

Optimization of Time and Cost of a Residential Building (G+24) Using Primavera P6

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Abstract: Resource management or the practice of planning, scheduling, and assigning people, money, and technology to a project is very important. In this current world, construction projects are massive and come with lots of complications. Thus, general schedule control techniques are useful in optimizing resource scheduling and project duration. Primavera P6 is one such software that is used for planning, managing, and executing project work. It is designed to handle large and small projects in several diverse industries such as construction, manufacturing, energy, and IT. Compared to conventional methods, this tool has been highly effective for project managers. Practically, work delays occur due to various uncertainties. Hence by software techniques, one can apply resource dependencies, reschedule the project, and fast-tracking critical activities which delay the duration. The main aim of the study is to optimize the time and cost of a residential building through planning and scheduling, allocation of needed resources, budgeting and tracking by using the Primavera P6 tool. In conclusion, it is important to realize that through crashing and resource leveling the time and cost will be optimized and hence in this paper there will be changes to the schedule between the expected and optimized progress. Based on that, the schedule needs to be changed to complete the paper.

Keywords: Planning, Scheduling, Optimization, Tracking, Primavera P6, Crashing, Resource leveling.

1. Introduction

Today construction and infrastructure industries are the second largest industries in India. Although being the second largest industry many projects are still carried out by conventional methods and approaches leading to improper planning and management. Due to this inadequate project formulation, the industry faces problems like cost overruns and time overruns. Many organizations use tools like labor wage cards, Excel, handling many files and papers, and many other traditional methods which makes it a tedious job for engineers and project managers to execute the project.

Project management and formulation seem to offer what is needed in terms of tools and techniques to solve this problem to make this job easier and more effective. In India, there is a lack of project management practices prior to the start of the project. Various complex phases are involved in large building construction projects. The pressure to complete such projects on time and within budget is making project developers implement the project management process.

In the absence of Managerial competence, projects which are otherwise feasible may fail. On the contrary, even a poor project may become a successful one with good managerial ability. Project management on the other hand seems to offer what is needed in terms of tools and techniques to solve this problem and to make the job easier and more effective. Hence to meet such perfect conditions there are tools in the form of software such as Primavera P6, MS Project, etc. So, to overcome this, in this analysis, we are using technology and software like Primavera P6 which can be used for effective and efficient management of projects. In this present study, we are planning and scheduling a residential building using Primavera P6 and performing a feasibility study on this project and finding the life cycle cost of the project.

The objectives of this study are:

- 1) To collect the data from the site and import it on Primavera P6.
- 2) To prepare a schedule of G+24 residential buildings and allocate resources using Primavera P6.
- 3) To reschedule and reallocate the resources which will give us the optimized cost.
- 4) Crashing schedule and finding the optimized duration.
- 5) To conduct a financial feasibility study.
- 6) To find the Life Cycle cost of the building.



Fig. 1. Primavera phases cycle

A. Problem Statement

Optimization of time and cost of a Residential (G+24) building using Primavera P6 along with its feasibility study and

life cycle costing analysis.

B. Scope

Feasibility study: The study involves the analysis basis on three different parameters of economical aspect, technical aspect, and schedule aspect.

Planning: The planning stage is the preliminary stage of project management where there will be data collection along with the specifications that are stated to carry out the smooth execution of the project.

Scheduling: The project is arranged in a proper work order which is drafted in Work Breakdown Structure (WBS) in Primavera P6. The list of activities is prepared and ordered properly with interrelationships. The duration of the project is determined along with the estimated cost of the project.

Tracking: After the start of the project track record of the project is taken with the help of Primavera P6 which helps in tracking the actual completion of the project with the drafted timeline.

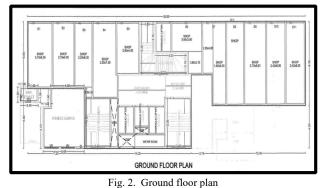
Life cycle costing: Costing of the life cycle is calculated with the cost of construction from day 1 till the completion of the project along with the maintenance and sinking fund.

C. Objectives

- 1) To collect the data from the site and import it on Primavera P6.
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2. Data Collection and Optimization

A. Planning



Construction planning is a fundamental and challenging activity in project management and execution of construction projects. It includes the selection of construction techniques, the definition of work tasks, the estimation of required durations and resources of individual tasks, and identify the interdependency between different work tasks. For this project, the Actual planning process starts with the collection of data like layout (Floor plan, section and elevation), project, start date, and activities involved in the construction of a G+24 Residential building at Anand Nagar, Thane; equipped with modern technologies. The activity sequences, duration taken, resources needed and the amount and cost spent for each and every activity.



Fig. 3. First floor plan



Fig. 4. Site location

60°

Fig. 5. 3-D model

B. Scheduling of (G+24) Residential Building

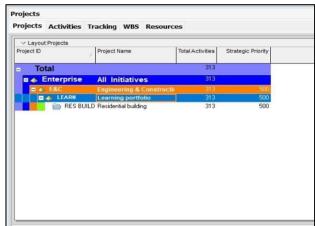


Fig. 6. Project

Project is a series of activities, which are performed to create a product, service, or a measurable business result in any organization. An ideal project will have a definite beginning and end. A project is concluded in the hierarchy, when its objectives have been reached or when the project is terminated.

A project portfolio is a collection of projects where you can easily view data from more than one project at a time. It facilitates effective new product development and management of the projects by grouping the projects and programs together to optimize the organization or a project's success. It also allows for reviewing the summary data and status information of an organization or a project.

