Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 10 Issue 08, August-2021

Management of Residential Building using Earned Value Analysis Method with the Help of Microsoft Project

Akash Patil
Post Graduate Student,
Department of Civil Engineering,
Pillai HOC College of Engineering and Technology,
Rasayani.

Manisha Jamgade
Associate Professor,
Department of Civil Engineering,
Pillai HOC College of Engineering and Technology,
Rasayani.

***Abstract*— Cost and time management are the main aspects of the Construction Project. This Paper explains about the steps of Microsoft Project Software for Project planning, Forecasting and tracking. A case study is carried out with the help of Microsoft Project for Tracking and Forecasting. Schedule Compression process such as Overlapping and Over-timing are also Approached.**

Keywords*— Cost Performance Index (CPI), Schedule Performance Index (SPI), Over-timing, Overlapping, Earned Value Analysis (EVA).

I. INTRODUCTION

The construction industry is an essential section at both the national as well as international growth and development. In India it is considered as the second largest contributor with respect to development. It provides employment to more than 40 million people. Construction Projects bears huge losses due to Project Delay. Time overrun is a serious problem where project development faces many challenges and uncertainties. Time overrun occurs when project exceeds the budgeted or planned time which was calculated at the start of the project. Cost overrun occurs when actual value or cost of the project exceeds the budgeted value.

II. LITERATURE REVIEW

Firas kh. Jaber el at (2019): In this study , a practical application of earned value analysis is applied in the Al-Hamza water treatment plant with the help of Microsoft Project 2016. Earned value parameters are obtained in order for better understanding of performances. The results obtained shows that the project is on budget but behind the schedule

Vaishnavi Tuljapurkar el at (2015):This study shows about the importance of Earned value method with the help of Microsoft Project . The case study includes the construction of a hospital building . Various earned value parameters are explained as well as calculated in this paper. Results obtained shows that project is over budget and ahead the schedule.

Awad S. Hanna el at (2013): In this research it is explained about various differentiation of crew-scheduling techniques on overall project performance. Crew-scheduling types includes 5days-8hrs, 4days-10hrs, second shift, Rolling schedules, and overtime schedule are explained

Reza Dehghan el at (2011): This paper explains about an effective technique for schedule compression which is known as overlapping. Description about four types of relationship between activities. This provides two formulas, overlapping cost and overlapping benefits, which is time-cost trade-off. If improper overlapping occurs it can increase the risk and cost of the project.

S. M. Bogus el at (2011):This paper provides a better understanding about the risk of rework. It explains about interaction of upstream activity (predecessor) and downstream activity (successor). Activity interaction depends upon evolution and sensitivity. Evolution is the feature of the precursor activity, and sensitivity is the feature of the descendent activity.

Extended Overtime on Construction Projects. The Construction Users Round table el at (2004): It provides the information about the effects of extended overtime. The impact of Extended Overtime on the productivity on the project. It provides numerous different solutions to decrease overtime method.

III. EARNED VALUE ANALYSIS

Earned value is a system used for computing project work conforming to project cost and time. Planned and Actual work which is carried out till date is compared in EVA. Earned Value Management is also used for tracking and forecasting of the project.

- Planned Value (PV): It is the cost and schedule of work which is calculated at the start of the project.
- Earned Value (EV): It's cost and schedule of work that is actually completed.
- Actual Cost (AC): It is the actual amount/cost on the project till date.
- Budget At Completion (BAC): It is total estimated cost of the project. This is the amount which was planned to finish the work.
- Schedule Performance Index (SPI): SPI = Earned Value / Planned Value
- Cost Performance Index (CPI) : CPI = Earned Value / Actual Cost
- Estimation At Completion with respect to time (EACt) = It is used to find the estimated completion of time.

  EACt = (BAC / SPI) / (BAC / months).

  months=Budget or planned months to complete the project.

