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Resource Optimization Of A Residential Building Using Primavera

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ABSTRACT

Time and money are the two most significant elements in the building industry. Time and cost are mostly determined by the efficient use of available resources, good management, and adequate planning at the appropriate time and location. Construction firms have encountered several issues in the past, including data overloading, cost overruns, prolonged durations, and resource overallocation, all of which were caused by poor resource management. So, for a better performance in the construction field proper project management is required. Project management will properly schedule the activities and allocate the resources to these activities at the right time and right place. The scheduling and optimization of resources are done by resource levelling. This project aims at the resource optimization of a residential building using primavera.

Keywords: Primavera, resource allocation, resource levelling, resource optimization.

INTRODUCTION

Construction projects are one-of-a-kind in that they come with their own set of challenges, uncertainties, and dangers. Data overloading, cost overruns, prolonged durations, and overallocation of resources have all been issues that construction businesses have encountered in the past. Budget, timing, and quality are the three pillars of client satisfaction in any project. The efficiency with which project management gets the task done by utilising the intended resources of personnel, machines, materials, money, and time determines the project's success. If the resources are managed in a well manner the performance of the construction project will be higher. Nowadays the competitive environment among the construction industry is increasing, and the companies are

always looking for improvements in equipment features, management techniques etc. One such improved technique of management is Oracle's Primavera P6.

Primavera P6 may provide cost management and resource management planning and planning software that helps companies to take educated decisions and enhance their capacity to deliver 'on schedule and on budget' programmes and projects.

PRIMAVERA

Primavera is effective in top-level planning for intricate details management. This provides planners, project managers, planning controllers and many other specialists with one single click of the button to obtain project information. PPM offers extensive information on all projects within

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a company, ranging from managers' summaries to full project plans. Persons across all organisational levels may analyse, record and share trustworthy information and decide on time, informed and supporting their business purpose. This implies that all employees may keep updated and stay in the loop using a single system.

Scope Of Primavera

PPM allows a company to: • it supports planing, manages project activities by placing the appropriate tool in the right hands.

- Check the details required to complete projects
- Comprise current resource requirements, define priorities and assess the needs of long-term personnel;
- The efficient and productive use of skilled resources
- We can monitor project performance and view prior achievements
- It helps you without effort to dismantle projects and operations

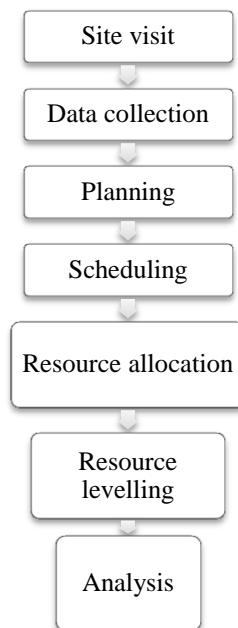
Benefits Of Primavera

- Primavera allows us to create Gantt charts, histograms and network diagrams.
- The float available can be recognised and all important routes can be identified.
- It can control the estimates and budgets even after changes at finishing points.
- It helps us to calculate risks and these risks probable effect or impact on the project cost, schedule and duration.
- It provides us project performance and also shows notification if it has deviated from the acceptable or minimum project performance.

Objectives

- Project activity planning and planning.
- Adopt correct sequencing of activities by establishing a link between activities.
- To allocate resource effectively for the available materials and equipment
- Resource levelling to remove over allocation.
- To analyse if spring is useful to carry out a project.

METHODOLOGY



Site Visit

The site for proposed residential building construction located at Vandithavalam, Palakkad district, is visited. The residential building is having an area of 1250 sq. ft and a single floor.

DATA COLLECTION

It includes collection of various information and data that is required for the project completion

in primavera from the experts like the site engineers, supervisors etc. for 1250 sq.ft. area residential building. Various data like, different

stages of construction, activities involved in each stage, necessary resources for each activity, which include men, machineries, materials etc.