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Fig.7. Project portfolio

Enterprise Project structure (EPS) represents the hierarchical structure of all projects in an organization. EPS will always occupy the highest level of the project management hierarchy. It can be subdivided into as many levels as needed to represent the entire work of an organization. The number of EPS levels or subsidiaries depends on the scope of the projects.

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Fig. 8. Enterprise Project Structure

Organizational Breakdown Structure is part of the CPM hierarchy which is used to identify or assign the responsible employees for a project. Example: Project Manager, Sales Manager, HR manager, etc. This is a very important phase in the project management hierarchy because the efficiency of a project will always depend on the right or skilled project manager.

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Fig. 9. Organizational Breakdown Structure

Calendar is assigned to activities and resources where they are used for scheduling activities and leveling resources. The Primavera P6 supports three types of calendars namely the Global calendar, Project Calendar, and Resource Calendar. In this project, we have used 6 Days X 8 Hours Global Calendar.

C Tota	al work h	ours/day				Detail	led work hours/day		
<		De	cember	2019		>	Work hours	1	ок
Mon	Tue	Wed	Thr	Fri	Sat	Sun	:00-:30 :30-:60	0	Cance
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İnherit	holidays	and exce	ptions fro	om Global	I Calenda	r:			

Fig. 10. Calendar

Work Breakdown Structure (WBS) is a hierarchical arrangement of work or activities that divides a project into discrete levels, phases or layers. Developing WBS is the foremost step done by a project manager while creating a project. WBS is a key project deliverable that organizes the project's total work into manageable sections. For this project, WBS is created for different stages involved in the construction of multistoried residential building.

Activities are the basic work elements of a project. An activity is also known as a task, item or event. These are the lowest level of manageable work elements in a project. The activities that are required for the project with their original duration are added under respective WBS. The total number of activities involved in this project are 313. Successors and predecessor are assigned for all the activities. Interdependencies of various activities for simultaneous independent work are assigned.

B5 Code	WBS Name	Total Activities
RES BUILD	Residential building	313
RES BUILD.1	Documentation	8
RES BUILD 2	Acquisition of material and equipments	5
RES BUILD.3	Initation	5
RES BUILD.4	Substructure	14
RES BUILD.5	Superstructure	220
RES BUILD.5.1	Ground floor	10
RES BUILD.5.1.1	Tower parking	3
RES BUILD.5.2	1st floor	8
RES BUILD.5.2.T	Tower parking	3
RES BUILD.5.3	2nd floor	8
RES BUILD.5.3.T	Tower parking	3
RES BUILD.5.4	3rd floor	8
RES BUILD.5.4.T	Tower parking	3
RES BUILD.5.5	4th floor	8
RES BUILD.5.5.T	Tower parking	3
RES BUILD.5.8	5th floor	8
RES BUILD.5.6.1	Tower parking	
RES BUILD.5.7	6th floor	8
RES BUILD.5.7.T	Tower parking	3
RES BUILD.5.8	7th floor	8
RES BUILD.5.8.1	Tower parking	3
RES BUILD.5.9	Sth floor	8
RES BUILD.5.9.1	Tower parking	
RES BUILD.5.10	9th floor	8
RES BUILD.5. 10.1	Tower parking	
RES BUILD.5.11	10th floor	8
RES BUILD.5.11.1	Tower parking	3
RES BUILD.5.12	11th floor	8
RES BUILD.5.12.1	Tower parking	
RES BUILD.5.13	12h floor	-
RES BUILD.5.13.T	Tower parking	-
RES BUILD.5.14	13h floor	
RES BUILD.5.14.1	Tower parking	1
RES BUILD.5.15	14h floor	8
RES BUILD.5.15.1	Tower parking	3
RES BUILD.5.16	15h floor	8
RES BUILD.5. 18.1	Tower parking	2
RES BUILD.5.17	10h fibor	4
RES BUILD.5.17.1	Tower parking	1
RES BUILD.5.18	17h floor	8
RES BUILD.5.18.1	Tower parking	

