# EARNED VALUE ANALYSIS ON AN ONGOING RESIDENTIAL BUILDING PROJECT IN BANGALORE, INDIA

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**Abstract-** *Earned Value Management (EVM) is one of the best method to track the progress of a construction project. It takes into account both the time and the cost factors to evaluate its performance and forecast its completion time and cost. This paper discusses about how Earned Value Analysis (EMA) is introduced to a residential construction project. It calculates the performance in cost and schedule and pin points areas where improvements have to be made. It is predicted that if corrective actions are not made as per the current situation, the project will get delayed by 17 days and also that the contractor is estimated to make an additional profit of over six lakhs than what was originally planned.*

*Key Words: Earned Value Management, Earned Value Analysis (EVA)*

## 1. INTRODUCTION

In developing countries like India, the construction industry faces a lot of project over runs due to the large amount of uncertainties. These project overruns are primarily attributed to time and cost overrun [1].

The conventional way of evaluating the budgeted cost is by analysing the difference between the planned and actual costs that arises in the project. Earned Value Management introduces a third variable called Earned Value which would give a clearer understanding of the budgeted cost and the schedule. It acts as an early warning to the project manager to spot and control potential problems that may arise so as to maximise profits and minimize delays [1] [2].

EVM is regarded as one of the best methods to track the project progress and its performance. It is said to have originated from the US Defence Agencies back in the 1960's. EVM is extensively used in the manufacturing industry and later found its way to the construction industry after it was standardized by the Project Management Institute. Using EVM the project manager can assess how ahead or behind the project and if the project is over budget or under budget [3].

By using three variables, the planned value, earned value and the actual cost other variables like schedule variance, cost variance, schedule performance index, cost performance index, budget at completion and so on can be computed. Using these computed variables the performance can be maintained or improved. It will even give a heads up concerning the required cash flow for the project, thereby giving ample time for the clients to raise the money [4].

## 2. IMPORTANT EARNEDVALUE MANAGEMENT TERMS

The basic terms associated with Earned Value Management [1] [2]

**Planned Value (PV):** It is the amount of money budgeted to be spent at a particular point of time.

**Earned Value (EV):** It is the amount of work in terms of cost that is actually accomplished at a particular point of time with respect to the planned value.

**Actual Cost (AC):** It is the actual amount of money spent for the corresponding planned and earned value.

**Cost Variance (CV):** It is the difference between Earned Value and Actual Cost. (EV-AC)

**Schedule Variance (SV):** It is the difference between Earned Value and Planned Value. (EV-PV)

**Cost Performance Index (CPI):** It is the ratio between Earned Value and Actual cost. If CPI greater than 1 then the project is under budget and CPI less than 1, then the project is under budget.

**Schedule Performance Index (SPI):** It is the ratio between Earned Value and Planned Value. It indicated how much ahead or behind schedule the project is at a particular point of time.

**Critical Ratio (CR):** It is the product of Cost Performance Index and Schedule Performance Index. It indicates the overall performance of the Project with respect to both cost and time.

**Estimate at Completion (EAC):** It's a prediction of the total project cost based upon the current trends in project performance.

**Variance at Completion (VAC):** It is the difference between the planned budgets at the beginning of the project to the Estimate at Completion. This value denotes how much more profit or loss the contractor will make on that Project.

**Time Estimate at Completion (EACt):** It predicts the completion time of a Project based on its current performance. EACt = (BAC / SPI) / (BAC / months)

## 3. CASE STUDY: EARNED VALUE ANALYSIS OF A RESIDENTIAL HOUSE PROJECT

Earned Value Analysis is done on a residential housing project in Bangalore. The project duration is 4 months and the budget at completion (BAC) is Rs.1,84,58,620/-. Earned Value analysis is done at the end of the first month. This analysis will reveal the efficiency at which the work was done and the rate at which it was completed. It also shows the additional profit or loss the contractor will make with respect to what was originally planned.

Based on the rate analysis and the planned profit and loss sheet prepared before the commencement of the project the cumulative Planned Value is established. Based upon the actual work completed the % completion is estimated and then from the % complete the Earned Value is computed.Finally from the accounts department, the actual expenditure for the work done till this point is acquired. This is called the Actual Cost.

**Table -1: Earned Value Analysis for activities done on the first month for the 1st month**

|  | PV | EV | AC |
|---|---|---|---|
| **FOUNDATION** | 2176578.00 | 2176578.00 | 2264750.00 |
| **PATIO** | 885411.00 | 885411.00 | 712300.00 |
| **EXTERIOR WALLS** | 891810.00 | 673872.00 | 601250.00 |
| **STAIRWAY** | 729312.50 | 364656.25 | 372400.00 |
| **PROJECT TOTAL** | **4683111.50** | **4100517.25** | **3950700.00** |

Project duration= 4 months
Budget at completion= Rs.1,84,58,620/-

The activities planned to be completed in the next 3 months include, frame interior walls, install roofing truss, install water lines, install wiring, install gas lines, install felt, install fixtures, install shingles, install dry wells, install vents, painting, install switches, and install carpeting.

From these three variables the following variables are computed.

CV= EV-AC
CV %= (CV/EV) X 100
SV= EV-PV
SV %= (SV/PV) X 100
CPI= EV/AC
SPI= EV/PV
EAC= BAC/CPI
VAC= BAC-EAC
EACt= (BAC / SPI) / (BAC / months)

## 4. RESULTS AND DISCUSSIONS

From the Planned Value, Earned Value, Actual Cost, and the Budget at Completion the following parameters are found out.

**Table -2: Earned parameters to calculate project performance, and forecast its completion time and cost**

| CV (Rs) | 149817.25 |
|---|---|
| CV % | 3.65 |
| SV (Rs) | -582594.25 |
| SV % | -12.44 |
| CPI | 1.04 |
| SPI | 0.88 |
| EAC (Rs) | 17784212.48 |
| VAC (Rs) | 674407.52 |
| EACt (Months) | 4.57 |

- This Project has a favourable CV%=3.65%. This means that the project is 3.65% under budget for the work performed.
- The project has an unfavourable SV%=-12.44%. This means that the Project is 12.44% behind schedule.
- This Project has a favourable CPI of 1.04. This means that for every rupee spent, 1.04 rupee in earned value is accomplished.
- This Project has a favourable SPI of 0.88. This means that for every rupee worth of work the Project planned to accomplish, 0.88 rupees worth of work was accomplished.
- This project is estimated to be completed is 4.57 months and not 4 months. 17 days more than what was planned.
- The Estimate at Completion of this Project is forecasted to be Rs.17784212.48/- and not Rs.18458620/-.
- When VAC= Rs.674407.52/-, the contractor is predicted to make an additional profit of Rs.674407.52/-.

## 5. CONCLUSIONS

With the introduction of Earned Value Analysis to the monitoring of this project the actual return of investment for the work done is found out. It gives better understanding of the cash flow.
It also brings to light if the project is going as per what was originally planned. It shows how much ahead of schedule or behind schedule the project is at a particular point of time. It also helps in the monitor if the corrective actions done to improve the performance of work are actually working.

Finally it will predict the final completion time of the project along with the additional profit or loss the contractor will make from what was originally planned. On a whole Earned

Value Analysis enables the contractor to monitor the progress of work in terms of Cost and Time in a much more effective.

## REFERENCES

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## BIOGRAPHIES



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