To Study and Implement Earn Value Management on Industrial Project Using Microsoft Project

Devanshu S Varia[1], Mamta B. Rajgor[2], Jayeshkumar R. Pitroda[3]
[1]*Final year M.Tech. student B.V.M. Engineering College Vallabh Vidyanagar*
[2]*Assistant Professor, Civil Engineering Department, Babariya Institute of Technology, Vadodara*
[3] *Assistant Professor, B.V.M. Engineering College Vallabh Vidyanagar*

***Abstract*- Earned Value is a well-known project management tool. It is an industry standard method of measuring a project's progress at any given point of time, forecasting its completion date and final cost, analysing variances in the schedule and budget as the project proceeds. It is a method for measuring project performance, it indicates how much of the budget should have been spent, in view of the amount of work done and the baseline cost for the task, assignment and resources. In order to organize these all information, there should be efficient use of the construction software available in the market. This thesis emphasizes on the use of this techniques in modern software such as Microsoft Project in order to exercise better management over the project.**

***Index Terms*- Planning, Scheduling, Tracking, Project Planning Software, Microsoft Project.**

I. INTRODUCTION

In an increasingly demanding world, the market that full of competitiveness between the competitor will make the focus of customer satisfaction is increasingly important for the company that wants to be successful. Nowadays, the satisfaction of the quality and performance of the project not enough to fulfill customer requirement, but the time or value relationship in its project can increase the satisfaction of the customer. Thus, good allocation of resources is very important to minimize the waste.

In order to make a project successful, it is very important for the project completed within schedule, complete within budget and the good quality. In addition, to ensure the project can complete within time and minimize the cost and others, it is important to implement a control system. By implementing the control system, the manager will have the latest information about the project. Then, if there is any problem occurs in the project, the control system can act as an alert signal to the manager and implement the corrective measures that are relevant to the project. Earned Value Analysis (EVA) is one of the methods believe is an effective control tool. Earned Value has unfading popularity, just because of its simplicity and manipulation of data requires some basic operations only. And performance indicators produced in the analysis are easy to interpret.

EVM is a major and widely used quantitative project management tool to measure and track the progress and performance of a project objective. It integrates three critical elements of project management success; project scope, schedule and cost and enables tracking schedule and cost variance between planned and accomplished work of a given project at any time. EVM additionally allows management to predict the future of the project with the estimates, including total cost at completion and the possible completion date based on the patterns and trends in the past. It is called as "Management with the lights on" since it sheds light on where the project is now and where it is going comparing to where it was supposed to be and supposed to be going. It basically compares the planned work and accomplished work at a specific time in a project and calculates the value of this accomplished work. It is a forewarning system against the possible cost overruns and delays in the schedule and so provides a valuable opportunity to take necessary actions in order to calibrate the cost and schedule plans. Czarnigowsk et al. (2011) stated that Earned Value has unfading popularity, just because of its simplicity and manipulation of data requires some basic operations only. And performance indicators produced in the analysis are easy to interpret.

II. OBJECTIVES OF THE STUDY

Following are the main objectives of the research work.

1. To Study and understand the concept of Earn Value Analysis (EVA).
2. To predict end date of project.
3. To know whether project is under budget or over budget.
4. To predict project is ahead of time, on time or under time.
5. To predict cost of remaining work.

III. EARN VALUE MANAGEMENT

Although it has only been of late that the earned value concept has truly gained in prominence, it is a concept conceived by industrial engineers who worked in American factories over a century ago. By converting "planned industry standards" into "earned standards" and then relating them against "actual hours" these engineers began to focus on true cost performance. This distinction forms the basis of earned value management. The driving force behind the evolution of this technique has been the United States Department of Defense (DOD). In 1958, the U.S. Navy first introduced the Program Evaluation and Review Technique (PERT) as a network-scheduling device for the Polaris Weapons System. By 1962, PERT incorporated resources into its network analysis thereby managing both time and cost. Due to a combination of insufficient computer resources, complexity, and rigorous implementation requirements PERT was essentially abandoned as a management tool by the mid-1960s. However, the significance of PERT was not its technique, but that it used earned value data to monitor the true cost performance during the life of a project. Realizing the usefulness of earned value data, the U.S. Air Force implemented the first true earned value management approach as part of their Minuteman Program in 1963. One key difference between this approach and the previous PERT techniques was that the Air Force compiled thirty-five criteria defining the minimum requirements of an acceptable project management system. This innovation gave each contractor the flexibility to tailor its individual system in order to meet contract requirements. Finally, in 1967, the DOD formally issued what was called Cost/Schedule Control Systems Criteria (C/SCSC) as part of DOD Instruction.

