

# Cost Analysis of Construction Building By Earned Value Method using MS Project Software

Lavanya S, G Narayana

**Abstract:** Earned value management is the utmost common method used in study of performance of the project. EVM incorporates the project possibility, budget and agenda processes to promote the project management crew to measure project performance from beginning to the end of the project. It is capable of providing exact predictions of project performance complications, which is an essential role for project management. EVA is reliant to two important elements such as detailed cost info and practical development of project. The profit of the project will get esteemed absolutely if these two elements are well-organized. This paper summarizes the evolution, basic terminologies of earned value analysis and effective use of it in the construction activities by using MS Project Software. There are many ways to implement EVM in the construction industry. MS Project is a software to define the earned value and its factors in an effective method with exactness and within time limits.

**Index Terms:** Earned value, Cost control, schedule variance, cost variance, tracking.

## I. INTRODUCTION

The construction work is a vigorous profitable initiative at national level and international level. So many construction projects face the illness of cost and time overrun due to several reasons. Project cost and calendar are the guiding elements in project success. The resources might have more influence on the project from beginning to the end of the project in addition to that after the end of the project also. These resources may include issues such as commercial issues, decision-making issues, inaccessibility of the resources and other exterior circumstances which distresses the act of the construction project over postponement and cost run-offs of the project.

Use of an earned value analysis for the project performance offers status of the project over which control of the project is through cost and schedule of the project. Earn value management is an efficient technique selected to assimilate and extent the schedule, cost and technical progress of project. Baseline of the project can be measured by using earn value management to check the development of the project.

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Earn value management offers project managers' ability to inspect complete critical program, schedule information, technical achievement and cost records. Earn value is an advanced conservative way of cost accounting. The method will give the best comparison of estimated cost of work to actual cost of the project. Usually the estimated cost is evaluated by analyzing difference between actual cost and planned cost obtains in the project.

The earned value analysis is done by the appropriate work breakdown structure of the project. Formula used for the calculation of the budgeted cost is subtraction of planned cost and actual cost of the project. By tracking, the actual cost of the project can able to acquire the accurate cost that sustained in the project. If the time required for the finishing of the project rises, we should calculate the additional cost essential to the finish of the project. The main intention is to complete the project on time with planned cost. Earned value analysis assistances project managers to analyze the uncertain zones, thorough project cost and work on it. It looks like risk avoidance for the managers to identify and understand the problems by taking sensible helpful procedure in advance they crack out difficult to overcome. Earn value assessment pattern is a set of instructions to provide suitable attainment of project.

## II. OBJECTIVES OF THE STUDY

The objectives of construction work are to bring to an end the project as firmed on record moreover, inside as estimated with suitable use of the significant amount of resources like manpower, money, materials and machine and to implement the project with quality. To achieve the above, planning is essential in the project.

- Project planning is done to complete the work within the planned time and cost.
- Cost analysis is to be used EVM to hand over the project work in the estimated cost to reach high profits.
- Creation of work breakdown structure (WBS) and project schedule in the MS Project software.
- To evaluate variance of cost and schedule of the project.
- To compare planned cost and actual cost of the project.

III. DESCRIPTION OF MS PROJET SOFTWARE

Microsoft project is project management software and it is established by Microsoft. In 1998 Microsoft project was established. MS Project is well considered to help the organization to create project plan, resource allocation to the respective tasks, project tracking, cost controlling and considerate the capabilities. This software can able to use by so several type of professions together with construction, government, project manufacturing, pharmaceuticals and electrical services etc.

a. Benefits of MS Project Software

- MSP is user pleasant software.
- Easy to plan the tasks, calendar and worthy to regulate the projects in this software.
- Project performance and plan of action will be compared.
- For smoothing the progression balancing of the resource capacity will be done by levelling.
- This software can able to create the detailed graphical representations and reports.
- Skilled and sufficient resources will be allocated and project performance will be tracked.
- Analysis of risk and its impacts can able to manage.
- Cost estimation and controlling will be done.
- In this software identification of critical issues is easy.
- Visualization of network diagram of activities will be shown in the Gantt chart.
- Software helps general managers to implement the project approaches and accomplish the aims.

IV. CONEPTS RELATED TO EVM

Arrangement of management approaches that will use “work in improvement” to state what will occur to work in future is known as earn value. Commonly EVA measures performance of project schedule and cost of project. EVA measures cost in hours, worker days, money or other determinates that can be used as an average measurement of the activity related with values.

In project management earn value is a fit in schedule, cost and policy enactment and it is a recognized management organization. The evaluation of cost variances and schedule variance, forecasts of project cost and performance indices and schedule duration.

