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Scheduling and Monitoring of Ongoing Bypass Construction Connecting NH 218 & NH 63 Using Primavera P6

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ABSTRACT

Infrastructure development plays a significant role in development of country. Road transport brings about a variety of benefits via all sectors of economy. Highway construction are benchmark to measure development of country. At present in India, there is a huge increase in demand for road construction projects. Project management plays a vital role in construction industry. Any construction projects require proper planning, scheduling and monitoring for good performance. We have observed many road construction projects running out of planned time and cost.

The work performed deals with scheduling and monitoring ongoing bypass construction connecting NH 218 and NH 63 using project management software Primavera P6. The length of this project bypass is 11.5 Kms, out of which, 3.80 Kms is being constructed by NH (PWD) Division, Hubli and balance stretch of 7.7 Kms is under construction by NHAI. Total width of land acquired for bypass construction is 60 mts in general and varies at junctions & interchanges. 4-Lane configuration of flexible pavement with median, lighting, construction of RE wall, ROB, minor bridges, culverts and VUPs etc., This project is having most of the variety of civil engineering structures.

Using primavera software, all the activities with practical durations to complete are created, ideal schedule is created, baselines are set for planned schedule, schedule is updated to a particular date, monitoring is done by using Earned Value Analysis (EVA) technique.

During the study reasons for cost variation and delays in construction of current project are identified. Importance of scheduling and monitoring of construction work to complete the project within time and cost are discussed.

Keywords: Scheduling, Monitoring, Road Construction, Using Primavera P6.

1. INTRODUCTION

Primavera is the Project Management Tool (software) that helps in planning the resources, monitor and control for a project. It is not only used in Civil Engineering but also other fields such as IT, Mechanical, Electrical, etc. It is based on Critical Path Method. A project might have many stages, and these stages can be clustered in different ways using various terminologies and methodologies. One broadly used and commonly believed classification is:

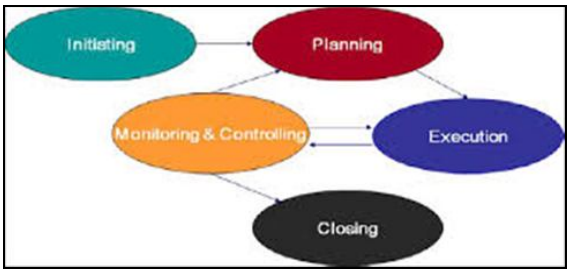


Figure 1: Project Lifecycle

Initiation – deciding whether to continue finding funding and resources.
Planning – computing scope, creating the schedule, and planning resources.
Execution – carrying out the work to create the project deliverables.
Controlling – gauging progress and making corrective actions as the project progresses.
Closing – delivering the project and reviewing lessons learned.

Primavera replicates exclusive professional actions and challenges that construction and engineering firms expect, empowering to:

1. Generate the critical path quickly.
2. Provide resources such as material, machinery and manpower on daily, weekly and monthly basics.
3. Provide platform for updating the progress.
4. Forecast when the project will be completed.
5. Earn Value Analysis [EVA] indicating whether project is on time, ahead or behind and at what cost.
6. Filing the document of lessons learnt for future reference.
7. Protect against claims: Primavera software allows to thoroughly impose a reliable procedure, ensuring responsibility of all project members and management of revised agreements.
8. Surge productivity by standardization: Enables standardization of corporate procedures throughout the projects which helps in project partnership and implementation. Benefits like greater reliability, meaningful metrics, and standardized reports throughout the project leading ultimately to an improved bottom line.
9. Inspect projects anytime and in anyplace: Primavera is 100% accessible over web and as easy to organize and utilize in home office as in site.
10. Avoid expensive shocks: Primavera software responses to instantaneously by allowing to access critical project data. By proper study and forecast, we can spot problems in premature stage, ease risks and do everyday development corrections beforehand of any crisis.
11. Optimize men, material, machinery: Stabilize resource necessities through numerous projects relating manpower, materials and machineries. Identification of bulk resources in fulfilling future project and program requirements.
12. Measure performance: This software helps to encounter specialized aims by bring into line projects and programs with planned specialized aims. By this, one can see throughout projects and prioritize their pending work, plan and assign resources accordingly and actively achieve the work and simply link the performance and agendas to the client. By vigorously linked graphical analysis, one can regulate cash flow by rapidly chasing present and upcoming cash flow effect. Also, other critical issues throughout the plans.
13. Regulate work charges: With this software, observation of performance of numerous projects at a glimpse up to completion can be done. Project performance measures, with real performance forecasts, auxiliary action can be done to keep project on path. Database level rate sheet inevitably gathers and summarizes cost particulars throughout numerous projects. By this one can track costs by end of each pace. Collection and establishment of data in an easy-to-understand form can be done to analyze the variances.
14. Take full advantage of bulk resources: Resource planning in this software can be done on top to down and bottom to up conditions. Future resource requirement both machinery and manpower throughout the company can be plot beforehand.
15. Allow combined scheduling: In Primavera one can generate, schedule and manage both simple and complex projects. One can understand and update only information that they need because of user level security. Entire project team gets benefited by this. Adding, removing and alteration is possible with communicating support team using Gantt charts. From work breakdown structure (WBS), activities, and relationships to resource allocation and costs everything can be done with combined scheduling provision.

2. OBJECTIVE OF STUDY

The objectives set for scheduling and monitoring of ongoing bypass construction connecting NH 218 and NH 63 are as follows:

1. To determine the practical durations that are required to complete the activities involved in ongoing construction.
2. Presentation of ideal road construction schedule.
3. Setting of base-line for planned schedule.
4. To suggest a layout for updating the schedule.
5. Tracking the project performance by EVA in terms of time and cost.
6. Generation of reports, which can be used as a reference for future projects.
7. To identify reasons for cost variation and delays in construction.
8. Listing of construction work monitoring importance.

