose, the availability of powerful project management tool Microsoft Project will help in scheduling models which can be easily created and used. This will help to improve management strategies. In this project work, a live project named as "RAMKY PEARLS" in Hyderabad is taken up as a case study. This project deals with construction of villas. For this project the scheduling and allocation of resources are done by using Microsoft project software which will help in scheduling and easily allocating resources to day-to-day activities. These resources are most effectively utilized by using two different methods. In the first method, three villas are constructed one after the other. In the second method, three villas are constructed simultaneously with effective usage of time and resources. From these two methods, the variations between the time and optimum usage of resources are observed and all necessary data of information are collected. This will help to use the resources effectively to similar kind of villas in the same place. Therefore the proper management can improve the productivity and cost efficiency of the project and help to ensure its timely completion with minimum cost. The results of this study are based on the proper scheduling and allocation of resources which are optimally utilized as per the planning and CPM charts*.*

I. INTRODUCTION

The success of the project highly depends on appropriate implementation of time management along with labour and materials management. Time management is the act or process of planning and exercising conscious control over the amount of time spent on specific activities, especially to increase effectiveness, efficiency or productivity. Materials Management is that listing out the various companies that are supplying the materials along with the time schedule. Time Management is a vital part of Construction Project. Time management starts from planning and taking off scheduling of the project activities till the final stage of completion in all aspects. Time allocation will depends upon the urgency, availability of funds and machines etc. Based on these aspects the project execution will be fixed. The success of the project highly depends on appropriate implementation of time management procedures within a project team. At present, the improvement of productivity and effective time management procedures become extremely important for completion of projects with positive results and even for surviving of a construction company as a business structure. Inappropriate time management and low productivity create a negative impact on project environment, particularly increased cost, losses in profit and damage to reputation. The extend of time for project execution will places a company in danger of paying liquidation damages, late completion penalty, losing current and future contracts, and company's reputation. Time management other activities such as resource allocating, setting goals, prioritizing tasks, and analysis of time spent are also vital. Poor planning, lack of updated project plans and a failure to apply a critical path analysis technique affect project performance and results. The most common way to design a project plan for construction project is by using a Gantt chart which is developed from a precedence network diagram indicating

a critical path of the project. Schedule control and progress monitoring processes are used to control and monitor actual project progress and as a result of these two processes outputs for required project correction are developed.

II. OBJECTIVE

To optimize the project duration i.e., to develop the schedule to minimize the time by minimizing workforce and equipment so as to minimize cost of the project.To optimize use of the existing construction workforce and develop a module to use it for other similar projects.Planning effective use of different materials for a luxurious building,
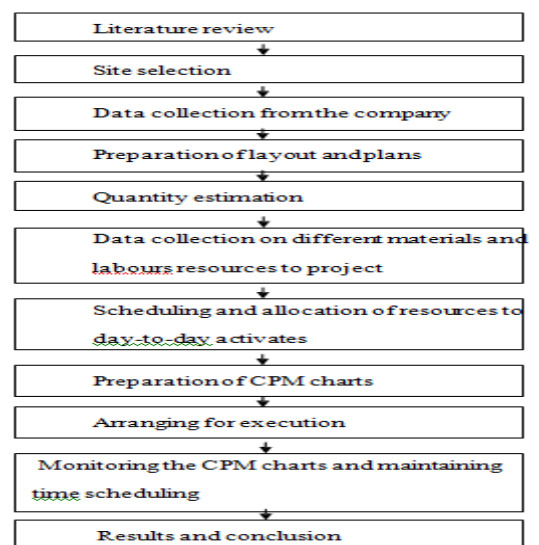
III. METHODOLOGY

