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Continuous Project Evaluation of An Infrastructure Using Earned Value Analysis

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Abstract: *Project is a temporary endeavor undertaken to give unique output or product and infrastructure is a physical structure needed for the operations of society. These infrastructure projects have different complexities and uncertainties, hence the continuous project performance evaluation becomes necessity for project. Scope, Schedule and Budget: these are the major potential measures in order to evaluate the performance of project. Earned value analysis can be used as a project performance evaluator for infrastructure project. Earned value analysis integrates cost, schedule and work performance to estimate the status of project. This is the technique which gives the quantitative measure of a project performance. In Earned value analysis comparison between planned baseline and actual progress of work is conducted. Study includes the continuous evaluation of PQC road project during 1st October 2014 to 15th March 2015. Work break down structure is prepared such that single work package is obtained and accordingly scheduling is done using MS-Project 2013.By comparing progress of actual work to baseline values of Cost variance, schedule variance, Critical ratio, Cost performance index, schedule performance index are calculated and continuous evaluation is carried out.*

Keywords: *Project Performance; Cost overrun; delay; cost variance; schedule variance*

I. Introduction

Project is a temporary endeavor undertaken to create a new product or service to achieve specified objectives within the assigned resources.Infrastructure projectare unique and transient andrisk-prone, complex situations and resource constraint.Infrastructure is basic physical structure needed for the operation of society & enterprise such as road, bridge, rail, dam, water supply etc. Infrastructure is one of the important aspect for development of any country especially for developing countries it is key factor or milestone. Construction industry itself is integral part of nation's infrastructure & industrial growth. These are the massive and need considerable time and resources. Most of these projects undergoes delays and cost overrun due to poor planning and project tracking. Hence the continuous project performance evaluation is required so that the project should not undergo delay or cost overrun.Earned value analysis is management tool that integrates the scope, schedule and budget of the project.If the project is completed, within the allocated time period, budgeted cost and at the proper performance or specification level then the project can be called as successful project.

Earned Value analysis is a method of performance measurement. Earned Value is a project management technique that uses "work in progress" to indicate what is the status of project and what will happen to work in the future. Earned Value is an enhancement over traditional accounting progress measures. With clearer picture, managers can create risk mitigation plans based on actual cost, schedule and technical progress of the work. It is an "early warning" project management tool that enables managers to identify and control problems before they become insolvable.

II. Earned Value Analysis

The construction industry was an early commercial adopter of Earned value analysis. Closer integration of Earned value analysis with project management profession accelerated in the 1990s. The primary professional association for Earned value analysis, called the performance management association merged with the Project Management Institute (PMI) in 1999 to become PMI's first college, the College of performance management. An overview of Earned value analysis was first included in PMBOK First Edition in 1987 and expanded in subsequent editions. Efforts to simplify and generalize Earned value analysis gained momentum in the early 2000s.

Due to Fixed Formula,Weighted Milestone,Percent Complete,Apportioned Effort and Level of Effort Earned value analysis has become simpler management tool.In the project execution process, Earned value analysis requires the recording of resource utilization (i.e., labour, materials, and the like) for the work performed within each of the work elements included in the project management plan. In other words, actual costs need to be captured in such a way that permits their comparison with the performance measurement

baseline.Analysis of Variance from the baseline provides the cost related information for problem identification, trend analysis and Corrective actions such as re-planning and revising budget. Also it calculates the budget at the completion, time require to complete the project, delays & cost overrun.

Elements of Earned value analysis

Earned value analysisdeals with three elements these are;

1. Planned value (PV=BCWS)
2. Earned value (EV=BCWP)
3. Actual cost (AC=ACWP)

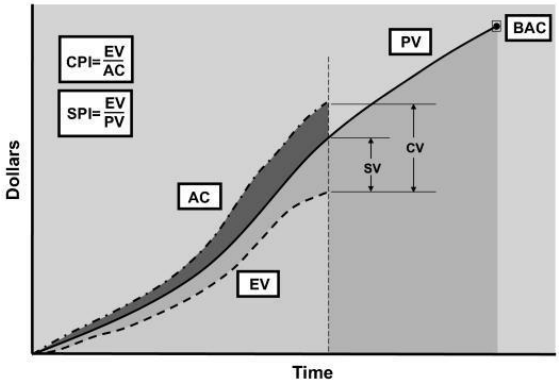


Fig.1 *Earned value graph*

ACWP (AC):- Actual Cost of Work Performed (ACWP) or Actual Cost (AC) is the actual cost incurred in accomplishing the work performed within a given time period.

BCWP (EV):- Budgeted Cost of Work Performed (BCWP) or Earned Value (EV) is the sum of budgets for completed work packages and completed portions of open work packages.

BCWS (PV):- Budgeted Cost of Work Scheduled (BCWS) or Planned Value (PV) is the sum of budgets for all work packages scheduled to be accomplished within a given time period.

Cost variance (CV), Schedule Variance (SV), Cost performance index (CPI) & Schedule performance index (SPI) are the performance measures of construction project and these measures can be derived.

Cost Variance: *CV* = EV – AC (difference between earned value and actual cost). A negative value points more has been spent for the activities than planned & positive value points less spent than planned cost. It can be expressed as a percentage (%CV) by dividing the cost variance (CV) by the earned value (EV).

Schedule Variance: SV = EV – PV (difference between earned value & planned value) A negative value means that

the project is behind schedule & a positive value means the project is ahead of schedule. It can be expressed as a percentage (%SV) by dividing the schedule variance (SV) by the planned value (PV)

Cost Performance Index (CPI) – The ratio of cost of work performed (BCWP) to actual cost (ACWP) A CPI of less (more) than one means that the project is currently running over (under) budget.

Schedule Performance Index (SPI) – The ratio of work accomplished (BCWP) to work planned (BCWS). A SPI of more (less) than one means that the project is ahead of (behind) plan.