3. METHODOLOGY

Two main phases in methodology adopted are: Phase one is collections of necessary data and second phase is to analyse the collected data in Primavera P6. For the cost analysis, research methodology flow is as follows:

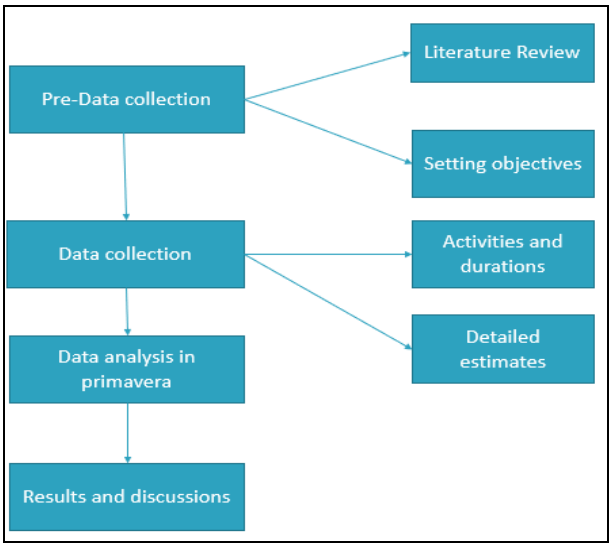


Figure 2: Research Methodology

3.1 Site Details

Working site details are as follows:

Name of the Project	Construction of bypass around Hubli city connecting NH-218 and NH-63, Karnataka.
Owner of the Project	PWD Division, Hubli, Karnataka
Contractor	Concord constructions and VKEC [V K Engg. Constructions Engineers & Contractors] as a joint venture.
Project manager	N. Nithyanand.
Location	Bommapur village, towards Gadag.
Length of Road Under Construction	3.8 Kms.
Project Start date	January 2, 2017
Duration	2 years
Planned Project Cost	Rs. 63,62,05,597.78/-

Table 1: Site Details

3.2 Data Collection

In pre-data collection phase papers on various construction projects using primavera were studied to set the objectives and understand data to be collected for research. Data collection:

- Planned and actual schedule dates.
- Planned cost estimate and actual cost.

Data collected was analysed in primavera P6 software to achieve the set objectives.

3.3 Analysis of Data in Primavera P6

The data collected was used in primavera for generating project and tracking the project performance in terms of time and cost. Data flow in primavera software is as follows:

1. EPS within which the project has to be created is created or if exists already, it is selected for creation of project.
2. Creating a project.
3. Spitting the project into various Work Breakdown Structures (WBS).
4. Spitting WBS into various activities involved.
5. Assigning logic relationships/ interrelationships between the activities.

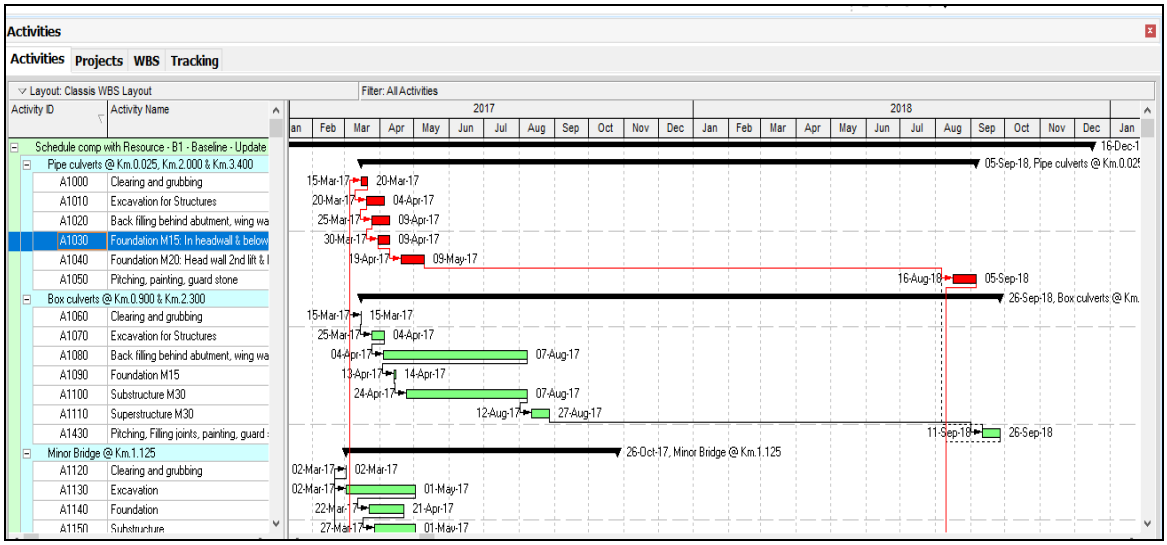
6. Scheduling of activities by critical path method [CPM].
7. Allocating resources for activities.
8. Setting up baseline as per planned dates.
9. Updating the project progress on required date.
10. Tracking the project performance by Earned Value Analysis (EVA).
11. Run reports for future reference.

