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Planning, Scheduling and Tracking of a residential Project using Primavera Software

Unmesh. Y. Polekar¹

Department of Civil Engineering
Maharashtra Institute of Technology, Pune
Pune – India

Rohit. R. Salgude²

Department of Civil Engineering
Maharashtra Institute of Technology, Pune
Pune – India

Abstract: *Proper planning and scheduling is very important in construction projects for reducing and controlling delays of the project. Substantial amounts of time, money, resources are wasted each year in a construction industry due to improper planning and scheduling. With globalization the construction projects have become vast and complex. Planning of such projects requires huge amount of paperwork, which can be reduced with the help of project planning software. Providing good planning, proper organization, sufficient flow of resources to a project cannot automatically achieve desired result. A warning mechanism must be present which can alert the organization about its possible success and failures throughout the project. The main objectives of this study are to plan, schedule, and track a residential project with help of primavera software, study the results generated, it is possible to suggest which method is suitable for the selected residential project. Also to recommend measures to the organization for enhancing their project planning skills for similar projects in future.*

Keywords: *Planning, Scheduling, Tracking, Project Planning Software, Primavera.*

I. INTRODUCTION

Construction industry is an integral component of a nation's infrastructure and industrial growth. Construction industry is the second largest industry in India still its growth has been differential across the nation. There is a vast difference of development in the rural and urban areas. To cope up with the status of development in urban areas the rural regions need tools for economic development, land use and environment planning. Here arises the need for effective project management. Many problems and issues are being faced by the construction industry, major of them are cost overruns and time overruns due to inadequate project formulation, poor planning for implementation and improper management during execution. Many analysts state that average cost of project goes up by 30% as of the budgeted cost due to improper planning and scheduling. Observations show that proper skillful management is essential for a project to complete within time, estimated budget and with allocated resources. Providing good planning, proper organization, sufficient flow of resources to project can automatically achieve the desired result. A warning mechanism must be present which can alert the organization about its possible success and failures throughout the project.

Project Monitoring acts like a warning mechanism; it is the process of recording, collecting and reporting information regarding project performance that the project manager and others wish to know. Monitoring includes watching the progress of the project against time, performance schedule and resources during actual execution of the project and it identified the lagging areas which require timely attention and actions. It is very common to see project failing to achieve their missions within specified time and budget, the factors causing overrun as stated above inadequate project formulation, poor planning and lack of project management during execution, but the main cause of failure can be attributed to cost estimation failure and management failure. Large projects become more complex and the ability to exchange information on paper within organization on a timely basis gets difficult.

The traditional project management system cannot meet the demands of today's projects, as tremendous amount of information and data on a project are always changing. Project managers from construction industry state that their 70-80% time is spent on communication and 70% of project documentation is paper based. The main objectives of this study are to plan, schedule, and track a residential project with help of primavera software, study the results generated, it is possible to suggest which method is suitable for the selected residential project. Also to recommend measures to the organization for enhancing their project planning for similar projects in future.

II. OBJECTIVE OF STUDY

The objectives of this study are:

1. To identify construction sequence for a residential building construction.
2. To work out the practical durations required to carry out the activities.
3. To identify scheduling technique used by the organization in developing plan and scheduling.
4. To develop scheduling using Primavera project planner's software.
5. To track the project and analyse the reasons for delays, and increase in estimated budget etc.
6. To investigate defects in the planning and scheduling procedure of the organization, and suggest suitable improvements in their methods.

III. CONSTRUCTION, PLANNING, AND SCHEDULING TRACKING

CONSTRUCTION PLANNING

Construction planning is a fundamental and challenging activity in management and execution of construction projects. It includes the selection of technology, the definition of work task, the estimation of required durations and resources of individual task, and identify the interactions between different work tasks. A good construction plan is the base for developing the schedule and the budget for work. Developing the construction plan is a critical task in construction management, even if the plan is not written or else formally recorded. During planning a planner begins with a result (a design) and he must synthesize the steps required to yield this result. The necessary aspects of construction planning include the generation of required activities, analysis of the implications of these activities and the choice among various alternatives methods of performing these activities. A planner must imagine the final design and describe it in plans and specifications.