Fig. 11. Work Breakdown Structure

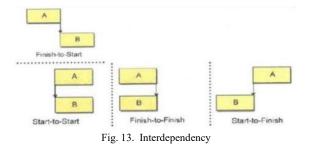
D	Activity Name	Start	Finish	Origina	Remaining		Budgeted Total Cost	Critica
Total		21-Dec-19	20-Aup-24	Duration 1461d	Duration 1461d		Rs 212 939 490 00	-
		21-Dec-19	20-Aup-24	1461d	1461d		Rs 212 939 490.00	
Res build		21-Dec-19	03-Mar-20	14010	14010		Rs 3,262,125.00	
A1000	Project start	21-Dec-19	00-mai-20	01	01		Bs 0.00	
A1010	Construction agreement	21-Dec-19	28-Dec-19	70	7d		Rs.777.000.00	R
📟 A1020	Architecturaldrawings	30-Dec-19*	21-Jan-20	20d	20d		Rs.150,000.00	5
📟 A1030	Specification	22-Jan-20*	07-Feb-20	15d	15d		Rs.555,000.00	P
📟 A1040	RCC drawings	08-Feb-20*	17-Feb-20	80	80		Rs.240,000.00	V
📟 A1050	Work orders	18-Feb-20*	24-Feb-20	6d	6d		Rs.666,000.00	P
🚍 A1060	Clearance certificate	25-Feb-20*	28-Feb-20	40	4d		Rs.485,625.00	2
A1070	Commencement certificate	29-Feb-20*	03-Mar-20 30-Mar-20	3d	3d		Rs.388,500.00	P
Acquisition of m	naterial and equipments Machinery	044Mar-20 044Mar-20*	30-Mar-20 17-Mar-20	2230	203		Rs 2 700 000 00	
A1080	Tools and plants	18-Mar-20*	21-Mar-20	40	120		Rs.5.545.000.00	- 12
A1100	Shuttering and centering	23-Mar-20*	30-Mar-20	70	70		Rs24.040.170.00	Ē
A1110	Steel	23-Mar-20*	26-Mar-20	40	40		Rs.32,756,895.00	Ē
A1120	Fixed Salary personals	27-Mar-20*	27-Mar-20	1d	1d		Rs.2,340,000.00	
E Initiation		25-Mar-20	04-Apr-20	10d	10d		Rs.1,417,480.00	
📟 A1130	Site cleaning	25-Mar-20*	25-Mar-20	1d	1d		Rs.3,200.00	P
🚍 A1140	Surveying and marking boundaries	26-Mar-20*	28-Mar-20	3d	3d		Rs.27,600.00	V
A1150	Water and electricity arrangement	30-Mar-20*	31-Mar-20	2d 2d	20		Rs.1,347,000.00 Rs.19.200.00	되
A1160	Labour camp setup Ste mobilization	01-Apr-20* 03-Apr-20*	02-Apr-20 04-Apr-20	2d	20		Rs.19,200.00 Rs.20.480.00	<u>प</u>
Sub-structure	are modezation	06-Apr-20*	22-Jun-20	28 67d	28		Rs.1,449,520.00	M
A1180	Excavation for foundation	06-Apr-20*	16-Apr-20	100	10d		Rs.271.200.00	R
A1190	PCC for foundation	17-Apr-20*	18-Apr-20	20	20		Rs.20,480.00	V
A1200	RCC	20-Apr-20*	02-May-20	12d	120		Rs.75,600.00	V
A1210	Shuttering	04-May-20*	09-May-20	6d	6d		Rs.120,000.00	P
A1220	Casting	11-May-20*	12-May-20	20	20		Rs.20,480.00	V
📟 A1230	Deshuttering	13-May-20*	14-May-20	26	28		Rs.40,000.00	P
📟 A1240	Backfiling	15-May-20*	20-May-20	5d	5d		Rs.34,600.00	2
A1250	PCC for PB RCC and shuttering of PB	21-May-20* 22-May-20*	21-May-20 04-Jun-20	1d 12d	1d 12d		Rs.10,240.00 Rs.225.200.00	ব
y ID	Activity Name	Start	Finish		Duration	temaining Duration	Budget ed Tota	
Total		21-Dec-19	15-Apr-24		13528	13526	Rs. 209,585,	
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A1010	Construction acrement	21-Dec-19 21-Dec-19	28-Dec-19		7d	7d	Rs.777,	
A 1020	Ar chite du al drawings	30-Dec-19*	21-Jan20		200	20d	Rs.150,	
A 1030	Specification	22-Jan-20*	07-Feb-20		15c	15d	Rs555	
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A 1050	Work orders				88	8d	Rs240.	
🚍 A1060		31-Jan-20*	08-Feb-20		8d 6d	8d 6d		000.00
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Acquisition of A1080 A1080 A1090 A1090 A1000 A1100 A1120 Initiation Sub-structure Sub-structure Ground flow A1220	Commencement confisio & Fmsthrial and equipments Machiney Tools and parts State Fixed Satary personals Fixed Satary personals RCC work	07.Feb-20* 12.Feb-20* 12.Feb-20* 12.Feb-20* 02.Mar-20* 02.Mar-20* 03.Mar-20* 03.Mar-20* 01.Apr-22 01.Apr-22 01.Apr-22	11-Feb20 14-Feb20 25-Feb20 25-Feb20 06-Mar-20 06-Mar-20 16-Mar-20 28-Mar-20 28-Mar-20 28-Mar-20 28-Mar-20 28-Mar-22 08-Mar-22		6d 6d 4d 3d 22k 12c 4d 7d 4d 10k 61c 50 tc 34c 7d	6d 4d 3d 238 12d 4d 7d 4d 1d 1d 100 610 610 34d 7d	Rs240, Rs485, Rs485, Rs57, Rs2700, Rs24040, Rs24040, Rs24040, Rs1417, Rs1442, Rs155, Rs175, Rs175, Rs175, Rs175, Rs175,	000.00 000.00 625.00 500.00 000.00 170.00 885.00 000.00 400.00 500.00 500.00 100.00 000.00
Acquisition of A1080 A1080 A1090 A1100 A1100 A1110 A1120 Initiation Sub-structure Superstandor	Commercement certifica le frankerial and equipments Machiney Tools and piants Shuttering and centering Steel Floed Salary personals or RCC work Shuttering	07.Feb-20* 12.Feb-20* 12.Feb-20* 23.Feb-20* 23.Feb-20* 02.Max-20* 03.Max-20* 07.Max-20* 07.Max-20 07.Apr-22 01.Apr-22 01.Apr-22	11 Feb20 14 Feb20 25 Feb20 25 Feb20 05 Mar 20 05 Mar 20 06 Mar 20 06 Mar 20 25 Mar 42 25 Mar 42 20 25 Mar 42 25 Mar 42 25 Mar 42 25 Mar 42 25 Mar 42 25 Mar 42 25 Mar 42 20 25 Mar 42 25		6d 6d 4d 3d 22k 12c 4d 7d 4d 10k 61c 50 ts 34c	66 68 43 234 126 43 76 43 16 100 614 65 10 346	Rs240, Rs485, Rs485, Rs2700, Rs2700, Rs2700, Rs2700, Rs2400, Rs2400, Rs2400, Rs240, Rs1417, Rs1442, Rs14243, Rs1528, Rs1528, Rs1528, Rs1528, Rs1528, Rs1528, Rs1528, Rs1528, Rs1528, Rs1528, Rs1528, Rs1528, Rs1558, R	000.00 000.00 625.00 500.00 005.00 000.00 170.00 555.00 000.00 400.00 500.00 100.00 100.00 000.00 000.00