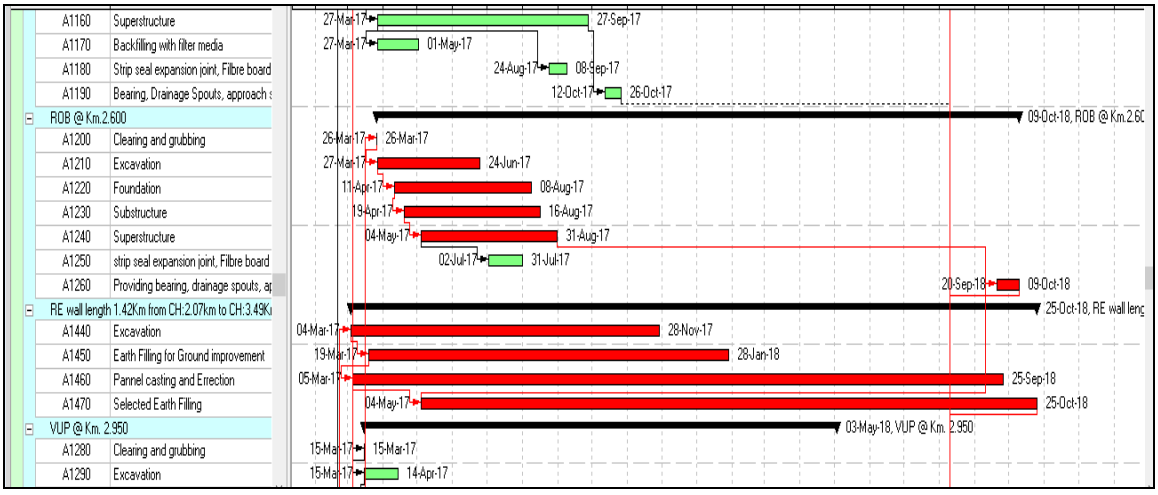
4. RESULTS

Using Primavera the following results were obtained according to the objectives set.

4.1 Activity Durations and Scheduling

Durations in terms of days for all the activities involved in construction was determined by discussion with the site engineer as shown in figure 5.1. A 7Days-9Hrs working calendar was adopted for scheduling of activities.
The Predecessors and Successors tabs show a list of activities that either precede or succeed the current activity. Relationships were assigned among the activities to specify when the activity can begin and finish. Once relationships are assigned, project was scheduled for computing completion dates for every activity.
Critical path was identified which is the longest path in terms of time connecting initial and end events. Events and activities in critical path are measured as critical that is a little delay in these activity occurrences delays project accomplishment. This also indicates that resources of non-critical events or activities can be shifted partially to critical ones to complete the project on time.
An ideal schedule for road construction was achieved using Primavera P6.





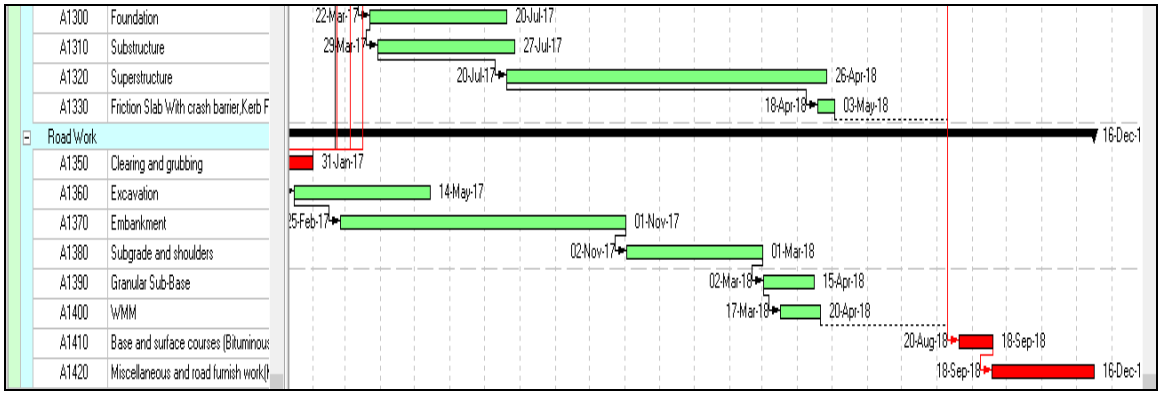


Figure 3: Activity duration and scheduling

4.2 Resource Creation and Allocation

Resources are items needed for completion of the activities. It may be labor, machinery or materials.
The following steps are followed for resources in Primavera Project Management:

- Create resources in the resource page.
- Assign the resource to the activities.
- Estimate the cost for the activities and for the project.

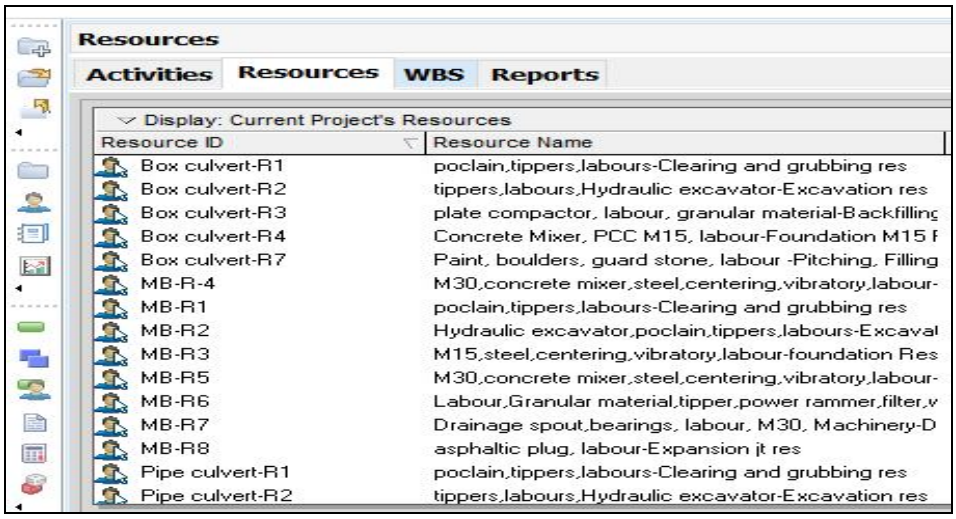


Figure 4: Resource creation and allocation

4.3 Baseline (BL) for Planned Schedule

After scheduling the project, baseline was assigned as a copy of current project plan. As base-line is reflection of plan, it is utilized in comparing actual progress against planned progress as shown in figure 5. Also, in Gantt chart it can be made visible as a yellow strip below the activity duration strip as shown in figure 6.
At any point of time, performance of the project can be monitored after updating the project progress. Whether the project is ahead schedule, on schedule or behind schedule.

