

# PROJECT TRACKING USING EARNED VALUE MANAGEMENT ON COST, TIME AND CARBON FOOTPRINT

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**Abstract** - The growing demand for accommodation has created a boom for high rise buildings in the world. Further, for managing work, time and investments efficiently, we require an efficient tool. Earned Value Management (EVM) is a project planning and control approach which provides cost, and schedule performance measurements. It is a project management technique that uses "work in progress" and to indicate what would happen to work in future. Major objectives of applying earned value to a contract are to encourage contractors to use effective internal views, cost and schedule management control systems and to permit the consumer to rely on timely data produced by those systems for better management insight. Measures for improving qualitative crediting and reduction of fossil CO<sub>2</sub> were suggested based on the green building concepts. Carbon footprint is defined as the total sets of greenhouse gas emissions caused by an organization, event, product or a person. Once project managers have an idea of the carbon value of the project, they can take steps to reduce carbon footprint by material selection, design and management practices.

**Key Words:** Earned Value, Carbon Footprint, Earned Value Management, Project Management

## INTRODUCTION

The Earned Value Management (EVM) is an approach for analyzing and controlling the performance of a project which allows a more accurate measurement of both performance and the progress of a project. Referring EVM to EV most often, the EV measures the project performance and the project progress by integrating efficiently the management of the three most important elements in a project that is cost, schedule and scope. Each task in a project earns value as planned work is completed. Earned Value can be compared to Actual cost and Budgeted cost to determine variance and predict future performance. The EVM concept is a sound management approach that once incorporated on any type of program whether research and development, construction, production, etc. provides all levels of management with early visibility into cost and schedule problems.

For the project discussed in this paper, the authors use Construction Computer Software-Candy. CCS Candy is project control software which deals with the various sections like estimation, planning, cash flow, valuation and Earned Value. The case study of bridge cum regulator is studied here.

The objectives of EVM are:

- Relate time phased budgets to specific contract task and/ all statements of work.
- Provide the basis to capture work progress assessments against the baseline plan.
- Relate technical, schedule, and cost performance.
- Provide valid, timely and auditable data / information for proactive project management analysis and action.
- Supply managers with a practical level of summarisation for effective decision making.

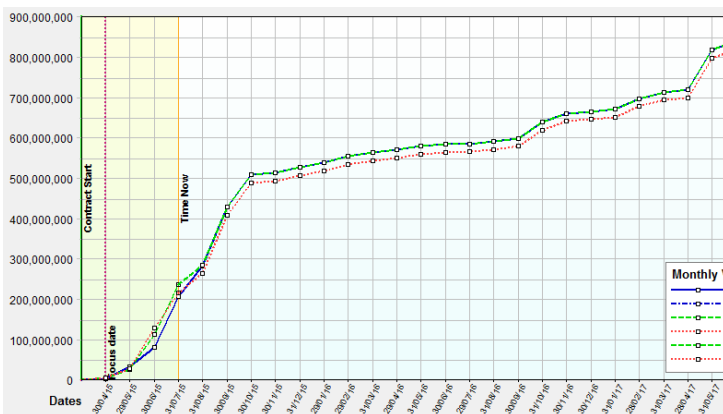
The objective of our project is to demonstrate the tracking of cost, and time, and propose an approach to incorporate carbon footprint of the construction process also in the construction project tracking.

## 2. CASE STUDY

The selected work for the project was construction of bridge cum regulator. The purpose of construction work is salinity control. The total contract amount is 100 Cr and the total duration of the project is 30 months. This is an ongoing project according to the schedule, project was started on 1<sup>st</sup> April 2015. The planned schedule was to complete the work in October 2017.

The required details and drawings are collected from the site. The quantity of different resources till date was collected. Valuations were done monthly.

Carbon emissions for each resource was found and carbon amount for total work was calculated.



SPI: Schedule Performance Index= EV/PV  
 CV = EV-AC  
 SV = EV-PV  
 Whenever CV<0 and CPI<1, there are over costs, and whenever SV<0 and SPI<1, the project is delayed.  
 A Positive value of SV and CV means the project is in advance from plan and under budget respectively.  
 Variables and variances can be represented graphically (fig.1), helping project managers to monitor project evolution. The graphical representation of PV is the project cost base line.