PERFORMANCE MEASURES		**SCHEDULE**		
		SV>0 & SPI>1	**SV=0 & SPI=1**	**SV<0 & SPI<1**
COST	**CV>0 & CPI>1**	Ahead of schedule under budget	On schedule under budget	Behind schedule under budget
	CV=0 & CPI=1	Ahead of schedule on budget	On schedule on budget	Behind schedule on budget
	CV<0 & CPI<1	Ahead of schedule over budget	On schedule under budget	Behind schedule over budget

Table.No.*1Performance matrix*

Application Of Earned Value Analysis To Infrastructure Project (Pqc Road Along With Utilities)

This paper attempts to apply the Earned value analysis as project performance evaluating tool to infrastructure construction project. 1 KM stretch of Concrete Road in Navi-Mumbai Region is considered for the study purpose.Quantites, resources, cost and planning is done only for this 1KM stretch. Planned Project duration is from 1st October 2014 to 30th April 2015. All activities are updated by their percentage completion on 15-Oct-14,1-Nov-14,15-Nov-14,1-Dec-14,15-Dec-15,1-Jan-15,15-Jan-15,1-Feb-15,15-Feb-15,1-Mar-15,15-Mar-15& Status of progress worked out on same date.

Work breakdown structure forms the basis for defining the scope of work, identifying activities, scheduling the work-logic, structuring the organization, assigning responsibilities, estimating costs, codifying systems, organizing data and analyzing the sources of risks. Work break down structure of concrete road is prepared such that separate packages are obtained and activities were listed out.

List of various activities is sequenced and their appropriate groups are maintained. For activity duration and their relationships, resources such as labour, material, machineries, time and fund are considered with the help of contractor.

Scheduling is done by logical sequencing of activities & "Start No Earlier than" Logic is applied to the activities.According to quantities of each activity resources are allocated i.e. human, materials, equipment. Duration of each activity is calculated by considering the Sunday as holiday & working time from 8AM to 1PM and 2PM to 5PM.working time for execution is set as 8 hours a day & 48 hours per week thus the baseline is formed & saved as standard baseline for execution plan. All activities are monitored and updated according to the status of completion and actual consumed resources along with if any fixed cost is required for activity.

Project performance is evaluated by methodology which consists of listing of activities by Work break down structure method, crating calendars i.e. deciding work time, appointing activity resources and durations, assigning logical sequencing, creating standard baseline, updating schedule according to their status and followed by Earned value operation. Comparison of standard baseline & updated schedule gives the values of ACWP (AC), BCWP (EV), BCWS (PV), CV, SV, CPI, SPI are obtained for each activity.

A] Planned value

1. Rate from the tender is considered as planned value.
2. Available budget amount from BOQ is the price of work. For analysis purpose, cost of work is calculated.
3. Items from BOQ are multiplied by cost of that particular item in rate analysis sheet and by summing all cost of items 'cost of work' is achieved.
4. Cost of items is distributed according to activity wise as schedule prepared to achieve cost of item.

B] Earned value

Earned value is directly calculated from RA bill; subsequently project tracking is done according to RA bill dates. First RA bill was available at 01-Oct-2014 and last RA bill at 30 April 2015.

C] Actual cost

1. Site expenses bill is directly taken as an actual cost.
2. Expenses i.e. Actual cost available are month wise from August to February.

Requirements of data as input to software are as follows

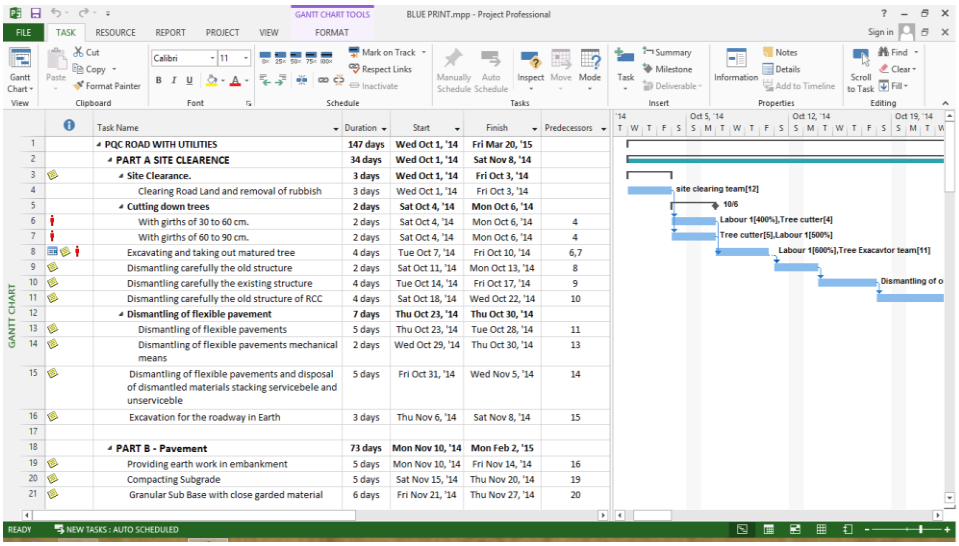
1. List of activity
2. Duration of activity
3. Predecessors or Link
4. Resources

Steps in applying data in software

1. Create Project
2. Define WBS
3. Creating Calendars
4. Define Activities
5. Appoint Activity Durations
6. Assign Logic Links
7. Perform Scheduling
8. Allocating Resources / budgeting
9. Creating Baselines
10. Updating Schedule
11. Earned value analysis
12. Publishing Reports