Activities

Activities | Projects | WBS | Tracking

Layout: Classis WBS Layout | Filter: All Activities

Activity ID	Activity Name	BL Project Duration	BL Project Start	BL Project Finish	Actual Duration	Actual Start	Actual Finish	Predecessors	Predecessor Details
Schedule comp	with Resource - B1 - Baseline - Update correct date	714d	02-Jan-17	16-Dec-18	449d	02-Jan-17			
Pipe culverts @ Km.0.025, Km.2.000 & Km.3.400		540d	15-Mar-17	05-Sep-18	56d	15-Mar-17			
A1000	Clearing and grubbing	6d	15-Mar-17	20-Mar-17	6d	15-Mar-17	20-Mar-17	A1350	A1350: SS 72d
A1010	Excavation for Structures	16d	20-Mar-17	04-Apr-17	16d	20-Mar-17	04-Apr-17	A1000	A1000: FS -1d
A1020	Back filling behind abutment, wing wall, return wall and foundation trenches	16d	25-Mar-17	09-Apr-17	16d	25-Mar-17	09-Apr-17	A1010	A1010: SS 5d
A1030	Foundation M15: In headwall & below pipe	11d	30-Mar-17	09-Apr-17	11d	30-Mar-17	09-Apr-17	A1020	A1020: SS 5d
A1040	Foundation M20: Head wall 2nd lift & Parapet wall	21d	19-Apr-17	09-May-17	21d	19-Apr-17	09-May-17	A1030	A1030: SS 20d
A1050	Pitching, painting, guard stone	21d	16-Aug-18	05-Sep-18	0d			A1430, A1040	A1430: SS -34(
Box culverts @ Km.0.900 & Km.2.300		561d	15-Mar-17	26-Sep-18	196d	15-Mar-17			
A1060	Clearing and grubbing	1d	15-Mar-17	15-Mar-17	1d	15-Mar-17	15-Mar-17	A1350	A1350: SS 72d
A1070	Excavation for Structures	11d	25-Mar-17	04-Apr-17	11d	25-Mar-17	04-Apr-17	A1060	A1060: FS 9d
A1080	Back filling behind abutment, wing wall, return wall and foundation trenches	126d	04-Apr-17	07-Aug-17	126d	04-Apr-17	07-Aug-17	A1070	A1070: FS -1d
A1090	Foundation M15	2d	13-Apr-17	14-Apr-17	2d	13-Apr-17	14-Apr-17	A1080	A1080: FS -117
A1100	Substructure M30	106d	24-Apr-17	07-Aug-17	106d	24-May-17	06-Sep-17	A1090	A1090: SS 11d
A1110	Superstructure M30	16d	12-Aug-17	27-Aug-17	16d	11-Sep-17	26-Sep-17	A1100	A1100: FS 4d
A1430	Pitching, Filling joints, painting, guard stone	16d	11-Sep-18	26-Sep-18	0d			A1110	A1110: FS 379
Minor Bridge @ Km.1.125		239d	02-Mar-17	26-Oct-17	363d	28-Mar-17			
A1120	Clearing and grubbing	1d	02-Mar-17	02-Mar-17	1d	28-Mar-17	28-Mar-17	A1350	A1350: SS 59d
A1130	Excavation	61d	02-Mar-17	01-May-17	55d	29-Mar-17	22-May-17	A1120	A1120: FS -1d
A1140	Foundation	31d	22-Mar-17	21-Apr-17	34d	31-May-17	03-Jul-17	A1130	A1130: FS -41(
A1150	Substructure	36d	27-Mar-17	01-May-17	216d	23-Jul-17	23-Feb-18	A1140	A1140: FS -26(
A1160	Superstructure	185d	27-Mar-17	27-Sep-17	246d	23-Jul-17		A1150	A1150: SS
A1170	Backfilling with filter media	36d	27-Mar-17	01-May-17	233d	05-Aug-17		A1160	A1160: SS
A1180	Strip seal expansion joint, Filbre board	16d	24-Aug-17	08-Sep-17	0d			A1160	A1160: SS 150