COST OPTIMIZTAION		Current Project's Resources		18-May-21 18:46	
Resource ID	Resource Name	Resource Type	Unit of Measure	Max Units/Time	
R-13	BRICK	Material	pieces	2000pcsd	
R-12	STEEL BARS	Material	kilogram	200kg/d	
HB	HOLLOW BRICK	Material	pieces	200pcsd	
R-29	GRANITE	Material	square feet	100sqft/d	
R-19	TILES	Material	square feet	90sqft/d	
R-17	WHITE CEMENT	Material	kilogram	35kg/d	
R-26	CEMENT	Material	bag	12bg/d	
R-41	ELECTRICAL PIPES	Material	pieces	8pcsd	
R-16	WINDOWS	Material	pieces	8pcsd	
R-38	PAINTING BRUSH	Material	pieces	8pcsd	
R-15	PAINTING MATERIALS	Material	litre	8ld	
R-14	CLOSET	Material	pieces	8pcsd	
R-34	PVC PIPES	Material	meter	8m/d	
R-43	LIGHTS AND FAN	Material	pieces	8pcsd	
R-42	SWITCHES AND PANELS	Material	pieces	8pcsd	
R-40	WIRES AND CABLES	Material	boxes	8box/d	

FIG.NO.1 RESOURCE SHEET

PLANNING

Project planning or simply planning in construction helps to achieve the expected goals and destinations. Planning involves the breakdown of the undertaken whole project into small identifiable and definable tasks and activities and then constitute the logical interdependencies between them. These small identifiable and definable tasks are known as WBS or Work Break

Down structure. After defining WBS calendars are created based on the working days, non-working days, intervals and lunch breaks. Next step is to find out the total number of activities and their respective durations. The activity relationships are assigned to each activity by analysing successors and predecessors. Cost of each material per unit is defined next.

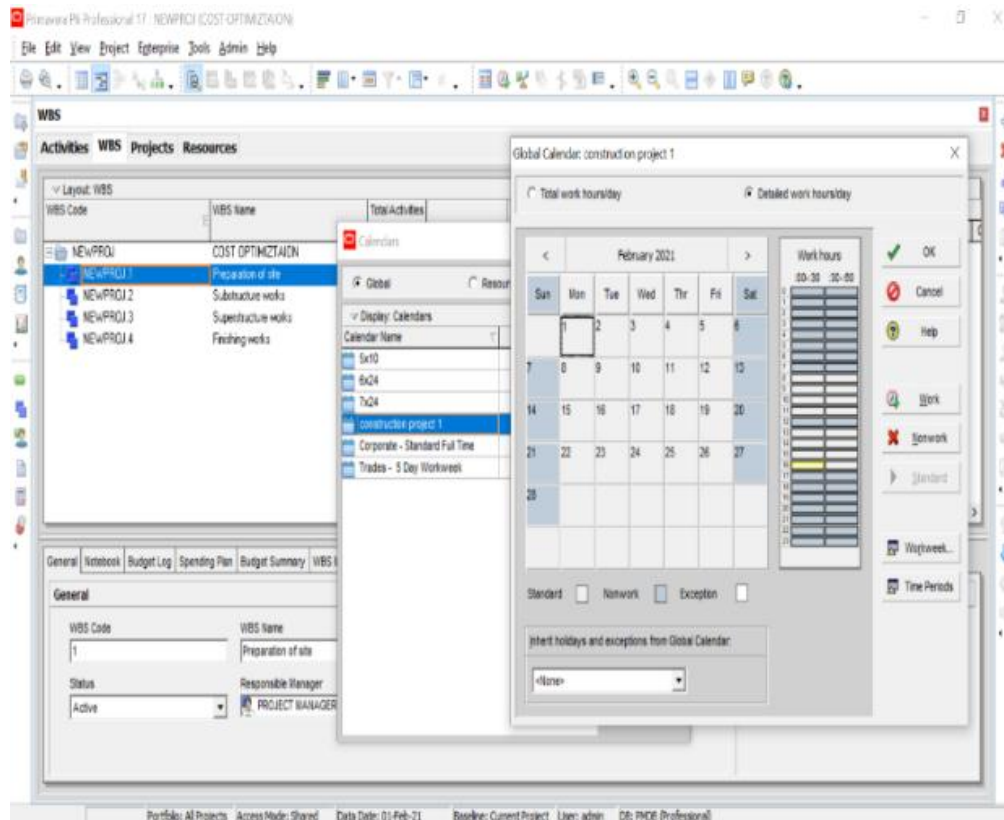


FIG.NO.2. CREATING CALENDARS AND WBS

SCHEDULING

The method is to organise the milestones, activities and outputs of a project within a given period. It refers to slotting out the time duration by thorough planning and analysis to each and every activity to know the total project duration. Scheduling the activities in an efficient way can

trigger better deliverables. Scheduling maintains a proper sequence of activity flow. Scheduling is the tool used by every project management team to predict the most probable project completion date. The project completion date is the total time taken for the critical activities. The critical path can be found out from Gantt chart in the scheduling stage.

