Project Planning, Scheduling and Costing- A Case Study on Highway Project

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Abstract— Construction projects become complicated and fragmented so that many special contractors are involved. The most important aspect of the contractor’s duties on any project is the effective management of materials, labour, time and safety. The management of project time is depending more and more on scheduling software. In such change environment, a proper planning, scheduling and costing are necessary for projects. This paper focuses on proper planning, scheduling, costing and critiques problems through interviews with professionals, data collection, and literature review. It proposes a new planning, scheduling and costing method, using different software applying (MS Project 2010, MS Excel).

Index Terms— Planning, Scheduling, Costing, MS Project, MS Excel

I. INTRODUCTION

GENERAL

Construction is the second largest economic activity next to agriculture in India. It creates large-scale employment, so which by itself is a significant contribution to the nation’s economy. It is also a good vehicle for distribution of wealth, which means the significant proportion of the money spent in construction moves directly from rich to poor people. The construction industry accounts for 7-8% of the GDP of many countries. The value of 11th 5 year plan (2012-2017) estimated by committee on infrastructure, 220000 crores for the modernization and up gradation of highway construction activity in world. Unfortunately, due to the secretive nature of construction business, knowledge gained in planning, scheduling and controlling of cost in construction process is rarely disseminated. Consequently, the cost of inefficiency is being incurred as a recurring cost. More over in various businesses, the rate of business failure of construction is one of the highest. One of the reasons for this high rate of business failures is the lack of knowledge and its application in preliminary state of construction management.

Construction industry is generally much fragment. It is here where proper management comes into picture. If proper management of work is done, the company could save from making loss. In construction industry there was a time when all project were labour intensive and management in those days meant proper utilization of labour to make optimum progress in construction in the most economical manner. But now-a-days technological advancement and scientific inventions have added in new dimensions to the construction industry. A project is now consider as a group of activity, having inter-relations, which may include the role of specialists and specialized work using latest knowledge, equipment and skill available, to be undertaken in most systematic manner. The “most systematic manner” involves adaptation of techniques commonly known as Critical path method (CPM) or Program evaluation and review techniques (PERT) are being applied for the management of project. The use of plant, machinery and expert workers has improved the quality of construction and reduces the time for construction. The application of this construction management technique, the use of plants, machinery, specialized workers, finding alternative solutions and selecting the best possible solution with the aid of computer, have made the whole process so scientific that it is now difficult to think of going for large construction activities without these exercises.

Planning, Scheduling and costing are important part of the project. If we planned proper then we assures that project will completed within time and budget. This paper provides a proper method for planning, scheduling and Recourse utilization in construction projects and an application of activity-based computerized (MS Project and M S Excel) planning, scheduling. It is followed a study to exemplify the new method. The study is confined to the perspective of a general contractor.

PROJECT PLANNING

Planning is the very important technique of construction management. It is the process of formulating of time as a constraint factor and inter link the various activities, all types of resources to achieve specified project objectives. In simple words, it is a process of developing whole project plan. The project plan shows how the project is to be directed to achieve the assigned goals. It specified a pre-determined and a committed future course of action, based on discussions and decisions made on the available knowledge of future trends.

REQUIREDMENTS OF PROJECT PLAN
PROJECT SCHEDULING

This phase follows the planning phase and concerns with time estimates of individual activities and the project as a whole. These time estimates represent normal duration, which would be expected to result if work was done at lowest direct cost for the activities. No unexpected delays or contingencies like fire, floods, strikes etc. are considered while making these estimates. The next step is to assign the activity times to the network and make computations for earliest and latest start and finish times of each activity. The earliest completion time of the last activity of the network gives the shortest completion time for the whole project. This time can be identified as the longest path of activities through the network from its start node to its finish node. This path is called critical path, and timely completion of project depends upon the timely completion each of the activities lying on this path. These activities are called as critical activities. An identification of critical activities helps management to pay due attention to the timely completion of these activities so that the project is completed in time.

PROJECT COSTING

There are two categories of project cost estimates: project planning cost estimates and project design cost estimates. Project planning cost estimates are used for project justification, programming, analysis of alternatives, and approval. Project design cost estimates are used to summarize the cost of a project’s contract items of work and are used for the bid item list in the construction contract documents. Most of the government works are in BOQ Type of contract work for that rate will be fixed for each items using SR book rate of particular regain it include both planning and designing cost estimate.

II. REVIEW OF LITERATURE

Many authors have concentrated their work on an optimum allocation of resources for construction works, and importance dealt details.