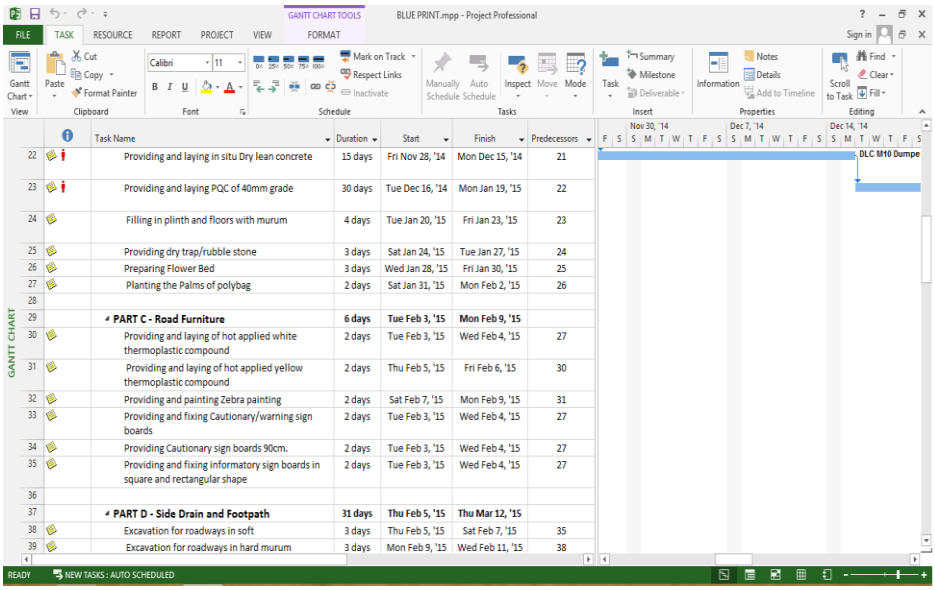
Schedule of project

At project, start date is the early phase one pre-executed baseline was prepared at start date 1 October 2014 & terminate date 20 March 2015. This schedule is prepared with help of contractor considering available time and resource. Microsoft Project 2013 is used to prepare schedule for that purpose WBS (work breakdown structure) is created. List of various activities is sequenced and their appropriate groups are maintained. For activity duration and their relationships, resources such as labour, material, machineries, time and fund are considered with the help of contractor.



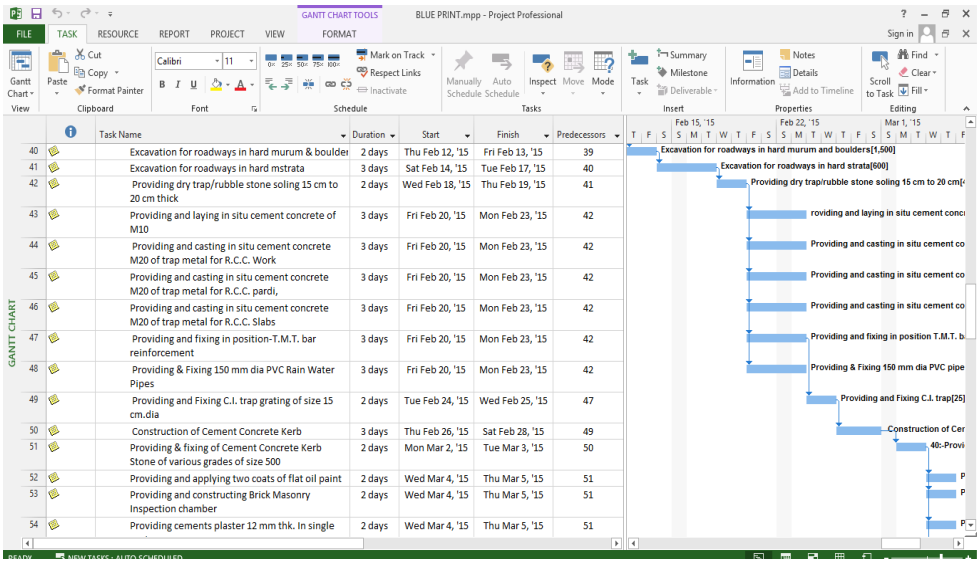
	Task Name	Duration	Start	Finish	Predecessors
1	**PQC ROAD WITH UTILITIES**	**147 days**	**Wed Oct 1, '14**	**Fri Mar 20, '15**	
2	**PART A SITE CLEARENCE**	**34 days**	**Wed Oct 1, '14**	**Sat Nov 8, '14**	
3	**Site Clearance.**	**3 days**	**Wed Oct 1, '14**	**Fri Oct 3, '14**	
4	Clearing Road Land and removal of rubbish	3 days	Wed Oct 1, '14	Fri Oct 3, '14	
5	**Cutting down trees**	**2 days**	**Sat Oct 4, '14**	**Mon Oct 6, '14**	
6	With girths of 30 to 60 cm.	2 days	Sat Oct 4, '14	Mon Oct 6, '14	4
7	With girths of 60 to 90 cm.	2 days	Sat Oct 4, '14	Mon Oct 6, '14	4
8	Excavating and taking out matured tree	4 days	Tue Oct 7, '14	Fri Oct 10, '14	6,7
9	Dismantling carefully the old structure	2 days	Sat Oct 11, '14	Mon Oct 13, '14	8
10	Dismantling carefully the existing structure	4 days	Tue Oct 14, '14	Fri Oct 17, '14	9
11	Dismantling carefully the old structure of RCC	4 days	Sat Oct 18, '14	Wed Oct 22, '14	10
12	**Dismantling of flexible pavement**	**7 days**	**Thu Oct 23, '14**	**Thu Oct 30, '14**	
13	Dismantling of flexible pavements	5 days	Thu Oct 23, '14	Tue Oct 28, '14	11
14	Dismantling of flexible pavements mechanical means	2 days	Wed Oct 29, '14	Thu Oct 30, '14	13
15	Dismantling of flexible pavements and disposal of dismantled materials stacking servicebele and unservicebele	5 days	Fri Oct 31, '14	Wed Nov 5, '14	14
16	Excavation for the roadway in Earth	3 days	Thu Nov 6, '14	Sat Nov 8, '14	15
17					
18	**PART B - Pavement**	**73 days**	**Mon Nov 10, '14**	**Mon Feb 2, '15**	
19	Providing earth work in embankment	5 days	Mon Nov 10, '14	Fri Nov 14, '14	16
20	Compacting Subgrade	5 days	Sat Nov 15, '14	Thu Nov 20, '14	19
21	Granular Sub Base with close garded material	6 days	Fri Nov 21, '14	Thu Nov 27, '14	20