Acquisition of A1080 A1080 A1080 A1080 A1180 A1180 A1180 Subestructure Ground floo A1120 A1120 A1120 A1120	Commencement confisio & Fmsthrial and equipments Machiney Tools and parts State Fixed Satary personals Fixed Satary personals RCC work	07.Feb-20* 12.Feb-20* 12.Feb-20* 25.Feb-20* 25.Feb-20* 26.Mar-20* 07.Mar-20* 07.Mar-20* 07.Mar-20 01.Apr-22 01.Apr-22 03.Apr-22	11 Feb20 14 Feb20 25 Feb20 25 Feb20 05 Mar 20 05 Mar 20 06 Mar 20 08 Mar 20 23 Mar 20 20 24 Mar 20 25 Mar 20 25 Mar 20 26 Mar 20 26 Mar 20 26 Mar 20 20 26 Mar 20 20 20 20 20 20 20 20 20 20 20 20 20 2		63 64 40 36 222 122 40 76 46 102 61 6 102 6 102 50 12 34 50 12 34 50 12 50 12 50 12 50 12 50 50 50 50 50 50 50 50 50 50 50 50 50	6d 4d 3d 226 12d 4d 4d 1d 1d 100 616 6316 34d 7d 3d	Rs240, Rs568, Rs485, Rs288, Rs2700, Rs2700, Rs24040, Rs24040, Rs24040, Rs240, Rs240, Rs1417, Rs1417, Rs1418, Rs150, Rs200, Rs200, Rs200,	000.00 625.00 500.00 000.00 000.00 170.00 855.00 500.00 480.00 550.00 550.00 550.00 550.00 550.00 550.00 550.00 550.00 550.00 550.00 550.00 550.00
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Acquisition of A1000 A1000 A1000 A1000 A1100 A1100 A1100 A1100 A1100 A1100 Sub-shucture Superstandar Superstandar A1300 A1300 A1300 A1340 A1300 A	Commensative controls to Machiney Tools and engineering Tools and engineering State of parts State of parts Field Satery periods Policy State of the State of the RCC work: Shut enging Casting Shut enging and RCC for sale and Casting	07.Feb-20* 12.Feb-20* 12.Feb-20* 12.Feb-20* 23.Feb-20* 24.Mar-20* 07.Mar-20* 07.Mar-20* 07.Mar-20* 07.Mar-20* 07.Mar-20* 07.Mar-20* 07.Mar-20* 07.Mar-20* 07.Mar-20* 07.Mar-20* 15.Apr-22* 15.Apr-22* 15.Apr-22* 15.Apr-22*	11 Feb20 14 Feb20 19 May 20 19 May 20 25 Feb20 25 Feb20 19 May 20 19 May 20 19 May 20 19 May 20 19 May 20 19 Apr 22 19 Apr 22 10 A	2	66 46 33 22k 12c 43 7d 45 10k 61k 30k 7d 3d 2d 2d 2d 2d 2d 14k 2d	66 40 36 128 40 76 40 40 10 40 10 616 616 616 616 20 16 346 24 26 140 26	Rs240, Rs568, Rs486, Rs2700, Rs2700, Rs2700, Rs224040, Rs224040, Rs224040, Rs2240, Rs24040, Rs24040, Rs24040, Rs250, Rs250, Rs250, Rs250, Rs40, Rs450, Rs451, Rs454, Rs454, Rs454,	000.00 000.00 550.00 550.00 000.00 170.00
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Accusion of the second se	Commensament carifa a manufacture and carifacture Machaney Totas and garris Stuttering and cartering Stuttering and cartering Pred Savery preconds Pred Savery preconds RCC color Stuttering Deal-barring Carifa Deal-barring Stuttering Deal-barring Stuttering Carifa Deal-barring Carifa Deal-barring Carifa Deal-barring Carifa Deal-barring	07 Feb-20* 12 Feb-20* 13 Apr 22 13 Apr 22	11 Feb20 14 Feb20 16 Marco 25 Feb20 25 Feb20 26 Marco 26 Marco 26 Marco 26 Marco 26 Marco 26 Marco 26 Marco 26 Marco 26 Marco 27 Harlow 26 Marco 20	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	66 43 33 224 121 44 74 45 101 65 344 346 346 346 341 342 343 344 346 346 346 346 346 363	6d 4d 3d 228 124 4d 1d 1d 1d 1d 3d 3d 2d 2d 3d 3d	Ra 240, Ra 450, Ra 450, Ra 500, Ra 250, Ra 220, Ra 20, Ra 20	000.00 000.00 525.00 500.00 105.00 100.00 170.00
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Accusation of Anone Anononone Anone Anone Anone A	Commensative transface to Commensative transface Machine and an ordering Stuttering and centering Stuttering and centering Pred Salary perioritis RCC work Shuttering Calaring Deshuttering Calaring Calaring Calaring Deshuttering Cala	01 F #630* 12 F #630* 10 A #672* 10 A #	14 Feb30 14 Feb30 15 Feb300 15 Feb300	2	6d 4d 223 12c 4d 12c 4d 12c 4d 12c 4d 12c 30 50 50 50 50 50 50 50 50 50 50 50 50 50	6d 4d 228 120 4d 1d 1d 1d 6d 6d 6d 6d 6d 6d 2d 2d 14d 2d 14d 2d 14d 2d 14d 2d 14d 2d 14d 2d 14d 2d 14d 14d	Ra240 Ra260 Ra580 Ra580 Ra580 Ra5200 Ra500 Ra5	000.00 000.00 025.00 000.00 000.00 170.00 000.00 170.00 000.00