Following Fig 1 explains about the earned value parameters.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 10 Issue 08, August-2021

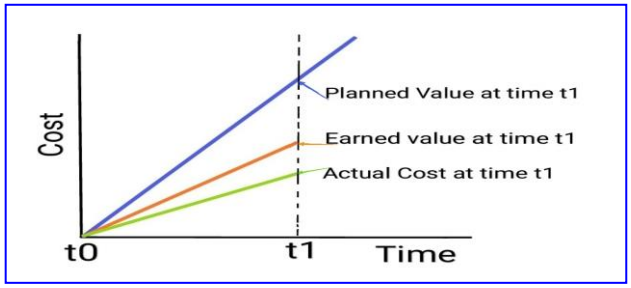

Fig 1 Earned Value Parameters

IV. MICROSOFT PROJECT [2],[4]

Microsoft project is a software which is used for planning , organizing, scheduling and managing a project by considering cost and time . Microsoft Project is used to track and forecast the project with the help of planned and actual data of the project.

Steps in Microsoft Project [2],[4]

- Create Project : Start Date
- Create Calender
- Define Activities and appoint their duration
- Assign Relationship to the Activities
- Create Resources and Allocate Resources
- Setting Baseline.
- Update the project with Actual labour,material and duration.
- Generate Earned Value Analysis Report

V. SCHEDULE COMPRESSION

Schedule compression is the process in which project duration is shorten without changing the project scope . Schedule compression techniques includes :

1] Overlapping or Fast-Tracking

2] Over-Time or Crashing

1] OVERLAPPING Or FAST-TRACKING: Overlapping is technique in which activities which are normally in series are performed in parallel manner in order reduce the project duration. Overlapping is only effective in schedule compression when it is applied on critical path activities.

Four types of relationships between activities are possible [5]

- Dependent activities: The successor activity can only start if predecessor activity is completed. It can also be state a finish to start relationship. The dependent activities are the riskiest to overlap.

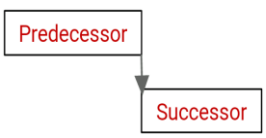

Fig 2 Dependent Activities

- Semi-independent activities: The successor activity can start with the help of partial information which is provided by the predecessor. It can also be state as start to start relationship.

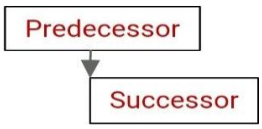

Fig 3 Semi-independent Activities

- Independent activities: Successor doesn't require any information from predecessor to start. Successor is not related to predecessor on basis of start.

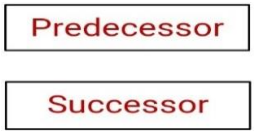

Fig 4 Independent Activities

- Interdependent activities: The predecessor and successor both require information from each other in order to complete.

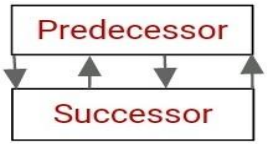

Fig 5 Interdependent Activities

Overlapping Dependent activities : On the basis of Evolution and Sensitivity.[6]

- The interconnection between precursor activity and descendent activity depends upon how the information develops in the precursor and how sensitive the descendent activity is to that developing information. Evolution is a characteristic of precursor and sensitivity is the characteristics of descendent.
- An activity that provides most of its details or data early in the activity period is called a fast-evolving activity. An activity that provides functional or important information late in the activity period is called a slow-evolving activity.
- If there is small change in predecessor information which results to rise in cost, time span and considerable rework then it is highly sensitive successor or downstream activity. If the downstream activity adapts with the change in information from predecessor with minimum or zero rework, and minimum cost then it is Less sensitive

2] OVERTIME [1][3]

Overtime is a schedule compression technique in which the working hours of labour are increased than the standard work hours per day or week, in order to increase the productivity. Labour must be paid 1.5 times more than standard rate per hour.

Types of overtime model.

1) 4Days-10hour (4-10hr) : The Fatigue in workers is low and the productivity is also increased .

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 10 Issue 08, August-2021

2) 5-9hr, 5-10hr, 6-8hr, 6-9hr, 6-10hr :Productivity and Fatigue both are increased .If there is reduction in productivity, limiting overtime up to 10-h days, including more breaks in the workday, and working not more than 6 days per week should be done.

Measures we have to take care in order for the proper implementation of Overtime Schedule

- Maximum working hours should be 10 hour per day.
- Maximum working days should be 6 day per week.
- We can use rolling shifts in alternate weeks.