COST OPTIMIZTAION		Classic Schedule Layout		
Activity ID	Activity Name	Original Duration	Start	Finish
NEWPROJ COST OPTIMIZTAION		186d	01-Feb-21	01-Nov-21
NEWPROJ.1 Preparation of site		13d	01-Feb-21	17-Feb-21
A1000	Site visit	1d	01-Feb-21	01-Feb-21
A1010	Site cleaning	1d	01-Feb-21	01-Feb-21
A1020	Drafting plan	2d	02-Feb-21	03-Feb-21
A1030	Building permission	5d	04-Feb-21	10-Feb-21
A1040	Temporary shed construction	2d	11-Feb-21	12-Feb-21
A1050	Electricity permission	1d	15-Feb-21	15-Feb-21
A1060	Setbut	1d	15-Feb-21	15-Feb-21
A1070	Excavation	2d	16-Feb-21	17-Feb-21
A1450	supervision	13d	01-Feb-21	17-Feb-21
NEWPROJ.2 Substructure works		12d	18-Feb-21	05-Mar-21
A1080	Dry rubble masonry	3d	18-Feb-21	22-Feb-21
A1090	Random rubble maonny	3d	23-Feb-21	25-Feb-21
A1100	Damp proof course	3d	26-Feb-21	02-Mar-21
A1110	Soil filling upto plinth area and consolidal	2d	03-Mar-21	04-Mar-21
A1120	Filling 40mm jelly on top of the soil	1d	05-Mar-21	05-Mar-21
A1460	supervision	12d	18-Feb-21	05-Mar-21
NEWPROJ.3 Superstructure works		48d	08-Mar-21	13-May-21
A1130	Setting main doorframe and other doorf	1d	08-Mar-21	08-Mar-21
A1140	Wall construction	10d	09-Mar-21	22-Mar-21
A1150	Setup lintel	4d	23-Mar-21	26-Mar-21
A1160	Sunshade construction	4d	23-Mar-21	26-Mar-21

