

“Work Breakdown Structure and Cost Analysis of a Residential Building”

Tejaswini.R¹, Swetha.K.S², Dr. S Rajendra³

¹ Post Graduate student, Department of Civil Engineering, N.C.E.T, Bengaluru, Karnataka, India

² Assistant Professor, Department of Civil Engineering, N.C.E.T, Bengaluru, Karnataka, India

³ Professor and Head of Department of Civil Engineering, N.C.E.T, Bengaluru, Karnataka, India

Abstract: Project scope is the work required to output a project’s deliverable. Change happens, and project scope management includes the process to manage scope changes and make sure the project will still come in on time and within budget. Scope is often defined by a work breakdown structure, and changes should take place only through formal change control procedures. WBS plays a major role in planning the entire framework of a project which includes various work packages as per the scope of the project. In this current project the residential building is taken as a case study and the scope of work is broken down into finite number of levels which helps the planning engineer to get clarity on cost, schedule. Two different approaches in WBS are followed, the regular approach (Top down) and Bottom Up approach. The comparative analysis is done on both the approach and resource planning is evaluated and the best method is suggested. Also Primavera’s WBS feature is presented with various colour contours to show different levels which help us to generate reports based on the work packages.

Keywords: WBS-Work Breakdown Structure, EPPM- Enterprise Project Portfolio Management, Costing, budgeting, Resource Planning

1. INTRODUCTION

A project work breakdown structure (WBS) is a deliverable or product-oriented grouping of project work elements shown in graphical display to organize and subdivide the total work scope of a project. The WBS is a particularly important project tool. Considerable thought and planning should be given to its development and implementation so that subsequent changes are minimized. Major revisions to a WBS require both substantial effort and resources, due to its application to a wide array of project activities. Project WBSs, which are driven by the scope of a project, should not be confused with other uses of WBS-like systems

A Work Breakdown Structure (WBS) identifies tasks and deliverables associated with a project. Resources are identified for each item within the WBS that facilitates budgeting as well as assignment of responsibilities. The WBS can be used to determine the critical path of the project and create the project schedule. The WBS forms the bases for the planning, estimation, scheduling, monitoring, management and control of all project activities. A well-defined and comprehensive WBS that fits the organizational structure and the project system profile is important to increase the probability of project success by ensuring that the best resources are applied to the correct selection of projects suiting the particular company

2. METHODOLOGY

2.1 Data analysis

The academic project is a “Residential Building” which has ground plus one floor.

- 1 Area: 1500sqft.
- 2 Location: Yelahanka.
- 3 The house is featured have a courtyard and skylight.
- 4 Start of the project: 1 December 2016.
- 5 Planned end of the project: 7 December 2017.

2.2 Planning features

- 1 Enterprise project structure [EPS]
- 2 Organizational breakdown structure [OBS]

3 Calendars.

2.3 Generation of WBS levels

According to my project, after the complete planning of the project, the next step is to create a work breakdown structure (WBS) to define and organize the project elements so as to clearly identify the deliverables, report and summarize schedule and cost data at different levels in detail. A WBS represents a hierarchical breakdown of a project into elements.

In my project, initially I have generated 3 levels. WBS chart displays and defines the product to be developed. It relates the elements of work to be accomplished to each other and to the end of the product. WBS is also called as an organized method of dividing a product into sub products at lower levels of detail. Later on WBS levels are divided into 6 more levels. Hence there are 9 different WBS levels.

