

TRACKING AND FORECASTING OF THE PROJECT PROGRESS

A case study at Sindhu Apartment Mangaluru

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Abstract—Earned value management (EVM) is a technique that forecast the project giving an early warning of project cost, schedule and performance. Study is to check effectiveness of EVM in the construction industries for tracking and forecasting the project progress using PRIMAVERA software. Tracking and forecasting enhance the opportunities for project success.

Keywords—Tracking, Forecasting, Earned value.

I INTRODUCTION

Important work in project planning is to develop the project plan before actual work starts. Project plan mainly deals with the time, cost and scope. Once actual work starts very next stage of project management is tracking of the project. Details obtained during tracking are called Actual. Importance of tracking is easy for judging where our project stands and its future move. Earned value analysis is the most common method using for tracking the project progress. Schedule, cost and scope performance measurements of a project together can be done through earned value analysis.

II SCOPE AND OBJECTIVES

- Planning and scheduling the different activities involved in the project.
- Estimating the total cost required for the project with respect to schedule, duration and number of total critical activities in the project.
- Developing the variance and indices related to the cost and schedule of the project in order to track the project.
- Developing the variance and indices related to the cost and schedule of the project in order to forecast the project.
- Measuring the project performance at current stage a, cumulative performance till date and forecasting the future performance based on EVM analysis.

III METHODOLOGY

A) Planning and scheduling the activities

Referring the completion date, BOQ requirements, resource availability and productivity of available resources and machineries planning and scheduling of the activities prepared using "PRIMAVERA" and referred as a "MASTER

SCHEDULE". This is fixed as a schedule baseline against this whole project progress is tracked. Tools and methods used are Critical path method, Program evaluation and review technique, Primavera, Microsoft excel. Duration of the activity is calculated using equation 1,

$$\text{Duration} = \text{Quantity of work} / (\text{Number of labour machinery} \times \text{productivity}) \quad (1)$$

B) Earned value analysis

In order to perform earned value analysis importantly requires three parameters they are, Planned value (PV), Earned value (EV), Actual cost (AC). Here Planned value (PV) is budgeted total cost for an activity or for the project up to certain time period. Budgeted cost obtained during planning stage. Earned value (EV) is nothing but the actual value of the work completed with reference to the planned value till date. Actual cost (AC) is nothing but the total cost (Direct and Indirect) incurred while execution of the activity or for the project up to certain time period.

C) Tracking methods

1) *Cost variance (CV)*: It indicates the cost performance of the project. Cost variance before completion of the project will get through subtracting Actual cost (AC) from the Earned value (EV). After completion of the project difference of the Budget at completion and actual amount spent will give overall cost variance of the project.

$$CV = EV - AC \quad (2)$$

2) *Schedule variance (SV)*: It defines the schedule performance of the project. Schedule variance before completion of the project will get through subtracting Planned value (PV) from the Earned value (EV). It helps to know whether the project is ahead or behind the schedule. During completion of the project scheduled variance will be Zero.

$$SV = EV - PV \quad (3)$$

3) *Cost performance index (CPI)*: It indicates the cost efficiency of the project. Cost performance index (CPI) is the ratio of Earned value (EV) to Actual Cost (AC). If CPI is greater than 1 it shows project is under budget, when it shows

equal to 1 it means project is on budget and while greater than one it shows project over the budget.

$$CPI = \frac{EV}{AC} \quad (4)$$

4) *Schedule performance index (SPI)*: It indicates the time efficiency of the project. Schedule performance is the ratio of Earned value (EV) to Planned value (PV). If SPI is greater than 1 it shows project is ahead of the schedule, when it shows equal to 1 it means project is on schedule and while greater than one it shows project is behind the schedule.

$$SPI = \frac{EV}{PV} \quad (5)$$

D) *Forecasting methods*

1) *Estimate at completion (EAC)*: Forecast the total project cost during completion of the project by considering present performance of the project. Most common method to calculate Estimate at completion (EAC) is by taking ratio of the Budget at completion (BAC) to the Cost performance index (CPI).

$$EAC = \frac{BAC}{CPI} \quad (6)$$

2) *Estimate to completion (ETC)*: Forecast the cost required from the present date up to completion of the project by considering present performance of the project. Subtracting Actual cost (AC) from the Estimate at completion will give further cost requirement.

