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# COST CONTROL AND TRACKING OF A BUILDING BY EARNED VALUE METHOD

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***Abstract*: Earned Value Management (EVM) is a technique that forecasts the project giving an early warning of cost & schedule. It not onely measures the project performance but also measure the progress of the schedule. It is an effective tool to measure cost, schedule & performance of the project. The EVA is useful in various fields such as IT, Industries and Construction companies etc.**

**The value of Earned Value Analysis (EVA) is dependent on two key areas i.e. Precise Cost information and pragmatic progress of project. If these two key areas are efficient then benefit of the project will definitely get valued. This paper summarizes the evolution, basic terminologies of Earned value Analysis and effective use of it in the construction industries by MS Project. There are many ways to implement EVA in the construction project. MS Project is a tool to determine the EV and its parameters in an efficient way with accuracy and within time constraints**.

***Keywords:* Earned value cost control, Scheduling, cost Variance, schedule Variance, Tracking.**

## I. INTRODUCTION

Earned Value Management (EVM) is a systematic approach to the integration and measurement of cost, schedule, and technical progress of a project or task. It provides project manager's ability to examine detailed schedule information, critical program, technical milestones, and cost data.EVM was applied for financial analysis in the United States Government programs in the 1960's. Earned value-based performance management began in the 1960's, based initially on Department of Defense (DOD) Cost/Schedule Control Systems Criteria (C/SCSC) Earned Value was used as an objective measure for progress, i.e., physical accomplishment. In 1970's-80's DOD continued its work using EV, also applied over the four decades. DOD then concluded that Earned Value Management System (EVMS) is very valuable project management and control system. It is a tool that gives Early Warning in cost schedule & project performance. [**23**]

Construction industry is one of the largest economy sectors in India. Many construction companies have to face lots of problems due to over budgeted cost, overtime and improper planning, delays in construction lack of manpower, machinery and many other common problems during project execution. One of the serious problems are overrunning of project and over budgeted cost of project. To overcome these problems, Earned Value analysis is the technique that fills up all the above loopholes. Due to implementation of EVA, project manager now have the capability to express, cost, schedule & project performance of their work in a systematic, well- defined & understandable manner to satisfy requirements of employees, superior and customers.

In Traditional management, there are two data sources, the budget (or planned) expenditures and the actual expenditures. The comparison of budget versus actual expenditures merely indicates what was planned to be spent versus what was actually spent at any given time. In Earned Value Management, unlike in traditional management, there are three data sources: the budget (or planned) value of work scheduled, the actual value of work completed, the "earned value" of the physical work completed. EVA considers these three data sources and is able to compare the budgeted value of work scheduled and compare it to the "earned value of actual work completed". With the help of EVA, project managers get adequate information to keep deep understanding of risk areas. With the help of it, project managers get an early signal of project cost and schedule and can make a risk attenuation plan which is based on cost, schedule and progress of project.

## II. LITERATURE REVIEW

Every project manager focuses on the point that the project should be within the budget and within the cost and how could this be done.

It may happen that project may be over schedule or over budget, to calculate this great mathematician are required. So to overcome with this problem EVA is the technique to be applied in the construction. Ample literature available on the Earned Value Analysis (EVA), Earned Schedule (ES) and Earned Value Management (EVM) and there are different ways to apply them in construction industry. Among them many are from different countries and very few are from India. Following are the various authors who have performed their work and reviewed on EVA.

*1. Lipke Walt et al (2007)*

In Project Management Institute (USA), Earned Value and Earned Schedule was applied and study was carried out by Lipke Walt. Author with a detailed study concluded that EVM with ES provides incredible management information. The author applied a Decision Logic Diagram as a tool that gives the good connection of EV with the project status indicators of EV.

*2. Agata Czarnigowska et al (2011)*

Author overviewed the recent work and concluded that Earned Value (EV) alone is not effective. By combining it with any other tool facilitates monitoring the project status,

identification of potentially negative signals and a generalized appraisal of their combined effect on the project's outcome.

*3. Kendrick et al (2004)*

Said that EVM seem complex but it has a simple foundation. It helps in tracking the performance of a project by simple arithmetical calculations. For larger projects these calculations become to tedious, so use of MSP, Primavera and other software is the solution. Author compared the three software and found accuracy by all the methods and concluded that by use of software in the construction project, EV work as a predictor within less duration of time.

*4. Harold Kerzner et al (1998)*

Considered EVA a relevant maturity differential in project management. Managing costs using EVA is referred to as "managing with open eyes" because the manager can clearly see what was planned, what was performed and the actual costs. This is a powerful tool in the decision making process. In the day-to-day activities of the project manager, EVA provides "alarm" signals and facilitates decisions that keep the project on time and on budget.

## III. CONCEPTS AND TERMINOLOGIES RELATED to EARNED VALUE MANAGEMENT

Earned Value analysis is a method of performance measurement. Earned Value is a program management technique that uses "work in progress" to indicate what will happen to work in the future. Earned value management is an "early warning system" for planning and controlling the project cost performances. EVM establish work packages earned value baseline by integrating project scope, time schedule and cost objectives. This baseline is called as cost control and is used for performance evaluation of project on a given date. Analysis of variance from the baseline provides the cost related information's for problem identification, trend analysis and corrective actions such as re-planning and revising budget and re-scheduling. Earned value analysis serves two main purposes. It analyses cost changes which is resulting in time and cost over-run or under-run so that timely corrective actions are taken such as modification of cash flow, updating financial forecast and project profitability expectations. Analysis of variance from the baseline using earned value management systems gives variety of variances which are analyzed to provide current status of project, to initiate corrective actions and to forecast future trends Earned Value Management has three measures: planned value (PV), actual cost (AC), and earned value (EV).From the three measures, project performance indicators are formed.