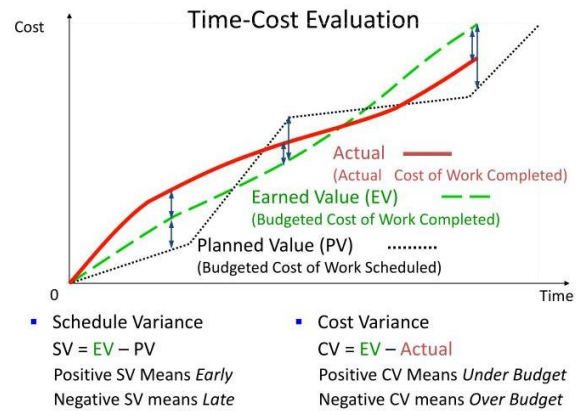
a. Earned value forecasting indicator

**Budget at completion (BAC):** - BAC is the budgeted cost which is planned before the project gets started or it is the cost planned to finish the tasks while planning.

**Estimate at completion (EAC):** - EAC is the estimate of total cost of the task when completed or it is the cost

estimated by individual to complete the project activities at the end of the project.

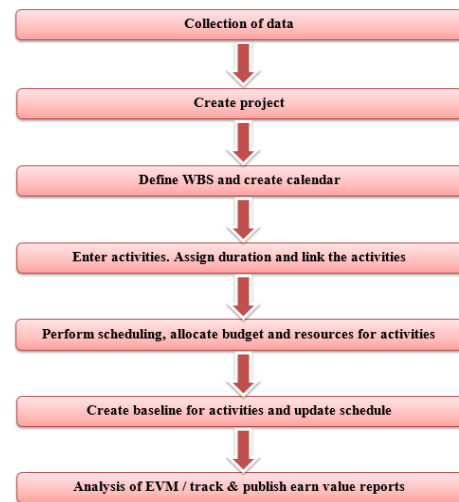
**Estimate to completion (ETC):** - ETC is the estimation of cost that will spend on the project to complete the remaining work except the actual cost spent.



**Variance at completion (VAC):** - VAC is the difference between budget at completion and estimate at completion. I.e.  $VAC = BAC - EAC$ .

Variance will be available later on =  $AC + (BAC - EV) / CPI$   
 Variance are typical =  $AC + (BAC - EV)$

V. METHODOLOGY



Flowchart 1 Project methodology

The construction projects are incredible and combined in nature. Therefore, for perfection of undertaking, consumption of software design tool performed. The project is planned and monitored by Microsoft project software. Study of this construction project is carried out on the earned value method and analysis of cost by monitoring and tracking the project.



The WBS is organized for the project and activities are recognized. The duration of the tasks is projected on statement of earliest info, consultation with project main. The information is studied and linked to the activities.

In Microsoft project software earned value method is a great appliance to track project performance. The following earned measures – budgeted at completion, estimate at completion, variance at completion, cost variance and schedule variance are tabulated and evaluated by using Microsoft project.

#### a. Collection of data

Following are the basic data's collected in this project

- Drawings: Sectional elevations and plan drawings
- Bill of quantities: BOQ is prepared by the cost professional who provides the declaration of dissimilar things works laterally with the amount charges and explanation as per the tender records.

#### b. Create project

Open Microsoft project, create new project and open the project. Creating project is the first stage of the project management process which comes after the data collection.

The project is created for the operational working of the project by sequencing the works in the controllable manner. The important purpose of sequencing the task is to distribute the task in the graded command called as work breakdown structure.

#### c. Define WBS

WBS is a classifying structure in which the project functioning components is sub-divided and gives graphical demonstration of whole project for the definitely controllable components of the work by breaking down the project into simpler way. Whole project probability can be distinct. In complex projects WBS is very useful to manage the project.

#### d. Create project calendar

Project calendar describes the ordered working hours, holidays, weekends and shifts where are related to the project crew. In work controlling project calendar offers improved environment for labours. It will assistance to improve the planning developments timetable. In the project standard project calendar is deliberated and it has shown below.

#### e. Enter activities and assign duration

The activity is a specific endeavour necessary for the attainment of a project. Select activity option in guidance button then selecting option add the activities in command bar button and type different activities, it will create with unit activity Id.

Enter the activity duration column after entering the activities for individual activity. Activity duration displays the interval of the time it consumes to complete the activity or task.

#### f. Assigning links to activities

Before scheduling the project, it is necessary to allot links or relationships to those activities. For every activity in WBS links can be assigned in two ways, i.e. links are given between two activities and another one is set of suitable constraints are applied to activities. These links are important along with duration to decide schedule dates. These links are explained by Gantt charts and network diagrams.

Primarily entry of all the construction activities are done which are involved in the construction project. In this all the activities are taken and initiate to series them into how work will be executed. In this the results are attained in the form of network diagram.