$$ETC = EAC - AC \quad (7)$$

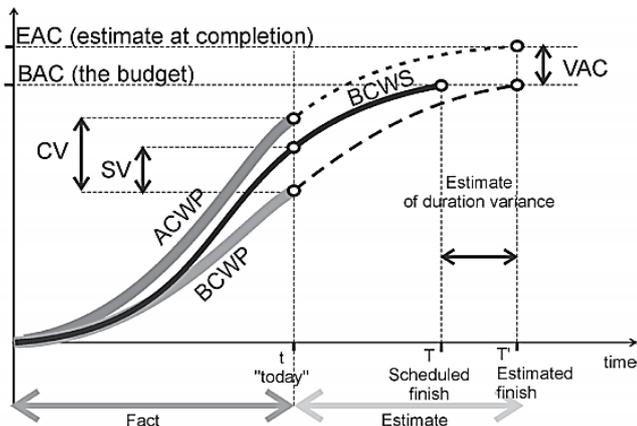


Fig. 1. Earned value curve for a project over budget and behind the schedule.

IV CASE STUDY

Sindhu Apartment Kottara chowki, Mangaluru is the site selected for the case study. Sindhu apartment is the residential apartment of Ground + 6 floors in plot area is 1909.99 sq.mt (47cents) equipped with modern amenities. Floor sub-division is ground floor with parking for 41no's four wheelers and 9 no's of two wheelers and remaining six floors with 36 no's of 2bhk flats with six flats in each floors. Area statement total super build up area is 4714.48 sq.mt, total net area 3523.57 sq.mt, total gross area from 1st to 6th floor each is 676.49 sq.mt.

TABLE I. PROJECT DETAILS

Description	Detail
Client	Prashanth, Prabhat And 34 others
Contractor	Nithin Enterprises
Total duration	16 months
Total contract value	Rs 62925807.21

The details required for the Cost estimation and for the Schedule preparation is collected from the site. By using that data total budget for the project and Master schedule is prepared with the help of PRIMAVERA it is shown in TABLE II and TABLE III.

TABLE II. PROJECT COSTDETAILS

Description	Cost (Rs)
Preliminary work	2100000
Structural work	26068875.91
Masonry and finishing	4988361.52
Plastering work	4898252
Electrical	3731852.8
Plumbing and sanitary	1633510
Miscellaneous work	19504955
Total	62925807.21

TABLE III. PROJECT SCHEDULE DETAILS

Task	Start	Finish
Total duration(414 days)	11 April 2015-8.30 AM	12 August 2016-5.30PM
Start of the project	11 April 2015-8.30 AM	
Preliminary works	11 April 2015-8.30 AM	27 April 2015-5.30 PM
Structural works	22 April 2015-12.30PM	25 April 2016-12.30PM
Masonry works	20 July 2015-12.30PM	7 April 2015-5.30PM
Electrical works	5 August 2015-8.30AM	27 July 2016-5.30PM
Plastering works	28 July 2015-12.30PM	18 June 2016-12.30PM
Painting works	22 April 2016-8.30AM	06 July 2016-5.30PM
Plumbing and sanitary	30 September 2015-12.30PM	11 June 2016-5.30PM
Flooring works	3 May 2016-12.30PM	21 July 2016-5.30PM
Other works	19 October 2015-12.30PM	5 August 2016-5.30PM
Finish of the work	12 August 2016- 5.30PM	

After collecting the data related to the cost and duration graph of cost vs duration plotted for the Planned value (PV). Curve obtained from this graph is called S-curve which form the baseline for the EV analysis. The curve is shown in fig 2.

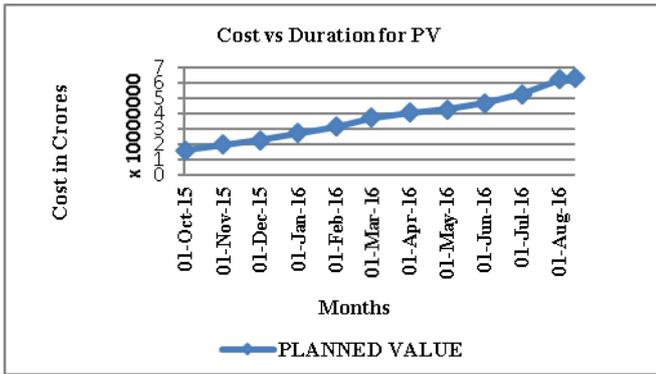


Fig.2. S-curve of the Project.

In order to check the progress of the project through earned value analysis, comparison between cumulative values of PV, EV and AC is done. Its shown in TABLE IV and in Fig 3.