3.1 General
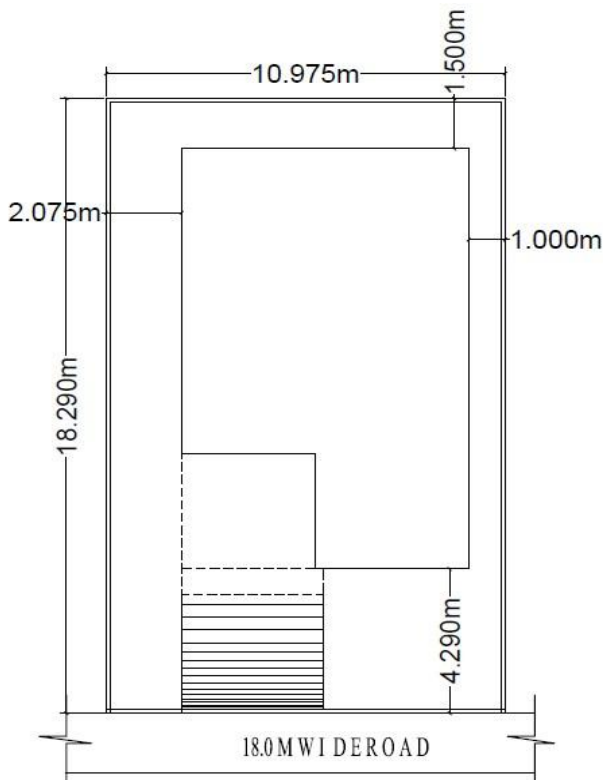

Fig.3.1 Flow Chart of Methodology
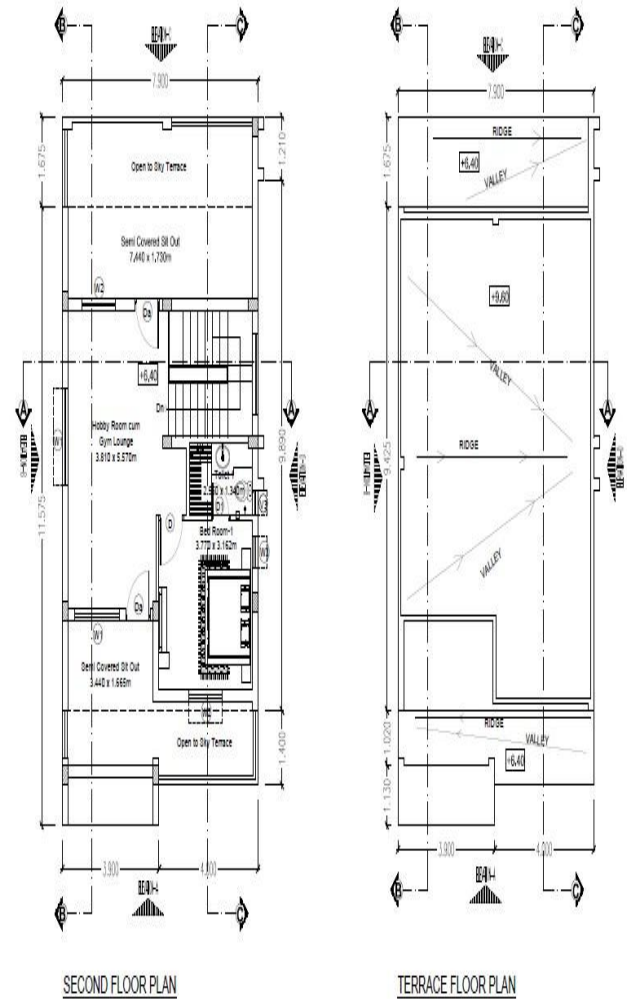
Fig. 3.2 Layout of villa