- A work done by three authors viz., Mr. Jonathan A. N. Booth, Research student Mr. William H. askew, lecturer Dr. Michael J.Mawdesley, Lecturer University of Nottingham Department of Civil Engineering University park Nottingham NG7 2RD united kingdom (1991-92), introduces techniques for planning and control, and which concentrates on recommending appropriate practice for the practical problems which readers may come across when using both computerized planning methods. They discuss the whole of planning and control cycle as a function of Construction management. [1]

- Another classical work by Faniran O. Faniran, Peter E. D. Love and Heng Li (1999), suggested that optimum allocation of resources for construction jobs have not been taken seriously till now, they have also given some case studies where they had shown how resources are not used in optimal way. They have also shown in their work that if resources are wasted, then in one day we will have to pay more to acquire the same thing. The importance of proper resource scheduling and proper implementation of it in actual construction is given prime importance. [2]

- Prof. Hera N. Ahuja and Mr. Mir Saif – uddin both faculties of engineering and applied science memorial university of new found land, St.Johns, Canada, has discussed about the role of computers in construction management and it various uses in different fields of civil engineering. They also illustrate how microcomputers have made an impact on computation work in civil engineering. [3]

- Another study done by Sanjay Bhayar, Dr. Dhanajay k. Parbat, International Journal of Emerging technology and Advanced Engineering (2014), a concept of optimum crew for each activity and its costing techniques were researched. Using different simulation techniques, they were able to find out a best crew for an activity and to see that the cost within the range. The entire study was done using algorithm and flow chart techniques. [4]

- In other study done Babatunde Omoniyi Odedairo, Oluwabunmi .A. Ogunsanya, berkly Ogagaoghome Anaro (2014), the need to reduce duration and minimize total while preserving the quality of the project cost in road construction project. The need to get the optimum number of segments a road project should be divided into and work to be carried out simultaneously using optimum crew sizes working at their natural rhythms is established. [5]

III. CASE STUDY

The selected site for case study is located in Padubidri to Karkala. The highway consisting of 27.8Km, Construction of work include, scarification, CD Works, protective work, embankment, sub grade (SG), granular sub base(GSB), wet mix macadam base course(WMM), dense bituminous macadam, bituminous mix surface or carpet (BC), emulsion spry, side drain, sidewalks, road marking & road furniture, traffic management & ENV protection measures.
As per the contract document the work should be completed in 18 month and within in the budgeted cost. For that a proper planning, scheduling is required and it is prepared using MS Project and MS Excel.

**MAJOR MATERIAL QUANTITY**

The major material quantity required for the project as per the BOQ is shown in below table

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate</td>
<td>475678 MT</td>
</tr>
<tr>
<td>Sand</td>
<td>9133 MT</td>
</tr>
<tr>
<td>Cement</td>
<td>4064 MT</td>
</tr>
<tr>
<td>Bitumen</td>
<td>3117 MT</td>
</tr>
<tr>
<td>Admixture</td>
<td>29430 Kg</td>
</tr>
<tr>
<td>Emulsion</td>
<td>357761 Kg</td>
</tr>
<tr>
<td>Steel</td>
<td>428 MT</td>
</tr>
</tbody>
</table>

**PLANNING OF MATERIAL FOR THE PROJECT**

Planning of materials for the project is done in MS Excel. As per the contract, the duration of the project is 18 month. So we should plan the material in such a way that it should be available while execution.

Total quantities of materials to be utilized in site for the duration of 18 month project, the requirements of material for each task have break down into monthly vise as shown in the above table.

**PLANTS AND MACHINERIES**

Plants and machinery chosen as per the output/capacity, from this we observed that how much machinery required for the completion of the project in estimated time.
Total number of plants and machinery required for the project is depending on time constraint to finish the project, quantity of works in the project and output/capacity of the machineries as shown in the above table.

**SCHEDULING OF THE PROJECT**

Scheduling of the project is done by using MS Project-2010 software. Time is consider as a constraint because as per the contract document project will be completed within 18 month. For that planning and scheduling are done.
Fig 1 scheduling in MSP

Scheduling of the project is done in MSP and it gives the maximum duration of the project to complete with the help of the critical activities involved in the project. And gives the completion date.

CASH FLOW OF THE PROJECT

Following table shows the cash flow of the project.
Fig 3 S-Curve of the project

If the project goes as per the plan and schedule then the project is completed within the time and cost. The above S-curve shows the stability of the project.

IV. CONCLUSION

- It is very important to divide the project into segments so that we can allocate the crew in optimal manner.
- Planning, Scheduling and Resource allocation is taken as mission because many companies don’t follow a proper plan and schedule, so that they face difficulty during execution of project. Due to improper management they are not able to complete the work with available time and cost. These were certain key factors which made to choose this planning, scheduling and resource allocation as the mission.
- This study mainly focuses on the planning, scheduling, costing and resource allocation using MS Project and MS Excel.
- The classifications of plants and machineries, manpower done according to their output/capacity of the plants and machineries.
- The study has provided immense knowledge in planning and scheduling of the mass project and what are all required for the preparation of schedule with using of software and also give knowledge about the resource planning. More than all, the project has created immense interest and confidence in taking up such projects.
- To conclude, if a mega projects is not planned, schedule and updated properly, the amount of money wasted would be enormous so at least in the future one hope that proper planning will take place in all departments of the company. Due to poor Planning, Scheduling and recourse allocation, construction organizations are finding it difficult to use available resources. The result of poor construction management means that money and recourses are wasted. These two important resource hold the key to successful completion of the project in time, hence due importance should be given.

V. ACKNOWLEDGMENT

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REFERENCES

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