In 1997, these 32 criteria were accepted by the DOD and incorporated as part of DOD Instruction 5000.2R. However, in the course of modifying the criteria, two significant shifts occurred. First, it came to be identified more as a project management technique vice a financial management one. Second, the ownership of earned value transferred from the DOD to private industry. To solidify these changes, the Earned Value Management System was adopted as American National Standards Institute (ANSI/EIA) Standard #748 in July 1998.

The usage of the method has already been spread out to the other governmental agencies and the other nations such as Australia, Canada, Sweden. In Australia, EVM has been released as standards, AS 4817-2003 and AS 4817-2006. Table 3.1 shows the summary of EVM history and its progress timeline.

Table 3.1 EVM History and Progress Timeline

Year	Event
late 1800s	First use of EV concept in American factories
1962	Initial introduction of EVM as a project management tool as a part of the PERT/Cost methodology by US DoD
1967	Formal introduction of EVM in C/SCSC by US DoD
1997	Revised and simplified EVMS by DoD, draft industry guideline
1998	ANSI/EIA-748-1998, formal industry guideline for EVMS
2000	Simplified EVM terminology published by PMI in PMBOK
2005	Practice Standard for Earned Value Management by the PMI
2011	Practice Standard for Earned Value Management by the PMI, 2nd edition

(Source: Pinar Efe, 2015)

IV. RESEARCH METHODOLOGY

Followings are the stages involved in research methodology.

1 Preliminary Studies

This study consists of four main stages.

A. Literature review

B. Objectives

C. Problem background and its statement

D. Scope of study

Based on these stages research area has been explored. First of all literature survey and then literature review on the subject of Earn Value Management were carried out. Literature published in various national, international and other online and

local journals; national, international and other conferences; various reports; master and Ph.D. dissertations; books; the various standards published by various authorities; etc. have been collected and studied.

Based on the literature review problem statement was formulated and objectives and its scope are decided.

2 Data Collection Stage

Based on the literature survey data which has to be collected from site is listed out. Data will be collected from project manager and planning engineer from site. Data will be rearranged and makes it ready for research analysis. Data collection contains following things.

A. Create Project Plan

B. Resource Allocation

C. Save Baseline

First step is to create the project plan. With the extensive surveys and interviews with the professionals list of all activities, its duration and relationship of each activity will be prepared. Relationships between activities may be Finish to Start (FS), Start to Finish (SF), Finish to Finish (FF) or Start to Start (SS). All this information will be fed into the Microsoft Project software. Based on this information Microsoft Project Software will prepare the Bar Chart.

The resource sheet view allows project managers to define the different type of resources available to a project. MS-Project tracks work resources and material resources. Work resources are the people and equipment that consume time to accomplish project tasks. Material resources are the consumable supplies, such as steel, concrete and other construction materials that are used to complete the project tasks. Most software projects are based on work resources with different costs rates.

To measure the status of project 'Baseline' function will be used depending upon the frequency of measurement. After you've built your plan, assigned resources and confirmed the budgeted costs, the next step is to baseline the project plan. Saving the project baseline is an important step to measure and manage your project's performance. To save the project baseline, follow these steps:

A. Select Tools – Tracking – Save Baseline

B. The Save Baseline Dialog box appears and select the Save Baseline radio button

C. Select the Entire Project radio button to baseline the entire project plan or select the Selected Tasks radio button to baseline any selected tasks.

D. Click OK

E. Update Project Plan

The Baseline Start, Baseline Finish, Baseline Work, Baseline Cost and Earned Value fields will be populated. If your project is in process and you haven't established a baseline, you'll need to baseline any future tasks and manually edit the baseline data for completed and in-process tasks. Saving the project baseline before project execution avoids these manual-editing procedures

After entering the necessary details for activity, project status can be tracked through update project plan. In this step, status date will be selected. This step is performed to set the desired date according to the progress of work. This will help to monitor the project performance as per the requirement.

3 Research Analysis

The data collected will be analyzed in Microsoft Project 2013 and results generated from the software will be studied and interactions with the organization will be made regarding selection of the planning procedure and software to be used in their future projects. For analysis purpose EVM method will be used.