– *BCWS (* PV)*Budgeted Cost of Works Scheduled* – It is the baseline for the analysis, cumulated planned costs related to time of their incurrence; **Figure 1** shows the graph of BCWS vs. Time

– *BCWP(EV) – Budgeted Cost of Work Performed* – It is a measure of physical progress of works expressed by cumulated planned cost of works actually done related to time, it is also called Earned Value (like the method it is used by);

– *ACWP (AC) – Actual Cost of Work Performed* – A cumulated amount payable for work done related to time;

– *BAC – Budget at Completion* – The total planned cost of the whole project, it equals *BCWS* at the planned finish;

– *T* – planned duration of the project.

**Fig.2** and **Fig.3** and **Fig.4** represents graph of BCWS BCWP and ACWP with time and show relationship with each other.

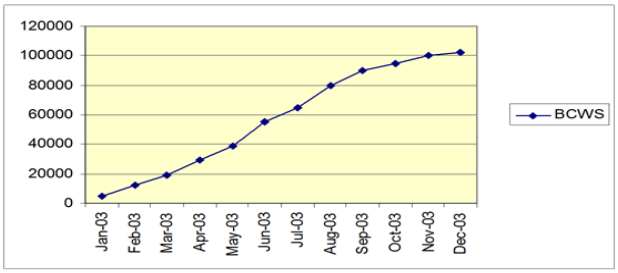


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**Fig-1 Graph of BCWS vs.Time**

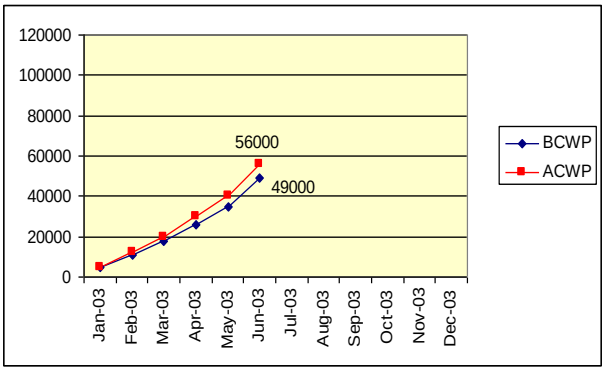



**Fig-2 Graph of BCWP and ACWP vs Time**

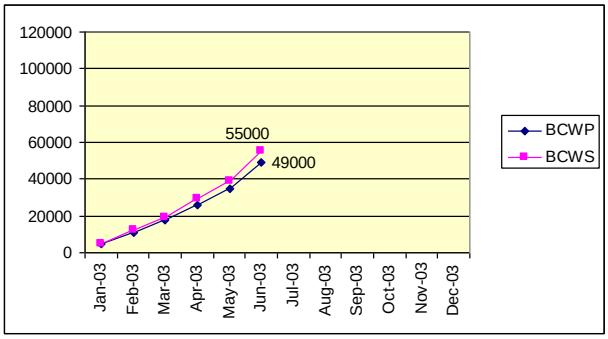



**Fig-3 Graph of BCWP and BCWS vs Time**

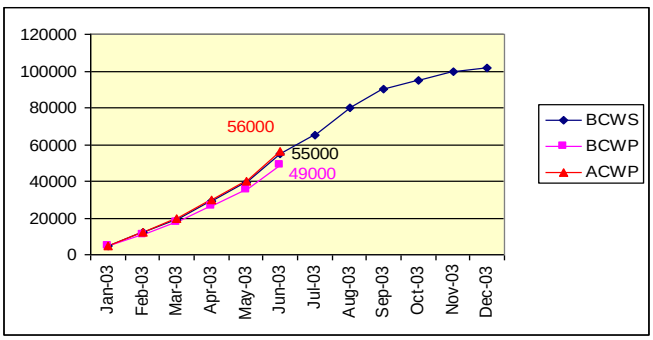



**Fig-4 Graph of BCWP, ACWP and BCWS vs. Time**

**Project Status Indicators:**

SV: *Schedule Variance (EV-PV)*

- A comparison of amount of work performed during a given period of time to what was scheduled to be performed.
- A negative variance means the project is behind schedule

CV: *Cost Variance (EV-AC)*

- A comparison of the budgeted cost of work performed with actual cost.
- A negative variance means the project is over budget
- SPI: Schedule Performance Index
  SPI=EV/PV
- If SPI<1 means project is behind schedule
- CPI: Cost Performance Index
  CPI= EV/AC
- If CPI<1 means project is over budget
- CSI: Cost Schedule Index (CSI=CPI x SPI)
- The further CSI is from 1.0, the less likely project recovery becomes.

Estimate at completion (EAC)

EAC=BAC+CV

$$EAC = AC + \frac{(BAC - EV)}{CPI} = \frac{BAC}{CPI}$$

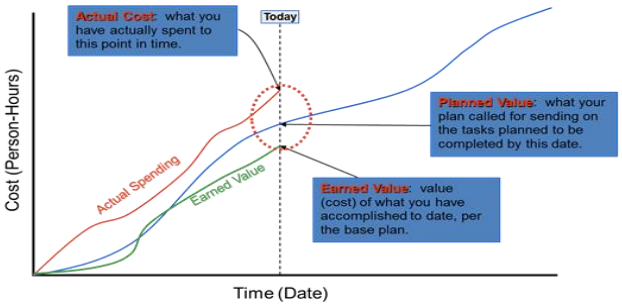



**Fig-5 Graph showing PV AC and EV**

Here **figure 5** defines AC EV and PV. All these are project status indicators that indicate the progress of project.

## IV. DETAILS of CASE STUDY:

In this paper, construction of hospital building is referred as a case study. The building is located in Gulbarga, Godutai Nagar, Sedam road. The name of the building is Esic multi specialty hospital which is one of the reputed hospitals in Karnataka. Currently, other different projects are going on namely Esic Medical College, residencies and dental college. The site map of the building is as shown in **figure 6**.

