Abstract
Construction projects are completely depends upon time and all project activities are directed towards the achievement of project time objectives. In a complex project, where a large number of activities are performed at different places by different agencies or task forces, with each having its own scheduled targets, a small delay in a work schedule affects the on-going progress of work. Delays can alter the planned level of resources and their mobilization. Time over runs increase overheads, reduce planned revenue sales and create cash inflow problems. Delays in constructed projects can result in penalties, and adversely affect the reputation of the company. The present study deals with comparing the RCC building with Green building. The main objectives of this study is to achieve a better understanding of the comparing the money material machinery manpower between both the on-going construction project. Optimization of resources is the process of making plans as effective as possible, by making requisite changes. In other words, it’s the process of improving an existing plan, based on the changes in the project parameters, to achieve efficient results. Optimization is carried out from the start of the project till the end of the project where the resource allocation process is carried out to optimize the 4M’s [money, material, machinery, and manpower] will play a vital role in finishing of the project at the allotted time.

1. Introduction
Now days for the effective management of construction projects a systematic method is to be adopted, with the aid of technique to control the day to day activities within the time frame at a certain cost and completion of a task at allocated time. Management is essential to the entire construction department to finish up the project at allotted time span and if the lag appears in the construction which will in turn affect the basic 4M’s [Money, Material, Machinery and Manpower].
Many of the projects in India have been completely stopped due to improper management, manpower availability and which created the huge problem and caused problem to the public convenience. Sometimes the on-going project caused problems due to improper work schedule and the survey reports also causes some problems due to wrong information during land surveying times. The work schedule has to be done exactly according to the time allotted to finish up the project a slight delay can happen but we have to finish up at time where there is no immense pressure caused on the name of the on-going projects.

2. Project Management

Construction management will not only help in developing a systematic model but it will also help us in comparing the various on-going projects it will also help us in optimization, innovative and growth and it also decrease the risk involved in project. Management in construction is been done to visualize the management like various task, skills, and techniques which will help in performing the activities or the proper work schedule. The project manager requires some experience in the previous constructions so as to allocate and prepare the work schedule according to the design and plan of the project.

2.1 Major Areas of Project Management

Construction Project management and Head of team are concerned with the following areas:

I. Work scheduling
II. Optimization of project
III. 4M’s allocation

Scheduling and tracking the project

3. Construction Project Management

The construction management was explained at previous chapters but the work schedule and 4M’s is been briefly explained in this chapter the construction management is been playing important role in all the construction to avoid the delay and shortage of manpower and wastage of money at on-going stages which will extend the project. Throughout the project management process there are four questions that must be addressed: Who? Does what? When? And How much? The work required often involves people outside of the project manager's Organization. Although these individuals do not report directly to the project manager, it is necessary that effective working
relationships be developed. A manager must be a motivated achiever with a “can do” attitude. Throughout a project there are numerous obstacles that must be overcome. The manager must have perspective with the ability to forecast methods of achieving results. The drive to achieve results must always be present. This attitude must also be instilled in everyone involved in the project.

3.1 Types of Resources required

The main 4M’s are been listed below which is important to complete the project on site which also plays vital role for all the team managers in the constructions.

- Money
- Material
- Manpower
- Machinery

Which together are known as the “4 M s” Apart from these 4, we also have INFORMATION or DATA which may be related to the scope or time or cost? Beyond this we also need the input of Energy or Enthusiasm which is of utmost importance in carrying a project to its rightful conclusion. The tangible inputs are explained in detail below:

3.1.1 Money

Money plays an important role to complete the project at fixed date. so Money is a medium it is required to complete any type of construction at required time set. As far as the project is concerned money is a very important resource. Which is need as per the planned budget? The procurement of any resource in the project depends on the funds availability.

3.1.2 Material

Material can be defined as the substance or substances out of which a thing is or can be made. It can also be defined as tools or apparatus for the performance of a given task. Material costs and their quantities are crucial for the estimation of overall budget and also help in giving an idea on the size and duration of the project. Material cost is volatile and depends on the day to day market rates, therefore an intelligent and conscious management is required to input the material cost. While the material quantity is constant and is estimated as required for the overall project completion.

3.1.3 Manpower

Manpower can be defined as unit of power based on the rate at which a man can work. It can also be defined as power supplied by men. The manpower used in the project is calculated based on the amount of material work per person to accomplish. The manpower required for an event depends upon the type of material and the capacity of the worker which can be obtained from the productivity constants.