In developing a construction plan the importance is given either cost or schedule. Some projects are primarily divided into expense categories with associated cost in these cases planning is cost oriented. In this category, a distinction is made between cost incurred directly in the performance of the activity and indirectly for the accomplishment of the project. For other projects where time is a critical or the planner ensures that proper precedence among activities is maintained and that efficient scheduling of the available resource prevails. In such cases a critical path scheduling procedure is followed. Finally most of the complex projects require considerations of both cost and schedule over time, so that planning; monitoring and record keeping must be considered in both dimensions. In these cases integration of budget and scheduling information is a major concern.

SCHEDULING

Scheduling is determination the timing of events in the project that is when and which task will be performed? Putting it in simple words it is a reflection of plan. In other words we can say, planning is How, What and Who whereas scheduling is when and why. Scheduling can be also defined as the detailed plan of the project work tasks with respect to time. A schedule is also a good communication tool between all the stakeholders of the project. Schedule gives an overall sense of expected progress of

the project without schedule it is very difficult to explain someone unfamiliar with the project what is going on and what is expected to take place.

TRACKING

Tracking is the process of collecting, entering and analyzing of actual project performance values, such as work on tasks and actual durations. Tracking is the second major phase of project management. The main thing to focus on project planning is developing and communicating the details of project plan before actual work starts. When work begins, the next phase of project management is tracking progress. Tracking means recording project details such as what work did by whom, when the work was done, and at what costs these details are called as actual. Properly tracking actual work and comparing it's against original plan is useful to identify the difference in actual and planned and it enables to adjust incomplete task of the plan.

IV. RESEARCH METHODOLOGY

Research methodology is designed in three stages:

- A. Pre data collection
- B. Data collection
- C. Post data collection
- A. Pre data collection:

This stage consists of literature review, setting of objectives and problem statement and based on that selection of research area has been done. For the research purpose, residential building is taken as a case study.

- B. Data collection:

Frequent site visits were carried out to identify the construction sequence. Of the residential building and also practical time durations for executing activities were worked out. The data required for conducting analysis in the software is collected.

- C. Post data collection:

The data collected will be analyzed in Primavera software, tracking of the project will be done and all the reports and results generated from the software will be studied and interactions with the organization will be done regarding selection of the planning procedure and software to be used in their future projects.

V. DATA COLLECTION

The data collection has been done in three parts:

- A. Daily progress reports (DPR)
- B. Work output of labour
- C. Activities with their planned duration
- A. Daily progress reports:

The DPR consist of detailed description of the work done, labor and resources required for the work and record of the inventory. All the DPR from the starting day of project till now have been collected. Sample of DPR is given in Appendix A.

- B. Work Output of labor:

Work output is the amount of work done by one person (Labor) in 1 day. It is used to calculate durations required for activity based on the available manpower on site.

C. Activities with their planned duration:

Total activities for construction of the residential project with their planned duration (based on work output and man power available on site) are entered in primavera for further working.

VI. DATA ANALYSIS

1. For data analysis each activity of construction of building are found out and noted down, which are used in Primavera software for working. (Figure 1, Appendix B).
2. Practical construction sequence is understood during field training and is used in linking of activities in primavera along with provision of necessary lag (Float) in predeceasing and succeeding activities. (Figure 2, Appendix B).
3. Resources required for each activity have been allocated in primavera along with their cost, which have given a cost of total project, which will be further referred to actual cost. (Figure 4, Appendix B)
4. No work was done for six months as technical sanction for upper floors was not given by the respective government authorities, hence the site was delayed by six months. The difference between cost due to delay is shown Chart 2, Appendix B.

The reasons for the changes in actual cost and budgeted cost of the activities from the Appendix B Table x are stated below.

1. Earthwork:-

Cost of earth work has increased because of delay in activity due to interference of ground water during excavation which caused the poclain (Power shovel) to remain idle, and also the hard strata was available at a depth more than anticipated.

2. RCC work :-

Cost of RCC work was reduced because of the penalty laid on the RCC contractor who was responsible for the delay.

3. Brickwork

Cost of masonry work was decreased because penalty was laid on the contractor who was responsible for the delay.

Plastering cost was increased because the work had to be taken away from the defaulter contractor and given to new contractor based on new increased rates.

4. Water proofing:-

There was no drastic change in cost of water-proofing.