Fig.2.*Schedule of project*



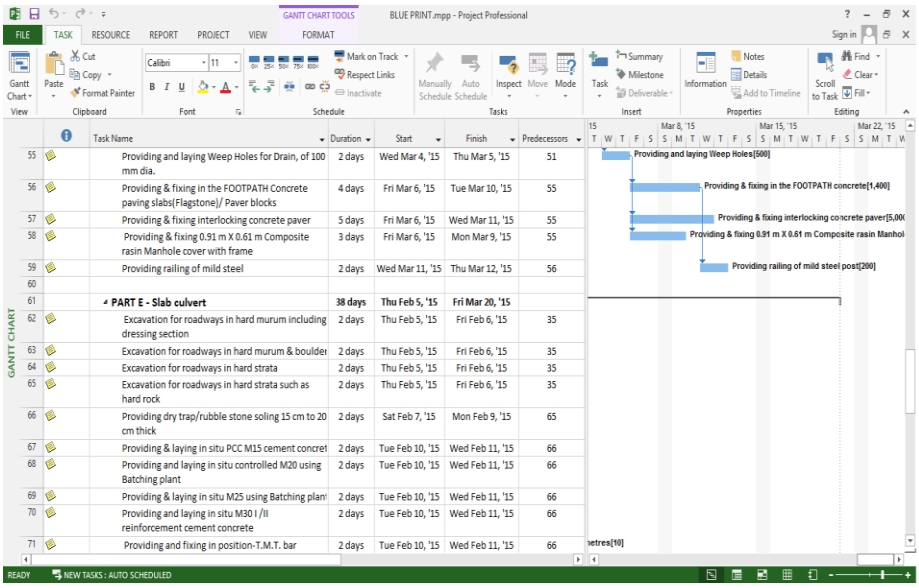
	Task Name	Duration	Start	Finish	Predecessors
22	Providing and laying in situ Dry lean concrete	15 days	Fri Nov 28, '14	Mon Dec 15, '14	21
23	Providing and laying PQC of 40mm grade	30 days	Tue Dec 16, '14	Mon Jan 19, '15	22
24	Filling in plinth and floors with murum	4 days	Tue Jan 20, '15	Fri Jan 23, '15	23
25	Providing dry trap/rubble stone	3 days	Sat Jan 24, '15	Tue Jan 27, '15	24
26	Preparing Flower Bed	3 days	Wed Jan 28, '15	Fri Jan 30, '15	25
27	Planting the Palms of polybag	2 days	Sat Jan 31, '15	Mon Feb 2, '15	26
28					
29	**PART C - Road Furniture**	**6 days**	**Tue Feb 3, '15**	**Mon Feb 9, '15**	
30	Providing and laying of hot applied white thermoplastic compound	2 days	Tue Feb 3, '15	Wed Feb 4, '15	27
31	Providing and laying of hot applied yellow thermoplastic compound	2 days	Thu Feb 5, '15	Fri Feb 6, '15	30
32	Providing and painting Zebra painting	2 days	Sat Feb 7, '15	Mon Feb 9, '15	31
33	Providing and fixing Cautionary/warning sign boards	2 days	Tue Feb 3, '15	Wed Feb 4, '15	27
34	Providing Cautionary sign boards 90cm.	2 days	Tue Feb 3, '15	Wed Feb 4, '15	27
35	Providing and fixing informatory sign boards in square and rectangular shape	2 days	Tue Feb 3, '15	Wed Feb 4, '15	27
36					
37	**PART D - Side Drain and Footpath**	**31 days**	**Thu Feb 5, '15**	**Thu Mar 12, '15**	
38	Excavation for roadways in soft	3 days	Thu Feb 5, '15	Sat Feb 7, '15	35
39	Excavation for roadways in hard murum	3 days	Mon Feb 9, '15	Wed Feb 11, '15	38

Fig.3 *Schedule of project (Contd.)*



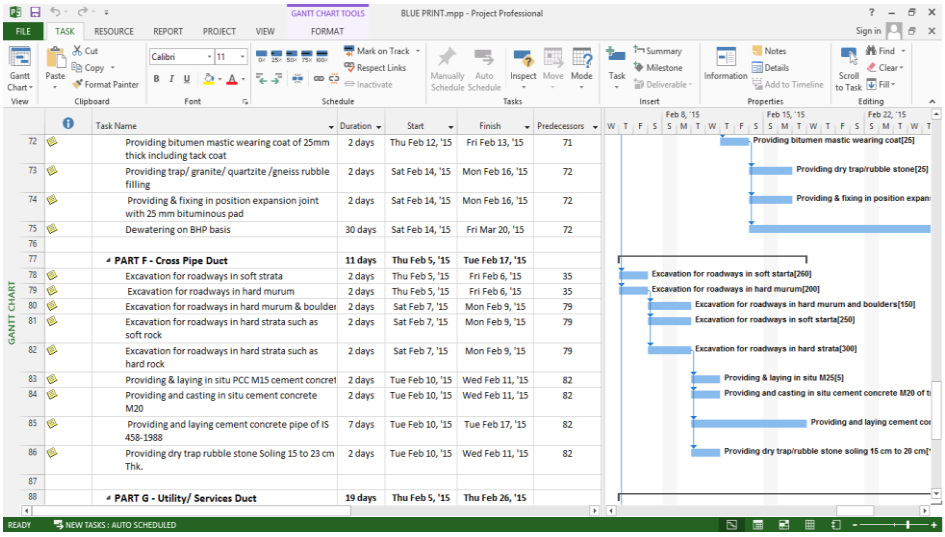
	Task Name	Duration	Start	Finish	Predecessors
40	Excavation for roadways in hard murum & boulder	2 days	Thu Feb 12, '15	Fri Feb 13, '15	39
41	Excavation for roadways in hard mstrata	3 days	Sat Feb 14, '15	Tue Feb 17, '15	40
42	Providing dry trap/rubble stone soling 15 cm to 20 cm thick	2 days	Wed Feb 18, '15	Thu Feb 19, '15	41
43	Providing and laying in situ cement concrete of M10	3 days	Fri Feb 20, '15	Mon Feb 23, '15	42
44	Providing and casting in situ cement concrete M20 of trap metal for R.C.C. Work	3 days	Fri Feb 20, '15	Mon Feb 23, '15	42
45	Providing and casting in situ cement concrete M20 of trap metal for R.C.C. pardi,	3 days	Fri Feb 20, '15	Mon Feb 23, '15	42
46	Providing and casting in situ cement concrete M20 of trap metal for R.C.C. Slabs	3 days	Fri Feb 20, '15	Mon Feb 23, '15	42
47	Providing and fixing in position-T.M.T. bar reinforcement	3 days	Fri Feb 20, '15	Mon Feb 23, '15	42
48	Providing & Fixing 150 mm dia PVC Rain Water Pipes	3 days	Fri Feb 20, '15	Mon Feb 23, '15	42
49	Providing and Fixing C.I. trap grating of size 15 cm.dia	2 days	Tue Feb 24, '15	Wed Feb 25, '15	47
50	Construction of Cement Concrete Kerb	3 days	Thu Feb 26, '15	Sat Feb 28, '15	49
51	Providing & fixing of Cement Concrete Kerb Stone of various grades of size 500	2 days	Mon Mar 2, '15	Tue Mar 3, '15	50
52	Providing and applying two coats of flat oil paint	2 days	Wed Mar 4, '15	Thu Mar 5, '15	51
53	Providing and constructing Brick Masonry Inspection chamber	2 days	Wed Mar 4, '15	Thu Mar 5, '15	51
54	Providing cements plaster 12 mm thk. In single	2 days	Wed Mar 4, '15	Thu Mar 5, '15	51

