PLANNING & SCHEDULING OF INFRASTRUCTURE PROJECTS

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Abstract

Time and cost estimation for infrastructure projects especially related to road construction often face challenges because of several factors included in it. Therefore, it is a tedious task to estimate the final project time, cost including contingencies especially at the pre-feasibility evaluation stage of the highway project in developing countries. Forecasting construction project duration for future with accurate efficiency by considering all the delay factors is a big deal. Various examinations have been done to evaluate the reasons for duration delays in a construction site. Most common similarity between many factors are flawed design, inadequate supervision in workplace, shortage of supplies, absence of teamwork and local climatic conditions, causes a myriad of issues. Focused on concept and importance of Earned Value Management (EVM). Also, it includes elements and performance indicators used for tracking and forecasting the project that benefits project manager and ultimately results in project success.

Key Words*: *CPM, EVM, ES, PERT, PPM, EDM

1.Introduction

The development of infrastructure plays a main role for the development of country. The important part of economic growth of the country depends on the road transportation. The construction projects like road construction needs a careful attention while planning as well it requires a very huge number of resources. As it's known the road construction projects is different from one another as there will be changes in place, situation, weather condition by seeing all this it is very tedious in planning and allocating resources as the resources are repetitively used in the execution of the project. The time taken for the construction of road projects at the beginning of 19th century took a very long duration because of lack in techniques used which leads to wastage of money, time as well as the resources used for construction. Project management could play a very important role in the construction industry. By using these management tools, it will be very helpful to execute the project in a very economical way as well with the limited duration with usage of optimum resources. This also enables to store the information and manage the project in a central location. The project management consist of balancing the needs which could be identifiable or unidentified expectation of the stake holders by giving the quality, scope, and time of the project. Project management gives the better understanding of overall project goals. Also, it provides more accurate and reliable project status information, better communication, faster response to conflicting project goals and greater awareness of project progress. It is a more organized way to manage project. It also helps in more efficient use of project resources, faster project completion, lower project costs. Due to proper project Management, the project failure rate is considerably decreased.

1.1 Literature Review

T Subramani et.al., (2015) "Preplanning and Scheduling of Road Construction by Using PPM**"** Planning project management is required to give complete project management solution, helps to schedules the working period in a proper manner and also purchase the goods at the right time. Advantages of using this software are having flexibility to manage multiple projects in centralized location and determine who can access each project. The main objective was to understand the role of scheduling and proper usage resources to timely completion of a construction project. Results showed the drawbacks of the present project management system in station work project and the importance of efficient planning, as well as the need and effectiveness of project management software.

J Vikrant et.al., (2012) "A study on resource planning in highway construction projects" Present construction practices in India are still adopt the methodology of as and when required resource management. Which results in Lack of professionalism, training programs no real time records. equipment cost for any project comprises of mainly 20-30% of project cost. man power planning is the process by which an organization ensures that it has the right number and right kind of people at the right place at right time. Which all should be controlled by proper allocation of resources so that effectively and efficiently works can be completed.

Anupam Shukla et.al., (2016) "A Survey on Cost and Time management in Highway Construction Projects" The estimation is affected by various cost related factors starting from the project planning and programming

(inception), design, bidding, practical realization and controlled execution, post evaluation and handover of highway projects. Though a number of works have been reported for this purpose. However, because of involvement of many risk factors, it is still challenging. A review of the literature has established that poor performance of projects in terms of cost overrun is common place in the construction industry. A proper cost estimation procedure is required to fulfil all these requirements. The project cost estimate is primarily concerned with the cost of resources needed to complete the project activities and include all the processes which are employed to maintain financial control over a project. Classically the project cost estimation was done by establishing a model in mathematical form using cost governing factors. The problem with classical regression analysis is their requirement of mathematical formulation which fails because of number of variables present.

Previous studies & their findings for overrun an estimate is a forecast of a cost to be incurred sometime in the future, the problem being that the future is not always predictable. Project cost overruns are caused by rising costs largely (inflation, inadequate analysis and inadequate information, The causes include (certain government fiscal/monetary policies/ poor costing of projects/ inflation within the economy / some practices of project participants/ especially those involving government projects.). A further reason advanced for the incidence of project cost overrun is attributed to costing methods.

Rhuta Joshi et.al., (2015) "Resource Scheduling of Construction Project" Any construction project requires proper scheduling of resources for its completion within time and cost. For this various scheduling techniques have been used. Critical Path Method (CPM) is a technique that has been used since 1950"s for scheduling and controlling of projects, communicating plan and training new managers. Since, it has some limitations like; this technique doesn't consider the resources required for the execution of construction project. Resource scheduling is normally used to minimize the duration & cost of project, by proper allocation and leveling of resources. For schedule monitoring Earned Value Management (EVM) technique is used. They have compared the budgeted cost of work performed against actual cost of work performed and budgeted cost of work scheduled to access cost and schedule variance respectively. For project scheduling CPM/PERT, different software's like MSP, Primavera and optimization techniques, fuzzy logic is used.

T. Santhosh Kumar et.al., (2019) "Comparison of Project Monitoring and Controlling Methods: Earned value management (EVM) & Earned Duration Management (EDM)" EVM requires so much of effort to record, analyze and to implement the corrective actions. But correct implementation of EVM gives a fruitful result. Recently, many researchers are working on the extensions of EVM, which will account schedule, quality, resources, scope, safety, inventory, etc. EVM is very efficient in generating cost performance index but it cannot develop schedule performance index that much compared to cost performance index. In spite of advantages in using EVM, there are some mistakes occur in measuring schedule performance in budgetary terms Due to this, at some point of time, Managers will feel that 'they had wrong belief about schedule performance indicators'. From this point of time onwards they cannot depend on these EVM indicators. Some managers give more importance to cost compared to time. Time is interlinked with cost but, no mathematical relationship defined between them. Time is also as important as cost. So, we cannot measure the correct schedule performance index using EVM.