Fig. 3.3 Ground and First floor plan

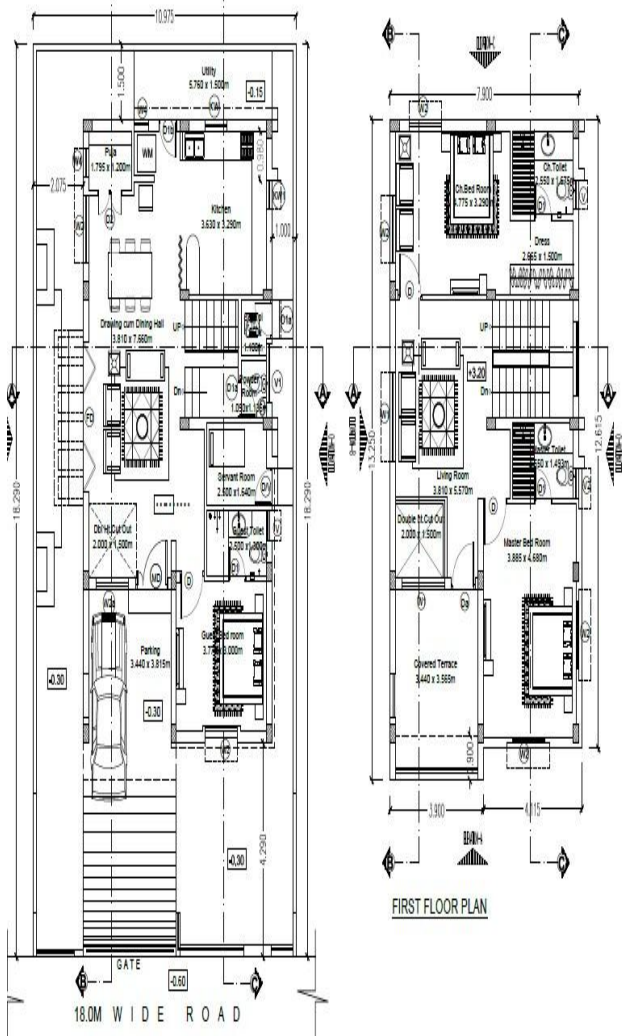Fig. 3.4 Second and Terrace floor plan

3.3 Quantity Estimation

An estimate is a calculation of the quantities of various items of work. . Importance of correct estimating is obvious. Under-estimating may result in the client getting an unpleasant shock when tenders are opened and drastically modifying or abandoning the work at that stage. Over-estimating may lose the engineer or estimator his client or his job, or in any case his confidence. Estimating is the most important of the practical aspects of construction management, and the subject deserves the closest attention of one aspiring to a career in the profession. It is a comparatively simple subject to understand; however, as it brings one up against practical work, methods and procedure, knowledge of it cannot be acquired without close application. These are mostly prepared either on a "Prorata" basis based on similar works in the past or on "Thumb rule" basis. In this project the quantity estimation is prepared based on past data. The abstract of quantity estimation of a villa is shown in **Appendix-1.**

3.4 Data Collection On Different Materials And Labours Required To Project

Materials and labours are like a payment bond. These two resources are most important resources for the project. More than 70% of the project depends upon these two resources which are properly used and utilized.

3.4.1 Materials

Building materials are any material which is used for construction purposes.Many naturally occurring substances, such as clay, rocks, sand, and wood, even twigs and leaves, have been used to construct buildings. The manufacture of building materials is an established industry in many countries and the use of these materials is typically segmented into specific specialty trades such as carpentry, insulation, plumbing, and roofing work. A wide range of building materials is available for the construction of rural buildings and structures. The proper selection of materials to be used in a particular building or structure can influence the original cost, maintenance, ease of cleaning, durability and, of course, appearance.

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3.4.2 Labour

A construction worker is a tradesman, labourer, or professional employed in the physical construction of the built environment and its infrastructure. Construction labourers are broadly classified into two types:
Type-1: Skilled labourers
Type-2: Unskilled labourers

3.4.2.1 Skilled Labourers

Skill is a measure of the amount of worker's expertise, specialization, wages, and supervisory capacity. Skilled workers are generally more trained, higher paid, and have more responsibilities than unskilled workers. Skilled labours need to be an expertise in their field of work. Skilled labours should master the job so that he can give your best. Some of the skilled labourers are:-
1. Mason
2. Carpenter
3. Bar bender
4. Electrician
5. Plumber
6. Tile layer
7. Painter

3.4.2.2 Unskilled Labourers

These are workers who have no special training and have few specific skills. Unskilled labourers are helpers to skilled labours. Some of the unskilled labourers are:-
1. Men Mazdoor
2. Women

3.5 Scheduling And Allocation Of Resources To Day-To-Day Activities

The basic objective of resource planning and resource allocation is to supply and support the field operations so that established time objectives can be met and costs can be kept within the construction budget. The planning of construction projects is often little detail of resulting in high coordination effort, low productivity rates and delays in overall progress. Therefore precedence diagrams in its different specifications such as PERT or CPM provide a basis for computerized project management. Resources required for the execution of activities are usually scarce and consequently provide additional constraints to the predecessor-successor relationships. Today, construction projects are more complex than ever before. Thousand of tasks must be precisely controlled if a project is to run smoothly, on time, and in budget. The completion of a construction project requires the judicious scheduling and allocation of available resources. Manpower, equipment, and materials are important project resources that require close management attention. Nevertheless, if time schedules and cost budgets are to be met, the work must be supply with the necessary workers, equipment, and materials when and as they are needed on the job site.

In this project the scheduling and allocation of resources have done in two different methods by using "Microsoft Project" software.
1. Method-1: Villas construction one after another.
2. Method-2: Villas construction simultaneously

3.5.1 Scheduling And Allocation Of Resources In Method-1

In this method, the villas are constructed one after another. The resources are assets used in the construction process. Example of construction resources are materials, labour, and equipments. The details of scheduling and allocation of resources are shown in **Appendix-2.**

3.5.2 Scheduling And Allocation Of Resources In Method-2

In this method, the villas are constructed simultaneously with the effective usage of time, labour, materials and equipments. The details of scheduling and allocation of resources.