Figure-1 Cost and allowable graph after 3 valuations  
 Blue line indicates baseline. Green indicates actual allowable. Red indicates actual cost.

The figure-1 shows the cost and allowable graph after 4 valuations. From the graph, actual allowable cost is above actual cost, so that work is going well.

**3. LITERATURE REVIEW**

According to Leila Moslemi Naemi, the EV of an activity is a measure of the completed work and represents the budgeted cost of work performed and indicates how efficiently the project team utilizes the project resources. The EV consists of techniques to assist project managers in measuring and evaluating the progress and the performance of a project by estimating the completion cost and completion time of a project based on its actual cost and actual time up to any given point in the project.

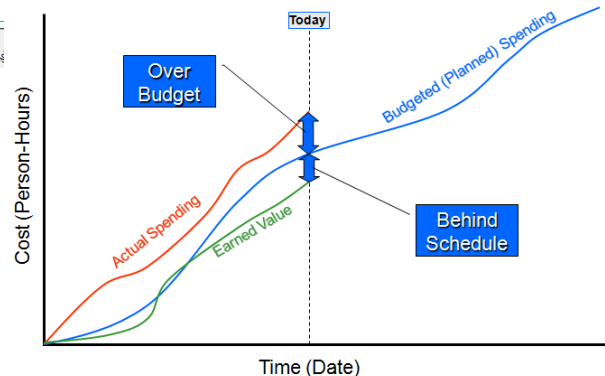


Fig- 3 Time Vs Cost graph

**4. METHODOLOGY**

Entire project is expected to divide into various sections such as:

- Estimation: Cost and carbon footprint estimate establishes the baseline of the project at the different stages of development of project.
- Planning: Making a good construction plan is the basis for developing the budget and schedule for a sustainable work.
- Valuation: In order to balance both employers and main contractor’s rights and interests, a fair and reasonable valuation approach is adopted.
- Earned Value: It forecast and track allowable cost against a baseline budget.

**5. TRACKING OF CARBON FOOTPRINT**

Carbon footprint is measure of total amount of greenhouse gas emissions of defined population, system or activities consider all relevant sources. It is calculated as carbon dioxide equivalent. Using EVM project can be tracked for cost and time. So tracking of carbon footprint along with time and cost can add a contribution to environmental sustainability. Carbon emission rate for each resource is unique. There by, plug in carbon emission rate for each resource, we can obtain total carbon emission on the site. Valuations were done periodically. During each valuation stage, total carbon emission till that stage was calculated. Graph of total carbon

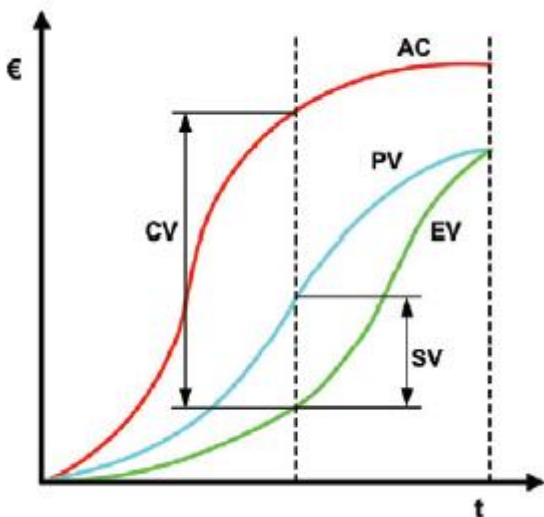


Fig-2: EVM main variables and variances

SV: Schedule Variance – Deviations from work planned  
 CV: Cost Variance – Deviations from the budget  
 AC: Actual Cost – What you have actually spent to the point in time  
 PV: Planned Value – What you have planned to spent till date  
 EV: Earned Value – Value of what you have accomplished to date, per the base plan  
 CPI: Cost Performance Index= EV/AC

content Vs time was plotted knowing the final carbon amount.