3.1.4 Machinery

Machinery is important feature of the on-going project where it acquires almost 15% of the total allotted cost. The machinery resources are used to reduce the manpower and to complete the project as early as possible and also to make the project cost effective. It is also used where some specific work cannot be done using the manpower. For small projects, the machinery is hired for rent and for big projects the machinery are purchased.

The machinery required for this project are calculated based on productivity constants per day. The following are the different types of machineries used in our project:

i.) Excavator
ii.) Concrete mixer
iii.) Vibrator
iv.) Concrete pumping unit etc.

### 4. Problem Definition and Methodology

The problem caused in on-going projects is due to improper planning and scheduling and improper maintainers. The work schedule shows the important aspects which have to be followed but also the cost increase due to improper maintenance at future stages. Many of the projects which begins at exact date as fixed but extends more than year after the fixed end date and sometimes the project stops due financial crisis in the company. A good work schedule helps the completion of the project within the expected time and with optimum resource and cost.

#### 4.1 Software Adopted for Project Management

**MS-Project [2010]**

Microsoft Project is a software program, developed and sold by Microsoft, which is designed to assist a manager in developing a plan, assigning resources to tasks, tracking progress, managing the budget, and analyzing workloads. Microsoft Project was the company's third Microsoft Windows-based application, and within a couple of years of its introduction it became the dominant PC-based project management software.

#### 4.2 Steps involved in Project Management

Only in the some circumstances the planned schedule followed precisely from start of a project to completion of project. Considerable time and effort are required during the project to check actual progress against the planned schedule. Marking progress on the gnat chart and making sequencing to match actual construction is called "updating". Normally this process also includes transferring the project status and logic adjustment marked on the logic diagram to the computer database and recalculating the schedule. The three basic things that make updating necessary are as under:

- Change in the project plan
  - Rescheduling activities.
  - Change in the duration of an activity.

If all the activities are progressing well according to the plan and schedule then there is no need of updating. Therefore, based on the progress of the work and due delays, the duration of unfinished activities are revised and this the network diagram are redrawn.

#### 4.2.1 Data Required For Updating

The details required for updating can also vary depending on what the Scheduling is done for certain activities. The updating may identify actual start and finish date for each work activity or merely shows n percentage that the work was either completed or in progressing. Original scheduled network.

- Original scheduled network's calculation chart.
- Activities completed at the updating stage.
- Time required for all activities in progress at the updating stage.
- Any new information which will affect the duration in the future.
- Change in logic, if any.

#### 4.2.2 Steps for Updating

Describe the stage: At what stage updating to be done according to the original plan?

Record the progress: List which activities have been completed till the date of updating?
Summary of work: Work completion of certain work has completed or not to be checked, time taken to complete certain activity.

Place: The information contained in the updating table should be placed on the original network.

Calculation: Calculate Early Start Time (EST), Earliest Occurrence Time (TE) and Latest Allowable Time (TL) and mark them as updated network.

4.2.3 Time for Updating
The following steps considered for deciding the time for updating: - The updating is done stage wise like quarterly or for every month. For big projects, the process of updating should be done more often as the project progresses towards the completion. For small duration projects, there must be frequent updating to be done while taking into consideration the latest position of execution of the project.

4.2.4 Manpower Management
Manpower management is most important in all the construction industries where the project manager will be having the list of total number of labours at the site and work schedule will be prepared according to that, but in some of the constructions the manpower has costed more due to sick and problems caused at site and more work pressures so it makes labours to quit the job and look for other on-going projects. So always we have to provide some lenience to the heavy workers and make them work according to their plan and finish at required time. The manpower management is written daily on the notice board of the site engineer’s room so that number of labours presents and no of labours non-working.

4.2.5 Manpower Planning
From the management techniques mentioned that Manpower planning has to be done during the time of planning itself. The number of workers required for each activity has to be calculated from standard data or from previous experience so that number of days required for completing each activity can be calculated. As it involves a large amount of computations, computers are normally used to estimate the total requirement of manpower.

4.2.6 Material Management for project
The material management includes the process of maintaining the machineries at day to day work at the on-going site. The managing of the materials is been carried out by on field accountants like inlet and outlet of materials like dumping up of materials at secured place where it doesn’t cause any damages to materials as well as wastages. The process of managing the onsite material very effectively and which doesn’t affect the next day’s work or delay in time.

4.2.8 Cost Management
The cost management plays a vital role so as to avoid of wastage of money at on-going construction. Cost management is been carefully handled at accountancy section and day to day cost is same as the work schedule prepared they do the cross check as day to day work completes.