al building			Classic Schedule			
	Activity Name	Start	Finish	Original Duration	Remaining Duration	Budget ed Total C
A251 0	RCC work and shu tering	24-Feb-23 07-Mar-23	27-Feb-23 07-Mar-23	3d	3d	Rs.67,500
A252.0	Casting			1d	1d	Rs.20,800
A2530	Desh uttering	09-Mar-23	09-Mar-23	1d	1d	Rs.20,000
15th floor		10-Mar-23	28-Mar-23	16c	18d	Rs. 1, 304, 300
A2540	La ying RCC	10-Mar-23	13-Mar-23	3d	3d	Rs.315,000
A2550	Erection of Auminium formwork	14-Mar-23	21-Mar-23	7d	7d	Rs.500,000
A2560	La ying of RCC Slab	22-Mar-23	23-Mar-23	25	2d	Rs.217,000
A2570	Casting of whole floor	24-Mar-23	25-Mar-23	25	2d	Rs.84,00
A2580	Desh uttering	27-Mar-23	28-Mar-23	25	2d	Rs.80,000
Tower part	ing	14-Mar-23	27-Mar-23	120	12d	Rs 108.300
A2590	RCC work and shu tering	14-Mar-23	16-Mar-23	3d	3d	Rs.67,50
A2500	Casting	74.Mar.73	24.Mar.23	10	1d	Rs 20.80
A2010	Deshuttering	27-Mar-28	27-Mar-23	10	1d	Rs 20 000
	Desnutiering					
ng 16th floor		28-Mar-23	14-Apr-23	16c	16d	Rs. 1, 304, 300
A2520	La ying RCC	28-Mar-23	30-Mar-23	3d	3d	Rs.315,000
A2830	Erection of Auminium formwork	31-Mar-23	07-Apr-23	7d	7d	Rs.500,000
A2840	La ying of RCC Slab	08-Apr-23	10-Apr-23	25	2d	Rs.217,000
A2550	Casting of whole floor	11-Apr-23	12-Apr-23	28	2d	Rs.84,00
A2860	Desh uttering	13-Apr-23	14-Apr-23	25	2d	Rs.80,00
Towner part		21.16-22	12 Arr 22	\$24	124	Pa 109 200
A270	RCC work and shu tering	31 Mar.78	03-Apr-23	34	3d	Rs67.50
		01110110				
A2580	Casting	11-Apr-23	11-Apr-23	1d	1d	Rs.20,800
🖬 A2590	Desh utering	13-Apr-23	13-Apr-23	1d	1d	Rs.20,000
17th floor		14-Apr-23	02-May-23	16c	16d	Rs. 1, 304, 300
A2700	Laying RCC	14-Apr-23	17-Apr-23	3d	3d	Rs.315,000
A2710	Erection of Auminium formwork	18-Apr-23	25-Apr-23	7d	7d	Rs.500,000
A2720	La ying of RCC Slab	28-Apr-23	27-Apr-23	25	2d	Rs.217,000
A2730	Casting of whole floor	28-Apr-23	29-Apr-23	28	2d	Rs84 000
A2740	Desh utering	01-May-23	02-May-23	28	2d	Rs.80.000
Tomat and	containing .	19 Acc 77	Of May 22	120	124	Re 1/8 200
A2750	RCC work and shu tering	18-Agr-23	20-Agr-23	34	3d	Rs87.50
🚍 A2750	Casting	28-Apr-23	28-Apr-23	1d	1d	Rs.20,800
🔲 A2770	Desh uttering	01-May-23 02-May-23	01-May-23	1d 18c	1d 18d	Rs 1, 308, 300
Actual Level of Ef	fort Remaining Work		19-May-23	10	1000	TASK filter AL
Actual Level of Ef			Page 11 of	18		TASK filter: All A
	fort Remaining Work			18		TASK filter: All A
Actual Level of Ef						
Actual Level of Ef Actual Work			Page 11 of	Layout	Remaining	
Actual Level of Ef Actual Work al building	Critical Remain.	Start	Page 11 of Classic Schedule Finish	Layout Original Duration	Duration	TASK filter: All A Budgeted Total C
Actual Level of Ef Actual Work al building A3320	Critical Remain.	Start 29-Aug-23	Page 11 of Classic Schedule Finish 29-Aug-23	Layout Original Duration 1d	Duration 1d	Budget ed Total C Rs20,300
Actual Level of Ef Actual Work al building A332.0 A333.0	Critical Remain.	Start 29Aug-23 31Aug-23	Page 11 of Classic Schedule Finish 29:Aug-23 31:Aug-23	Layout Original Duration 1d 1d	Duration 1d 1d	Budget ed Total C Rs.20,000 Rs.20,000
Actual Level of Ef Actual Work al building A3320 A3330 Terrace	Critical Remain	Start 29-Aug-23 31-Aug-23 01-Sep-23	Page 11 of Classic Schedule Finish 25Aug-23 314ug-23 15Jan24	Layout Original Duration 1d 1d 117d	Duration 1d 1d 117d	Budget ed Total C Rs20,800 Rs20,000 Rs.11,413,300
Actual Level of Ef Actual Work al building A320 A330 Terrace A3340	Critical Remain Activity Name Casting Desh utening RCC laying	Start 29Aug-23 31Aug-23 01-Sep-23 01-Sep-23	Page 11 of Classic Schedule Finish 29 Aug-23 31 Aug-23 15 Jan 24 05 Geg-23	Layout Original Duration 1d 1d 117d 4d	Duration 1d 1d 117d 4d	Budget ad Total C Rs20,800 Rs20,000 Rs.11,413.30 Rs.25,200