V. CASE STUDY

Case study – 1: Blade Storage

A. Project Information

Project Name	Blade Storage
Client	LM Wind Power
PMC	Shah & Talati
Contractor	Reeca Infrastructure Pvt. Ltd
Scope of work	Industrial civil work
Location	Chandrapura, Halol
Duration of project	Days - 97
Project Start Date	08-01-2018
Project Finish Date	30-04-2018
Budgeted Cost of Project	₹ 23,572,910.00

Table: 6.1 Case study information

B. Conclusion

Nos.	Description Blade Storage	Updated on 31-03-2018	Updated on 30-04-2018
1	Planned Value (PV)	₹ 1,85,41,906	₹ 2,35,40,783
2	Earned Value (EV)	₹ 1,81,88,277	₹ 2,29,03,283
3	Actual Cost	₹ 1,87,69,099	₹ 2,35,40,783

	(AC)		
4	Schedule Variance (SV)	₹ 3,53,628	₹ 6,37,500
5	Schedule Variance % (SV%)	-2%	-3%
6	Cost Variance (CV)	₹ 5,80,822	₹ 6,37,500
7	Cost Variance % (CV%)	-3%	-3%
8	Estimated At Completion (EAC)	₹ 2,43,31,054	₹ 2,42,34,379
9	Budgeted At Completion (BAC)	₹ 2,35,78,090	₹ 2,35,78,090
10	Variance At Completion (VAC)	₹ 7,52,964	₹ 6,56,289
11	Schedule Performance Index (SPI)	0.98	0.97
12	Cost Performance Index (CPI)	0.97	0.97
13	Planned % Complete	78%	100%
14	Actual % Complete	75%	96%

Table 6.2 Earn value Analysis of Blade Storage

Case study – 2 : Post Mould Factory

A. Project Information

Project Name	Post Mould Factory
Client	LM Wind Power
PMC	Shah & Talati
Contractor	Reeca Infrastructure Pvt. Ltd
Scope of work	Industrial civil work
Location	Chandrapura, Halol
Duration of project	Days - 91
Project Start Date	15-01-2018
Project Finish Date	30-04-2018
Budgeted Cost of Project	₹ 1,48,16,850

Table : 6.3 Case study information

B. Conclusion

Nos.	Description Post Mould Factory	Updated on 31-03-2018	Updated on 30-04-2018
1	Planned Value (PV)	₹ 1,29,17,382	₹ 1,48,13,090
2	Earned Value (EV)	₹ 1,26,61,919	₹ 1,46,92,386
3	Actual Cost (AC)	₹ 1,29,17,382	₹ 1,49,70,235
4	Schedule Variance (SV)	₹ 2,55,463	₹ 1,20,703
5	Schedule Variance %	-2%	-1%
	(SV%)		
6	Cost Variance (CV)	₹ 2,55,643	₹ 2,77,848
7	Cost Variance % (CV%)	-2%	-2%
8	Estimated At Completion (EAC)	₹ 1,51,15,797	₹ 1,50,97,053
9	Budgeted At Completion (BAC)	₹ 1,48,16,850	₹ 1,48,16,850
10	Variance At Completion (VAC)	₹ 2,98,947	₹ 2,80,203
11	Schedule Performance Index (SPI)	0.98	0.99
12	Cost Performance Index (CPI)	0.98	0.98
13	Planned % Complete	69%	100%
14	Actual % Complete	67%	98.5%

Table 6.4 Earn value Analysis of Post Mould Factory

A. Project Information

Project Name	RCC Hardpad
Client	LM Wind Power
PMC	Shah & Talati
Contractor	Reeca Infrastructure Pvt. Ltd
Scope of work	Industrial civil work
Location	Chandrapura, Halol
Duration of project	Days - 88
Project Start Date	12-02-2018
Project Finish Date	25-05-2018
Budgeted Cost of Project	₹ 92,35,278

Table : 6.5 Case study information

B. Conclusion

Nos.	Description RCC Hardpad	Updated on 31-03-2018	Updated on 30-04-2018
1	Planned Value (PV)	₹ 14,59,620	₹ 58,65,443
2	Earned Value (EV)	₹ 14,44,029	₹ 60,98,019
3	Actual Cost (AC)	₹ 13,35,888	₹ 56,67,344
4	Schedule Variance (SV)	₹ 15,591	₹ 2,32,576
5	Schedule Variance % (SV%)	-1%	4%
6	Cost Variance (CV)	₹ 1,08,140	₹ 4,30,675
7	Cost Variance % (CV%)	7%	7%
8	Estimated At Completion (EAC)	₹ 85,43,668	₹ 85,83,039
9	Budgeted At Completion (BAC)	₹ 92,35,278	₹ 92,35,278
10	Variance At Completion	₹ 6,91,610	₹ 6,52,238