Sequencing of activities will perform as a base for the entire project. These bases are evidently based on the purposes of the project. Planning inputs are got from the contractors, project engineers and estimating department.

The main links or relationships for activity sequencing are mentioned below:

- Finish to start
- Start to finish
- Finish to finish
- Start to start

#### g. Allocating budget and resources to activities

Resource allocation is the method of allocating and supervision of resources in such a way that it supports to attain the planned objectives of the organisation. Generally, resources refer to the labour, cash and material.

- A work resource or consumable resources denotes to man power and machineries and they need precise duration to implement the activity.
- Material resources are concrete, bricks wood and electrical etc.
- Cost resources are time reliant on resources such as travelling expenses, accommodation charge.

In effective management the resource allocation is an important tool and it helps in planning for unusual resources. The time required for the resources can be accomplished inside the project schedule by resource allocation. It should suggestion the tractability for the consumption of resources for the duration of the acute scheduling of the project the resource management has to be done.

#### h. Create baseline and update schedule

Baseline is a standard level based on this the enactment of a project is stated. Select project option in activity tool bar and then select set baseline to create baseline. Assign baseline to the project after setting. This planned schedule of construction purpose to carry out each activity is intended with the help of allocated

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quantity and resources of work to be done. For the analysis of project, the schedule is made to update after assigning a baseline.

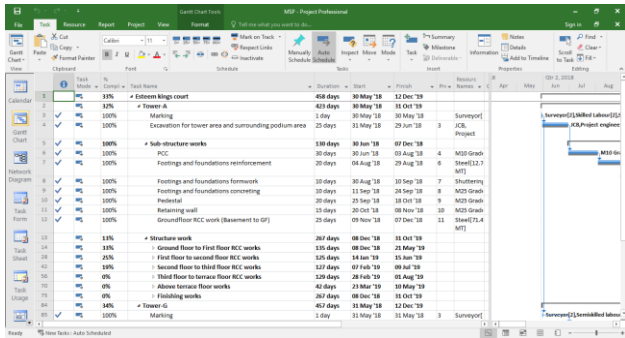


Fig 1: MSP entry table

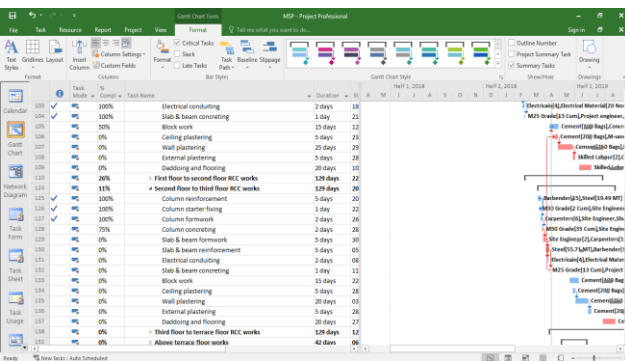


Fig 2 Project with critical path

The representative traced project will be as above with the help of variance we can get to know that whether the project schedule is late or project schedule is early (SV) and under budget or over budget (CV), these variances can be shown in MSP project.