Actual Level of Ef Actual Work al building Actual Work al building Actual Work Actual Work Actual Work Actual Level of Ef Actual Vork Terrace Actual Vork Terrace Actual Vork	Critical Remain.	Start 29Aug-23 31Aug-23 01-Sep-23 01-Sep-23 06-Sep-23	Page 11 of Classic Schedule Finish 25Aug-23 31Aug-23 15Jan24 05-Sep-23 11-Sep-23	Layout Original Duration 1d 1d 117d	Duration 1d 1d 117d	Budget ed Total C Rs 20,800 Rs 11,413,340 Rs 25,000 Rs 150,000
Actual Level of Ef Actual Work al building A3320 A3380 A3380 A3380 A3380	Critical Remain.	Start 29Aug-23 31Aug-23 01-Sep-23 01-Sep-23 06-Sep-23 12-Sep-23	Page 11 of Classic Schedule Finish 25 Aug-23 31 Aug-23 15 Jan-24 05 Sep-23 11 Sep-23 12 Sep-23	Layout Original Duration 1d 1d 117d 4d 5d 1d	Duration 1d 1d 117d 4d 5d 1d	Budget ad Total C Rs20,800 Rs11,413,300 Rs150,000 Rs150,000 Rs10,240
Actual Level of Ef Actual Work al building Actual Work al building Actual Work Actual Work Actual Work Actual Level of Ef Actual Vork Terrace Actual Vork Terrace Actual Vork	Critical Remain.	Start 29Aug-23 31Aug-23 01-Sep-23 01-Sep-23 06-Sep-23 12-Sep-23	Page 11 of Classic Schedule Finish 25Aug-23 31Aug-23 15Jan24 05-Sep-23 11-Sep-23	Layout Original Duration 1d 1d 117d 4d 5d	Duration 1d 1d 1d 1d 4d 5d	Budget ad Total C Rs20,800 Rs11,413,300 Rs150,000 Rs150,000 Rs10,240
Actual Level of Ef Actual Work al building A3320 A3320 Britace A3340 A3360 A3380	Critical Remain.	Start 29Aug-23 31Aug-23 01-Sep-23 01-Sep-23 06-Sep-23 12-Sep-23	Page 11 of Classic Schedule Finish 25 Aug-23 31 Aug-23 15 Jan-24 05 Sep-23 11 Sep-23 12 Sep-23	Layout Original Duration 1d 1d 117d 4d 5d 1d	Duration 1d 1d 117d 4d 5d 1d	Budget ef Total C Rs20,800 Rs20,000 Rs11,413,340 Rs26,200 Rs150,000 Rs10,244 Rs37,000
Actual Level of Ef Actual Work al building A320 A330 Terrace A330 A330 A330 A330 A330 A330 A330 A33	Critica Remain.	Start 25-Aug-23 31-Aug-23 01-Sep-23 01-Sep-23 01-Sep-23 12-Sep-23 13-Sep-23	Page 11 of Classic Schedule Finish 25Aug-23 31Aug-23 31Aug-23 15-Jan24 05-6eg-23 11-5ep-23 12-5ep-23 19-5ep-23	Layout Original Duration 1d 1d 1d 117d 4d 5d 1d 1d	Duration 1d 1d 17d 4d 5d 1d 4d 4d	Budget el Total C Rs20,800 Rs20,000 Rs11,413,300 Rs11,413,300 Rs10,240 Rs150,000 Rs10,240 Rs17,700
Actual Level of Ef Actual Work al building Actual Work al building Actual Work Actual Level of Ef Actual Work Actual	Critical Remain.	Start 25Aug-23 31Aug-23 01-Sep-23 01-Sep-23 10-Sep-23 10-Sep-23 13-Sep-23 18-Sep-23 19-Sep-23	Page 11 of Classic Schedule Finish 29-Aug-23 31-Aug	Layout Origina Duration 1d 1d 1d 1d 6d 1d 6d 1d 1d 4d 1d 4d	Duration 1d 1d 1d 4d 5d 1d 4d 1d 4d 1d 4d 4d	Budget ef 'bta' C Rs20,800 Rs21,000 Rs11,413,340 Rs25,200 Rs10,204 Rs57,000 Rs17,000 Rs17,000 Rs17,000 Rs17,000 Rs17,000 Rs17,000 Rs17,000 Rs17,000 Rs17,000 Rs17,000 Rs10,000
Actual Level of Ef Actual Work al building A3220 A3220 A320 A3300	Cating Critical Remain.	Start 29Aug-23 31Aug-23 01-Sep-23 01-Sep-23 12-Sep-23 13-Sep-23 13-Sep-23 19-Sep-23 23-Sep-23	Page 11 of Classic Schedule Finish 234.up.23 314.up.23 154.un24 056.pp.23 116.pp.23 126.pp.23 186.pp.23 186.pp.23 226.pp.23 226.pp.23	Layout Origina Duration 1d 1d 1d 1d 6d 1d 1d 1d 1d 1d	Duration 1d 1d 1176 4d 5d 1d 1d 4d 1d 1d	Budget ed Total C Rs20,800 Rs20,800 Rs11,413,300 Rs12,300 Rs150,000 Rs10,200 Rs17,700 Rs17,700 Rs10,200 Rs10,200 Rs10,200
Actual Level of Ef Actual Work al building Actual Work al building Actual Work Actual Level of Ef Actual Work Actual	Critical Remain.	Start 25Aug-23 31Aug-23 01-Sep-23 01-Sep-23 10-Sep-23 10-Sep-23 13-Sep-23 18-Sep-23 19-Sep-23	Page 11 of Classic Schedule Finish 29-Aug-23 31-Aug	Layout Origina Duration 1d 1d 1d 6d 1d 4d 1d 4d 1d 1d 1d	Duration 1d 1d 17d 4d 5d 1d 4d 1d 4d 1d 1d 1d	Budget ed Total C Rs20,800 Rs20,800 Rs11,413,300 Rs12,300 Rs150,000 Rs10,200 Rs17,700 Rs17,700 Rs10,200 Rs10,200 Rs10,200
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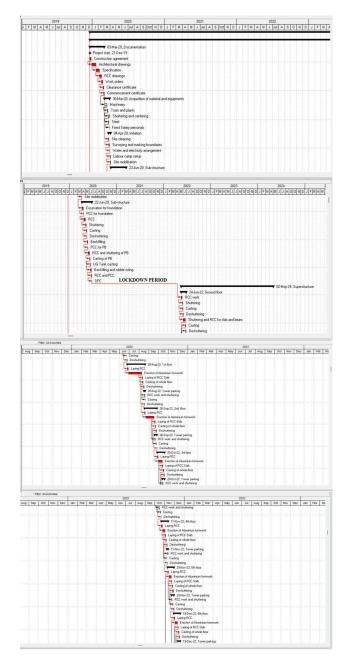
C. Predecessor/Successor Relationship