3.6 Preparation Of Cpm Charts

A CPM chart, is a network type of diagram with boxes that represent the tasks or activities of the project, and with connecting arrows that represent the sequence and dependencies between tasks. The strength of a CPM chart is that, as a network, it provides a visual representation of the relationships between tasks of a project. During the development of the project schedule, and especially while trying to determine task dependencies, a CPM chart is an effective tool. We will first develop a CPM chart by hand so that you can learn and understand the basic concepts. Then we will illustrate a CPM chart in MS Project.
Developing a CPM chart is a five-step process:

1. Identify all the tasks for the project (that is, build a work breakdown structure).
2. Determine the amount of work necessary to complete each task.
3. For each task, identify the immediate predecessor tasks.
4. Enter the tasks on a CPM chart, with connecting arrows for task dependencies.
5. Calculate start and end times based on durations and resources.

3.6.1 Network Diagrams In Microsoft Project

A CPM chart is useful in building the original schedule because it enables the project manager to easily view dependencies. For project tracking, the tracking Gantt chart view is more helpful because it shows the project on a calendar backdrop. MS Project is the most widely used project-scheduling tool. However, MS project has enhanced the Gantt chart view, and it is now often chosen both for building the chart and for tracking progress. The data-entry Gantt chart view is an effective way to enter tasks with their durations, dependencies, and resources A project network is a graph (flowchart) depicting the sequence in which a project's terminal elements are to be completed by showing terminal elements and their dependencies. An example of network graph is shown in fig.3.4.
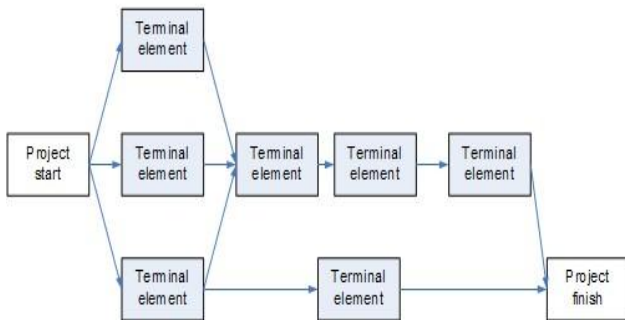
Fig. 3.5 An example of network graph,

A project schedule is a specific timetable. It also involves selecting and staffing the project team, assigning specific tasks to team members, and arranging for other necessary resources. The network diagrams of this project are shown in **Appendix-2** and **Appendix-3**

3.7 Monitoring The CPM Charts And Maintaining The Time Schedule

Monitoring is the systematic and routine collection of information from projects. It will help to improve practices and activities in the future like internal and external accountability of the resources. Monitoring is a periodically recurring task already begins in the planning stage of a project. Monitoring allows results, processes and experiences to be documented and used as a basis to steer decision- making and learning processes. Monitoring is checking progress against plans. Maintaining a project schedule can be a challenging task. The better the original plan, the easier it will be to control the project. If enough milestones and frequent checkpoints exist, problems will be detected rapidly. Project managers often spend most of their time tracking the tasks along the critical path.

IV.RESULTS

4.1 Time Variation Between Method-1 And Method-2
Table 4.1 Variation in Time

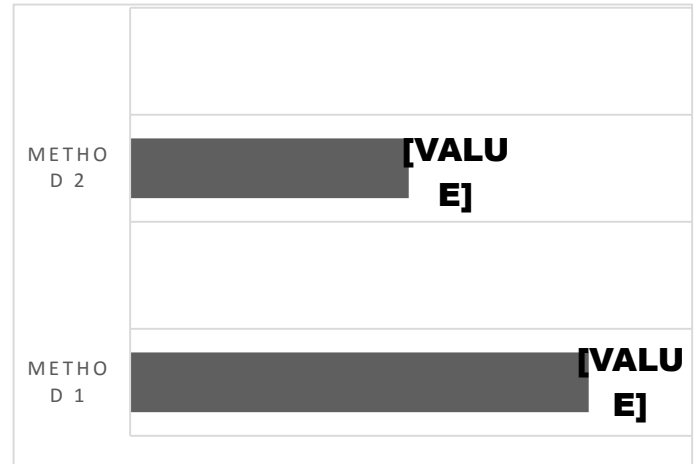| TIME VARIATION BETWEEN TWO METHODS		
	METHOD-1 METHOD-1	METHOD-2 METHOD-2
DAYS	408	248