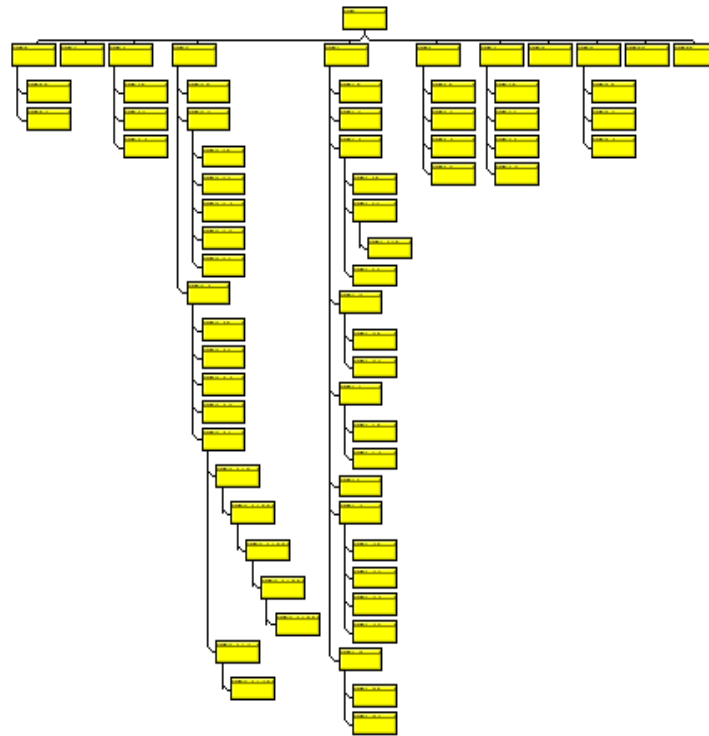


Fig 2.1 WBS into 9 different levels

2.4 WBS, resource allocation and resource planning in EPPM according to top-down approach

1. Top down approach

Resource planning is done with respect to WBS of top-down approach.

2. Resources, assigning and planning

A resource can be defined as an entity that is assigned to an activity and is required to accomplish the task.