The four types of relationships in Primavera P6 include the following:

- 1. Finish to Start or FS Relationship: A successor activity cannot be started until a predecessor activity is finished.
- 2. Start to Start or SS Relationship: A successor activity cannot be started until a predecessor activity is started.
- 3. Finish to Finish or FF Relationship: A successor activity cannot be finished until a predecessor activity is finished.
- 4. Start to Finish or SF Relationship: A successor activity cannot be finished until a predecessor activity is started.



Schedule Chart is a type of bar chart that illustrates a project schedule. This chart lists the tasks to be performed on the vertical axis and time on horizontal axis. The width of the horizontal bars in the graph shows the duration of each activity. It shows the start and finish date of the activities.



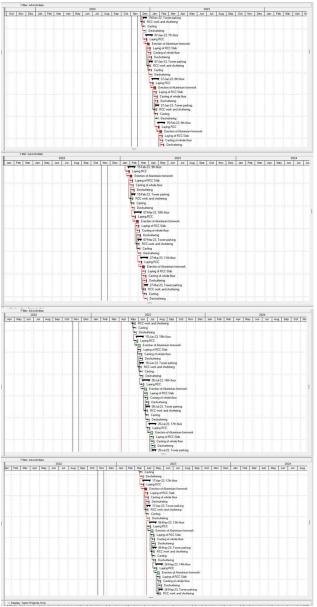
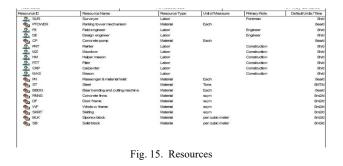


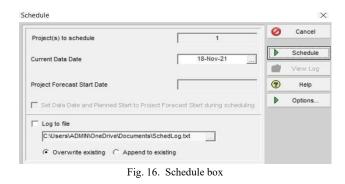
Fig. 14. Schedule chart

Resource creation to complete the activity there are requirements of various resources such as labor, equipment's, materials and machinery. So, we need to create different categories of resources with unit cost and hours of working.



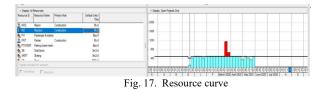
Resource Allocation for Activities: The created resources are then assigned to each and every activity with their respective need. After the resources are allocated the cost for the activity is calculated and the total cost is found out.

Schedule: Critical path methodology scheduling assigns dates to project activities, calculates project's finish date and also reveals the project's critical path.



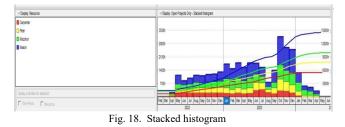
D. Resource Curve

Resource/cost distribution curves enable you to specify how you want resource units or costs spread over the duration of an activity. Resource units and costs are distributed evenly from the assignment start to the assignment finish unless you specify a nonlinear distribution by assigning a curve. You can assign a resource distribution curve to any resource or role assignment on activities with a duration type of Fixed Duration and Units/Time or Fixed Duration & Units. Assign the appropriate curve to a resource or role assignment by selecting a curve in the Curve column in the Resource Assignments window. You can also assign a resource curve in the Resources tab in the Activity details.



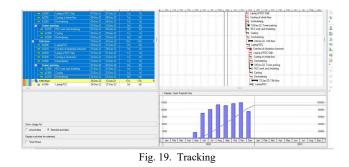
E. Stacked Histogram

Stacked Histogram are a common sight in project environments. Primavera P6's stacked histogram stacks each bar on top of each other to give you a full view of your resourcing over time. The stacked histogram can be graph either at Completion Units or at Completion Costs.