Fig.4 *Schedule of project (Contd.)*



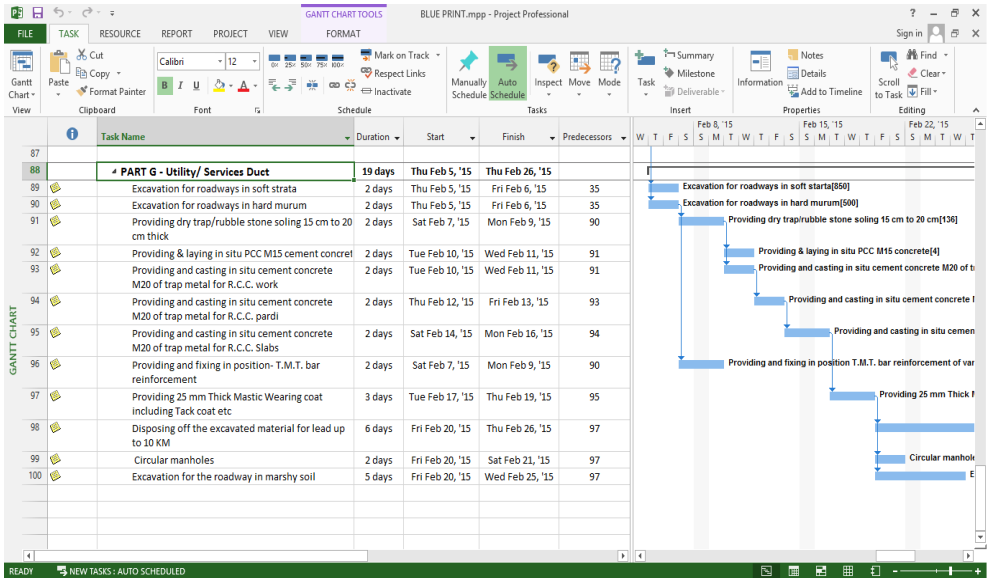
	Task Name	Duration	Start	Finish	Predecessors
55	Providing and laying Weep Holes for Drain, of 100 mm dia.	2 days	Wed Mar 4, '15	Thu Mar 5, '15	51
56	Providing & fixing in the FOOTPATH Concrete paving slabs(Flagstone)/ Paver blocks	4 days	Fri Mar 6, '15	Tue Mar 10, '15	55
57	Providing & fixing interlocking concrete paver	5 days	Fri Mar 6, '15	Wed Mar 11, '15	55
58	Providing & fixing 0.91 m X 0.61 m Composite rasin Manhole cover with frame	3 days	Fri Mar 6, '15	Mon Mar 9, '15	55
59	Providing railing of mild steel	2 days	Wed Mar 11, '15	Thu Mar 12, '15	56
60					
61	**PART E - Slab culvert**	**38 days**	**Thu Feb 5, '15**	**Fri Mar 20, '15**	
62	Excavation for roadways in hard murum including dressing section	2 days	Thu Feb 5, '15	Fri Feb 6, '15	35
63	Excavation for roadways in hard murum & boulder	2 days	Thu Feb 5, '15	Fri Feb 6, '15	35
64	Excavation for roadways in hard strata	2 days	Thu Feb 5, '15	Fri Feb 6, '15	35
65	Excavation for roadways in hard strata such as hard rock	2 days	Thu Feb 5, '15	Fri Feb 6, '15	35
66	Providing dry trap/rubble stone soling 15 cm to 20 cm thick	2 days	Sat Feb 7, '15	Mon Feb 9, '15	65
67	Providing & laying in situ PCC M15 cement concret	2 days	Tue Feb 10, '15	Wed Feb 11, '15	66
68	Providing and laying in situ controlled M20 using Batching plant	2 days	Tue Feb 10, '15	Wed Feb 11, '15	66
69	Providing & laying in situ M25 using Batching plant	2 days	Tue Feb 10, '15	Wed Feb 11, '15	66
70	Providing and laying in situ M30 I /II reinforcement cement concrete	2 days	Tue Feb 10, '15	Wed Feb 11, '15	66
71	Providing and fixing in position-T.M.T. bar	2 days	Tue Feb 10, '15	Wed Feb 11, '15	66