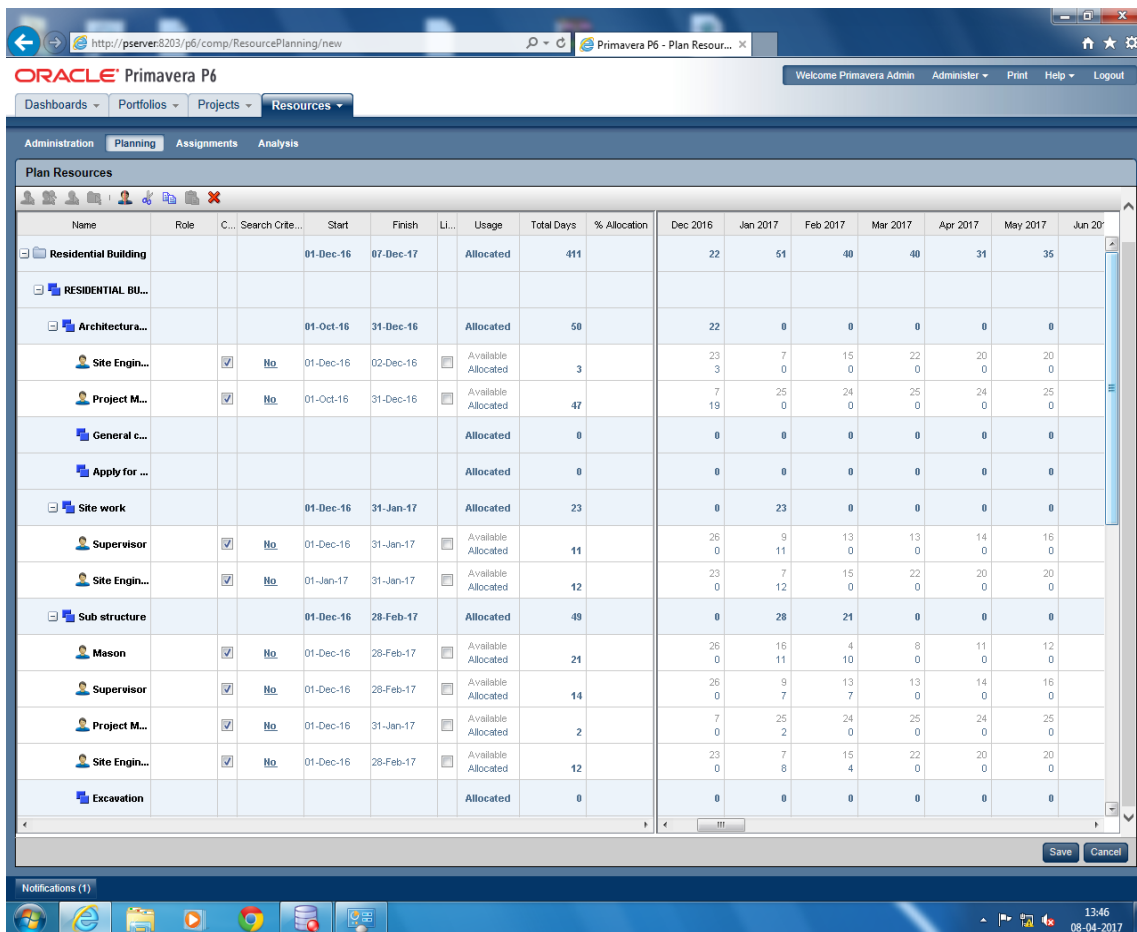


Fig 2.2 Resource assigning, planning according to WBS

Selected resources are assigned for WBS levels till the project progress. According to this, the number of resources which are available and also if more number of resources are needed we can assign. This is how resource planning is done in Top-down approach.

Table 2.1 Estimated number of resources in each month based on WBS

RESOURCES	DEC 2016	JAN 2017	FEB 2017	MARCH 2017	APRIL 2017	MAY 2017
Project Manager	19	2	1	2	1	2
Site Engineer	3	12	9	5	5	7
Supervisor	0	11	11	14	11	11
Mason	0	11	20	19	14	15

Above table shows the number of resources assigned and, planned with respect to WBS levels according to the project.

2.5 Generation of micro level WBS according to bottom-up approach in p6

2.5.1 Bottom-up approach

After generating 3 initial levels of WBS, 6 more levels are generated. Now the total numbers of WBS are 9.

In this the allocation of resources are done at the activity level and then the total requirement of the resources are calculated for the WBS and for the entire project.