5. Flooring:-

The cost of tiles was overestimated whereas when the tiles were actually procured the cost went down, decreasing the total cost.

6. Wooden work:-

Change in specifications resulted in reduction cost of wooden works, initially the door frames were to be made of black granite which was costly, was changed to normal wooden frames and door shutters were ordered readymade from market instead of making them on site.

7. Aluminium work:-

The cost of aluminium works has increased because the sliding window specification was changed from two track to three track.

8. Painting work:-

The Painting contractor demanded increase in rates as their was no proper condition in contract regarding fix working rate, hence he was given a increase in working rates.

9. Plumbing and electrical and fabrication works:-

No change in cost.

Even when their was no work going on the organization had to pay their staff their salary and monthly expenses which is directly considered as loss.

TABLE I Monthly expenses of Kalashree developers

SR.	DISCRIPTION	MONTHLY PAYMENT RS.
1	Project manager salary	55000
2	Owners drawings	50000
3	Fuel,mobile bills,electricity charges.	40000
4	Engineer 1 salary	25000
5	Engineer 2 salary	25000
6	Marketing representative salary	20000
7	Departmental labour (4)	36000
8	Accountant salary	14000
9	Office clerk	7000
10	Site security guard	15000
	Total	287000

TABLE II Total loss in six months

SR.	DISCRIPTION	AMOUNT RS.
1	Six months indirect cost	1722000
2	Building work cost	-63000
	Total loss in six months	1659000

If the site was not idle, and work would had taken place these six months could be utilized and also the next project is already delayed by six months, where the loss is now doubled i.e. $[1659000 \times 2] = \text{Rs. } 3318000$.

Inferences

While comparing to the schedule generated from the software, there were some major delays in some activities. Some of the reasons for the delays have been noted down which took place on site.

1. Irresponsible contractors- the major contractors did the work good during the initial stage but as the work expanded, they were unable to supply the required manpower on site, also they were not present on site regularly to check what difficulties were there for the work to be continued.
2. Delay were caused due to the government sanctioning authorities which failed to issue the F.S.I certificate on time due to which, the work of next floors was stopped.
3. The market conditions were down; hence there was no sale of flats for months which disturbed the cash flow of the organization causing the organization to take slow decisions related to execution of the work.

VII. CONCLUSION

- This study has investigate the defects in the planning , scheduling procedure of the client organization.
- Activities on the site with respect to execution of the residential project are thoroughly observed and comparison is made between planned and actual executed schedule.

- The results revealed that the contractors and subcontractors plays vital role in completion of project as scheduled. Major of the reasons are related with the contractors performance such as lack of manpower, site management, equipment management and lack of supervision during execution.
- The organization has found that monitoring and tracking project using software is useful to keep a more precise watch on the contractors performance.
- The organization has changed their planning and scheduling methods by,
 - a) Set weekly targets to contractors instead monthly targets.
 - b) Recruit or train the project managers and engineers to use softwares during planning, scheduling and tracking.

KALASHREE DEVELOPERS							
NAME OF SITE:- KALASHREE M D RIVERA BHUGAON					DATE - 01.11.2012		
DAILY PROGRESS REPORT							
NO.	DESRIPTION			QUANTITY	UNIT	LABOUR	NOS.
1	PLINTH BEAM SHUTTERING WORK IS COMPLETED.					MASON	0
2	PLINTH BEAM SHUTTERING WORK IS CHECKED AS PER WORKING DRAWING.					M/C	7
3	LIFT RAFT PARDI SHUTTERING WORK IN PROGRESS.					F/C	6
4	CURING WORK FOR LIFT RAFT, FOOTING, STUB COLUMN COMPLETED.					SUPERVISOR	1
5	FIRST SLAB COLUMN STEEL ERECTION WORK IN PROGRESS.					CARPENTER	3
6	PLINTH BEAM STEEL ERECTION WORK IS COMPLETED.					HELPER	3
7	PLINTH BEAM GROUND AREA COMPACTION WORK IN PROGRESS.					FITTER	3
8	PLINTH BEAM STEEL CHECKED AS PER DRAWING.					HELPER	3
9	B' BLDG. SIDE & BANDH SIDE BACKFILLING BY JCB. TIME 9:20 A.M. TO 12:50 P.M. & 2:00 P.M. TO 6:00 P.M.			7.3	HRS	SECURITY	1
10	PLINTH BEAM CASTING WORK IS COMPLETED.			5.07	CUM	DEPART M/C	1
11	VISITED TO ARCHITECT FOR DRAWING HE GAVE ONLY PLINTH BEAM WORKING DRAWING SOFT COPY.					DEPART F/C	0
12	BIG BOLDER CONVERTED IN RUBBLE WORK IS COMPLETED			640	NOS	BOLDER M/C	2
13	MYCEM COMPANY QC ENGINEER VISITED ON SITE & ONE TRIAL MIX CONCRETE 6 NOS.CUBE CASTED.						
14							
15							
16							
17							
18							
19							
20							
21							
MATERIAL	GRADE	BALANCE		CONSUMPTION	PLINTH BEAM		
CEMENT	53	410 BAG		CEMENT	34	BAG	
		34 BAG		CRUSH SAND	92.11	CFT	
BALANCE		376 BAG		20MM METAL	126.90	CFT	