A1190	Bearing, Drainage Spouts, approach slab, joint sealing , crash barrier, PVC ul	15d	12-Oct-17	26-Oct-17	0d			A1160	A1160: FS 14d
ROB @ Km.2.600		563d	26-Mar-17	09-Oct-18	365d	26-Mar-17			
A1200	Clearing and grubbing	1d	26-Mar-17	26-Mar-17	1d	26-Mar-17	26-Mar-17	A1350	A1350: SS 83d
A1210	Excavation	90d	27-Mar-17	24-Jun-17	43d	11-Feb-18		A1200	A1200: FS
A1220	Foundation	120d	11-Apr-17	08-Aug-17	41d	13-Feb-18		A1210	A1210: SS 15d
A1230	Substructure	120d	19-Apr-17	16-Aug-17	0d	25-Apr-18		A1220	A1220: SS 8d
A1240	Superstructure	120d	04-May-17	31-Aug-17	0d			A1230	A1230: SS 15d
A1250	strip seal expansion joint, Filbre board	30d	02-Jul-17	31-Jul-17	0d			A1240	A1240: SS 59d
A1260	Providing bearing, drainage spouts, approach slab, crash barrier, RCC handr	20d	20-Sep-18	09-Oct-18	0d			A1240, A1470	A1240: FS 384
RE wall length 1.42Km from CH:2.07km to CH:3.49Km		601d	04-Mar-17	25-Oct-18	388d	04-Mar-17			
A1440	Excavation	270d	04-Mar-17	28-Nov-17	368d	04-Mar-17	07-Mar-18	A1350	A1350: SS 61d
A1450	Earth Filling for Ground improvement	316d	19-Mar-17	28-Jan-18	373d	19-Mar-17	27-Mar-18	A1440	A1440: SS 15d
A1460	Pannel casting and Erection	570d	05-Mar-17	25-Sep-18	386d	05-Mar-17		A1450	A1450: SS -14(
A1470	Selected Earth Filling	540d	04-May-17	25-Oct-18	326d	04-May-17		A1460	A1460: SS 60d
VUP @ Km. 2.950		415d	15-Mar-17	03-May-18	376d	15-Mar-17			
A1280	Clearing and grubbing	1d	15-Mar-17	15-Mar-17	1d	15-Mar-17	15-Mar-17	A1350	A1350: FS 42d
A1290	Excavation	30d	15-Mar-17	14-Apr-17	4d	15-Mar-17	19-Mar-17	A1280	A1280: FS
A1300	Foundation	120d	22-Mar-17	20-Jul-17	120d	28-Apr-17	25-Aug-17	A1290	A1290: SS 7d
A1310	Substructure	120d	29-Mar-17	27-Jul-17	120d	08-Aug-17	05-Dec-17	A1300	A1300: SS 7d
A1320	Superstructure	280d	20-Jul-17	26-Apr-18	118d	28-Nov-17		A1310	A1310: SS 113
A1330	Friction Slab With crash barrier,Kerb Fixing, painting, etc..	15d	18-Apr-18	03-May-18	0d			A1320	A1320: SS 272
Road Work		714d	02-Jan-17	16-Dec-18	448d	02-Jan-17			
A1350	Clearing and grubbing	30d	02-Jan-17	31-Jan-17	31d	02-Jan-17	01-Feb-17		
A1360	Excavation	120d	15-Jan-17	14-May-17	121d	14-Feb-17	14-Jun-17	A1350	A1350: SS 13d
A1370	Embankment	250d	25-Feb-17	01-Nov-17	121d	27-Mar-17	25-Jul-17	A1360	A1360: SS 41d
A1380	Subgrade and shoulders	120d	02-Nov-17	01-Mar-18	244d	25-Jul-17		A1370	A1370: FS
A1390	Granular Sub-Base	45d	02-Mar-18	15-Apr-18	0d			A1380	A1380: FS
A1400	WMM	35d	17-Mar-18	20-Apr-18	0d			A1390	A1390: SS 15d
A1410	Base and surface courses (Bituminous)	30d	20-Aug-18	18-Sep-18	0d			A1050, A1430,	A1050: FS -17(
A1420	Miscellaneous and road furnish work(Kerb,painting,sign bord,signal light,road	90d	18-Sep-18	16-Dec-18	0d			A1410	A1410: FS -1d

