

# An Effective Study and Significance of Earned Value Analysis for Construction Projects

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## Abstract:

This paper presents an Earned value Analysis for Constructions projects by using the various parameters. As we all knew, Construction projects can be completed timely and cost- effectively with a minimum risk factor. By using Earned value analysis, evaluate work progress in order to identify schedule slip and area of budget overruns. In this paper, various performance indicators for finding earned values are to be used. Earned values are used to implement the project monitoring and controlling throughout all project steps.

**Keywords:** Earned value Analysis, Project Monitoring.

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## 1. INTRODUCTION:

The construction industry is one of the most booming industries in the whole world. The construction industry faces a lot of project overruns due to a large number of uncertainties. Primarily project overruns are attributed to time and cost overrun. The traditional method or conventional way to evaluating the budgeted cost is by analyzing the difference between planned value (PV) and the actual cost of the project. These parameters help to compare how much was planned to spend and how much has been spent to till date. As the traditional method did not give any idea about the completed work, so this data was not sufficient. Moreover, it was also not possible to relate to completed work with the amount of money spent on it. Earned value management gives a variable called Earned value which would give a simple understanding of the budgeted cost and the schedule. It indicates project manager to spot and control potential problems that may arise to maximize profits and minimize delays.

The Earned Value Management that can be effectively used to monitor and control the project, actual costs to date by simply comparing the budgeted cost of work performed against the actual cost of work done, reasons of the cost performance can be then figured out.

Earned Value Management system is only used to the data extrapolated from the past performance and limited to use the Earned Value Management to predict the future, the Risk Management on the other hand is the specialized tool in this regard. The issue is that The Earned Value Management and Risk Management can and should be implemented in an integrated way, not only during the project execution phase but also from the project initiation phase till project completion.

## 2. LITERATURE REVIEW:

[1]Amruta B.Vyas and Prof.B. V. Birajdar proposed the tracking of construction projects by

earned value management, In this paper, the author gives the benefits of project management, the importance of Earned Value Management( EVM) in construction projects. Tracking of construction projects using Earned Value Management is useful in recognizing the risk factors of the construction projects also forecast the potential problems in order to face the remaining project work. The EVM also forecasting total project cost as well as its date of completion.

[2]A Work is done by Prof.Shelke, Prof.Attrde,&Mrs.Chavan(2015) was primarily focused on planning, scheduling, and delay analysis of construction projects under which the information was provided regarding the introduction of planning, steps in project planning, scheduling, Project Scheduling Steps, Manpower Management, and manpower planning. later on, the case study of the residential project or residential apartment was included by using MS Project and MS Excel software. At the end of the paper, a discussion was done regarding Master Schedule, Activities, Unskilled labors, Shortage of workers, Shortage of materials, improper management, improper planning & Weather problems which causes the delay. Also, recommendations were given to minimize the delay.

[3] In another research of Antony Prasanth MA, Thirumalai Raja K proposed that EVM provide early indications of expected project results based on project performance and forecasting of the project which creates an opportunity to make better decisions and highlights the possible need for corrective action by using the EVM technique. The author applied EVM to various levels of a project WBS and to various cost components, such as labor, material, and subcontractors. Author highlights that EVM enables a contractor and his customer to monitor the progress of a project objectively and in terms of cost schedule and technical performance values and helps them to be aware of the status of the project.

[4] In another research of Dr. Mohamed El Mikawi, Dr. Ayman Hussein Hosny Khalil, Mohamed Kamal Asaad. A case study was used to demonstrate the effect of the absence of the integration between Earned Value Management and

Risk Management process as a project monitoring and controlling technique. The author concluded that Earned Value Management in a project cost and time monitoring and controlling is very efficient regarding the past performance evaluation, and although that the Earned Value Management technique. EVM has some theoretical mechanisms for predicting future performance and trends. The integration technique between Earned Value Management and Risk Management is crucial to meet the project allocated budget and scheduled time, depending on the Earned Value Management indices in forecasting the project future performance and trends is risky as the future performance cannot be predicted using the data extracted from the Earned Value Management measures of the project past performance. The project measurement baseline is monitored and controlled by the Earned Value Management, and on the other hand, the project Management Reserve is monitored and controlled by the Risk Management technique.