CHART I: SAMPLE OF DAILY PROGRESS REPORT (D.P.R)

TABLE III Work output

SR	PARTICULAR OF ITEM	QUANTITY DONE PER DAY BY ONE PERSON (LABOUR)		
		M ²	M ³	
1	Brick work in lime or cement mortar in foundation & plinth		1.25	
2	Brick work in lime or cement mortar in super structure		1	
3	Coursed rubble stone masonry including dressing		0.8	
4	Cement concrete 1:2:4		5	
5	R.C.C work		3	
6	12mm cement plaster	8		
7	White washing or color washing	200		
8	Painting or varnishing doors and windows (1 coat)	25		
9	Painting large surface 1 coat	35		
10	Distempering 1 coat	35		
11	2.5 cm Thick Cement Concrete Flooring	7.5		

12	Timber framing Sal of teak wood		0.07	
13	Door and window shutter panel or glazed	0.7		
14	Single Allahabad tilling	6		
15	Double Allahabad tilling	4		
16	Ashlar stone dressing		0.7	
17	Flag stone dressing	1.5		
18	Earthwork in---			
	ordinary soil		3	
	hard soil		2	
	rock		1	
19	Number of brick laid by mason in brick work up to a height of 10"			600
20	Amount of work done by helper per day			
	1) mix			3 m3 of mortar
	2) Deliver bricks			4000 no's at distance of 15 m
	3) Deliver mortar			5.5 m3 per day