Case Study :The Project is a Residential building located at Thane.The Total floor area of the structure is 585.50 sq m. It is a G+3 RCC structure.

Microsoft Project steps:

1)Create Project : Assign Project Start Date

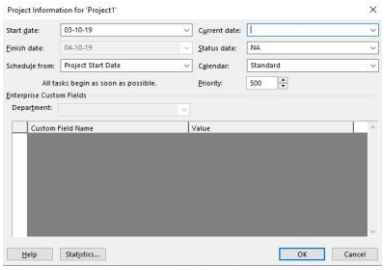

Fig 6 Project Start Date

2)Creating Calendar : Calendar is 6 days/week and 9hr / day.

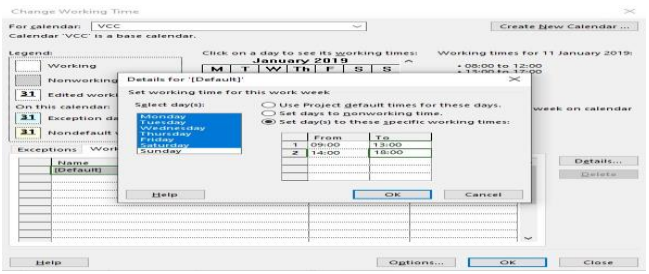

Fig 7 Creating Calendar

3) Defining Activities and Appointing Activity Duration: All major Activities and their respective duration are appointed.

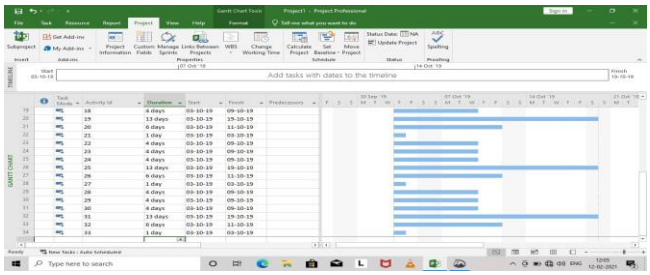

Fig 8 Defining Activities 0-33

4) Assigning Relationships to the Activities : Predecessors are assigned to the activities. Also, Start to Start and Finish to Start relationship are assigned to particular activities.

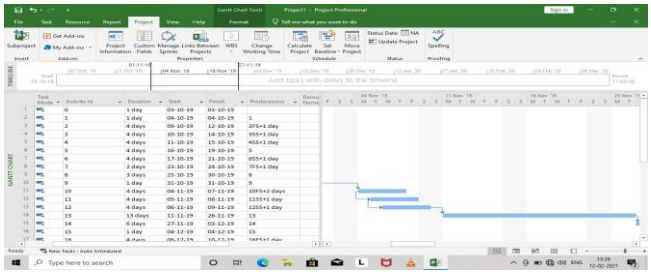

Fig 9 Assigning Relationships

5) Creating Resources : Mason, Carpenter, Bar-Bender and Helper are created and their respective cost per day are assigned.

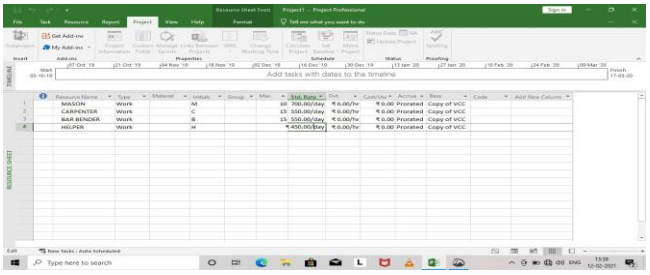

Fig 10 Creating Resources

6) Assigning Resources : Labours and Materials are allocated to the activities as per planned.

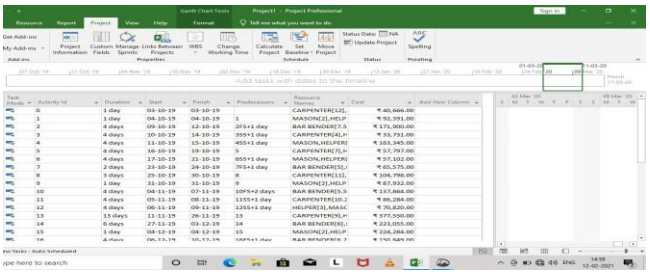

Fig 11 Resource Allocation

7) Setting Baseline : Baseline is a reference line which helps us to visualize the actual progress of the project with the planned project.