	(VAC)		
11	Schedule Performance Index (SPI)	0.99	1.04
12	Cost Performance Index (CPI)	1.08	1.08
13	Planned % Complete	15%	64%
14	Actual % Complete	22%	76%

Table 6.6 Earn value Analysis of RCC Hardpad

VI. CONCLUSION

Case study-1 : Blade Storage

The Schedule Variance (SV) of the blade storage project is -3% resulting in project to be behind the schedule. The Schedule Performance Index (SPI) tells that the project is progressing with the rate of 97% of the original planned value. The rate at which the project is progressing is indicated by SPI.

The original estimated completion time for the project was 97 days. But, at this stage we found that if this continues at this current rate, then the project will take 10 days more than the original planned date leading to the final work completion in 107 days.

The cost variance of the project is -3% which is very unfavorable for the project resulting in project to be over the budget. The Cost Performance Index (CPI) of 0.97 tells the project is currently running over the budget by 3% for the total cost we spend, leading to attaining the value of rupees 0.97 for every 1 rupee spent.

The Estimate at Completion (EAC) shows that expected total cost of Project at Completion is based on the performance of data ₹ 2.35 Cr (i.e. BAC) divided by 0.97 (ie. CPI) is ₹ 2.42 Cr. Thus, EAC is ₹ 2.42 Cr. In other words, as the project is getting only 0.97 rupee for every 1 rupee, resulting in project to cost 2.42 Cr instead of 2.35 Cr that was planned.

The Variance at Completion (VAC) shows variance of total cost of the project work and the expected cost. Here the value of VAC is -0.065. That means, by the date the project is over budget by 6.56 lakh. The Estimate to Complete (EAC) shows the expected cost required finishing all the remaining work, here it is 2.42 Cr. This is the real amount needed to complete the work.

Case study-2 : Post Moulid Factory

The Schedule Variance (SV) of the post mould project is -1% resulting in project to be behind the schedule. The Schedule Performance Index (SPI) tells that the project is progressing with the rate of 99% of the original planned value. The rate at which the project is progressing is indicated by SPI.

The original estimated completion time for the project was 91 days. But, at this stage we found that if this continues at this current rate, then the project will take 08 days more than the original planned date leading to the final work completion in 99 days.

The cost variance of the project is -2% which is very unfavorable for the project resulting in project to be over the budget. The Cost Performance Index (CPI) of 0.98 tells the project is currently running over the budget by 2% for the total cost we spend, leading to attaining the value of rupees 0.98 for every 1 rupee spent.

The Estimate at Completion (EAC) shows that expected total cost of Project at Completion is based on the performance of data ₹ 1.48 Cr (i.e. BAC) divided by 0.98 (ie. CPI) is ₹ 1.51 Cr. Thus, EAC is ₹ 1.51 Cr. In other words, as the project is getting only 0.98 rupee for every 1 rupee, resulting in project to cost ₹ 1.51 Cr instead of ₹ 1.48 Cr that was planned.

The Variance at Completion (VAC) shows variance of total cost of the project work and the expected cost. Here by the date the project is over budget by 2.80 lakh. The Estimate to Complete (EAC) shows the expected cost required finishing all the remaining work, here it is 1.51 Cr. This is the real amount needed to complete the work.

Case study-3 : RCC Hardpad

The Schedule Variance (SV) of the post mould project is 4% resulting in project to be ahead of the schedule. The Schedule Performance Index (SPI) tells that the project is progressing with the rate of 104% of the original planned value. The rate at which the project is progressing is indicated by SPI.

The original estimated completion time for the project was 88 days. But, at this stage we found that if this continues at this current rate, then the project will take 15 days less than the original planned date leading to the final work completion in 73 days.

The cost variance of the project is 7% which is very favorable for the project resulting in project to be under the budget. The Cost Performance Index (CPI)

of 1.08 tells the project is currently running under the budget by 8% for the total cost we spend, leading to attaining the value of rupees 1.08 for every 1 rupee spent.