### **3. TERMINOLOGY USED TO ANALYSIS IN EARNED VALUE ANALYSIS:**

Basically, three parameters based on cost performance are used in earned value analysis. They are namely planned value (PV), Earned Value(EV), and actual cost(AC).

**Project Plan Metric (BCWS):** Project plan is a budget cost of work(BCWS) that comprises the total planned cost for all tasks or subtasks for work undertaken to be achieved by a given point in time.

**Project Actual cost(AC or ACWP):** Actual Cost (AC) also known as the actual cost of work performed (ACWP)is the total amount of expenditure on tasks or sub-tasks at any point in time. It is the value of cost which is assessed at point analysis at work performed within a given time period.

**Project Accomplishment Metric(BCWP):** Project Accomplishment Metric(BCWP) is nothing but the value of work completed within a point in a time. It is given by the Actual percentage completed to budget at completion.it is known as the Budget cost of work performed.

EVM measures project performance for the current situation scenario and cumulative performance to date. For calculating EVM some parameters like variances, indices, and forecasts were developed using planned value, earned value, and actual cost which are elaborated further.

**Schedule Variance (SV):** Schedule variance (SV) is the difference between Work actually performed (BCWP) and Work scheduled (BCWS). in simple words, scheduled work has been finished than was planned.

**Cost Variance(CV):** Cost Variance (CV) is the difference between the planned cost of work performed (BCWP) and the actual cost incurred for the work (ACWP). Total spend to complete work than budgeted cost.

**Schedule Performance Index(SPI):** Schedule Performance Index(SPI) is a ratio of work accomplished (BCWP) to work planned (BCWS) during a specific time duration.SPI denotes the rate at which the project is progressing. it shows work being completed more or less than scheduled work.

**Cost Performance Index (CPI):** The cost performance index is the ratio of cost of work performed (BCWP) to actual cost (ACWP).CPI value 1 states that the actual cost is matched with an estimated cost. CPI greater than 1 states that work is at under cost or less cost than budgeted cost.CPI is less than 1 indicates the project is facing a cost overrun.

**Estimate at Completion (EAC):** Estimate at completion is the total estimated cost of a project based on project performance. At the start of a project, the Budgeted cost at completion(BAC) and EAC will be equal.BAC will vary from EAC When actual cost (ACWP) differs from planned cost (BCWP).

**Variance at completion (VAC):** It is nothing but a difference between budget at completion(BAC) and estimated cost at completion (EAC). This variance gives more or less to add to the total project to complete the project. The value much under/over budget will the project be at completion.

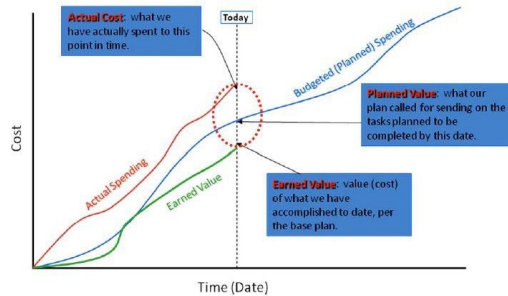


Figure 1: Standard Earned Value Graph

**4. CASE STUDY :**

The selected site for this case study is located in Chikhaldara, Amravati, Maharashtra. Municipal Council Chikhaldara decided to construct a road for tourist points. The facilities provided to the local as well as tourist. The project started on 15 Nov. 2020. The details are as follows:

TABLE 1  
Briefing of Project

Authority (Responsible for work)	Municipal Council Chikhaldara
Name of work	Construction of concrete road from Shivaji high school to Devi point for M.C Chikhaldara.
Work Amount	30,74,467/-INR
Contract Amount(After below) 26%	22,75,106/-INR
Date of work order /Start Date	15 Nov.2020

From the details of data collected from the respective Government Authority and contractor, the project to be completed in 180 days and the cost of the project is 22,75,106/-INR. So the data collected from the Contractor, the amount spent on the project till 15 Feb 2021 is 16,00,000/- INR.