5. Data Collected and Discussions

5.1 Project 1 Details [RCC Building]
The project 1 detail was collected from Aswani constructions, which is one of the leading names in the real estate industry. They have started up their new project at Electronic City Phase II.

5.2 Project 2 Details [Green building] I have chosen Nitesh Columbus Square because of the most impressive interpretations of leading premium condominiums. Green building was chosen to list out the major differences between the RCC building and Green building.
6. Results and Analysis

Comparison of RCC Building with Green Building w.r.t 4M’s

![Graph showing cash flow zone for RCC vs Green Building](image)

**Figure 6.7 Cash flow zone RCC Vs Green building**

7. Discussion

From the resource allocation done for both the ongoing projects namely Aswani [RCC building] and Nitesh [Green building] the above bar chart shows the cash flow vs total no of activities of both the projects. It can be seen from the above cash flow chart that green building is having almost the same cash flow for all the activities whereas for RCC the cash flow varies drastically for different activities.

7.1: Analysis on Material [Block Work]

![Graph showing comparison of block work](image)

**Figure 6.4 Comparison of Machineries between RCC building and Green building**
In this comparison I have taken few costly equipment’s like excavation equipment’s and material handling equipment’s throughout this project, so the above chart clearly shows that foundation work for RCC building is 44 days and 91 days for Green building from project management [MSP]. Therefore the chart shows the total cost of excavation and material handling equipment’s Vs total no of days in which the green building has higher cost compared to RCC building due to total no of day’s case of excavation work.

7.2 Over view of RCC with Green building for all 4M’s

Table 7.1: Overview of all 4M’s

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>4M’s</th>
<th>RCC</th>
<th>Green Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Money</td>
<td>Uneconomical</td>
<td>Economical</td>
</tr>
<tr>
<td>2</td>
<td>Material</td>
<td>Higher cost</td>
<td>Preferably lower</td>
</tr>
<tr>
<td>3</td>
<td>Manpower</td>
<td>Less skilled and cost</td>
<td>Skilled and higher cost</td>
</tr>
<tr>
<td>4</td>
<td>Machinery</td>
<td>More maintenance</td>
<td>Less maintenance preferred</td>
</tr>
</tbody>
</table>

8 Conclusion

i.) This study mainly focuses on the planning, scheduling, 4M’s allocation and updating for the Aswani groups [RCC building] and Nitesh estates [Green building]. The comparison has been done between this two types of construction to overcome the cost and resource management.

ii.) From the cost analysis done which is carried out shows the 4M’s comparison between RCC and Green building.

iii.) The cost of RCC building has ended up with 538,960,114/- for 400 units. At the same time the Columbus square green building ended up with 516,250,390/- for 416 units.

iv.) The manpower allocation chart shows that green building requires skilled engineers and skilled labors when compared to RCC building.

v.) The material management chart shows that the block works plays vital role in Green building in which the cost drastically varies for RCC building for each block work but in the Green building steady flow of cost is been maintained.

vi.) The fourth and final resource i.e. machineries, the equipment’s is almost similar for both the projects but in case of green building the surveying, hvac and hauling equipment’s for intake of reused materials and demolished waste through tippers. Therefore the utilization of equipment’s is more in Green building compared to RCC building.

vii.) From the results and discussions we can see that there is a total overall cost redemption in the green building due to its planned process and from the graphs we come to conclusion that Green building has better 4M’s allocation than RCC. The total overall redemption for 4M’s in Green Building is 9.57%.

viii.) This project management helps out to sort out the delays in the ongoing project, Resource scarcity, money, machineries’.

ix.) The RCC building Vs Green building the results shows the comparison of 4M’s which proves that green building is economical and it has all the amenities and good ecosystem with zero carbon. Green Building is an non polluter and which is constructed by IGBC [Indian Green Building Council].
x.) To conclude, if mega projects are not planned, scheduled and updated properly, the total cost waste will be more and which will some time makes the project to stop. Hence these 4M’s plays a main role in successful completion of the project on time.

9. Scope of future study

The future scope of this project of optimization can also be used to optimize various resources involved in the construction projects such as material money manpower machinery, etc. Which in turn help in overall optimization of the entire project. This will help us to determine the effect of various optimized resources in a project and also help to find out which resource has the significant impact. This will further help to concentrate more on the particular resource which has the significant effect on any other project management. This optimization of 4M’s can be adopted for large scale infrastructure like Metro, Flyovers, National Highways, Sky scrapers etc. in which the project dealing with hundreds of crores to find its effect and this will give the reason why the necessity of optimization is needed for any proposed project, which can give results in similar proportion to the results already seen in this current project.

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References