Further, tracking of carbon footprint can be done.

Figure: 4 shows the tracking of carbon foot print with time. The quantity usage of various items were obtained from the software. Individual carbon emission of each resources were found separately and the total carbon emission till that valuation period was found.

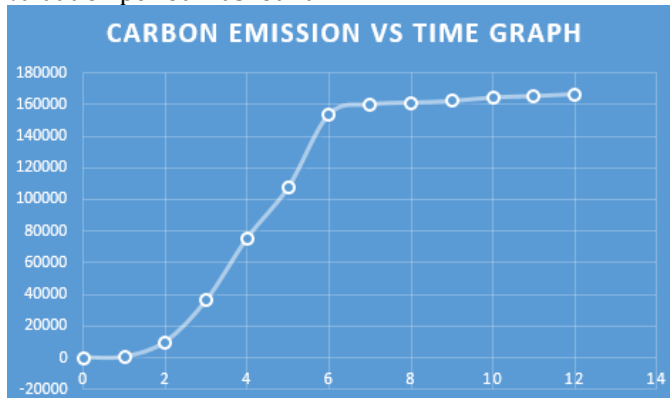


Fig:4 Time Vs Carbon emission graph

Here, X axis indicates time and Y axis indicates total carbon amount till that point of time (ton).

V1, V2, V3... V12 indicates Valuations done from April 2016. The time duration of each valuation is 1 month.

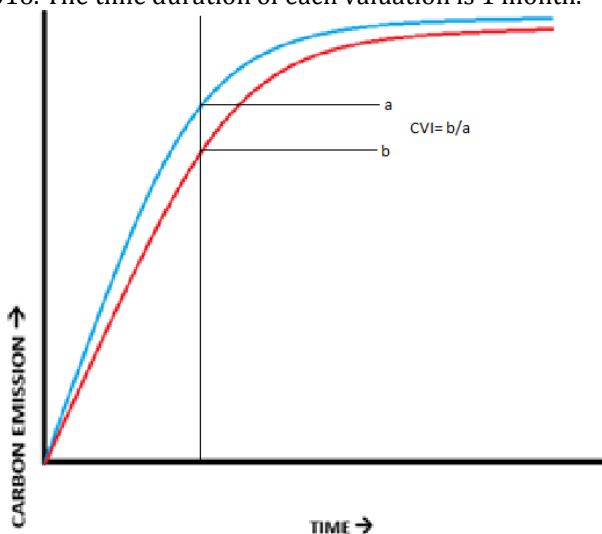


Fig:5 Carbon emission Vs time graph

Fig: 5 shown above indicates the proposed graph of carbon emission Vs time. Here the blue curve indicates the planned value and red curve indicates the actual value. As the work progress, carbon emission from materials, individuals, machineries goes on increasing, which can be interpreted from the graph. Actual value is expected to be below the planned value. If so, carbon emission is under the limit. But, in most cases actual value goes above the planned value. Further methods can be adopted to reduce this emission rate .So, we would like to keep forward a new index, carbon variance index. Where, Carbon Variance Index (CVI) =Actual

Value/Planned Value. If  $CVI < 1$ , carbon emission is under limit and if  $CVI > 1$ , carbon emission is more.

Plotting the graph manually, carbon emission rates during the whole work is measured. Thus carbon footprint is tracked along with cost and time.

### CONCLUSION

Earned Value analysis is a method of program/ project management because it integrates cost, schedule and scope and can be used to forecast future performance and project completion dates. It is an “early warning” program /project management tool that enables managers to identify and control problems before they become insurmountable. It allows projects to be managed better on time, on budget.

Sustainability has been enshrined as a goal of society to ensure the other satisfaction of present means does not compromise ability of future generations to meet their own needs. Therefore making an attempt to calculate carbon footprint and to reduce them relatively along with earned value management cooperate in fulfilling the associated demands of the society.

An alternate method for tracking carbon footprint along with tracking of cost and time was suggested.

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