Fig.5 *Schedule of project (Contd.)*



	Task Name	Duration	Start	Finish	Predecessors
72	Providing bitumen mastic wearing coat of 25mm thick including tack coat	2 days	Thu Feb 12, '15	Fri Feb 13, '15	71
73	Providing trap/ granite/ quartzite /gneiss rubble filling	2 days	Sat Feb 14, '15	Mon Feb 16, '15	72
74	Providing & fixing in position expansion joint with 25 mm bituminous pad	2 days	Sat Feb 14, '15	Mon Feb 16, '15	72
75	Dewatering on BHP basis	30 days	Sat Feb 14, '15	Fri Mar 20, '15	72
76					
77	**PART F - Cross Pipe Duct**	**11 days**	**Thu Feb 5, '15**	**Tue Feb 17, '15**	
78	Excavation for roadways in soft strata	2 days	Thu Feb 5, '15	Fri Feb 6, '15	35
79	Excavation for roadways in hard murum	2 days	Thu Feb 5, '15	Fri Feb 6, '15	35
80	Excavation for roadways in hard murum & boulder	2 days	Sat Feb 7, '15	Mon Feb 9, '15	79
81	Excavation for roadways in hard strata such as soft rock	2 days	Sat Feb 7, '15	Mon Feb 9, '15	79
82	Excavation for roadways in hard strata such as hard rock	2 days	Sat Feb 7, '15	Mon Feb 9, '15	79
83	Providing & laying in situ PCC M15 cement concret	2 days	Tue Feb 10, '15	Wed Feb 11, '15	82
84	Providing and casting in situ cement concrete M20	2 days	Tue Feb 10, '15	Wed Feb 11, '15	82
85	Providing and laying cement concrete pipe of IS 458-1988	7 days	Tue Feb 10, '15	Tue Feb 17, '15	82
86	Providing dry trap rubble stone Soling 15 to 23 cm Thk.	2 days	Tue Feb 10, '15	Wed Feb 11, '15	82
87					
88	**PART G - Utility/ Services Duct**	**19 days**	**Thu Feb 5, '15**	**Thu Feb 26, '15**	

Fig 6. *Schedule of project (Contd.)*



	Task Name	Duration	Start	Finish	Predecessors
87					
88	**PART G - Utility/ Services Duct**	**19 days**	**Thu Feb 5, '15**	**Thu Feb 26, '15**	
89	Excavation for roadways in soft strata	2 days	Thu Feb 5, '15	Fri Feb 6, '15	35
90	Excavation for roadways in hard murum	2 days	Thu Feb 5, '15	Fri Feb 6, '15	35
91	Providing dry trap/rubble stone soling 15 cm to 20 cm thick	2 days	Sat Feb 7, '15	Mon Feb 9, '15	90
92	Providing & laying in situ PCC M15 cement concret	2 days	Tue Feb 10, '15	Wed Feb 11, '15	91
93	Providing and casting in situ cement concrete M20 of trap metal for R.C.C. work	2 days	Tue Feb 10, '15	Wed Feb 11, '15	91
94	Providing and casting in situ cement concrete M20 of trap metal for R.C.C. pardi	2 days	Thu Feb 12, '15	Fri Feb 13, '15	93
95	Providing and casting in situ cement concrete M20 of trap metal for R.C.C. Slabs	2 days	Sat Feb 14, '15	Mon Feb 16, '15	94
96	Providing and fixing in position- T.M.T. bar reinforcement	2 days	Sat Feb 7, '15	Mon Feb 9, '15	90
97	Providing 25 mm Thick Mastic Wearing coat including Tack coat etc	3 days	Tue Feb 17, '15	Thu Feb 19, '15	95
98	Disposing off the excavated material for lead up to 10 KM	6 days	Fri Feb 20, '15	Thu Feb 26, '15	97
99	Circular manholes	2 days	Fri Feb 20, '15	Sat Feb 21, '15	97
100	Excavation for the roadway in marshy soil	5 days	Fri Feb 20, '15	Wed Feb 25, '15	97

Fig 7. *Schedule of project (Contd.*

III. Results And Discussions

***Table No2**. Values of BCWS, BCWP and ACWP at various dates*

Sr. No.	Status Date	Planned Value - PV (BCWS)	Earned Value - EV (BCWP)	AC (ACWP)
1	15-Oct-14	644,635.90	131,938.80	149,100.66
2	1-Nov-14	4,030,220.31	1,891,327.15	1,951,477.53
3	15-Nov-14	9,703,078.76	6,856,313.76	6,954,199.40
4	1-Dec-14	16,194,978.26	11,452,573.76	11,570,685.73
5	15-Dec-15	21,533,633.76	15,971,473.61	16,162,467.17
6	1-Jan-15	28,162,404.66	23,301,306.00	23,508,903.34
7	15-Jan-15	32,610,285.26	28,024,305.26	28,788,354.95
8	1-Feb-15	35,429,188.86	32,610,285.26	33,848,917.10
9	15-Feb-15	41,577,639.24	33,182,762.58	34,501,502.22
10	1-Mar-15	51,008,834.58	38,268,129.82	39,820,965.91
11	15-Mar-15	57,912,076.25	47,804,932.50	49,570,978.49

***Table No.3.** Schedule performance parameters*

Sr. No.	Status Date	SV	SV%	SPI	Critical Ratio
1	15-Oct-14	-512,697.10	-80%	0.2	0.176
2	1-Nov-14	-2,138,893.16	-53%	0.47	0.4559
3	15-Nov-14	-2,846,765.00	-29%	0.71	0.7029
4	1-Dec-14	-4,742,404.51	-29%	0.71	0.7029
5	15-Dec-15	-5,562,160.15	-26%	0.74	0.7326
6	1-Jan-15	-4,861,098.66	-17%	0.83	0.8217
7	15-Jan-15	-4,585,979.99	-14%	0.86	0.8342
8	1-Feb-15	-2,818,903.60	-8%	0.92	0.8832
9	15-Feb-15	-8,394,876.66	-20%	0.8	0.768
10	1-Mar-15	-12,740,704.76	-25%	0.75	0.72
11	15-Mar-15	-10,107,143.75	-17%	0.83	0.7968

***Table No.4.** Cost performance parameters*

Sr. No.	Status Date	CV	CV%	CPI
1	15-Oct-14	- 17,161.86	-13%	0.88
2	1-Nov-14	- 60,150.38	-3%	0.97
3	15-Nov-14	- 97,885.64	-1%	0.99
4	1-Dec-14	-118,111.98	-1%	0.99
5	15-Dec-15	- 190,993.56	-1%	0.99
6	1-Jan-15	- 207,597.34	-1%	0.99
7	15-Jan-15	-764,049.68	-3%	0.97
8	1-Feb-15	-1,238,631.84	-4%	0.96
9	15-Feb-15	- 1,318,739.64	-4%	0.96
10	1-Mar-15	- 1,552,836.09	-4%	0.96
11	15-Mar-15	- 1,766,045.99	-4%	0.96