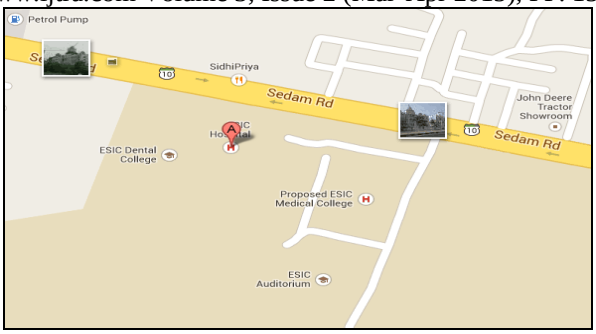



**Fig.6 Site map of Esic Hospital**

The Esic Hospital building is a multi specialty hospital having 500 beds capacity, having air-conditioned operation theatres, residencies for doctors as well as employees. It consists of Basement+G+7 floors. It has total floor area 11230 sq.m. The total height of the building is 41.6 m.

## V. METHODOLOGY USED

In construction industry before commencement of the project, the project has to be planned properly in terms of activities, schedule as well as cost and if the project is behind schedule and over budgeted, it can be controlled by EARNED VALUE ANALYSIS. One of the tools used for Earned Value Analysis is by using MS Project. MS-Project produces a tabular report that totals the following earned value measures:

– BCWS, BCWP, ACWP, SV, CV, EAC, BAC and VAC. Microsoft Project is a great tool to track project performance using Earned Value. **Figure 7** shows the flowchart of the steps used in MS Project and **Figure 8** give the view of MS Project entry table.

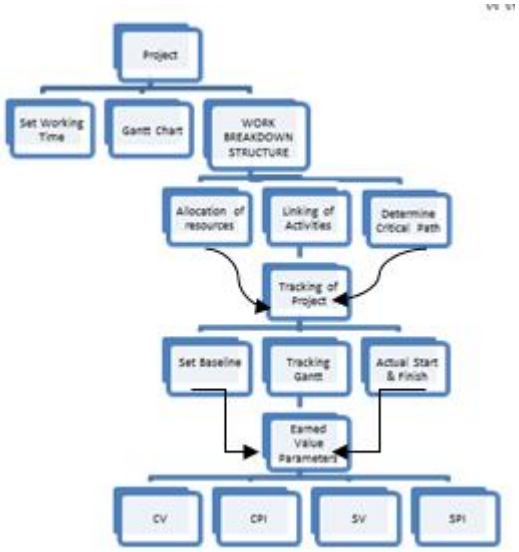
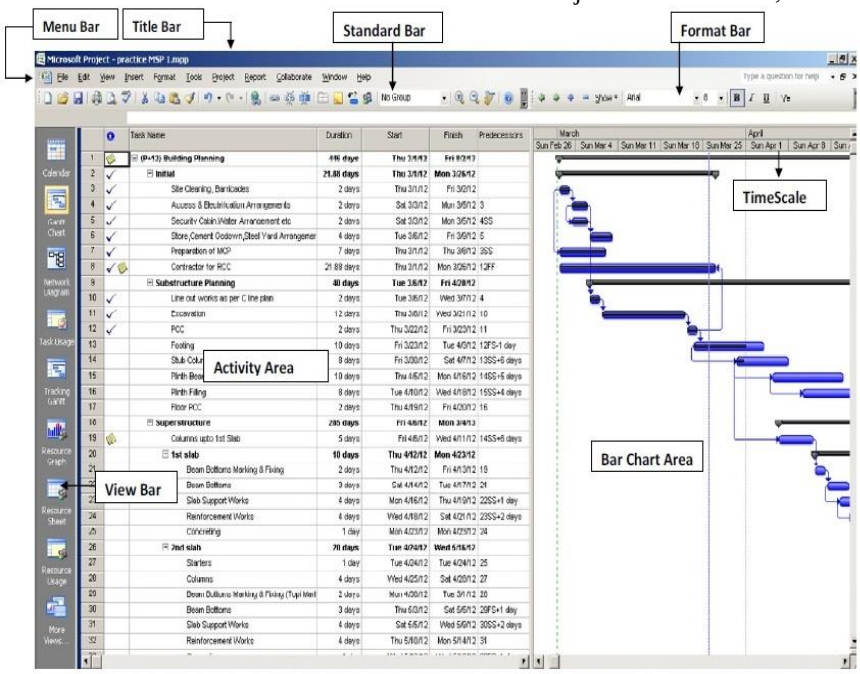



**Fig.7 Flowchart of Steps in MS Project**



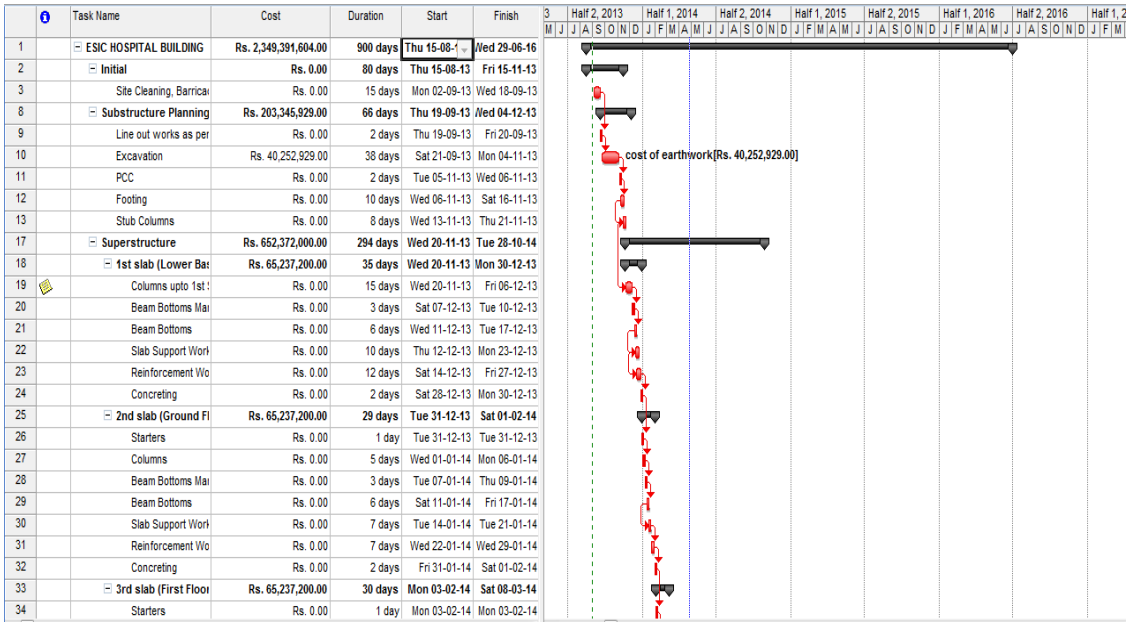

MSP ENTRY TABLE VIEW

**Fig-8**

### *A. Activity Planning and Scheduling in MSP Software*

For understanding of project at different time stages, Outline option gives better view, which is understood by attached bar charts generated by M S Project. **Figure 9** shows the task dependency relationship. Linking of activities clearly indicate SS (Start to Start), SF (Start to Finish), FS (Finish to Start) and FF (Finish to Finish) activities. After linking of activities, the typical project gets formed with critical path. (**Fig.10**)