Figure 5: Baseline for planned schedule and actual progress

4.4 Updating the Schedule

Manual update is done using physical % completion type as it is more practical.

Information like actual start date and remaining duration of activity is obtained after updating the project to a particular date. It is easy to compare the performance with respect to baseline.
In figure 6, yellow strip represents activity duration as per baseline set or planned duration of activity, blue strip represents activity duration as per actual progress, green strip shows the remaining duration for completion of activity. These processes cannot be done easily without using construction management software like primavera.

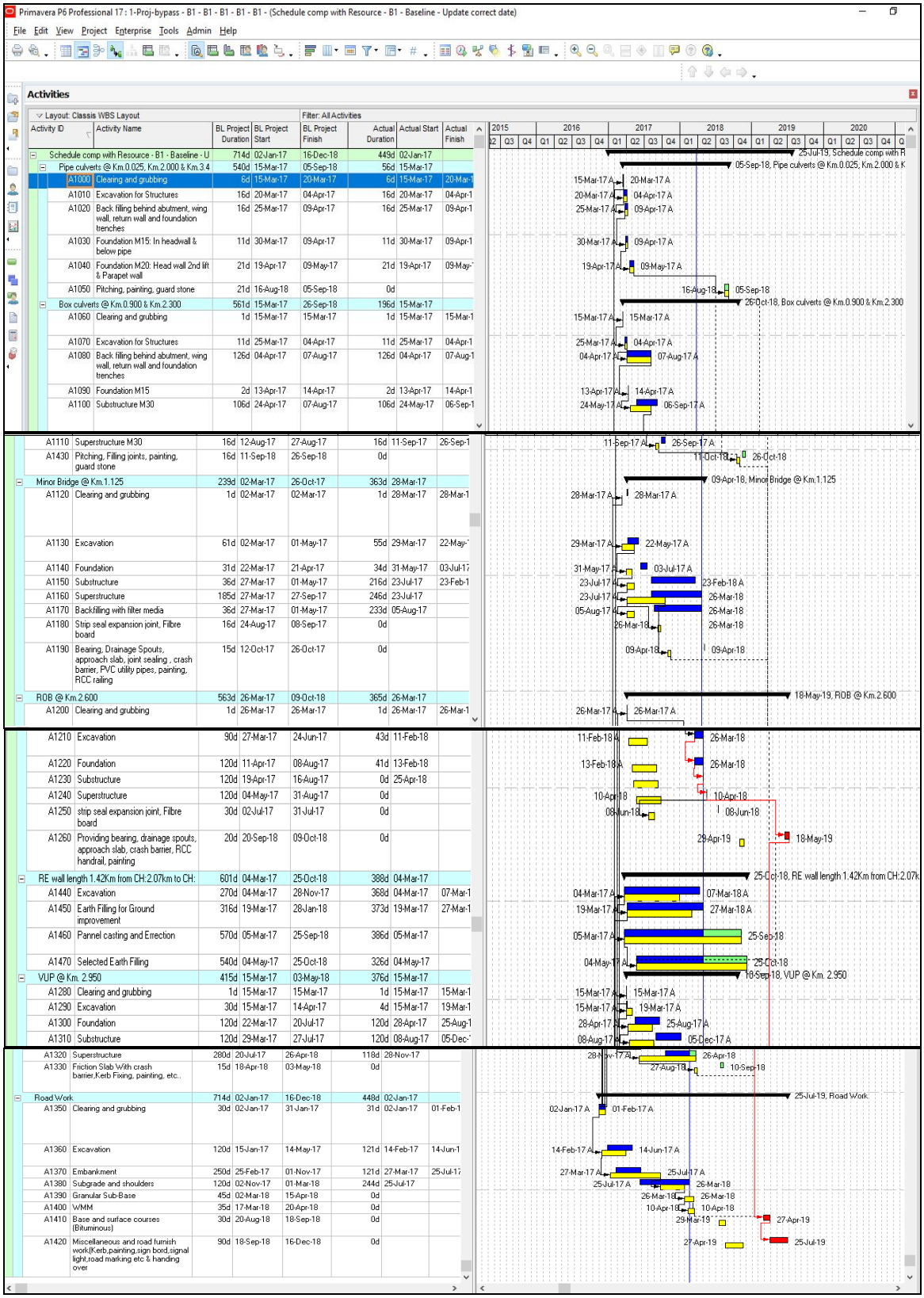


Figure 6: Updating the schedule

4.5 EVA Technique

This is commonly utilized performance quantifying technique. In simple words, it says how much one has to spend and how much one has actually spent. For this the following terms need to be recognized: Planned Value [PV], Actual Cost [AC] and Earned Value [EV].

1) Planned value [PV]: Planned costs of activities to be done through required period. It is also called as budgeted cost of work to be done. It is done during the planning stage.
2) Actual Cost [AC]: This is expenditure of executed work during the considered time period.
3) Earned Value [EV]: Value of execution accomplished to date. It is also called as budgeted cost of work executed.
4) Budgeted At Completion [BAC]: it is cumulative of planned value [PV].
5) Cost Variance [CV]: It will indicate whether the expenditure is higher than budgeted [displayed with negative sign] or lower than the budgeted [displayed with positive sign].

$$CV=EV-AC$$

6) Schedule Variance [SV]: It will indicate whether the dates of completion are ahead or behind the planned time.

$$SV= EV-PV$$

7) Performance Indexes: it is used to compute performance competences.
   7.1 Cost performance Index [CPI]: It is earned value divided by actual cost.

$$CPI=EV/AC$$

   If, CPI < 1, Project has got poor performance.
   CPI = 1, Project is right on target.
   CPI > 1, Project has got better than expected performance.

   7.2 Schedule performance index [SPI]: It is used in estimating the projected time to complete the project.

$$SPI=EV/PV$$

   If, SPI<1, Project has got poor performance.
   SPI=1, Project is right on target date of completion.
   SPI>1, Project has got better than expected performance.

8) Forecasting method
   1.1 Estimate At Completion [EAC]: It estimates total cost of project at accomplishment originated on what one knows currently regarding project performance till now and hazard quantification. It is basically an actual cost acquired till now plus estimate of remaining work.
   1.2 Estimate To Complete [ETC]: It is more predictable cost essential to complete the remaining work execution.

$$ETC=EAC-AC$$

   1.3 Variance At Completion [VAC]: It computes variance among budget at completion and estimate at completion.

$$VAC=BAC-EAC$$

4.6 Reports Generated

4.6.1 Tabular reports

4.6.1.1 Baseline and actual completion dates.

Activity ID	Activity Name	Activity Status	Actual Start	Actual Finish	BL Project Start	BL Project Finish
A1000	Clearing and grubbing	Completed	15-Mar-17	20-Mar-17	15-Mar-17	20-Mar-17
A1010	Excavation for Structures	Completed	20-Mar-17	04-Apr-17	20-Mar-17	04-Apr-17
A1020	Back filling behind abutment, wing wall, return wall and foundation trenches	Completed	25-Mar-17	09-Apr-17	25-Mar-17	09-Apr-17
A1030	Foundation M15: In headwall & below pipe	Completed	30-Mar-17	09-Apr-17	30-Mar-17	09-Apr-17
A1040	Foundation M20: Head wall 2nd lift & Parapet wall	Completed	19-Apr-17	09-May-17	19-Apr-17	09-May-17
A1050	Pitching, painting, guard stone	Not Started			16-Aug-18	05-Sep-18
A1060	Clearing and grubbing	Completed	15-Mar-17	15-Mar-17	15-Mar-17	15-Mar-17
A1070	Excavation for Structures	Completed	25-Mar-17	04-Apr-17	25-Mar-17	04-Apr-17