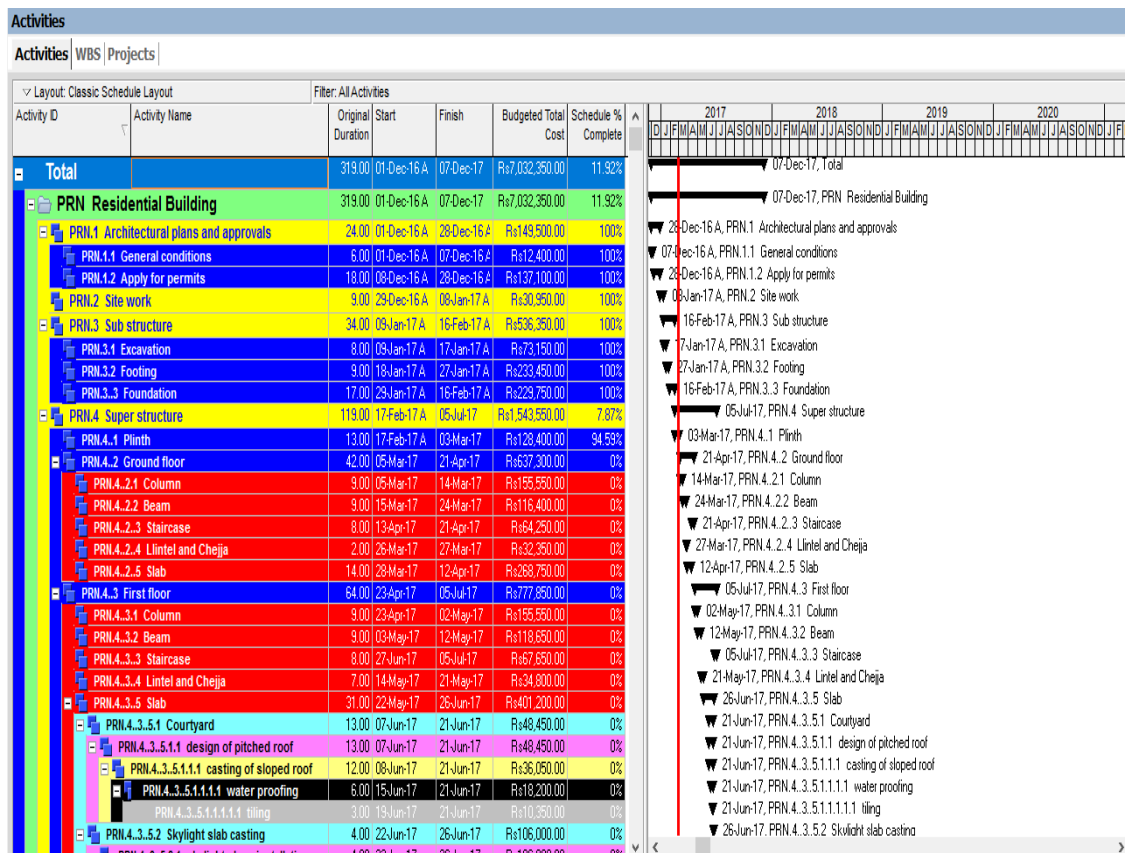


Fig 2.3 project broken down into different levels

2.6 Entering activities, duration and assigning predecessors in p6

2.6.1 Activities

Activities are the fundamental work elements of the project. They are the lowest level of work breakdown structure. Activities must have certain durations, costs, and resource or role requirements.

Totally there are 193 activities in this project under 83 WBS.

2.6.2 Predecessors

This is used to view and manage predecessors from a single activity details tab. These tabs are highly used for defining relationship for an activity.

2.7 Scheduling

Schedule of each activity should be calculated every time activities are added or deleted, or edit their dates, durations or relationships.

2.8 Resources assigning

Without the resource we cannot measure or perform anything in a project. All three types of resources are assigned for my project. They are

1. Labour.
2. Non – labour.
3. Material.

2.9 baseline assigning

A baseline is copy or snapshot of project data at a given time. Since baseline is a static representation of a project plan, it can be used in compare against measure performance as the project progresses. Only 2 baselines can be used at any given time to display and compare data. Primary baseline is taken for current project. Baseline is assigned for the start date of project.

2.10 Updating Project progress

Update is very essential in a project. Update of project gave clear idea about the project for efficient decision making and also in analysing the project status. Project progress is updated till 1st of March 2017. Progress is recorded to the status date and the scheduler updates. By updating the Project we will get to know the percentage of work completed and the percentage of work left. According to project progress update 11.92% of work is completed.

2.11 Budgeting

Under budgeting, initially total project budget and monthly spending plan are entered. So that the project manager and the investigator get clarity on the fund management, and fund can be arranged based on WBS and progress.

This feature gives us clarity on the over spending and under spending and hence entire project budget comes under control. Budgeting is done for each WBS level.

Budget log of the project is: Rs.7500000
Actual budget of the project: Rs.7032500