The Estimate at Completion (EAC) shows that expected total cost of Project at Completion is based on the performance of data ₹ 92.35 Lakh (i.e. BAC) divided by 1.08 (ie. CPI) is ₹ 85.83 Lakh. Thus, EAC is ₹ 85.83 Lakh. In other words, as the project is getting only 1.08 rupee for every 1 rupee, resulting in project to cost ₹ 85.83 Lakh instead of ₹ 92.35 Lakh that was planned.

The Variance at Completion (VAC) shows variance of total cost of the project work and the expected cost. Here by the date the project is under budget by 6.52 lakh. The Estimate to Complete (EAC) shows the expected cost required finishing all the remaining work, here it is ₹ 85.83 Lakh. This is the real amount needed to complete the work.

ACKNOWLEDGEMENT

I express sincere and wholehearted thanks to Dr. C. L. Patel, Chairman C.V.M., Er. V. M. Patel, Hon. Jt. Secretary, C.V.M., Prof. (Dr.) I. N. Patel, Principal, Birla Vishvakarma Mahavidyalaya Engineering College, Vallabh Vidyanagar, Prof. (Dr.) L. B. Zala, Head & professor Civil Engineering Department, Birla Vishvakarma Mahavidyalaya Engineering College and Prof. J. J. Bhavsar, Associate Professor, PG Coordinator of M.Tech. Construction Engineering and Management, Civil Engineering Department, Birla Vishvakarma Mahavidyalaya Engineering College, Vallabh Vidyanagar for providing me an opportunity to undertake this topic for my study.

I express a deep sense of gratitude to, Prof. Mamata B. Rajgor, Assistant Professor, Civil Engineering Department, Babaria Institute of Technology, Vadodara, Dr. Jayeshkumar Pitroda, Assistant Professor, Civil Engineering Department, Birla Vishvakarma Mahavidyalaya Engineering College, Vallabh Vidyanagar for his extreme constructive support, constant encouragement, guidance and challenging my efforts in the right direction.

REFERENCES

[1] Badgujar Kunal B., Konnur B.A., Landage Amarsinh B., "A Review of EVM Analysis with Primavera", International Journal of Engineering Research ISSN:2319-6890, Volume No.5, Issue Special 1 pp : 164-167.

[2] Batselier Jordy, Vanhoucke Mario, "Empirical Evaluation of Earned Value Management Forecasting Accuracy for Time and Cost", Journal of Construction Engineering and Management, © ASCE, ISSN 0733-9364/05015010(13)/$25.00. DOI: 10.1061/(ASCE)CO.1943-7862.0001008. © 2015 American Society of Civil Engineers.

[3] Bhave Anup Parag, Joshi Deepa A., "A Review Paper on Earned Value Analysis" , International Journal of Engineering Research and Development, e-ISSN: 2278-067X, p-ISSN: 2278-800X, Volume 12, Issue 8 (August 2016), PP.01-03.

[4] Bhosekar Sagar K., Vyas Gayatri, "Cost Controlling Using Earned Value Analysis in Construction Industries", International Journal of Engineering and Innovative Technology (IJEIT) ISSN: 2277-3754 Volume 1, Issue 4, April 2012.

[5] Byung-Cheol Kim, Kenneth F. Reinschmidt, "Combination of Project Cost Forecasts in Earned Value Management", e Journal of Construction Engineering and Management, Vol. 137, No. 11, November 1, 2011. ©ASCE, ISSN 0733-9364/2011/11-958–966. DOI: 10.1061/(ASCE)CO.1943-7862.0000352. © 2011 American Society of Civil Engineers.

[6] Cabri Anthony, Griffiths Mike, "Earned Value and Agile Reporting", 6 Reinertsen, Donald, "Managing the Design Factory – A Product Developers Toolkit", Free Press, New York NY, 1997

[7] Czarnigowska Agata, "Earned value method as a tool for project control", Budownictwo i Architektura 3 (2008) 15-32

[8] 8. Czarnigowska Agata, Jaskowski Piotr, Biruk Slawomir, "Project Performance Reporting And Prediction: Extensions Of Earned Value Management", International Journal Of Business And Management Studies Vol 3, No 1, 2011 ISSN: 1309-8047.

[9] Daniel R. McConnell, "Earned Value Technique for Performance Measurement", Journal of Management in Engineering, Vol. 1, No. 2, April, 1985. ©ASCE, ISSN 0742-597X/85/0002-0079/$01.00. Paper No. 19663.