FIG.NO.3 SCHEDULING ACTIVITIES

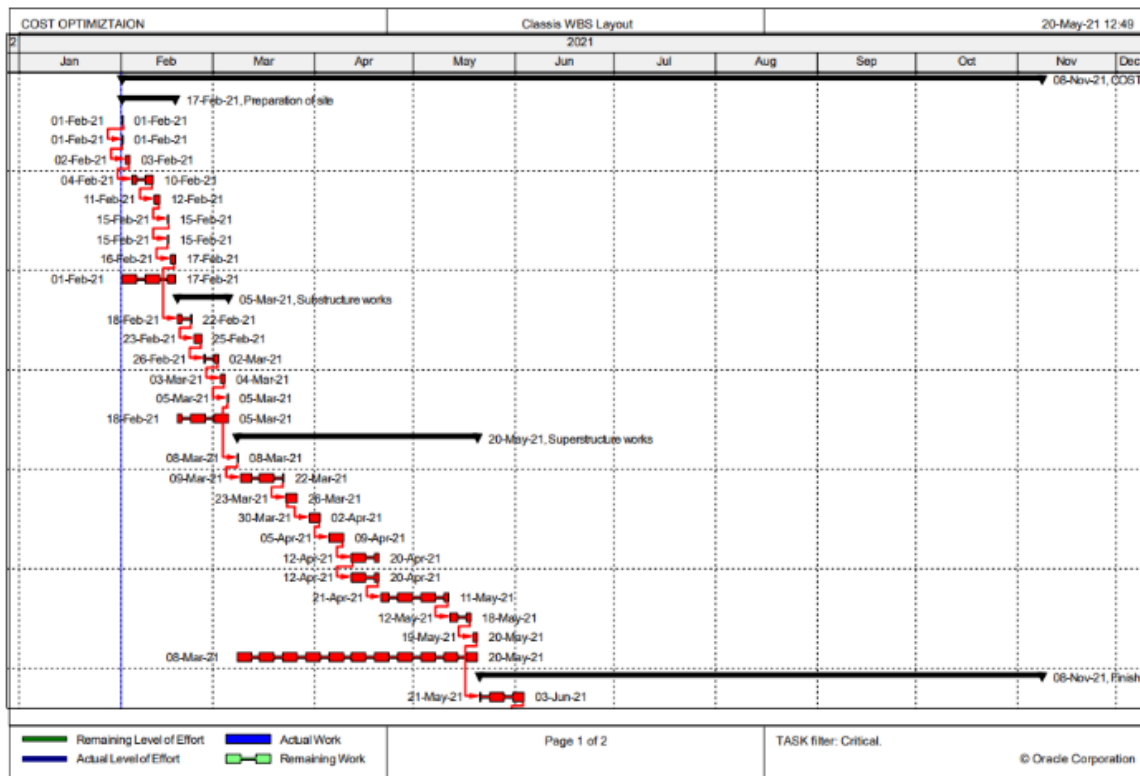


FIG.NO.4 GNATT CHART

RESOURCE ALLOCATION

The resources are men (labour), material, machinery (non-labour). After scheduling the resource sheets are prepared or resources are added and are allocated to each activity. The resource can be allocated appropriately by adjusting the Max Units/Time, for each respective time period of the project. So, by this resource allocation process one is able to pre-plan the anticipated resource needs for each working day of the project even before the time schedule is put into action.

The allocated total resource requirement is then compared with the quantity on hand. If the supply on hand exceeds the requirement, then the

work can be scheduled as planned. If it is found that the demand exceeds supply, proper steps should be taken to ensure the required quantity of resources should be on hand on the date the work has to be carried out. This resource allocation process determines whether there is enough supply of resources as needed for the work. How the resources are allocated in the primavera p6 is shown fig.no.5. At the end of resource allocation, the total budgeted cost for each individual activity, each WBS and budgeted total project cost is found out. This can be compared with the ongoing working cost.

COST OPTIMIZATION		Classic Schedule Layout		31-Mar-21 13:00
Activity ID	Activity Name	Original Duration	Resources	Budgeted Total Cost
NEWPROJ COST OPTIMIZATION				Rs.1,912,753.81