**Fig-9 Task Dependency Relationship**




| | Task Name | Cost | Duration | Start | Finish |
|---|---|---|---|---|---|
| 1 | ESIC HOSPITAL BUILDING | Rs. 2,349,391,604.00 | 900 days | Thu 15-08-13 | Wed 29-06-16 |
| 2 | Initial | Rs. 0.00 | 80 days | Thu 15-08-13 | Fri 15-11-13 |
| 3 | Site Cleaning, Barrica | Rs. 0.00 | 15 days | Mon 02-09-13 | Wed 18-09-13 |
| 8 | Substructure Planning | Rs. 203,345,929.00 | 66 days | Thu 19-09-13 | Wed 04-12-13 |
| 9 | Line out works as per | Rs. 0.00 | 2 days | Thu 19-09-13 | Fri 20-09-13 |
| 10 | Excavation | Rs. 40,252,929.00 | 38 days | Sat 21-09-13 | Mon 04-11-13 |
| 11 | PCC | Rs. 0.00 | 2 days | Tue 05-11-13 | Wed 06-11-13 |
| 12 | Footing | Rs. 0.00 | 10 days | Wed 06-11-13 | Sat 16-11-13 |
| 13 | Stub Columns | Rs. 0.00 | 8 days | Wed 13-11-13 | Thu 21-11-13 |
| 17 | Superstructure | Rs. 652,372,000.00 | 294 days | Wed 20-11-13 | Tue 28-10-14 |
| 18 | 1st slab (Lower Ba | Rs. 65,237,200.00 | 35 days | Wed 20-11-13 | Mon 30-12-13 |
| 19 | Columns upto 1st | Rs. 0.00 | 15 days | Wed 20-11-13 | Fri 06-12-13 |
| 20 | Beam Bottoms Ma | Rs. 0.00 | 3 days | Sat 07-12-13 | Tue 10-12-13 |
| 21 | Beam Bottoms | Rs. 0.00 | 6 days | Wed 11-12-13 | Tue 17-12-13 |
| 22 | Slab Support Work | Rs. 0.00 | 10 days | Thu 12-12-13 | Mon 23-12-13 |
| 23 | Reinforcement Wo | Rs. 0.00 | 12 days | Sat 14-12-13 | Fri 27-12-13 |
| 24 | Concreting | Rs. 0.00 | 2 days | Sat 28-12-13 | Mon 30-12-13 |
| 25 | 2nd slab (Ground Fl | Rs. 65,237,200.00 | 29 days | Tue 31-12-13 | Sat 01-02-14 |
| 26 | Starters | Rs. 0.00 | 1 day | Tue 31-12-13 | Tue 31-12-13 |
| 27 | Columns | Rs. 0.00 | 5 days | Wed 01-01-14 | Mon 06-01-14 |
| 28 | Beam Bottoms Ma | Rs. 0.00 | 3 days | Tue 07-01-14 | Thu 09-01-14 |
| 29 | Beam Bottoms | Rs. 0.00 | 6 days | Sat 11-01-14 | Fri 17-01-14 |
| 30 | Slab Support Work | Rs. 0.00 | 7 days | Tue 14-01-14 | Tue 21-01-14 |
| 31 | Reinforcement Wo | Rs. 0.00 | 7 days | Wed 22-01-14 | Wed 29-01-14 |
| 32 | Concreting | Rs. 0.00 | 2 days | Fri 31-01-14 | Sat 01-02-14 |
| 33 | 3rd slab (First Floor | Rs. 65,237,200.00 | 30 days | Mon 03-02-14 | Sat 08-03-14 |
| 34 | Starters | Rs. 0.00 | 1 day | Mon 03-02-14 | Mon 03-02-14 |

**Fig.10 Project with Critical Path**

***B. Tracking of Project (Time Factor)***

After setting up of baseline and linking of activities with each other we can get the entire duration of project with the help of critical path.

The project progress can be ensured by tracking process. Microsoft Office Project helps us by creating reports that will clearly explain the status of a project. The two major analyses that are performed during tracking phase are:

*1. Variance Analysis*

Any variance between a Planned and Actual Data is called Variance Analysis

Example:

1. Planned Start VS. Actual Start
2. Planed Duration VS. Actual Duration
3. Planned Cost VS. Actual Cost Etc.

*2. Earned Value Analysis*

An Advanced method to check the overall Project Performance in terms of Schedule and Cost (Schedule Performance Index and Cost Performance Index) and Forecasting Microsoft Office Following are the steps.

***Settings before Tracking***

1. The Project Schedule should be complete with, all the approvals related to resources Assignment and Cost estimated.
2. Freeze the Project Schedule by using the following command. This step, MS Office Project stores all the planned data, which can be used to do variance Analysis during Tracking *Tools* > *Tracking* > *Set-Baseline.* Setting of baseline is shown in **figure no.11.**
3. Select the option as per the above figure and click OK.
4. Go to "Tracking Gantt" View using the View Bar as shown in **figure no.12-16.**
5. In the tracking Gantt, If you notice the bar chart area, we find 2 bars for each task. The bar in black colour and which is at the bottom indicates the frozen planned data (also Called Baseline Bar).
6. The bar above in red colour is the current bar (which will indicate our actual progress of the project tasks).
7. Now the bar chart is almost ready for graphical comparison (Plan VS Actual).