[10] Dubey Anuj, "Earned Value Analysis for a Construction Project", International Journal of Civil Engineering and Technology (IJCIET), ISSN 0976 – 6308 (Print) ISSN 0976 – 6316(Online), Volume 6, Issue 6, June (2015), Pp. 53-66.

[11] Gedi Ji, Yunna Wu, Qing Chang, "Research on Optimization of Earned Value Management Method in Engineering Budget Management", The Open Civil Engineering Journal, 2015, 9, pp-369-375.

[12] Henderson Kym, "Earned Schedule: A Breakthrough Extension to Earned Value Management", 2007 PMI Asia Pacific Global Congress Proceedings – Hong Kong.

[13] Luis Felipe Cândido, Luiz Fernando, Mählmann Heineck, José de Paula Barros Neto, "Critical Analysis on Earned Value Management (Evm) Technique in Building Construction"

[14] Ming-Fung Siu, Ming Lu, "Scheduling Simulation based Techniques for Earned Value Management on Resource-Constrained Schedules under Delayed Scenarios" , Proceedings of the 2011 Winter Simulation Conference.

[15] Mohammed Abed Ibrahim, Mohammed Faiq Sarhan, Duha Sameer, "Evaluation the Performance of the Infrastructure Project using Earned Value Management", International Journal of Civil Engineering & Technology (IJCIET), ISSN 0976 – 6308 (Print) ISSN 0976 – 6316(Online) Volume 5, Issue 9, September (2014), pp. 145-155.

[16] Mohd Sahar Sauiana, Tuan Arif Tuan Mahmood, "Monitoring Project Performance Through Earned Value Analysis", Proceedings of the 2013 International Conference on Information, Operations Management and Statistics (ICIOMS2013), Kuala Lumpur, Malaysia, September 1-3, 2013

[17] Picornell Miguel, Pellicer Eugenio, Torres Cristina, Sutrisna Monty, "Implementation of Earned Value Management in Unit-Price Payment Contracts", Journal of Management in Engineering, © ASCE, ISSN 0742-597X. DOI: 10.1061/(ASCE)ME.1943-5479.0000500. © 2016 American Society of Civil Engineers.

[18] Subramani T., Jabasingh D. S. Stephan, Jayalakshmi J., "Analysis of Cost Controlling In Construction Industries by Earned Value Method using Primavera", Int. Journal of Engineering Research and Applications, ISSN : 2248-9622, Vol. 4, Issue 6(Version 1), June 2014, pp.145-153

[19] Suresh Sandhya, Ramasamy Ganapathy N, "Analysis of Project Performance using Earned Value Analysis", International Journal of Science, Engineering and Technology Research (IJSETR), ISSN: 2278 – 7798 Volume 4, Issue 4, April 2015

[20] 20. Tsui Frank, "Analysis and Application of Earned Value Management in Software Development"

[21] 21. Valle Jose Angelo, Soares Carlos Alberto Pereira, "The Use of Earned Value Analysis (Eva) in the Cost Management of Construction Projects".

[22] 22. Hayes, Richard D., "Analysis and Aplication of Earned Value Management to the Naval Construction Force", Calhoun: The NPS Institutional Archive DSpace Repository, Division of Construction Engineering and Management School of Civil Engineering Purdue University West Lafayette, Indiana 47907-1294

[23] 23. Óskar Gísli Sveinsson, "Implementation of the Earned Value and Earned Schedule Methods for Project Cost and Schedule Control in the Icelandic Construction Industry", Faculty of Civil and Environmental Engineering, School of Engineering and Natural Sciences University of Iceland

[24] 24. Pinar Efe, Nazife Baykal, "Qevm: Quality Integrated Earned Value Management", The Department Of Information Systems, The Middle East Technical University, August 2015

[25] 25. "Practice Standard for Earned Value Management", Project Management Institute, Inc. Four Campus Boulevard Newtown Square, Pennsylvania 19073-3299 USA, ISBN: 1-930699-42-5.

[26] 26. Shukla Manojkumar Rajendra, Dr. Magar R. B., "Cost and Schedule Analysis of a Structure using Earn Value Management", Department of Civil Engineering Anjuman-I-Islam's Kalsekar Technical Campus, University of Mumbai, Sector- 16, New Panvel- 410206 (2015-2016)