NEWPROJ.1 Preparation of site				Rs.58,316.40
A1C	Site visit	1d		Rs.0.00
A1C	Site cleaning	1d	JCB	Rs.9,600.00
A1C	Drafting plan	2d	DRAFTSMAN	Rs.5,000.00
A1C	Building permission	5d		Rs.0.00
A1C	Temporary shed construction	2d	MASON, MALE HELPER, FEMALE HELPER, HOLLOW BRICK, CEMENT, MSAND, CEMENT	Rs.24,490.00
A1C	Electricity permission	1d		Rs.0.00
A1C	Sebut	1d	MALE HELPER	Rs.600.00
A1C	Excavation	2d	EARTH WORKERS, MALE HELPER	Rs.7,800.00
A14	supervision	13d	SITE ENGINEER, SUPERVISOR	Rs.10,826.40
NEWPROJ.2 Substructure works				Rs.181,868.60
A1C	Dry rubble masonry	3d	MASON, MALE HELPER, FEMALE HELPER, BOLDER, DUST SAND	Rs.63,600.00
A1C	Random rubble maony	3d	MASON, MALE HELPER, FEMALE HELPER, BOLDER, MSAND, CEMENT	Rs.57,300.00
A11	Damp proof course	3d	COARSE AGGREGATE, STEEL BARS, BINDING WIRES, MASON, MALE HELPER	Rs.29,675.00
A11	Soil filling upto plinth area and consolidation	2d	MALE HELPER, FEMALE HELPER	Rs.11,000.00
A11	Filling 40mm jelly on top of the soil	1d	MALE HELPER, FEMALE HELPER, COARSE AGGREGATE	Rs.10,300.00
A14	supervision	12d	SITE ENGINEER, SUPERVISOR	Rs.9,993.60
NEWPROJ.3 Superstructure works				Rs.591,976.60
A11	Setting main door frame and other door fram	1d	MALE HELPER, FEMALE HELPER, MASON	Rs.3,700.00
A11	Wall construction	10d	MASON, MALE HELPER, FEMALE HELPER, CEMENT, MSAND, BRICK	Rs.146,800.00
A11	Setup lintel	4d	MASON, MALE HELPER, FEMALE HELPER, COARSE AGGREGATE, STEEL BARS, BINDING WIRES, CEMENT, MSAND	Rs.76,325.00
A11	Sunshade construction	4d	MASON, MALE HELPER, FEMALE HELPER	Rs.7,400.00