A1080	Back filling behind abutment, wing wall, return wall and foundation trenches	Completed	04-Apr-17	07-Aug-17	04-Apr-17	07-Aug-17
A1090	Foundation M15	Completed	13-Apr-17	14-Apr-17	13-Apr-17	14-Apr-17
A1100	Substructure M30	Completed	24-May-17	06-Sep-17	24-Apr-17	07-Aug-17
A1110	Superstructure M30	Completed	11-Sep-17	26-Sep-17	12-Aug-17	27-Aug-17
A1120	Clearing and grubbing	Completed	28-Mar-17	28-Mar-17	02-Mar-17	02-Mar-17
A1130	Excavation	Completed	29-Mar-17	22-May-17	02-Mar-17	01-May-17
A1140	Foundation	Completed	31-May-17	03-Jul-17	22-Mar-17	21-Apr-17
A1150	Substructure	Completed	23-Jul-17	23-Feb-18	27-Mar-17	01-May-17
A1160	Superstructure	In Progress	23-Jul-17		27-Mar-17	27-Sep-17
A1170	Backfilling with filter media	In Progress	05-Aug-17		27-Mar-17	01-May-17
A1180	Strip seal expansion joint, Filbre board	Not Started			24-Aug-17	08-Sep-17
A1190	Bearing, Drainage Spouts, approach slab, joint sealing , crash barrier, PVC utility pipes, painting, RCC railing	Not Started			12-Oct-17	26-Oct-17
A1200	Clearing and grubbing	Completed	26-Mar-17	26-Mar-17	26-Mar-17	26-Mar-17
A1210	Excavation	In Progress	11-Feb-18		27-Mar-17	24-Jun-17
A1220	Foundation	In Progress	13-Feb-18		11-Apr-17	08-Aug-17
A1230	Substructure	In Progress	25-Apr-18		19-Apr-17	16-Aug-17
A1240	Superstructure	Not Started			04-May-17	31-Aug-17
A1250	strip seal expansion joint, Filbre board	Not Started			02-Jul-17	31-Jul-17
A1260	Providing bearing, drainage spouts, approach slab, crash barrier, RCC handrail, painting	Not Started			20-Sep-18	09-Oct-18
A1280	Clearing and grubbing	Completed	15-Mar-17	15-Mar-17	15-Mar-17	15-Mar-17
A1290	Excavation	Completed	15-Mar-17	19-Mar-17	15-Mar-17	14-Apr-17
A1300	Foundation	Completed	28-Apr-17	25-Aug-17	22-Mar-17	20-Jul-17
A1310	Substructure	Completed	08-Aug-17	05-Dec-17	29-Mar-17	27-Jul-17
A1320	Superstructure	In Progress	28-Nov-17		20-Jul-17	26-Apr-18
A1330	Friction Slab With crash barrier,Kerb Fixing, painting, etc..	Not Started			18-Apr-18	03-May-18
A1350	Clearing and grubbing	Completed	02-Jan-17	01-Feb-17	02-Jan-17	31-Jan-17
A1360	Excavation	Completed	14-Feb-17	14-Jun-17	15-Jan-17	14-May-17
A1370	Embankment	Completed	27-Mar-17	25-Jul-17	25-Feb-17	01-Nov-17
A1380	Subgrade and shoulders	In Progress	25-Jul-17		02-Nov-17	01-Mar-18
A1390	Granular Sub-Base	Not Started			02-Mar-18	15-Apr-18
A1400	WMM	Not Started			17-Mar-18	20-Apr-18
A1410	Base and surface courses (Bituminous)	Not Started			20-Aug-18	18-Sep-18
A1420	Miscellaneous and road furnish work(Kerb,painting,sign bord,signal light,road marking etc & handing over	Not Started			18-Sep-18	16-Dec-18
A1430	Pitching, Filling joints, painting, guard stone	Not Started			11-Sep-18	26-Sep-18
A1440	Excavation	Completed	04-Mar-17	07-Mar-18	04-Mar-17	28-Nov-17
A1450	Earth Filling for Ground improvement	Completed	19-Mar-17	27-Mar-18	19-Mar-17	28-Jan-18
A1460	Pannel casting and Errection	In Progress	05-Mar-17		05-Mar-17	25-Sep-18
A1470	Selected Earth Filling	In Progress	04-May-17		04-May-17	25-Oct-18
	Total		**02-Jan-17**		**02-Jan-17**	**16-Dec-18**

Table 2: Baseline report

1. Table showing WBS cost details.

1-Proj-bypass - B1 - B1 - B1 - B1 - B1 -.Pipe culvert	Pipe culverts @ Km.0.025, Km.2.000 & Km.3.400	Rs4,190,030.00	Rs5,155,755.00	Rs81,322.00	(Rs1,047,047.00)
1-Proj-bypass - B1 - B1 - B1 - B1 - B1 -.Box Culvert	Box culverts @ Km.0.900 & Km.2.300	Rs13,517,711.00	Rs13,941,188.00	Rs815,716.00	(Rs1,239,193.00)
1-Proj-bypass - B1 - B1 - B1 - B1 - B1 -.Minor Bridge	Minor Bridge @ Km.1.125	Rs28,189,587.00	Rs35,102,712.60	Rs134,800.73	(Rs7,047,926.34)
1-Proj-bypass - B1 - B1 - B1 - B1 - B1 -.ROB	ROB @ Km.2.600	Rs71,221,435.86	Rs28,042,308.40	Rs64,823,546.31	(Rs21,644,418.85)
1-Proj-bypass - B1 - B1 - B1 - B1 - B1 -.RE wall	RE wall length 1.42Km from CH:2.07km to CH:3.49Km	Rs207,238,438.34	Rs117,292,103.40	Rs101,013,097.65	(Rs11,066,762.71)
1-Proj-bypass - B1 - B1 - B1 - B1 - B1 -.VUP	VUP @ Km. 2.950	Rs37,451,002.43	Rs64,253,383.32	Rs6,590,626.39	(Rs33,393,007.29)
1-Proj-bypass - B1 - B1 - B1 - B1 - B1 -.Road work	Road Work	Rs274,397,393.16	Rs139,385,226.55	Rs176,329,879.33	(Rs41,317,712.72)