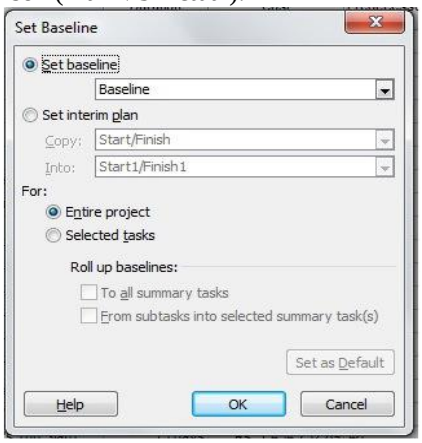



**Fig-11 Setting up Baseline**

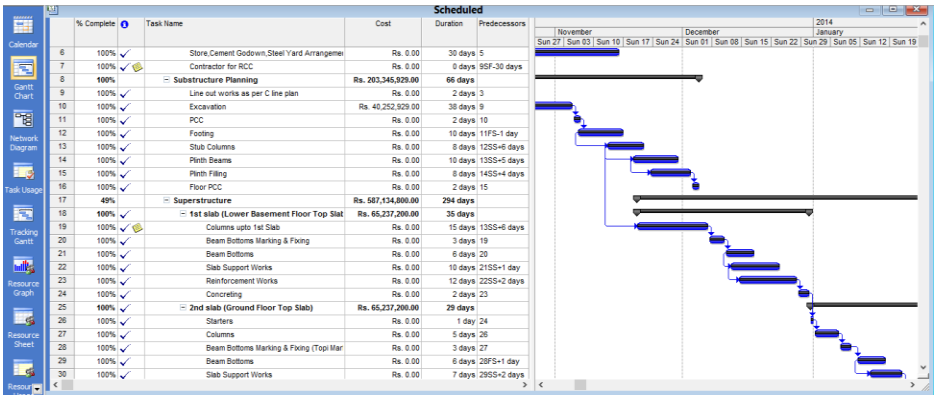



**Fig-12 Activities with Baseline**

8. For better understanding, vertical lines can also be provided to indicate actual start and actual finish of the work. This can be done with the help of formatting of gridlines. After selecting a unique colour for project data, project status and critical path, the updated project is as shown below.(**Fig.13**)