FIG.NO.5. RESOURCE ALLOCATION

RESOURCE LEVELLING

The resources required for the project are allocated in primavera p6. While allocating the resources there is a chance that you may over allocate resources. So, removing over allocated resources from your project is usually called as resource levelling. Resource leveling is a project management technique used to overcome the

resource constrains. In resource levelling the start and end dates of the scheduled projects are adjusted accordingly to the available resources. Adjusting the start and end dates are not advisable, since it can increase the cost of project. The other way of resource leveling is by delaying the non-critical activities of the project without affecting the project duration.

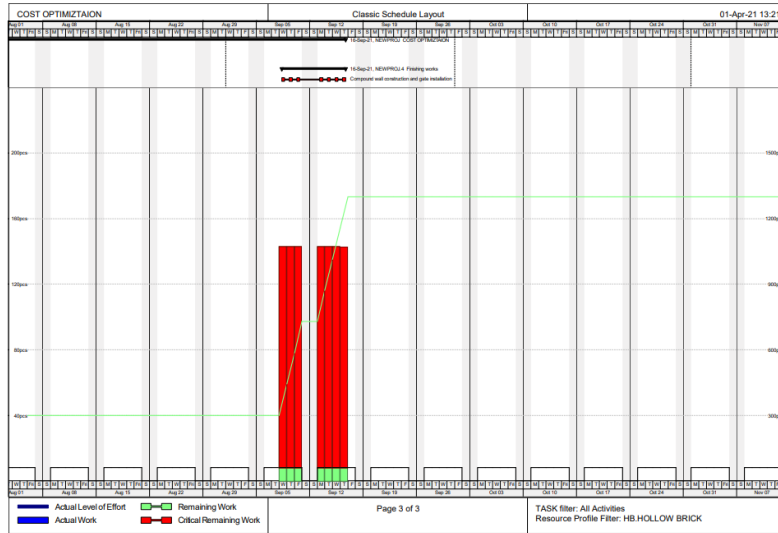


FIG.NO.6 OVER ALLOCATION OF RESOURCE

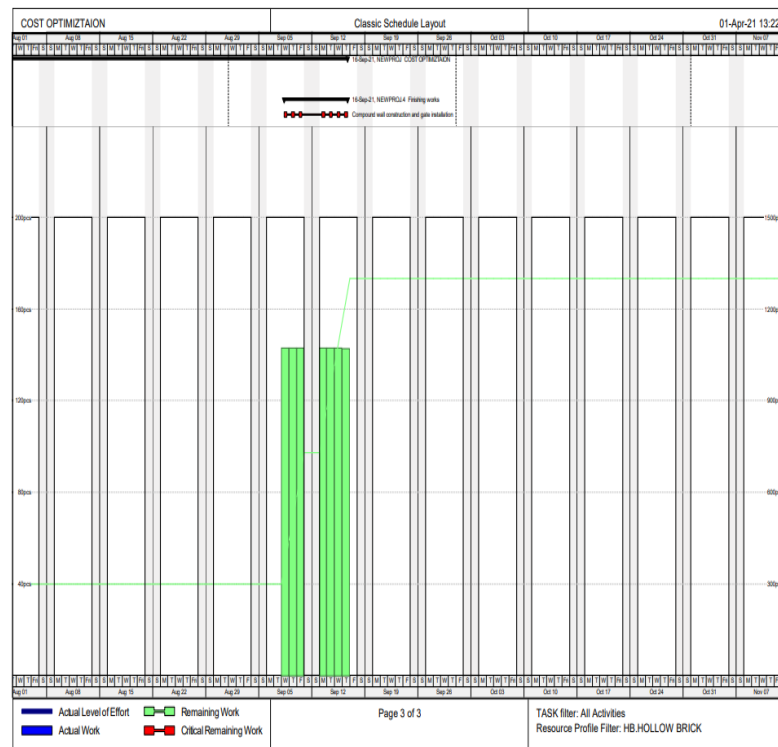


FIG.NO.7. LEVELED RESOURCE

S-Curve

S-Curve is the graph showing the plot between cost, units or hours over time. This graph helps us to track the budgeted cost of labour or non-labour, units or hours with the on-hand values. So, we can easily analyse any change from the budgeted values. This s-curve is usually depicted at the

bottom right hand of the screen in primavera, i.e., at activity usage profile. The s-curve for any values over time can be generated, here the s-curve for total budgeted labour cost for all the activities has been generated. This curve can also be generated for selected activities of the project. On

updating this curve with the on-hand project labour cost will helps us to track changes.

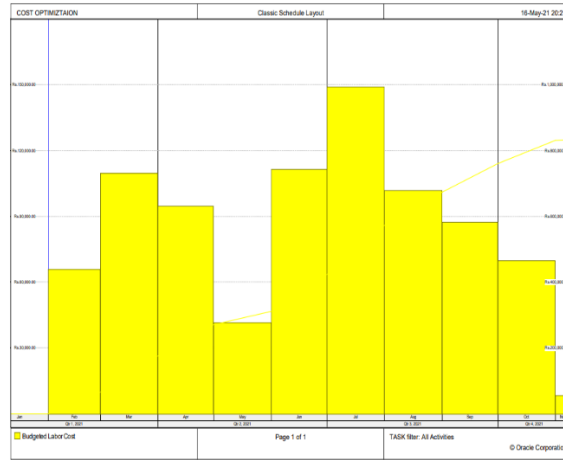


FIG.NO.8. S-CURVE FOR BUDGETED LABOUR COST

ANALYSIS

A residential building of 1250 sq. Ft. area is selected for the project. The data required for the project has been collected and all the required data are entered in primavera p6. At the stage of planning and scheduling gnatt chart can be easily generated using primavera which is very useful to determine the order to complete the task, they also show the dependencies between the tasks, also the expected completion date of the project. As the gnatt chart provide all this information so accurately we can easily carryout the activities and track progress of the work. Resource allocation

was the next stage in which a pre calculated or budgeted resources were assigned to each individual activities of the project. On assigning resources to activities, it gives a total budgeted cost for labour, non-labour and materials, for the entire project as well as for each individual activity and for each WBS, shown in fig.no.9. This budgeted cost plays an important role as it is useful to compare with the on-hand work. Over allocated resources were levelled at the next stage. Over allocation creates constrains in project. Primavera is very helpful in removing over allocation.