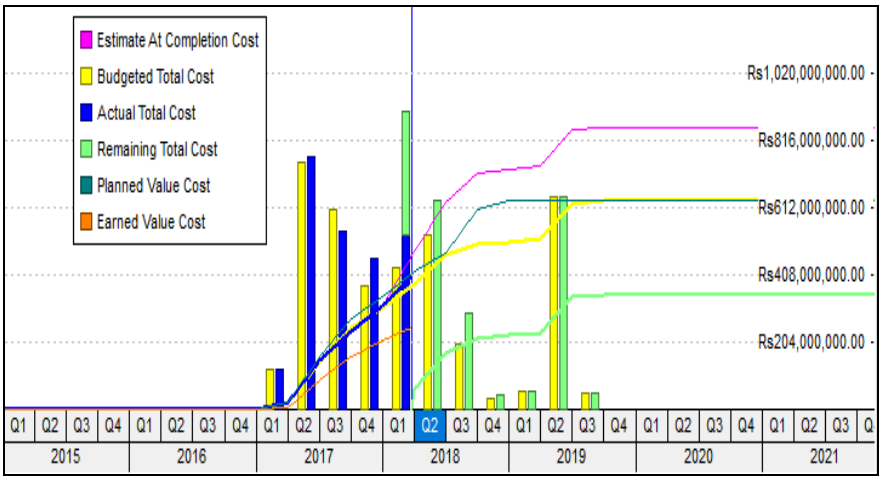
Table 3: WBS cost

2. Table showing overall project cost details.

Project ID	Project Name	BL Total Cost	Actual Total Cost	Remaining Total Cost	Variance - Total Cost
1-Proj-bypass - B1 - B1 - B1 - B1 - B1 -	Schedule comp with Resource - B1 - Baseline - Update correct date	Rs636,205,597.78	Rs403,172,677.28	Rs349,788,988.41	(Rs116,756,067.90)

Table 4: Project cost

ii. Graphical reports: S-curve showing Standard Earned Value Analysis.



Budgeted Total Cost	Actual Total Cost	Earned Value Cost	Planned Value Cost	Schedule Variance	Cost Variance
Rs632,826,110.84	Rs403,172,677.28	Rs249,011,243.42	Rs406,136,047.15	(Rs157,124,803.73)	(Rs154,161,433.86)

Figure 7: Earned Value Analysis (EVA) using graphical method

In graphical method shown, EVA parameters can be read in approximation.

5. DISCUSSIONS

Project is having schedule variance as (Rs157,124,803.73), bracket indicates negative value, which means project is behind schedule and cost variance as (Rs154,161,433.86), bracket indicating negative value, specifying project is over the budget.

Also, CPI is 0.62, less than 1, indicates project has got poor performance cost wise and SPI is 0.61, less than 1, indicates project has got poor performance in terms of scheduled dates.

Similarly, all activities status and work breakdown structure (WBS) status can be analyzed.

This method is very helpful in following ways:

1. One can recognize the project status and action to be taken.
2. Recognize hazards, by this one will take needful action.
3. Enables project managers to concentrate on solving critical issues and confusions are avoided.
4. Enables to reduce wastage of resources.
5. Team members can easily update their concerns.
6. Reduce site meetings.
7. Improved decisions due to correct information till date available.

In current method at site, no such procedure is being followed. Only the cost difference of planned and actual is calculated for approval of bills.

Delays and cost variations are occurring in construction due to the following reasons:

1. Due to shortage of scaffolding material.
2. Due to delay in approval of drawings.
3. Client improper coordination, monitoring and managing.
4. Improper planning.
5. Inadequate site investigation during planning stage which increased cost of project.
6. Due to delay in drawing approval from railway department in Road Over Bridge (ROB) section.
7. Due to shortage of construction materials.
8. Delays due to land acquisition problems. This was not considered during planning stage.
9. Due to climatic conditions like monsoon rain during which kept the work closed for two weeks since the site is having black cotton soil, trucks were unable to reach site location and dewatering charges were extra. This was not well-thought-out during planning stage.

By having proper idea of project variation from planned baseline and using the previous project data as baseline in primavera project performance can be efficiently monitored and minimized.

In continuation to the study performed, following work can be taken up as scope for future work:

1. Planning, scheduling and resource optimization using primavera can be used for all road construction happenings which help the contractor to achieve good results.
2. Control over resource wastage and loss in budgets could be identified and minimized throughout at various stages of project.
3. Resource levelling can be done for all ongoing projects in the company during construction at different stages.
4. Risk analysis can be performed.
5. Issues can be addressed efficiently.
6. Management of employees by using project management-staffing method which shows ways of managing employees can be done.
7. Economic impacts of adopting primavera software can be analyzed.
8. Primavera can be used for multi projects in an enterprise, handling them in a centralized location by developing security passwords.
9. Project progress update can be performed online during site visits using mobile or tablets.

6. CONCLUSION

At present situation in India, there is an immense increase in demand for road construction projects. We have noticed many underperforming projects in terms of cost and time.

To overcome this poor performance, we should overcome improper planning, scheduling and monitoring techniques being followed.

For best planning, scheduling and monitoring techniques we can use Primavera P6. It is a proper project management solution not only in civil engineering but also in various other fields like mechanical, information science, electrical, etc.

Some of the conclusions drawn from study using primavera are as follows:

1. Creating calendars will set targets for contractors which plays a vital role in execution of project.
2. Activity sequencing and proper planned interrelationships between the activities will help in managing the project duration without any delay.
3. Gantt charts will give clear picture for site engineers regarding execution of activity and be prepared for upcoming activities.
4. CPM chart helps in the identifying critical activities and scheduling.
5. By systematic allocation of resources needed for various activities wastage of resources can be avoided.
6. Provides extra lead time for procurement of resources.
7. It will not cause lack of availability of laborer's during construction.
8. It will help in effective supervision by the staff available.
9. Project is having schedule variance as (Rs157,124,803.73), bracket indicates negative value, which means project is behind schedule.
10. Cost variance as (Rs154,161,433.86), negative value, which means project is over budget.
11. Cost performance index [CPI] is 0.62, less than 1, specifies project has got poor performance cost wise.
12. Schedule performance index [SPI] is 0.61, less than 1, specifies project has got poor performance in terms of scheduled dates.
13. Reports generated after scheduling this project can be used as a benchmark for future projects. Assigning this as a baseline and comparing the progress, risks and issues of future projects can be done.
14. Study made showed that contractors play vital role in completion of project on schedule. By using primavera software, this can be done efficiently.
15. Organization now has believed that monitoring and tracking the project performance utilizing primavera software P6 is beneficial to have a more accurate observation on contractor's actions.

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