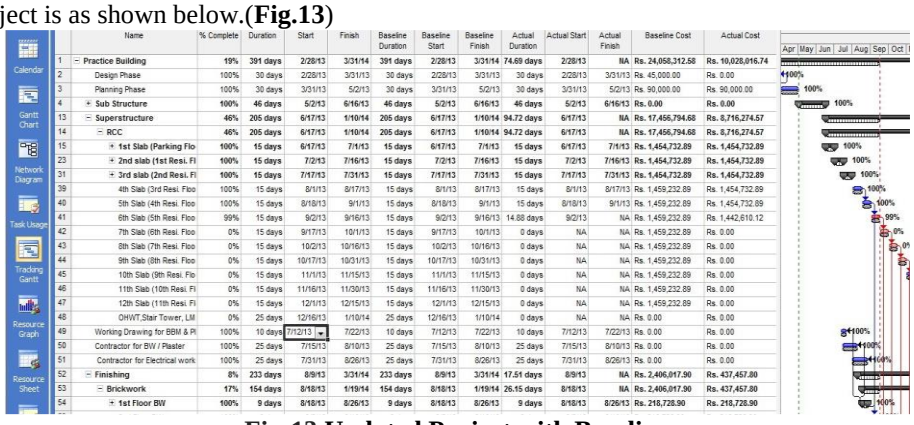


**Fig-13 Updated Project with Baseline**

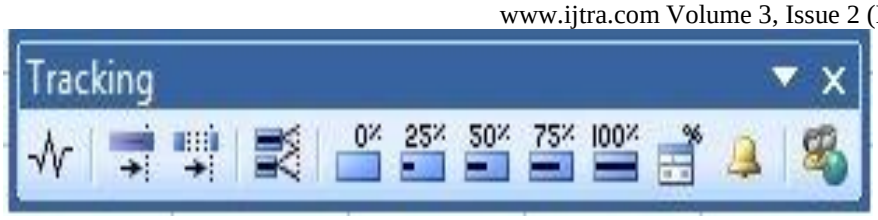


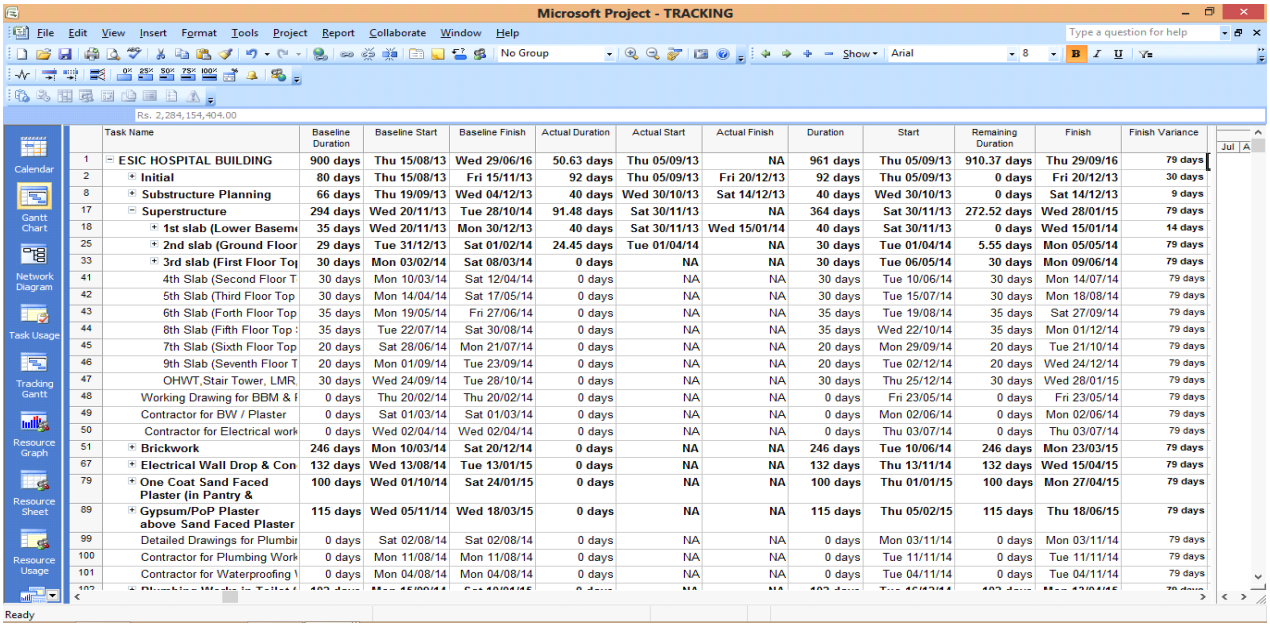

**Fig-14 Load the "Tracking" Toolbar(Fig.14)**

The typical tracked project will be as follows-(**Fig.15**)

With the help of variance we can get to know that whether the project is behind schedule or within the schedule (SV) and within the budget or over budget (CV), these variances can be tabulated in MS Project (**Fig.16**)

| | % omple | Task Name | Baseline Duration | Baseline Start | Baseline Finish | Baseline Cost | Actual Cost | Actual Start | Actual Finish | Duration | Start | Finish | Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5% | ESIC HOSPITAL BUILDING | 900 days | Thu 15/08/13 | Wed 29/06/16 | Rs. 2,349,391,604.00 | Rs. 321,746,291.76 | Thu 05/09/13 | NA | 961 days | Thu 05/09/13 | Thu 29/09/16 | Rs. 2,284,154,404.00 |
| 2 | 100% | Initial | 80 days | Thu 15/08/13 | Fri 15/11/13 | Rs. 0.00 | Rs. 0.00 | Thu 05/09/13 | Fri 20/12/13 | 92 days | Thu 05/09/13 | Fri 20/12/13 | Rs. 0.00 |
| 8 | 100% | Substructure Planning | 66 days | Thu 19/09/13 | Wed 04/12/13 | Rs. 203,345,929.00 | Rs. 203,345,929.00 | Wed 30/10/13 | Sat 14/12/13 | 40 days | Wed 30/10/13 | Sat 14/12/13 | Rs. 203,345,929.00 |
| 17 | 25% | Superstructure | 294 days | Wed 20/11/13 | Tue 28/10/14 | Rs. 652,372,000.00 | Rs. 118,400,362.76 | Sat 30/11/13 | NA | 364 days | Sat 30/11/13 | Wed 28/01/15 | Rs. 587,134,800.00 |
| 18 | 100% | 1st slab (Lower Basem | 35 days | Wed 20/11/13 | Mon 30/12/13 | Rs. 65,237,200.00 | Rs. 65,237,200.00 | Sat 30/11/13 | Wed 15/01/14 | 40 days | Sat 30/11/13 | Wed 15/01/14 | Rs. 65,237,200.00 |
| 25 | 81% | 2nd slab (Ground Floor | 29 days | Tue 31/12/13 | Sat 01/02/14 | Rs. 65,237,200.00 | Rs. 53,163,162.76 | Tue 01/04/14 | NA | 30 days | Tue 01/04/14 | Mon 05/05/14 | Rs. 65,237,200.00 |
| 26 | 100% | Starters | 1 day | Tue 31/12/13 | Tue 31/12/13 | Rs. 0.00 | Rs. 0.00 | Tue 01/04/14 | Wed 02/04/14 | 1.88 days | Tue 01/04/14 | Wed 02/04/14 | Rs. 0.00 |
| 27 | 100% | Columns | 5 days | Wed 01/01/14 | Mon 06/01/14 | Rs. 0.00 | Rs. 0.00 | Thu 03/04/14 | Wed 09/04/14 | 5.88 days | Thu 03/04/14 | Wed 09/04/14 | Rs. 0.00 |
| 28 | 100% | Beam Bottoms Markin | 3 days | Tue 07/01/14 | Thu 09/01/14 | Rs. 0.00 | Rs. 0.00 | Thu 10/04/14 | Mon 14/04/14 | 3.88 days | Thu 10/04/14 | Mon 14/04/14 | Rs. 0.00 |
| 29 | 100% | Beam Bottoms | 6 days | Sat 11/01/14 | Fri 17/01/14 | Rs. 0.00 | Rs. 0.00 | Tue 15/04/14 | Tue 22/04/14 | 6 days | Tue 15/04/14 | Tue 22/04/14 | Rs. 0.00 |
| 30 | 100% | Slab Support Works | 7 days | Tue 14/01/14 | Tue 21/01/14 | Rs. 0.00 | Rs. 0.00 | Thu 17/04/14 | Thu 24/04/14 | 6.88 days | Thu 17/04/14 | Thu 24/04/14 | Rs. 0.00 |