APPENDIX B

Auto Compute Actuals	Activity ID	Activity Name	Original Duration	Start	Finish	Schedule % Complete	Planned Value Cost	BL Project Total Cost
		Building B	255	01-Dec-12 09:00 AM	24-Sep-13 06:00 PM	0%	Rs0.00	Rs54,188,280.85
	No 1	Building B	255	01-Dec-12 09:00 AM	24-Sep-13 06:00 PM	0%	Rs0.00	Rs13,395,100.00
		Milestones for Payments	207	26-Jan-13 09:00 AM	24-Sep-13 06:00 PM	0%	Rs0.00	Rs0.00
		EARTH WORK	45	01-Dec-12 09:00 AM	22-Jan-13 06:00 PM	0%	Rs0.00	Rs503,844.33
		CONCRETE & REINFORCEMENT WORK	169	07-Dec-12 09:00 AM	21-Jun-13 06:00 PM	0%	Rs0.00	Rs15,268,701.21
	No	CONC LABOUR1 CONCRETE & REINFORCEMENT WORK	169	07-Dec-12 09:00 AM	21-Jun-13 06:00 PM	0%	Rs0.00	Rs2,694,840.00
		PCC (Plain Cement Concrete)	43	07-Dec-12 09:00 AM	25-Jan-13 06:00 PM	0%	Rs0.00	Rs264,850.03
	No	PCC1 PCC Below footing & Lift Raft	2	07-Dec-12 09:00 AM	08-Dec-12 06:00 PM	0%	Rs0.00	Rs57,427.85
	No	PCC2 PCC Below plinth beam	1	11-Jan-13 09:00 AM	11-Jan-13 06:00 PM	0%	Rs0.00	Rs39,753.28
	No	PCC3 PCC -Below Parking Flooring	3	23-Jan-13 09:00 AM	25-Jan-13 06:00 PM	0%	Rs0.00	Rs167,668.90
		RCC (Reinforcement Cement Concrete)	164	13-Dec-12 09:00 AM	21-Jun-13 06:00 PM	0%	Rs0.00	Rs12,309,011.17
		PLINTH WORK	33	13-Dec-12 09:00 AM	19-Jan-13 06:00 PM	0%	Rs0.00	Rs1,406,124.93
	No	RCC PL1 RCC Footings	14	13-Dec-12 09:00 AM	28-Dec-12 06:00 PM	0%	Rs0.00	Rs309,609.32
	No	RCC PL2 RCC Lift Raft	4	13-Dec-12 09:00 AM	17-Dec-12 06:00 PM	0%	Rs0.00	Rs166,869.52
	No	RCC PL3 Lift Paradi - Raft Top to Plinth Top	3	18-Dec-12 09:00 AM	20-Dec-12 06:00 PM	0%	Rs0.00	Rs270,036.74
	No	RCC PL4 Columns - footing to Plinth Top	5	29-Dec-12 09:00 AM	03-Jan-13 06:00 PM	0%	Rs0.00	Rs416,297.76
	No	RCC PL5 RCC Beam - Plinth Beam	5	15-Jan-13 09:00 AM	19-Jan-13 06:00 PM	0%	Rs0.00	Rs243,311.59
		PARKING FLOOR / 1ST SLAB	14	26-Jan-13 09:00 AM	11-Feb-13 06:00 PM	0%	Rs0.00	Rs1,339,407.51
	No	RCC PARK1 Columns - 1st slab	7	26-Jan-13 09:00 AM	02-Feb-13 06:00 PM	0%	Rs0.00	Rs431,453.83
	No	RCC PARK2 Lift Paradi_1st slab	3	28-Jan-13 09:00 AM	30-Jan-13 06:00 PM	0%	Rs0.00	Rs170,265.93
	No	RCC PARK3 Staircase - 1st slab (Building)	3	29-Jan-13 09:00 AM	31-Jan-13 06:00 PM	0%	Rs0.00	Rs48,667.17
	No	RCC PARK4 RCC Beam - 1st Slab	7	04-Feb-13 09:00 AM	11-Feb-13 06:00 PM	0%	Rs0.00	Rs349,727.87
	No	RCC PARK5 RCC Slab - 1st Slab	7	04-Feb-13 09:00 AM	11-Feb-13 06:00 PM	0%	Rs0.00	Rs339,292.71
		1ST FLOOR / 2ND SLAB	14	12-Feb-13 09:00 AM	27-Feb-13 06:00 PM	0%	Rs0.00	Rs1,300,494.09

FIGURE I: Activities entered in Primavera software.