TABLE 2  
Schedule of project

Sr. No.	Item of work(in brief)	Quantity	Rate	Per day Cost	Duration (Days)	Total Cost for individual Activity
1	Excavation for roadway	400.16	60	1000	15	15000
2	Conveying of excavated material	200.08	280	8032	7	56224
3	Supplying of stone	72.03	980	10084	7	70588

4	Spreading 80/40 mm metal for road work	72.03	50	720	5	3600
5	Compacting metal in layers by power means	1600.63	15	3000	8	24000
6	M-10 for Foundation.	160.06	4800	42685	18	768330
7	M-20 pavement	240.09	5100	48980	25	1224500
8	Cutting Transverse contraction joints	363.75	266	19350	5	96750
9	Fixing board.	1	6000	6000	1	6000
				<b>Total</b>		<b>22,75,106/-</b>

Cost performance index(C.P.I.): $\text{Earned Value} / \text{Actual cost} = 15,92,575 / 16,00,000 = 0.99$

Schedule Performance Index(S.P.I.):  $\text{Earned Value} / \text{Planned Value} = 15,92,575 / 19,33,840 = 0.82$

Estimate Cost to completion(ETC):  $(\text{BAC}-\text{EV}) / \text{CPI} = (22,75,106 - 15,92,575) / 0.99$

$= 682531 / 0.99 = 6,89,425/-$

**5. RESULTS:**

1) As per the above case study the said project has an unfavorable schedule variance of 3,41,265 that means the project is behind schedule. An SPI of 0.82 would give that the project is progressing at 82% of the rate originally planned.

2) The said project has an unfavorable cost variance of 7,425 which means the project is over budget. A CPI of 0.99 gives that the project is presently running over budget by 1% that is for each rupee we spend, we get a value of rupee 0.99.

3) Estimate at Completion (EAC) shows that the expected total cost of the project at completion is based on the performance of the data date 22,75,106/- divide by 0.99 is 22,98,086/-. Hence EAC is 22,98,086/-. It means that, since the project is getting only 0.99 rupees out of every rupee, the project will cost 22,98,086 instead of 22,75,106/- that was planned.

Based on the data collected from the contractor prepared before commencement of the work, the cumulative planned value was established. Based on the actual work completed the percentages of work estimated and then from percentage (%) complete the earned value is calculated. The actual expenditure collected from contractors account department, the actual expenditure for the work done till the date is acquired. This value is planned is called Actual Cost.

TABLE 3  
Completion of Project

	Duration(Days)	COMPLETION (%)
Item 1 to 5-	42	100
Item-6 &7.	31	70

On 15 Feb 2021, on closer review, 75 % of work has been completed. so,  
 The actual cost of the work (AC):16,00,000/-  
 Earned value (EV):70% of Budget at completion(BAC)= $0.70 * 2275106 = 15,92,575/-$   
 Planned Value(PV):85 % of Budget at completion(BAC)= $0.85 * 2275106 = 19,33,840/-$   
 Schedule Variance(SV): Earned value- Planned Value= $15,92,575 - 19,33,840 = -3,41,265/-$   
 Cost Variance (CV): Earned value- Actual cost= $15,92,575 - 16,00,000 = -7,425/-$

**6. CONCLUSION:**

The most important significance of Earned value in construction projects gives the caution advice to take a remedial measure. As per the study, it can be concluded that the project is behind schedule and over budget. The project is progressing at a rate of 82% of the rate originally planned. To get a project on track respective team should work on Resource Management problems, Inflation, delay due increase in cost due to late decisions, delay in nominations of subcontractors. The monetary value of this work comes out to 0.99 rupees(INR). Using this earned value analysis to track real-time project is extremely useful and give the overall idea about the performance of the project for a certain duration of the project. We easily predicted the future of the project by considering or analyzing cost and scheduled variances. Earned value also helps to monitor if the corrective actions done to improve,

by doing this performance of work are actually working.

**7. REFERENCES :**

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