F. Tracking

Project tracking is a project management method used to track the progress of tasks in a project. By tracking your project, you can compare actual to planned progress, and identify issues that may prevent the project from staying on schedule and within budget. Project tracking helps project managers and stakeholders know what work has been done, the resources that have been used to execute those tasks, and helps them create an earned value analysis by measuring project variance and tracking milestones.



The purple bar represents the tracking of selected activities from 1st floor to 12th floor as an example. We can see a clear difference between the month of Nov 22 to Dec 22. This way we can easily track the progress of any selected activities or all activities from the project which will really beneficial till the end.

G. Resource Levelling

Resource levelling is a project management technique used to balance the demand for resources with the availability of those resources. It involves adjusting the project schedule to ensure that the resources required for each task are available when needed, without overloading or underutilizing them. The goal of resource levelling is to optimize resource utilization while maintaining the project schedule and budget. It is especially important for projects with limited resources or those that require specialized skills or equipment. By balancing resource demand and availability, resource levelling can help prevent delays, reduce costs and improve project outcomes.

H. Rescheduling

Rescheduling in Primavera P6 is a process of updating the project schedule to reflect changes in the project scope, timeline, or resource availability. It involves adjusting the project schedule to ensure that it reflects the most up-to-date information and accurately reflects the status of the project.

To reschedule a project in Primavera P6, follow these steps:

- Update the project schedule: Update the project schedule to reflect any changes in the project scope, timeline, or resource availability. This may involve adding, deleting, or modifying activities, as well as adjusting durations and dependencies.
- 2) Review the critical path: Review the critical path to ensure that it reflects the most up- to date information. The critical path is the longest sequence of activities that determines the earliest possible completion date of the project. It is important to ensure that the critical path is accurate, as it will drive the project timeline.
- 3) Analyze resource usage: Analyze resource usage to ensure that resources are being utilized efficiently and

effectively. This may involve adjusting resource assignments or re-allocating resources to different activities.

Overall cost after Rescheduling:

Table 1				
Comparison of cost between two schedules				
S.No.	Туре	Cost (including additional investments=Rs.3,22,82,500)		
1	Budgeted total cost	Rs. 24,52,21,990		
2	Optimized cost	Rs. 20,84,65,750		

I. Schedule Crashing

Schedule crashing is a project management technique that is used to accelerate the completion of a project by shortening the project schedule. In Primavera P6, schedule crashing involves reducing the duration of critical activities in order to achieve the desired project completion date.

To perform schedule crashing in Primavera P6, follow these steps:

- 1) Identify critical activities: Identify the critical activities in the project schedule that are on the critical path and have the biggest impact on the overall project duration.
- 2) Determine the crashing options: Determine the options available to shorten the duration of these critical activities. This may include adding additional resources, increasing work hours, or reducing the scope of the activity.
- 3) Analyze costs: Analyze the costs associated with each option, including the cost of additional resources, overtime pay, and other expenses. Determine the most cost- effective option for each critical activity.
- 4) Update the schedule: Once the most cost-effective option has been determined, update the project schedule to reflect the new duration of the critical activities.

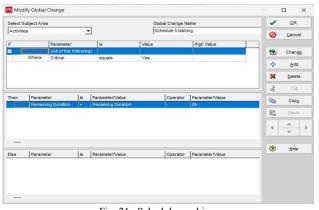


Fig. 21. Schedule crashing

J. Optimized Crashing

✓ Layout: Classic Schedule Layout					Filter: All Activities			
Activity ID	Activity Name	Start	Fin	ish	Original Duration	Remaining Duration		
Total		21-Dec-19	11-	Apr-24	1348d	1348d		
- 🕜 Res build		21-Dec-19	11-	Apr-24	1348d	1348d		

Fig. 22.	Optimized	crashin
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Table 2			
Crashed duration			
Туре	Duration		
Original duration	1461 Days		
After Crashing	1348 Days		

3. Result

- 1) The project completion date according to the planned schedule is 11 Apr -2024.
- 2) Total duration of the project is 1348 Days.
- 3) Total of 313 activities are involved with this project from its initiation to delivery.
- 4) It shows the critical activities and path which helps to keep more focus on them to avoid schedule and cost overrun.
- 5) It provides an idea of arranging the required resources for the upcoming activity.
- 6) Total Construction Cost is ₹20,84,65,750.
- 7) After Life Cycle Cost Analysis (LCCA) the cost we have calculated is ₹57,95,46,811. The feasibility of the project is good in terms of its long-term investment

4. Conclusion

The main goal and mission of the study were to learn and optimize the residential building with the timely accomplishment of any construction project. This helps to forecast the total duration of the project which was expected to be 1461 days. After rescheduling and reallocating the resources we found out the optimized cost of the project is less than the budgeted cost. The difference was about 3 crores from the budgeted total cost After the schedule crashing, we found a new critical path and a new optimized duration is about 1348 days. The usage in this study proved as an interpreting the progress of Horizon Exotica Building, which helps to recognize the various problems aroused during or prior the execution process. The output results of the current case study define the usefulness of efficient planning, Scheduling, Monitoring and Controlling. Primavera helps Project Manager to help him aware about the schedule with respect to the activities which are to be started or finished according to the schedule.

Thus, with this study it could be concluded that:

- 1) For the current project the planned schedule activities are productive.
- The implementation of immense monitoring policies 2) could be well observed.
- 3) On the various tasks of schedule completion, the very high and systematic priority is been provided.
- 4) The usages of various resources throughout the project would be optimum.
- 5) The software Primavera P6 proved like a perfect and efficient tool for the purpose of monitoring and controlling of the various construction project. The time for updating effort will be highly decreased by the help of it.

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