TABLE IV. CUMULATIVES OF PV, EV AND AC

Months	Cum. Actual cost (AC) Rs	Cum. Earned value (EV) Rs	Cum. Planned value (PV) Rs
1-Oct-15	16378729.82	16084350.58	16091118.22
1-Nov-15	20720481.36	20385169.71	19677101.51
1-Dec-15	23151295.52	23397544.88	22862009.27
1-Jan-16	27505303.56	27361489.74	27174076.86
1-Feb-16	31211499.24	31366897.67	31323936.32
1-Mar-16	35014068.3	35449725.17	37288751.96
1-Apr-16	35481009.5	36354360.78	40501194.78

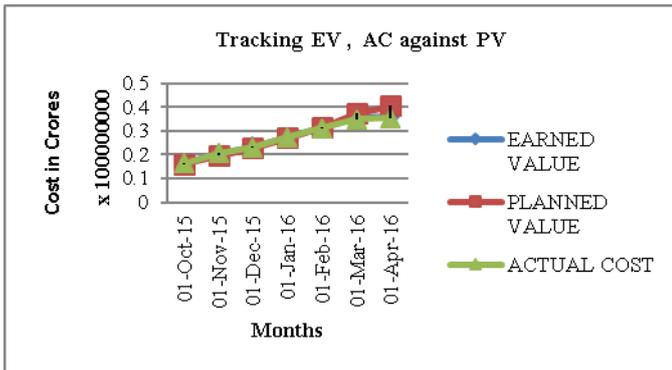


Fig.3. Cumulative EV, PV and AC for the Project.

By using Earned value analysis parameters calculating the Schedule variances and indices, Cost variances and indices for forecasting cost and performance of the project. Its shown in TABLE V and VI

TABLE V. TRACKING PRAMETERS

Months	Cost Variance (CV)Rs	Cost performance index (CPI)	Schedule variance (SV)Rs	Schedule performance index (SPI)
1-Oct-15	-294379.24	0.98	-6767.64	0.99
1-Nov-15	-335311.65	0.98	708068.2	1.03

1-Dec-15	246249.36	1.01	535535.6	1.02
1-Jan-16	-143813.82	0.99	187412.9	1.00
1-Feb-16	155398.43	1.00	42961.35	1.00
1-Mar-16	435656.87	1.01	-1839027	0.95
1-Apr-16	873351.28	1.02	-4146834	0.89

TABLE V. FORECASTING PRAMETERS

Months	Estimate at completion (EAC) Rs	Variance at completion (VAC) Rs	Estimate to complete (ETC) Rs
1-Oct-15	64077488.85	-1151681.6	47698759.03
1-Nov-15	63960861.45	-1035054.2	43240380.09
1-Dec-15	62263539.45	662267.76	39112243.93
1-Jan-16	63256549.46	-330742.25	35751245.9
1-Feb-16	62614059.08	311748.13	31402559.84
1-Mar-16	62152484.99	773322.22	27138416.69
1-Apr-16	61414122.42	1511684.79	25933112.92

V RESULTS

Cumulatives of PV, EV, AC with tracking and forecasting parameters required to evaluate the progress of the project. In the S-Curve analysis in fig.3 indicates, from initial stage of the project to 1-feb-16 EV, PV and AC overlapped. It indicates no much variation with the EV, PV and AC values of the project. But when curve reaches to the month of 1-March-16 and 1-Apr-16 EV and AC shows slight deviation from the planned value, this deviation is because of delay in the project. During 1-Apr-16 SV is -4146834 which shows project lagging behind the schedule. SPI gives an idea of percentage of work accomplished as compared to the schedule. Here SPI .89 during the month of 1-Apr-2016 which shows project is progressing 89% at the rate of originally scheduled. This rate is achieved with the expense of 2% less than the budgeted cost which indicated by the CPI 1.02. Reference to the performance of the project till 1-Apr-2016 Estimation at completion is Rs 61414122.42 and estimate to completion is Rs 25933112.2.

VI CONCLUSIONS

Tracking and forecasting the project progress plays an important role to complete the project within the stipulated scheduled time and budgeted cost. Based on the result project in charge can take perfect decision to complete the planned activities. From the collected data and calculated results we can conclude, Project is lagging behind the schedule but under budget. Reason for delay in the project is improper material management and because of this delay may leads to overall escalation in the budgeted cost. So Project needs immediate attention towards material management to get it back on track.

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