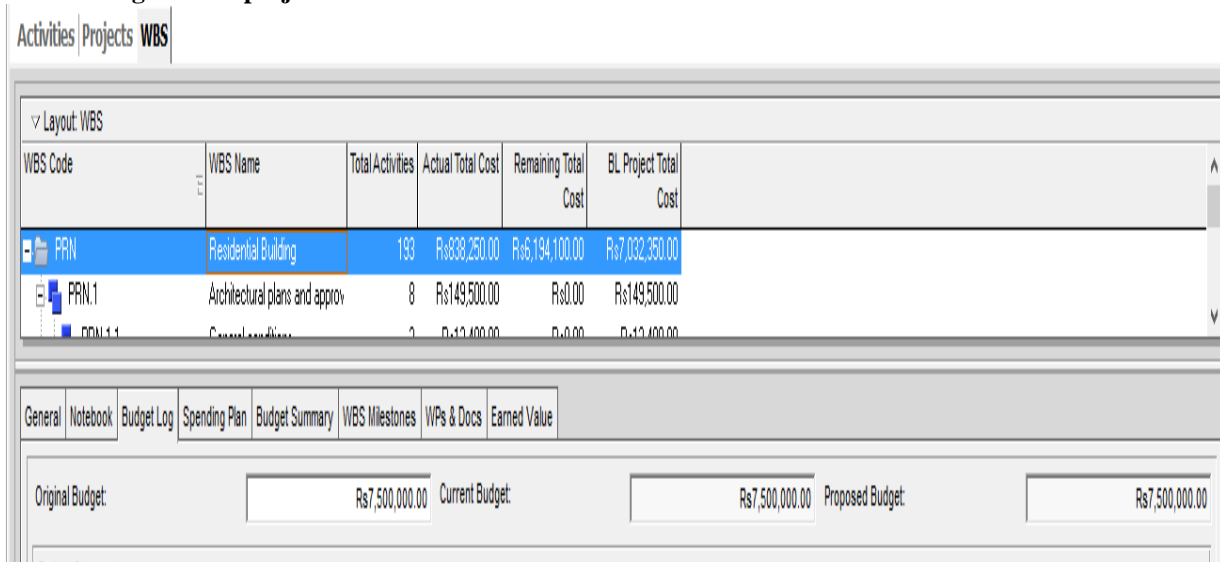


Fig 2.11.1 budget log for whole project

Table 2.12.1 Total number of WBS levels and Budgeted cost

SL.NO	WBS LEVEL	TOTAL NO OF WBS	BUDGETED COST IN RS
1	1	1	7032350
2	2	11	7032350
3	3	27	6777400
4	4	23	3112500
5	5	3	483850

6	6	2	154450
7	7	1	36050
8	8	1	18200
9	9	1	10350

3. CONCLUSION

The project concludes the result of best approach to break down a project. It also gives out the ways for resource planning and budgeting for a construction project.

3.1 Comparison of approaches for a WBS

3.2.1 Top – down approach

Top – down approach can be recommended for project feasibility and for more macro level resource planning and also working out on the project budget and spending plan on monthly basis, which will result in giving clarity on the fund used and the fund unutilised and the additional fund required.

WBS						
Activities Projects WBS						
Layout: WBS						
WBS Code	WBS Name	Total Activities	Actual Total Cost	Remaining Total Cost	BL Project Total Cost	
PRN	Residential Building	193	Rs838,250.00	Rs6,194,100.00	Rs7,032,350.00	
PRN.1	Architectural plans and approv	8	Rs149,500.00	Rs0.00	Rs149,500.00	
PRN.1.1	Conceptual design	2	Rs12,400.00	Rs0.00	Rs12,400.00	

General	Notebook	Budget Log	Spending Plan	Budget Summary	WBS Milestones	WPs & Docs	Earned Value
Date	Spending Plan	Spending Plan Tally	Undistributed Current Variance	Benefit Plan	Benefit Plan Tally	Benefit Variance	
Total	Rs839,800.00	Rs839,800.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	
16 - Sep	Rs0.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	
16 - Oct	Rs0.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	
16 - Nov	Rs0.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	
16 - Dec	Rs149,500.00	Rs149,500.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	
17 - Jan	Rs347,300.00	Rs347,300.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	
17 - Feb	Rs343,000.00	Rs343,000.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	
17 - Mar	Rs0.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	Rs0.00	

Fig 3.2.1.1 project budget and spending plan based on top – down approach

3.2.2 Bottom – down approach

Bottom – up approach can be done at the project level with reference to the input from the top – down approach.

It gives us exact duration and cost estimates which can be verified or tallied with the top – down estimate value.