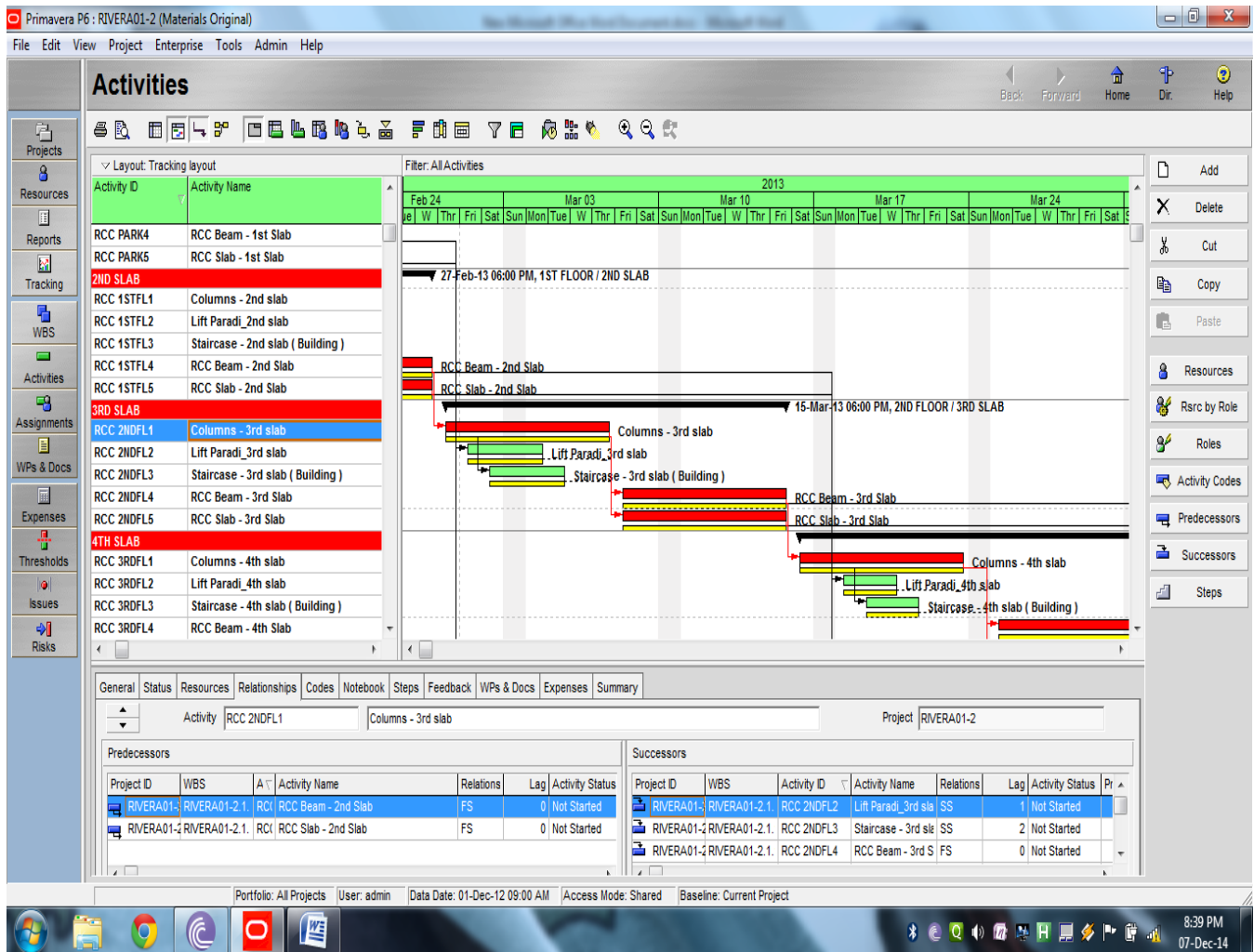


FIGURE II: Activities linked in Primavera software.