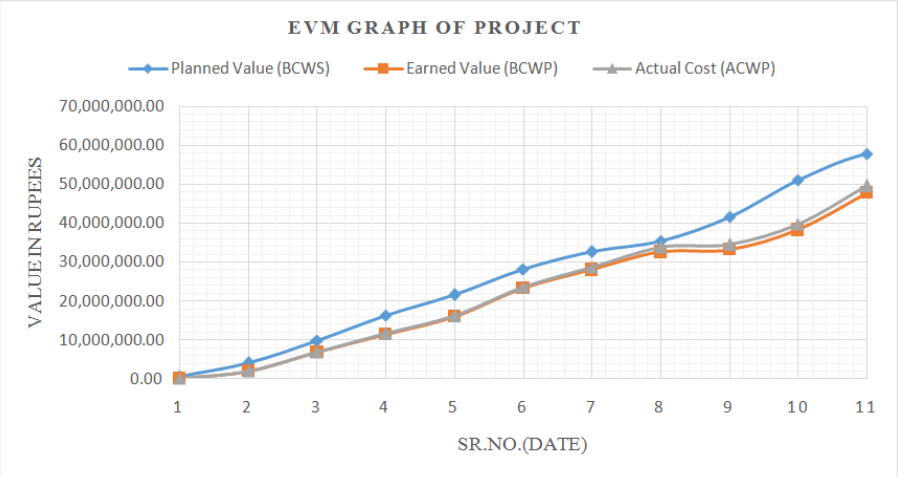


Fig 8. EVM Graph throughout project life

Above graph is cost vs. Sr.No. (STATUS DATE) which shows Behaviour of Earned Value, Planned Value and actual cost of construction work throughout the entire project lifecycle. It shows values of ACWS, BCWP and ACWP on the respective status date.

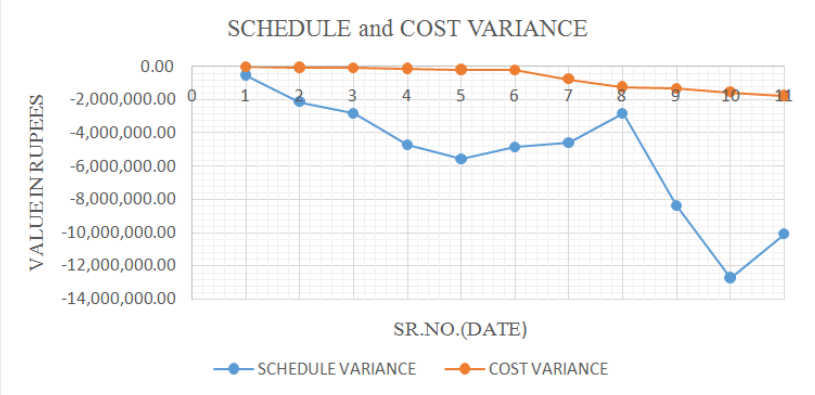


Fig.9.*Cost and schedule Variances at different status dates*

Above graph is cost vs. Sr.No. (STATUSDATE) which shows Behaviour Schedule and cost variance of construction work throughout the entire project lifecycle. It shows values of SV and CV on the respective status date. All the values are negative which results that more money has been spent and more time is required to complete the project.

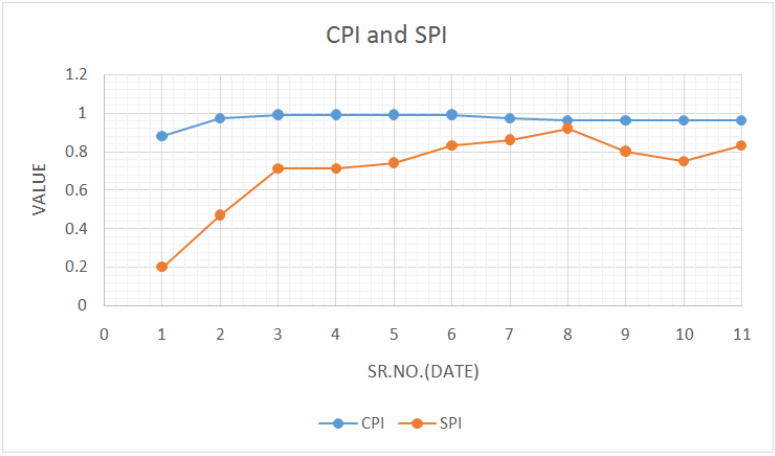


Fig.10.*Cost and Schedule Performance Index at various status dates*

Above graph is value vs. Sr.No. (STATUSDATE) which shows Behaviour Schedule Performance Index and cost Performance Index of construction work throughout the entire project lifecycle. It shows values of SPI and CPI on the respective status date. All the values are less than 1 which shows that project is cost overrun and delay.

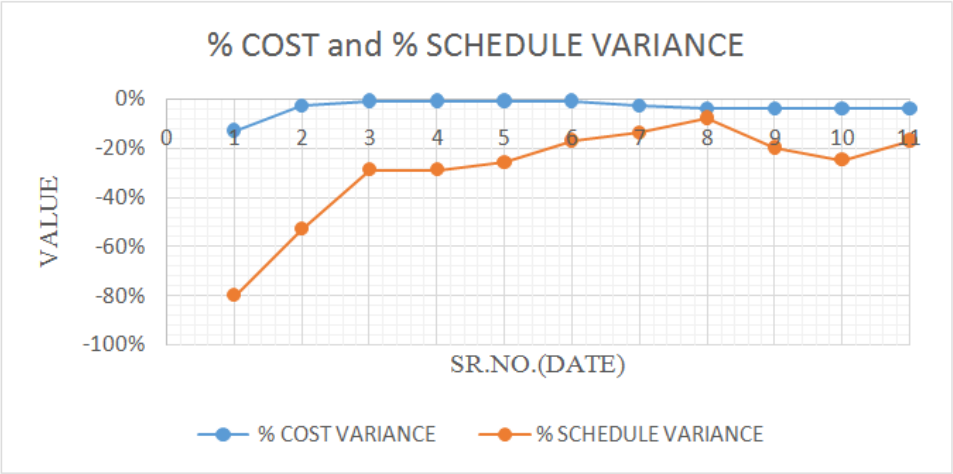


Fig.11. *% Cost and % schedule Variances at different status dates*

Above graph is cost vs. Sr.No. (STATUSDATE) which shows Behaviour Percentage Schedule and Percentage cost variance of construction work throughout the entire project lifecycle. It shows values of %SV and %CV on the respective status date. All the values are negative which results that more money has been spent and more time is required to complete the project. Also it shows how much more cost and time consumed in percentage of planned baseline.