| 31 | 40% | Reinforcement Works | 7 days | Wed 22/01/14 | Wed 29/01/14 | Rs. 0.00 | Rs. 0.00 | Thu 24/04/14 | NA | 7 days | Thu 24/04/14 | Thu 01/05/14 | Rs. 0.00 |
| 32 | 0% | Concreting | 2 days | Fri 31/01/14 | Sat 01/02/14 | Rs. 0.00 | Rs. 0.00 | NA | NA | 2 days | Sat 03/05/14 | Mon 05/05/14 | Rs. 0.00 |
| 33 | 0% | 3rd slab (First Floor To | 30 days | Mon 03/02/14 | Sat 08/03/14 | Rs. 65,237,200.00 | Rs. 0.00 | NA | NA | 30 days | Tue 06/05/14 | Mon 09/06/14 | Rs. 65,237,200.00 |
| 41 | 0% | 4th Slab (Second Floor To | 30 days | Mon 10/03/14 | Sat 12/04/14 | Rs. 65,237,200.00 | Rs. 0.00 | NA | NA | 30 days | Tue 10/06/14 | Mon 14/07/14 | Rs. 0.00 |
| 42 | 0% | 5th Slab (Third Floor Top S | 30 days | Mon 14/04/14 | Sat 17/05/14 | Rs. 65,237,200.00 | Rs. 0.00 | NA | NA | 30 days | Tue 15/07/14 | Mon 18/08/14 | Rs. 65,237,200.00 |
| 43 | 0% | 6th Slab (Forth Floor Top S | 35 days | Mon 19/05/14 | Fri 27/06/14 | Rs. 65,237,200.00 | Rs. 0.00 | NA | NA | 35 days | Tue 19/08/14 | Sat 27/09/14 | Rs. 65,237,200.00 |
| 44 | 0% | 8th Slab (Fifth Floor Top Sl | 35 days | Tue 22/07/14 | Sat 30/08/14 | Rs. 65,237,200.00 | Rs. 0.00 | NA | NA | 35 days | Wed 22/10/14 | Mon 01/12/14 | Rs. 65,237,200.00 |
| 45 | 0% | 7th Slab (Sixth Floor Top S | 20 days | Sat 28/06/14 | Mon 21/07/14 | Rs. 65,237,200.00 | Rs. 0.00 | NA | NA | 20 days | Mon 29/09/14 | Tue 21/10/14 | Rs. 65,237,200.00 |
| 46 | 0% | 9th Slab (Seventh Floor To | 20 days | Mon 01/09/14 | Tue 23/09/14 | Rs. 65,237,200.00 | Rs. 0.00 | NA | NA | 20 days | Tue 02/12/14 | Wed 24/12/14 | Rs. 65,237,200.00 |
| 47 | 0% | OHWT,Stair Tower, LMR, ( | 30 days | Wed 24/09/14 | Tue 28/10/14 | Rs. 65,237,200.00 | Rs. 0.00 | NA | NA | 30 days | Thu 25/12/14 | Wed 28/01/15 | Rs. 65,237,200.00 |
| 48 | 0% | Working Drawing for BBM & Pla | 0 days | Thu 20/02/14 | Thu 20/02/14 | Rs. 0.00 | Rs. 0.00 | NA | NA | 0 days | Fri 23/05/14 | Fri 23/05/14 | Rs. 0.00 |
| 49 | 0% | Contractor for BW / Plaster | 0 days | Sat 01/03/14 | Sat 01/03/14 | Rs. 0.00 | Rs. 0.00 | NA | NA | 0 days | Mon 02/06/14 | Mon 02/06/14 | Rs. 0.00 |
| 50 | 0% | Contractor for Electrical works | 0 days | Wed 02/04/14 | Wed 02/04/14 | Rs. 0.00 | Rs. 0.00 | NA | NA | 0 days | Thu 03/07/14 | Thu 03/07/14 | Rs. 0.00 |
| 51 | 0% | Brickwork | 246 days | Mon 10/03/14 | Sat 20/12/14 | Rs. 120,959,880.00 | Rs. 0.00 | NA | NA | 246 days | Tue 10/06/14 | Mon 23/03/15 | Rs. 120,959,880.00 |
| 67 | 0% | Electrical Wall Drop & Condu | 132 days | Wed 13/08/14 | Tue 13/01/15 | Rs. 119,126,911.50 | Rs. 0.00 | NA | NA | 132 days | Thu 13/11/14 | Wed 15/04/15 | Rs. 119,126,911.50 |