COST OPTIMIZATION		Class: WBS Layout		21-May-21 12:08
Activity ID	Activity Name	Budgeted Labor Cost	Budgeted Material Cost	Budgeted Nonlabor Cost
COST OPTIMIZATION		Ru\$38,538.40	Ru\$1,028,615.00	Ru\$44,000.00
Preparation of site		Ru\$27,202.40	Ru\$20,750.00	Ru\$8,000.00
A1000	Site visit	Ru\$0.00	Ru\$0.00	Ru\$0.00
A1010	Site clearing	Ru\$0.00	Ru\$0.00	Ru\$0.00
A1020	Dredging/plan	Ru\$5,000.00	Ru\$0.00	Ru\$0.00
A1030	Building permission	Ru\$0.00	Ru\$0.00	Ru\$0.00
A1040	Temporary shed construction	Ru\$3,700.00	Ru\$20,750.00	Ru\$0.00
A1050	Electricity permission	Ru\$0.00	Ru\$0.00	Ru\$0.00
A1060	Soil	Ru\$0.00	Ru\$0.00	Ru\$0.00
A1070	Excavation	Ru\$7,800.00	Ru\$0.00	Ru\$0.00
A1400	supervision	Ru\$10,802.40	Ru\$0.00	Ru\$0.00
Substructure works		Ru\$1,645.60	Ru\$1,190,225.00	Ru\$0.00
A1080	Drytable masonry	Ru\$11,100.00	Ru\$2,200.00	Ru\$0.00
A1090	Non-drytable masonry	Ru\$10,100.00	Ru\$28,100.00	Ru\$0.00
A1100	Camp proof course	Ru\$1,100.00	Ru\$1,375.00	Ru\$0.00
A1110	Soil filling upto 10th area and consolidation	Ru\$10,000.00	Ru\$0.00	Ru\$0.00
A1120	Filling 40mm jelly on top of the soil	Ru\$3,300.00	Ru\$7,200.00	Ru\$0.00
A1400	supervision	Ru\$9,960.00	Ru\$0.00	Ru\$0.00
Superstructure works		Ru\$2,091.60	Ru\$348,750.00	Ru\$35,000.00
A1130	Setting main door frame and other door frames	Ru\$3,700.00	Ru\$0.00	Ru\$0.00
A1140	Wall construction	Ru\$50,000.00	Ru\$6,300.00	Ru\$0.00
A1150	Setup frame	Ru\$18,000.00	Ru\$1,325.00	Ru\$0.00
A1160	Structural construction	Ru\$7,400.00	Ru\$0.00	Ru\$0.00
A1170	Wall construction upto roof	Ru\$2,200.00	Ru\$4,250.00	Ru\$0.00
A1180	Main slab concreting	Ru\$37,100.00	Ru\$103,000.00	Ru\$0.00
A1190	Sheet piling	Ru\$12,000.00	Ru\$0.00	Ru\$35,000.00
A1200	Camp/Proct	Ru\$0.00	Ru\$0.00	Ru\$0.00
A1210	Proct	Ru\$50,000.00	Ru\$20,000.00	Ru\$0.00
A1220	Column base construction	Ru\$2,000.00	Ru\$1,610.00	Ru\$0.00
A1400	supervision	Ru\$8,141.60	Ru\$0.00	Ru\$0.00
Finishing works		Ru\$42,772.20	Ru\$398,150.00	Ru\$0.00
A1230	Pumping	Ru\$0.00	Ru\$400.00	Ru\$0.00
A1240	Electric pipe setup inside roof	Ru\$0.00	Ru\$498.00	Ru\$0.00

FIG.NO.9. BUDGETED LABOUR, MATERIAL, NON-MATERIAL COST

CONCLUSION

The project aimed at the resource optimization of a residential building using primavera through proper planning and scheduling of activities. Activities were properly sequenced by providing activity relationship. Resources are allocated with the available materials and equipment. The project management tool primavera was very effective for preparing the budgeted cost of the residential

building of 1250 sq.ft. area. The allocated resources were levelled, this levelling leads to resource optimization. The prepared budgeted cost for labour, non-labour, and materials are used to track the work on site, so it will be useful to keep the project on track without much deviations. Thus, it has concluded that the primavera software was helpful for the execution of project.

REFERENCES

- [1]. **Prof. M. C. Paliwal and Divya Chouriya** (2019), 'A Comprehensive Review on Cost Optimization by Resource Allocation Using Primavera'. vol.4 no. 9
- [2]. **Vignesh V** (2017), 'Resource Optimization of Construction Project Using Primavera' Vol.14, Issue 1
- [3]. **Bhajanthri Thirumalesha and Rajani V. Akki**(2017), 'Resource Optimization In Construction of A Residential Apartment Using Primavera', Vol.4 Issue;6
- [4]. **Sushma. H, Mrs. Bhavya.S** (2017), 'Planning, Sceduling and Resource Optimization for road construction', Vol.4, Issue 3, IJIRT
- [5]. **Mohammad Zaki Haider¹, Rajendra S², Vijay K³** " Planning, Tracking and Application Administration using primavera web logic p6" IJRET eISSN: 2319-1163 / pISSN: 2321-7308.
- [6]. **S. Ragavi¹, Dr. R.N. UMA²** "Review of Project Management Software- MS Project and Primavera" IRJET e-ISSN:2395-0056, p-ISSN: 2395-0072, Vol:03 Issue:11, Nov-2016