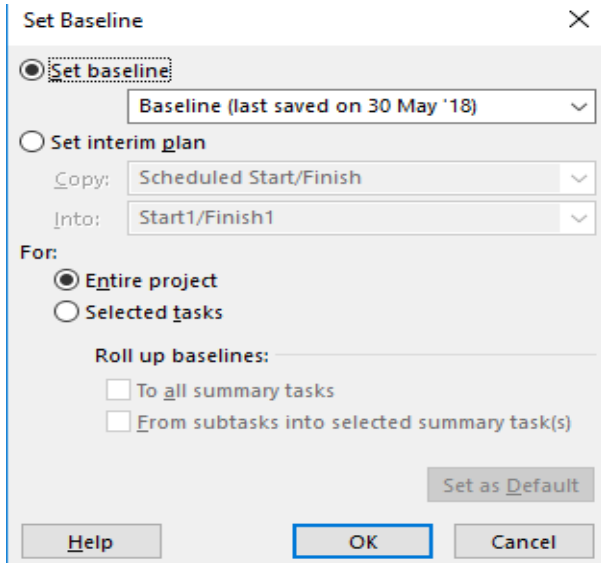


Fig 3: Creation of baseline

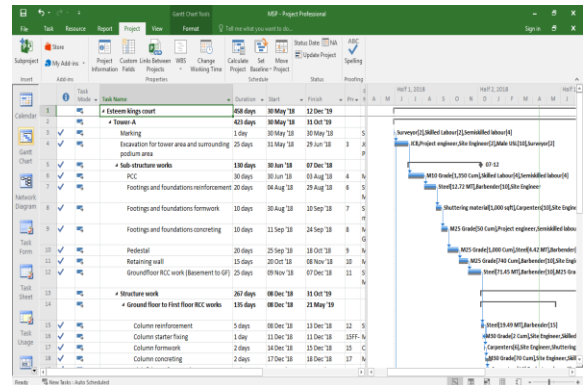


Fig 4: Activities with baseline

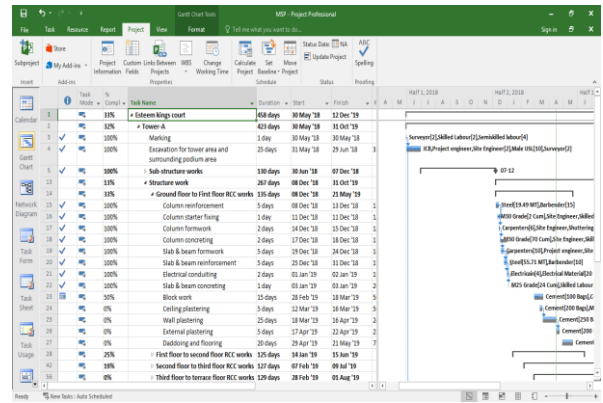


Fig 5: Updated project with baseline

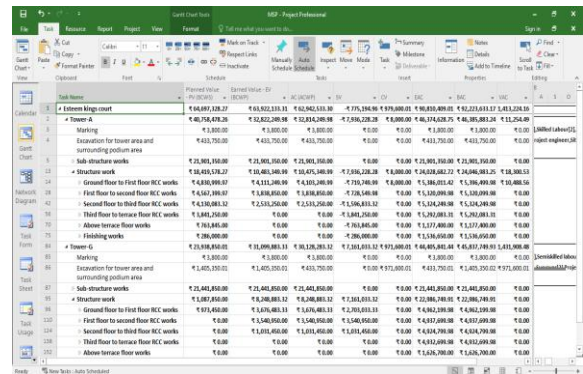


Figure. 6 Tracked project with variance

## VI. RESULTS AND DISCUSSIONS

In this construction project by doing cost controlling and tracking of residential building, by using earned value analysis technique. The Microsoft project management software helps in making the reports from the report wizard and that will give the specific data from data base. Earn value management help the administration to perform their task effectively and efficiently. The cost management includes the process required in planning, evaluating and controlling charges so that the adventure can be completed inside the



affirmed spending plan. Finally resulted in obtaining minimum duration and cost, by tracking/earned value analysis cost and duration is required for the completion of this project.

The results were calculated using the following formula:

$$1) \text{ Cost variance (CV) = BCWP - ACWP}$$

$$CV = 63922133.31 - 62942533.30$$

$$CV = 979600.01$$

$$2) \text{ Cost performance index (CPI) = BCWP/ACWP}$$

$$CPI = 63922133.31/62942533.30$$

$$CPI = 1.0155$$

$$3) \text{ Schedule variance (SV) = BCWP - BCWS}$$

$$SV = 63922133.31 - 64697328.21$$

$$SV = -775194.96$$

$$4) \text{ Schedule performance index (SPI) = BCWP/BCWS}$$

$$SPI = 63922133.31/64697328.21$$

$$SPI = 0.9880$$

The cost variance (CV) and cost performance index (CPI) denotes the cost performance of the project,

If CPI is less than 1 then cost consumed by activities is more. If CPI is greater than 1 then cost consumed by activities is less.

If SPI is less than 1 then activities are consuming more time. If SPI is more than 1 then activities are consuming less time to complete the task within planned duration.

Estimated cost at project completion = project budgeted cost/CPI =  $92223633.17/1.0155 = 90815985.39$ .

Estimated time at project completion = project schedule time/SPI =  $509/0.9880 = 515.182$ .

## VII. CONCLUSION

Earned value offers a speedy facade caution advise to managers to carry out the remedial measure. EVM permits both cost and schedule examination in contradiction of objective work achieved. If the customer and client are fulfilled, then the project is effective and it is completed within planned schedule and planned cost. The project schedule and cost is interrelated with each other. If we are spending more assets for distinct activity, the activity will finish within the time interval. If we are spending less assets for the activity, it will take more time to finish the activity. So, accurately distribute an optimal assets and schedule of a construction project to make it effective achievement.

- As per study, it can be concluded that the project is within the budget and behind schedule.
- Earned value parameters i.e. cost per index and schedule per index evidently shows the omissions of project terminologies of cost and schedule. it helps in effective finishing of project.
- The evaluation of earned value terminologies can also be done manually but with the help of MS Project,

evaluation can be done efficiently within limited time, this will be helpful in big construction projects.

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