Fig.4.1 Time Variation Bar Chart Graph

4.2 Resources Variation Between Method-1 And Method-2
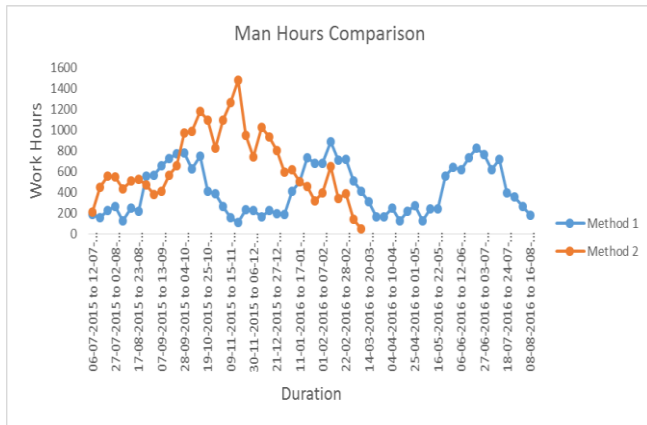
Table 4.2 Resources Usage and Work Hours

Fig 4.2 Resources Usage and Work Hours

Fig 4.3 Resources Usage and Work Hours

| PERCENTAGE VARIATION OF WORK DONE BETWEEN METHOD-1 & METHOD-2		
DATE	METHOD-1 (%)	METHOD-2 (%)
06-07-2015 to 31-07-2015	3	7
01-08-2015 to 31-08-2015	5	8
01-09-2015 to 30-09-2015	12	11
01-10-2015 to 31-10-2015	10	20
01-11-2015 to 30-11-2015	4	22
01-12-2015 to 31-12-2015	3	15
01-01-2016 to 31-01-2016	10	8
01-02-2016 to 29-02-2016	13	9
01-03-2016 to 31-03-2016	5	1
	TOTAL	100
01-04-2016 to 30-04-2016	4	
01-05-2016 to 31-05-2016	5	
01-06-2016 to 30-06-2016	13	
01-07-2016 to 31-07-2016	10	
01-08-2016 to 16-08-2016	2	
TOTAL	100	
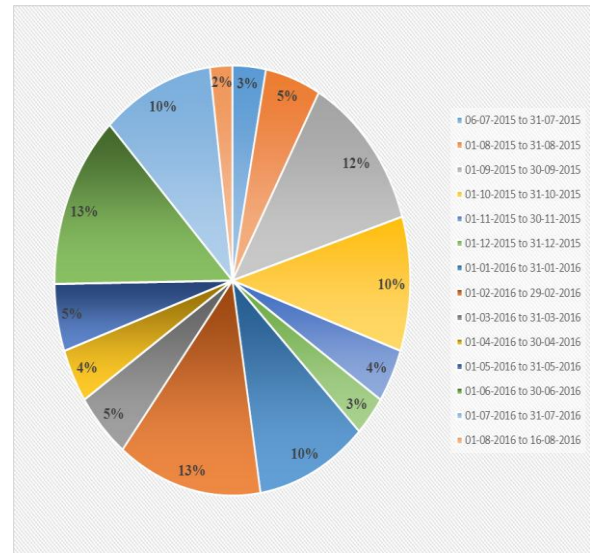
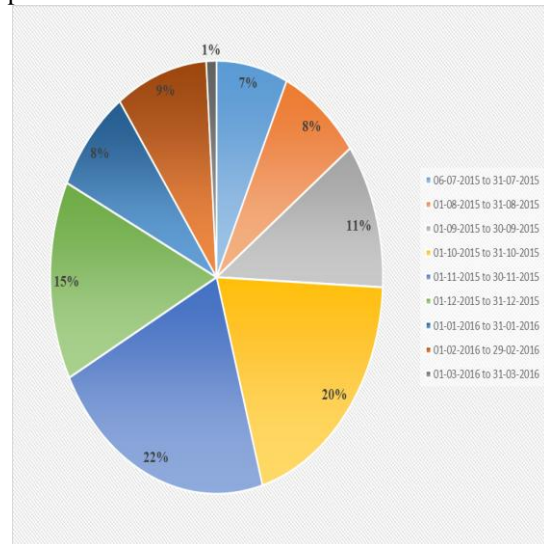Fig. 4.4 Percentage of Work Done in Method-1 Pie Chart Graph

Fig. 4.5 Percentage of Work Done in Method-1 Pie Chart Graph

V.CONCLUSIONS

The project study was carried out to have an overall schedule of the project and to find out the optimized use of resources to complete the project. This project helped to have a comprehensive study about the scheduling, monitoring, and optimization of various construction activities and to use software Microsoft Project.In this project work three villas are constructed simultaneously with the effective usage of time, labour, materials and equipments which leads to the early completion of tasks. Further more, there is possibility to increase the number of villas to be constructed simultaneously which will help in minimizing the time and cost.

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