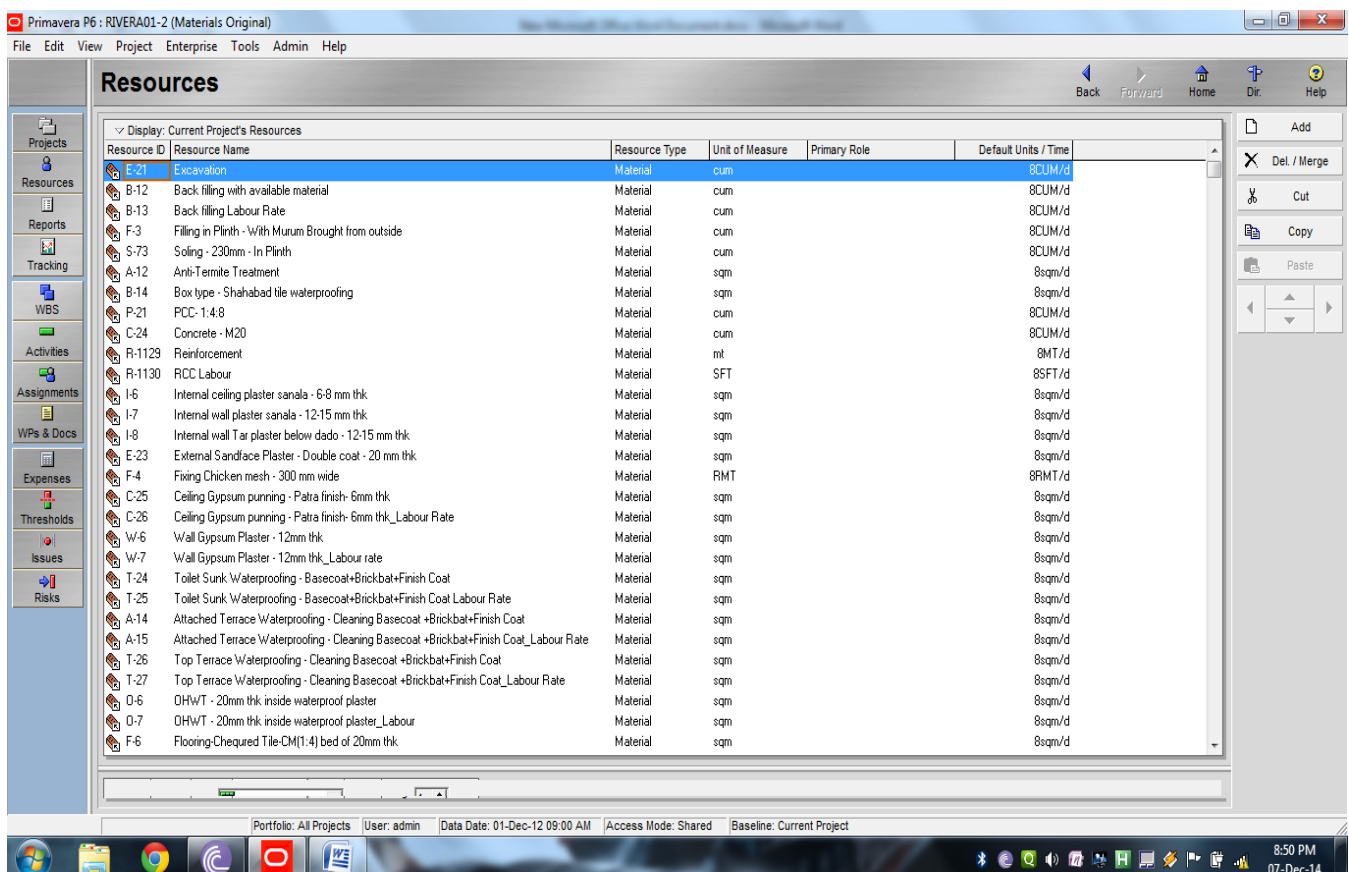


FIGURE III: Resources entered in primavera.