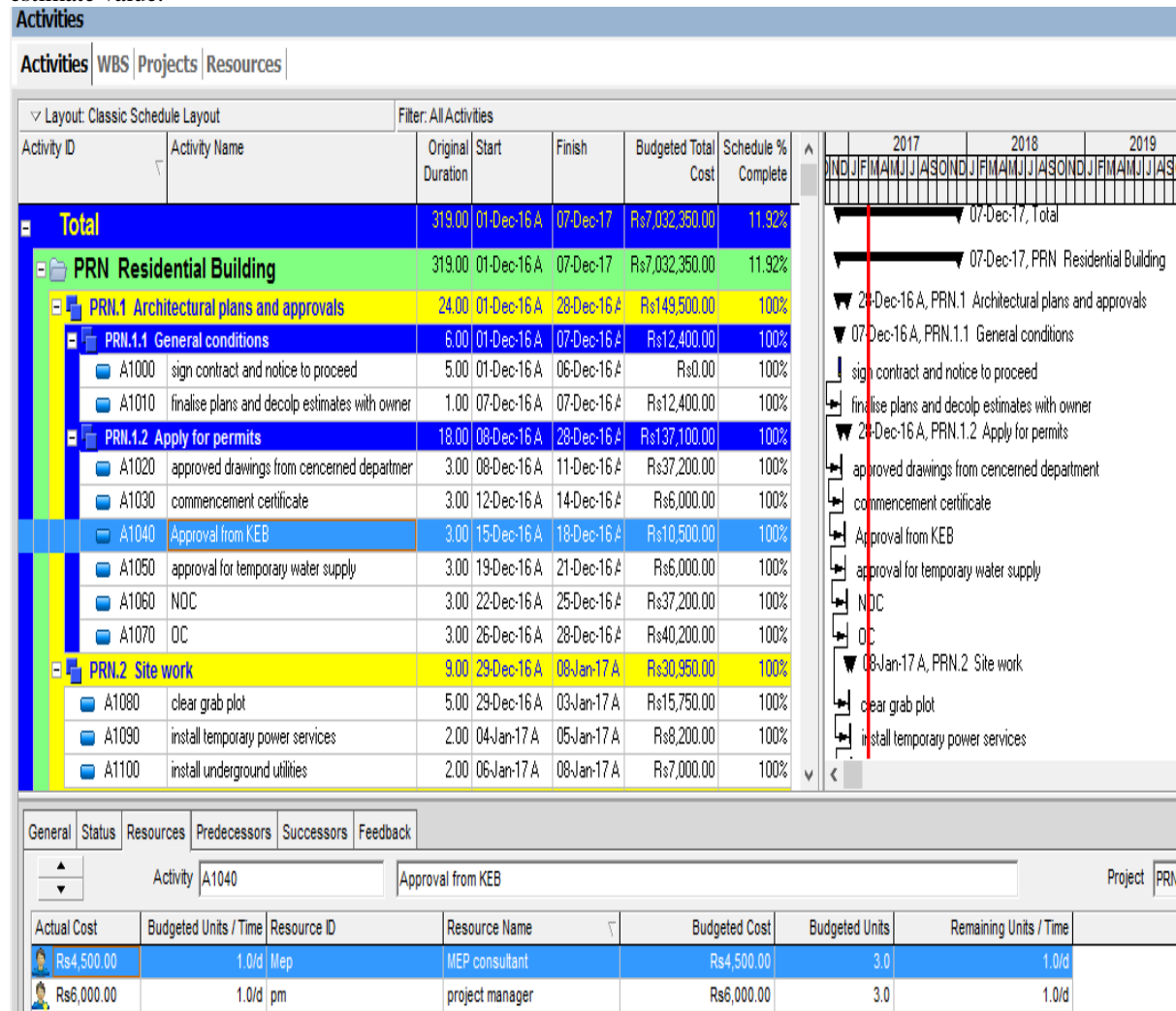


Fig 3.2.2.1 Exact cost and duration estimate

Both the approaches are required for a project. If the project is new, top – down approach is necessary. If the project is being planned more number of times, bottom – up approach is enough.

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