**Fig-15 Tracked Project**




| | Task Name | Baseline Duration | Baseline Start | Baseline Finish | Actual Duration | Actual Start | Actual Finish | Duration | Start | Remaining Duration | Finish | Finish Variance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ESIC HOSPITAL BUILDING | 900 days | Thu 15/08/13 | Wed 29/06/16 | 50.63 days | Thu 05/09/13 | NA | 961 days | Thu 05/09/13 | 910.37 days | Thu 29/09/16 | 79 days |
| 2 | Initial | 80 days | Thu 15/08/13 | Fri 15/11/13 | 92 days | Thu 05/09/13 | Fri 20/12/13 | 92 days | Thu 05/09/13 | 0 days | Fri 20/12/13 | 30 days |
| 8 | Substructure Planning | 66 days | Thu 19/09/13 | Wed 04/12/13 | 40 days | Wed 30/10/13 | Sat 14/12/13 | 40 days | Wed 30/10/13 | 0 days | Sat 14/12/13 | 9 days |
| 17 | Superstructure | 294 days | Wed 20/11/13 | Tue 28/10/14 | 91.48 days | Sat 30/11/13 | NA | 364 days | Sat 30/11/13 | 272.52 days | Wed 28/01/15 | 79 days |
| 18 | 1st slab (Lower Basem | 35 days | Wed 20/11/13 | Mon 30/12/13 | 40 days | Sat 30/11/13 | Wed 15/01/14 | 40 days | Sat 30/11/13 | 0 days | Wed 15/01/14 | 14 days |
| 25 | 2nd slab (Ground Floor | 29 days | Tue 31/12/13 | Sat 01/02/14 | 24.45 days | Tue 01/04/14 | NA | 30 days | Tue 01/04/14 | 5.55 days | Mon 05/05/14 | 79 days |
| 33 | 3rd slab (First Floor To | 30 days | Mon 03/02/14 | Sat 08/03/14 | 0 days | NA | NA | 30 days | Tue 06/05/14 | 30 days | Mon 09/06/14 | 79 days |
| 41 | 4th Slab (Second Floor T | 30 days | Mon 10/03/14 | Sat 12/04/14 | 0 days | NA | NA | 30 days | Tue 10/06/14 | 30 days | Mon 14/07/14 | 79 days |
| 42 | 5th Slab (Third Floor Top | 30 days | Mon 14/04/14 | Sat 17/05/14 | 0 days | NA | NA | 30 days | Tue 15/07/14 | 30 days | Mon 18/08/14 | 79 days |
| 43 | 6th Slab (Forth Floor Top | 35 days | Mon 19/05/14 | Fri 27/06/14 | 0 days | NA | NA | 35 days | Tue 19/08/14 | 35 days | Sat 27/09/14 | 79 days |
| 44 | 8th Slab (Fifth Floor Top : | 35 days | Tue 22/07/14 | Sat 30/08/14 | 0 days | NA | NA | 35 days | Wed 22/10/14 | 35 days | Mon 01/12/14 | 79 days |
| 45 | 7th Slab (Sixth Floor Top | 20 days | Sat 28/06/14 | Mon 21/07/14 | 0 days | NA | NA | 20 days | Mon 29/09/14 | 20 days | Tue 21/10/14 | 79 days |
| 46 | 9th Slab (Seventh Floor T | 20 days | Mon 01/09/14 | Tue 23/09/14 | 0 days | NA | NA | 20 days | Tue 02/12/14 | 20 days | Wed 24/12/14 | 79 days |
| 47 | OHWT,Stair Tower, LMR, | 30 days | Wed 24/09/14 | Tue 28/10/14 | 0 days | NA | NA | 30 days | Thu 25/12/14 | 30 days | Wed 28/01/15 | 79 days |
| 48 | Working Drawing for BBM & F | 0 days | Thu 20/02/14 | Thu 20/02/14 | 0 days | NA | NA | 0 days | Fri 23/05/14 | 0 days | Fri 23/05/14 | 79 days |
| 49 | Contractor for BW / Plaster | 0 days | Sat 01/03/14 | Sat 01/03/14 | 0 days | NA | NA | 0 days | Mon 02/06/14 | 0 days | Mon 02/06/14 | 79 days |
| 50 | Contractor for Electrical work | 0 days | Wed 02/04/14 | Wed 02/04/14 | 0 days | NA | NA | 0 days | Thu 03/07/14 | 0 days | Thu 03/07/14 | 79 days |
| 51 | Brickwork | 246 days | Mon 10/03/14 | Sat 20/12/14 | 0 days | NA | NA | 246 days | Tue 10/06/14 | 246 days | Mon 23/03/15 | 79 days |
| 67 | Electrical Wall Drop & Con | 132 days | Wed 13/08/14 | Tue 13/01/15 | 0 days | NA | NA | 132 days | Thu 13/11/14 | 132 days | Wed 15/04/15 | 79 days |
| 79 | One Coat Sand Faced Plaster (in Pantry & | 100 days | Wed 01/10/14 | Sat 24/01/15 | 0 days | NA | NA | 100 days | Thu 01/01/15 | 100 days | Mon 27/04/15 | 79 days |
| 89 | Gypsum/PoP Plaster above Sand Faced Plaster | 115 days | Wed 05/11/14 | Wed 18/03/15 | 0 days | NA | NA | 115 days | Thu 05/02/15 | 115 days | Thu 18/06/15 | 79 days |
| 99 | Detailed Drawings for Plumbir | 0 days | Sat 02/08/14 | Sat 02/08/14 | 0 days | NA | NA | 0 days | Mon 03/11/14 | 0 days | Mon 03/11/14 | 79 days |
| 100 | Contractor for Plumbing Work | 0 days | Mon 11/08/14 | Mon 11/08/14 | 0 days | NA | NA | 0 days | Tue 11/11/14 | 0 days | Tue 11/11/14 | 79 days |
| 101 | Contractor for Waterproofing \ | 0 days | Mon 04/08/14 | Mon 04/08/14 | 0 days | NA | NA | 0 days | Tue 04/11/14 | 0 days | Tue 04/11/14 | 79 days |

**Fig.16 Tracked Project with Variance**

## VI. RESULTS AND DISCUSSIONS

With the help of referred case study, the various project status indicators were calculated. The results were determined by using following formulae.

BCWS= Rs. 51, 90, 40, 13
BCWP = Rs. 52, 29, 60,158
ACWP = Rs. 52, 84, 58,027

1) CV= BCWP – ACWP
=52,29,60,158– 52,84,58,027
= Rs. - 54,97,869

2) CPI = BCWP / ACWP
= 52,29,60,158 / 52,84,58,027
= 0.9895

3) SV = BCWP – BCWS
= 52,29,60,158 -51,90,40,136
= Rs. 39,20,022

4) SPI =BCWP / BCWS
= 1.0075

The CV and CPI represent cost performance of the project, If CPI,

1. Less than 1 (< 1) means 'Cost is Over run' (Project is uneconomical in terms of cost)
2. More than 1 (>1) means 'Cost is Under run' (Project is economical in terms of cost)

*Estimated cost at project completion (ECPC) = Project Budgeted cost/ CPI*

*= 234, 93, 91,604/0.9895*
*= 237, 43, 21,985*

Cost impact @ 30/4/14 = Approximate 2.5 crore SV and SPI represent time performance of the project, If SPI,

1. Less than 1 (< 1) means Project is behind schedule.
2. More than 1 (>1) means Project is ahead of schedule.

*Estimated Time at project completion*
*=Project Scheduled time / SPI*

*=900/1.0075*

*=893.30*

## VII. CONCLUSION

***1. Specific Conclusion:***

- According to referred case study, it can be concluded that the project is over budget and within the schedule
- Two parameters of EV i.e. CPI and SPI clearly indicate the lacunas of project in terms of cost and schedule which can help to track the project and hence help in successful completion of project.
- The calculation of EV parameters can also be done manually but with the help of MS Project, calculation can be done in an efficient manner within short time, this can be helpful in megaprojects.

***2. General Conclusion:***

Construction of project comprises of large numbers of activity which indeed very complex in nature MS-Project gives better interface which help:

- To create a work sequence at micro level and macro level.
- To create constraints, deadline and milestone within the project which further helps the manager to plan the resources to achieve the same.
- To form 'Work packages' at different interval or in project duration helps to set short term milestone achievement plan.
- Gives various options for duration crashing, by which one can reduce the time and justify the project for duration as well as cost reduction.
- To create resources procurement plan (Man /Machine /Material) with respect to lead time chart of respective company. Bar chart option available in MS-Project tool, gives us the time study, project analysis and its optimization.

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