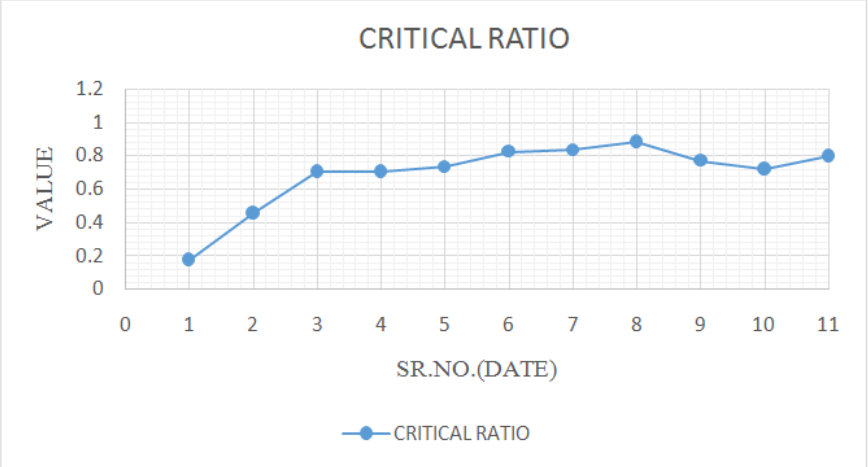


Fig. 12. *% Critical Ratio at different status dates*

Above graph is value vs. Sr.No. (STATUSDATE) which shows Behaviour critical ratio of construction work throughout the entire project lifecycle. It shows values of critical ratio on the respective status date. All the values are less than 1 which results that more money has been spent and more time is required to complete the project. Project delayed and cost overrun.

Table No.5.*Critical analysis of values of CV, SV, SPI and CPI.*

Sr. No.	Status Date	SV	CV	SPI	CPI	Status of Project
1	15-Oct-14	Negative value hence behind the schedule	Rs.17161.86 more money has been spent than planned baseline	0.2<1,hence project is performing at rate 20% of planned baseline	0.88<1,hence project is cost overrun	Cost Overrun and delayed
2	1-Nov-14	Negative value hence behind the schedule	Rs.60150.38 more money has been spent than planned baseline	0.47<1,hence project is performing at rate 47% of planned baseline	0.97<1,hence project is cost overrun	Cost Overrun and delayed
3	15-Nov-14	Negative value hence behind the schedule	Rs.97885.64 more money has been spent than planned baseline	0.71<1,hence project is performing at rate 71% of planned baseline	0.99<1,hence project is cost overrun	Cost Overrun and delayed
4	1-Dec-14	Negative value hence behind the schedule	Rs.118111.98 more money has been spent than planned baseline	0.71<1,hence project is performing at rate 71% of planned baseline	0.99<1,hence project is cost overrun	Cost Overrun and delayed
5	15-Dec-15	Negative value hence behind the schedule	Rs.190993.56 more money has been spent than planned baseline	0.74<1,hence project is performing at rate 74% of planned baseline	0.99<1,hence project is cost overrun	Cost Overrun and delayed
6	1-Jan-15	Negative value hence behind the schedule	Rs.207597.34 more money has been spent than planned baseline	0.83<1,hence project is performing at rate 83% of planned baseline	0.99<1,hence project is cost overrun	Cost Overrun and delayed
7	15-Jan-15	Negative value hence behind the schedule	Rs.764049.68 more money has been spent than planned baseline	0.86<1,hence project is performing at rate 86% of planned baseline	0.97<1,hence project is cost overrun	Cost Overrun and delayed
8	1-Feb-15	Negative value hence behind the schedule	Rs.1238631.84 more money has been spent than planned baseline	0.92<1,hence project is performing at rate 92% of planned baseline	0.96<1,hence project is cost overrun	Cost Overrun and delayed
9	15-Feb-15	Negative value hence behind the schedule	Rs.1318739.64 more money has been spent than	0.8<1,hence project is performing at rate 80% of planned baseline	0.96<1,hence project is cost	Cost Overrun and delayed

			planned baseline		overrun	
10	1-Mar-15	Negative value hence behind the schedule	Rs.1552836.09 more money has been spent than planned baseline	0.75<1,hence project is performing at rate 75% of planned baseline	0.96<1,hence project is cost overrun	Cost Overrun and delayed
11	15-Mar-15	Negative value hence behind the schedule	Rs.1766045.99 more money has been spent than planned baseline	0.83<1,hence project is performing at rate 83% of planned baseline	0.96<1,hence project is cost overrun	Cost Overrun and delayed

IV. Conclusion

Status of project worked out on 15th March 2015 by comparing planned baseline & actual progress. The values of performance measures for each activity is also calculated. This helps to control each activity according to their work progress. Earned value (BCWP) of project is Rs. 47,804,932.50, Planned Value (BCWS) is Rs. 57,912,076.25, and Actual Cost is (ACWP) Rs 49,570,978.49. Hence, the Cost variance is Rs. (-1,766,045.99),and Schedule variance is Rs. (-10,107,143.75), %SV is -17%. Project has negative value of Cost variance means more amount of Rs. 1,766,045.99 has been spent than planned baseline. Cost performance Index (CPI) is 0.96 and Schedule performance index (SPI) is 0.83. Cost Performance Index (CPI) is 0.96 and Schedule Performance Index (SPI) is 0.83 which signals that project is Cost overrun and delayed respectively. A SPI of 0.83 shows that the project is only progressing at 83% of the rate originally planned.

Time utilization is good and resources are consumed less efficiently. Project cost is likely to be Rs. 57,912,076.25 And cost variance is likely to be -1,766,045.99 which hints that Seventeen lakhs sixty six thousands and forty five rupees is more spent than the planned one. Construction project has no particular standard Behaviour. It is much different than the planned one. Project performance of an infrastructure at every status date was behind the schedule and more amount has been spent for execution than the planned baseline.Critical Ratio is 0.7968 which is less than 1 hence project is delayed and cost overrun.

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