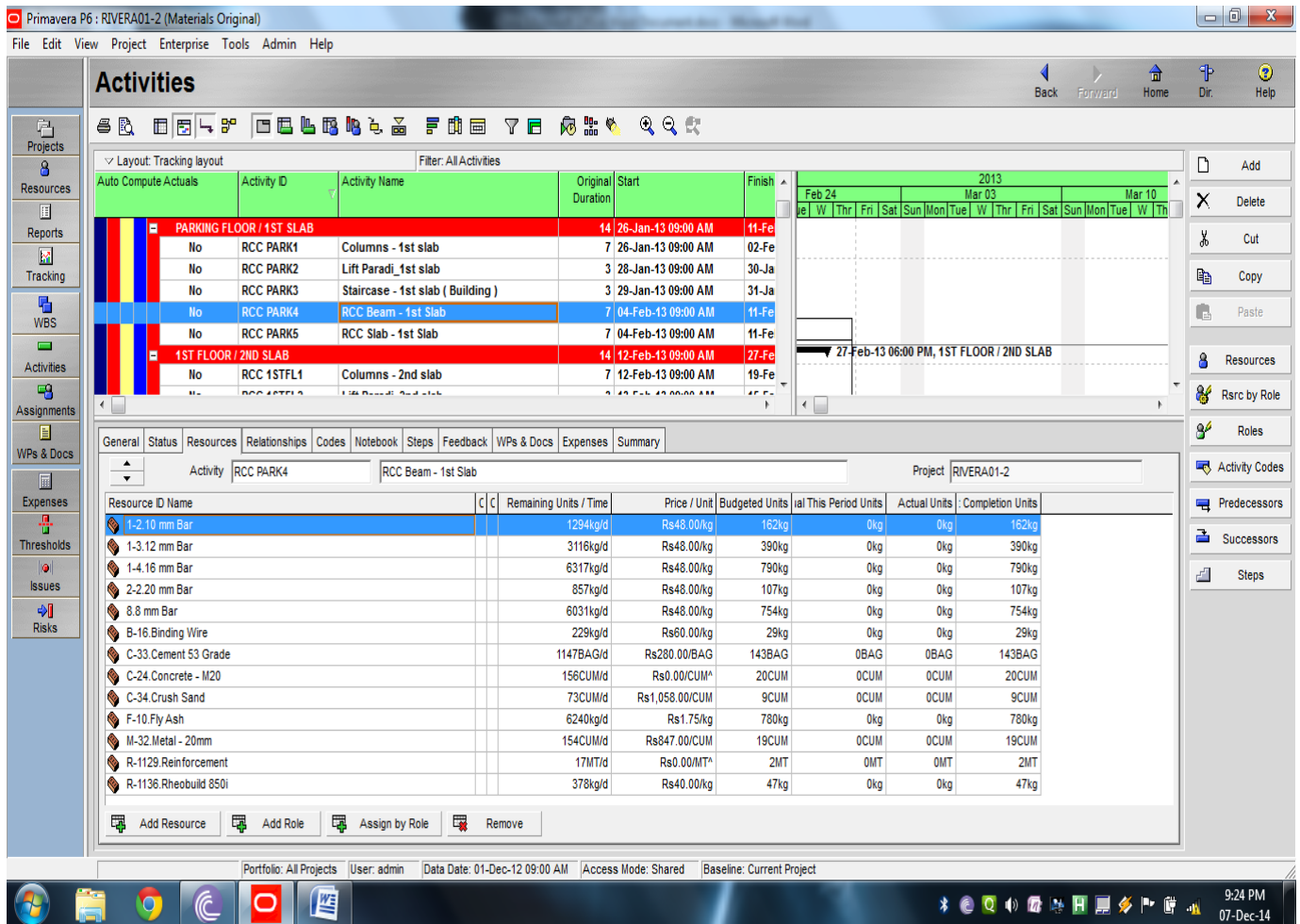


FIGURE IV: Resources allocated to activities in Primavera software.

SR NO.	WORK	Budgeted total cost from primavera (Rs.)	Actual cost (Rs.)	Difference (Rs.)
1	EARTH WORK	272721	311329	-38608
2	RCC WORK	1230901	1178542.619	52358.4
3	MASONRY			
	FLYASH MASONRY 40%	244295	180558.56	63736.4
	INTERNAL PLASTER 25%	39587.5	112849.10	-73261.6
	EXTERNAL PLASTER 35%	110172	157988.74	-47816.7
4	WATERPROOFING WORK			
	TOILET/DRY TERRACE 75%	50270	48004.98214	2265.0
	TOP TERRACE/ATTACH TERRACE 25%	32400	31197.7	1202.3
5	FLOORING			
	DADO 30%	134736	123489.025	11247.0
	KITCHEN OTTA WITH DADO 20%	89824	82326.01667	7498.0
	FLOORING 50%	224560	205815.0417	18745.0
6	POP FOR CEILING	97905	69922.57	27982.4
7	WOODEN WORK			
	DOOR FRAME 25%	54500	33769.87	20730.1
	DOOR & DOOR FITTING 75%	163500	101309.61	62190.4
8	FABRICATION WORK			
	MS GRILL 50%	53742	53742.33	-0.3
	RAILLING 35%	37619	37619.63	-0.6
	OTHER WORK 15%	16123	16122.70	0.3
9	ALUMINIUM WORK	115846	129274.5	-13428.5
10	PAINTING WORK			
	INTERNAL PAINTING 45%	50008	60602.14	-10594.1
	EXTERNAL PAINTING 55%	52828	74069.29	-21241.3
11	PLUMBING WORK			
	INTERNAL PIPING 20%	249312	249312.00	0.0
	EXTERNAL PIPING 40%	498624	498624.00	0.0
	CP FITTING & SANITARY FITTING 25%	311640	311640.00	0.0
	DRAINAGE WORK 15%	186984	186984.00	0.0
12	ELECTRICAL WORK			
	INTERNAL 70%	1121904	1121904.00	0.0
	EXTERNAL 30%	480816	480816.00	0.0
13	OTHER WORK			
	LIFT	2800000	2800000	0.0
	TOTAL DIFFERENCE			63004

Chart II: Difference in work cost due to delay.

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AUTHOR(S) PROFILE



Unmesh Yeshwant Polekar Post graduate student, Department of Civil Engineering, Construction management, Maharashtra Institute of Technology, Pune-411038 (Maharashtra, India),