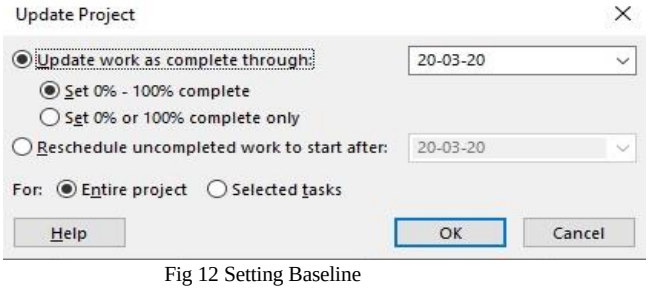

Fig 12 Setting Baseline

8) Updating the project with Actual Duration, material and labour cost : Actual Data is collected from Site engineer / site supervisor. Work Progress Report is used.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 10 Issue 08, August-2021

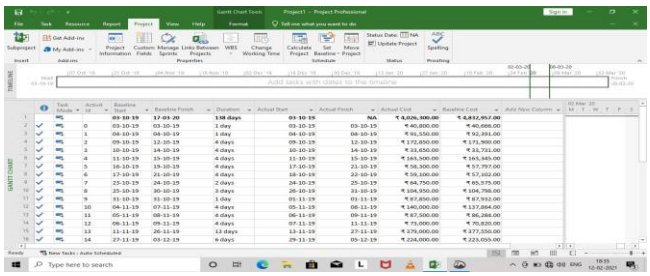

Fig 13 Updating till tracking date

9) Earned Value Analysis : This Report is Formulated from Tracking when Actual data is fed into the Microsoft Project

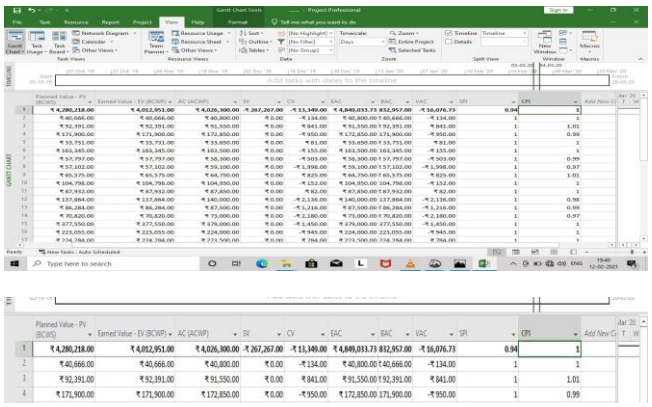

Fig 14 Earned Value Analysis Reports

Tracking and Forecasting of Project.
Tracking :
Tracking is done on 18 February 2020
Budget at completion- BAC. (17 march 2020)= 48, 32,957 ₹.
Earned Value - EV. (Till 18 February 2020)= 40,12,951 ₹.
Actual Cost - AC. (Till 18 February 2020)= 40,26,300 ₹.
Planned Value - PV(Till 18 February 2020)= 42,80,218 ₹.
Months or Days: Total completion period of the project planned by contractor=5.45 months or 164 days
Schedule Performance Index (SPI) = 0.94
Cost Performance Index (CPI) = 1
Forecasting :
Estimate At Completion (EAC) =48, 49, 033 ₹.
Estimate To complete is the amount which is needed to finish the remaining work of the project.
Delay=(BAC/SPI) / (BAC/Months or days)
= (48, 32,957 / 0.94) / (48,32,957/ 164 days)
= 174.5 Days
The project will be completed in 175 days instead of 164 days.
By providing proper Overlapping measures as mention above on considered activities [5][6]
And Over-timing with limitations of 6 days per week and 10 hr per day we can compress the project .[1][3]

Fig 15 Earned value analysis report after compression

TABLE 1: RESULTS

CASE STUDY	Table Column Head		
	Planned value	***Estimated Value of Schedule Compression***	***Estimated Value After Schedule Compression***
Days	164	175	167
BAC and EAC	4832957 Rs	4849033 Rs	4864366 Rs

Graph 1 : Containing Duration of Planned Value, Estimated Value Before and After Compression.