3. Proposed Methodology

Following methodology was implemented to complete the research work.

- Primary data was gathered by conducting a questionnaire survey and expert interview amongst many specialists like construction manager, architects, professors, contractors and builders.
- Review of literature was done by referring local and global research papers, reference books, construction journals etc.
- Data analysis was done on the basis of the collecteddata. Importance Performance Analysis (IPA) method & Applying EVM technique
- Declaring the results and conclusion from the analyzed data.

Evm Method

Earned Value Management is a methodology used to measure and communicate the real physical progress of a project taking into account the work complete, the time taken and the costs incurred to complete that work. Earned Value helps evaluate and control project risk by measuring project progress in monetary terms. The S-curve in its simplest form is a graph showing how project budget is planned to be spent over time. We can complicate the graph by showing the actual costs of doing the work over the same period. And also, on the same graph we can show how the value of the product of the project increases over the same period. The basics of Earned Value can best be shown on the ubiquitous 'S-Curve'.

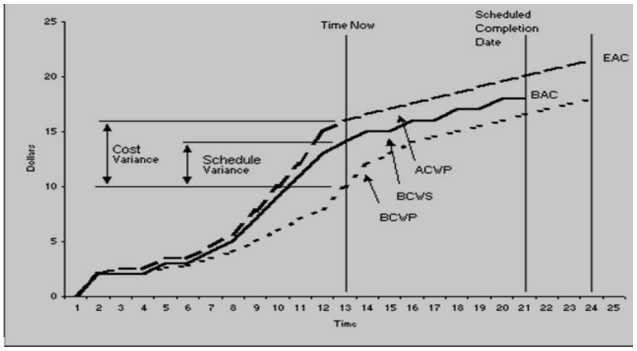

Figure-1- EVM Graph

The three curves on the graph represent:

Budgeted Cost for Work Scheduled (BCWS) - the budgets for all activities planned to be completed.

Actual Cost of Work Performed (ACWP) - the real costs of the work charged against the completed activities.

Budgeted Cost of Work Performed (BCWP) - the planned costs of the work allocated to the

completed activities. This is the EV.

Earned Value = Percentage project complete X Project Budget

Variances

Schedule and cost variances can both be calculated in monetary terms from the data needed to produce the S-curves.

Schedule variance is the difference between the Earned Value and the planned budget.

SV = BCWP – BCWS

Cost Variance is the difference between the Earned Value and the actual costs of the works.

CV = BCWP – ACWP

1. Performance Indices

Schedule Performance Index is a ratio of Earned Value and the planned value of completed works.

SPI = BCWP / BCWS **SPI < 1 is not good**

Cost Performance Index is a ratio of Earned Value and the actual costs of completed works.

CPI = BCWP / ACWP **CPI < 1 is not good**

Conclusions

Earned Value provides a standard means of objectively measuring work accomplished by integrating cost, schedule and technical performance into one set of metrics so that effective comparisons can be made. The EAC gives an idea of the final costs of a project. It takes into account the original budget (BAC), the Earned Value and the Cost Performance Index of the already completed works. Earned Value is based on the idea that the value of the product of the project increases as tasks are completed. And therefore, the Earned Value is a measure of the real progress of the project.

References

[1] T. Subramani, Shekar International Journal of Application or Innovation in Engineering Management Volume 4 Issue 5, May 2015. "Preplanning And Scheduling of Road Construction by Using Ppm".

[2] K Swarna Kumari and J Vikrant International Journal of Engineering Research and Application Volume 2, Issue 4 July –August 2012"A Study on Resource Planning in Highway Construction Projects"

[3] Rhuta Joshi and Prof V.Z. Patil International Journal of Science and Research Volume Issue 5 May 2015. "Resource Scheduling of Construction Project: Case Study"

[4] Comparison of Project Monitoring and Controlling Methods: Earned value management (EVM) & Earned Duration Management (EDM) Chitti Babu Kapuganti, Balaji K.V.G.D, T. Santhosh Kumar

[5] Homayoun, K.A.A. Project duration forecasting using earned duration management with exponential smoothing techniques. J. Manage. Eng. 2016, 33,

[6] Shr, J.F.; Chen, W.T. Functional model of cost and time for highway construction projects. J. Mar. Sci. Technol. 2006,

[7] Anupam, S.; Rajesh, T.; Ramtekkar, G.D. A Survey on Cost and Time management in Highway Construction Projects. Int. J. Sci. Dev. Res. (IJSDR) 2017, 2, 426–427

[8] Chua D. K. H. and Shen L. J., "Key Constraints Analysis with Integrated Production Scheduler" Journal Of Construction Engineering And Management, 7, 2003, pp.753-764.

[9] Jacob, D. B., & William T. McClelland, J. (2001). Theory of Constraints Project Management: A brief introduction into the basics. Retrieved 7 24, 2017.

[10] Lau E. and Kong J. J., "Identification of Constraints in Construction Projects to Improve Performance" The Joint International Conference on Construction, Culture, Innovation and Management, 2006, pp - 655-663.