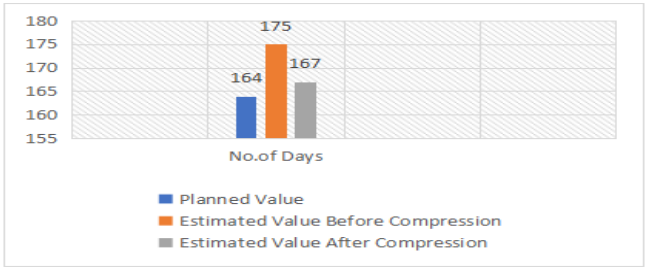

Fig 16 Graph of Results Regarding Duration

Graph 2 :Containing Cost of Planned Value, Estimated Value Before and After Compression

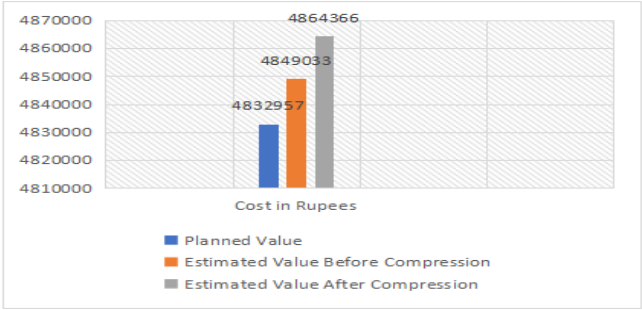

Fig 17 Graph of Results Regarding Cost

Case Study Results:
a) SPI= 0.94 which concludes project is behind the schedule.
b) CPI= 1 which concludes project is on budget.
c) EAC= 4849033 ₹ which is more than the Budgeted At Completion.
d) Delay= 175 days, Which means project will be completed in 175 days rather than 164 days.
e) Project duration after compression is 167 days, Estimate At Completion is = 48, 64, 366 ₹

CONCLUSIONS

Microsoft Project is efficient and preferable tool for planning and scheduling the Project. Microsoft Project enables us to create only 11 baselines for Tracking. This Software can be very useful for small projects. Microsoft Project helps us to

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 10 Issue 08, August-2021

track the project on any given status date easily. Microsoft project can be used as an alarming system for Time and cost overrun factor.

Overlapping of activities mainly depends upon the type of relationships between the two activities and on evolution and sensitivity factor.

For Schedule compression without loss of productivity we have to limit the Over-timing for 6 days per week and 10hr per day

REFERENCES

[1] Awad S. Hanna, Aviad Shapira,Mounir El Asmar,and Craig S. Taylor."Impact of Crew Scheduling on Project Performance". Practice Periodical on Structural Design and Construction, Vol. 18, No. 1, February 1, 2013.

[2] Dr.Arun Dhawale , Vaishanvi Tuljapurkar .Cost Control and Tracking of a Building by Earned Value Method. International journal of Technical Research and Application. Volume 3 , Issue 2 (Mar-Apr 2015)

[3] Extended Overtime on Construction Projects. The Construction Users Roundtable.2004

[4] Firas kh. Jaber , Saba W. Hachem , Faiq M.S. Al-Zwainy. Calculating The Indexes of Earned Value for Assessment The Performances of Waste Water Treatment Plant. ARPN Journal of Engineering and Applied Sciences.VOL 14, NO. 4 , February 2019

[5] R. Dehghan , and J. Y. Ruwanpura."The Mechanism of Design Activity Overlapping in Construction Projects and the Time-Cost Tradeoff Function",Elseveir, Procedia Engineering 14 (2011) 1959–1965..

[6] S. M. Bogus, J. E. Diekmann, K. R. Molenaar, C. Harper, S. Patil, and J. S. Lee."Simulation of Overlapping Design Activities in Concurrent Engineering". Journal of Construction Engineering and Management, Vol. 137, No. 11, November 1, 2011.