

Planning and Scheduling of a Multi-Storey Building using Primavera P6

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Abstract - As cities continue to grow, the way we construct and manage buildings differ and the complexities keep tremendously increasing in the project. Planning and scheduling have become a major concept to be considered for a smooth execution of construction works. In order to reduce the complexities, an effective tool called Oracle's Primavera P6 is used for determining an ideal schedule for construction activities. Construction planning is the necessary forerunner to scheduling and it includes determining general sequence, assigning responsibilities, defining construction methods and work tasks. Planning refers to everything you do to set up your project for success. The success or completion of any project will mainly depend upon the cost and schedule details of the project. This paper tries to explain planning and scheduling of a G+5 building using the Primavera software.

Key Words: Planning, Scheduling, Project Management, Primavera

1. INTRODUCTION

Construction Management is used to overcome the major problem in every project i.e. cost overruns by identifying the resources needed and helps to maintain the budget throughout the project. The life cycle of a project includes initiation, planning, execution, monitoring & controlling and closing phases.

Planning is the process of identifying all the activities necessary to successfully complete the project. Scheduling is the process of determining the sequential order of the planned activities, assigning realistic durations to each activity and determining the start and finish dates of each activity.

CPM provides an effective time line to complete the project within the desired budget. It also offers techniques to identify any delay in projects to avoid the time conflicts. It provides a proper communication system to keep all the stakeholders and team members informed throughout the project. This outcome will reduce conflicts of different parties present in the project. These parties include labor vendors, material vendors, designer team, accounting personnel, clients, etc. These are all the reasons that strengthen the significance of project management techniques in construction projects.

The objectives of this study are:

1. To identify the scheduling techniques used by the organization in developing plan and scheduling.

2. To compute the practical durations required to carry out the activities and to identify the construction sequence.

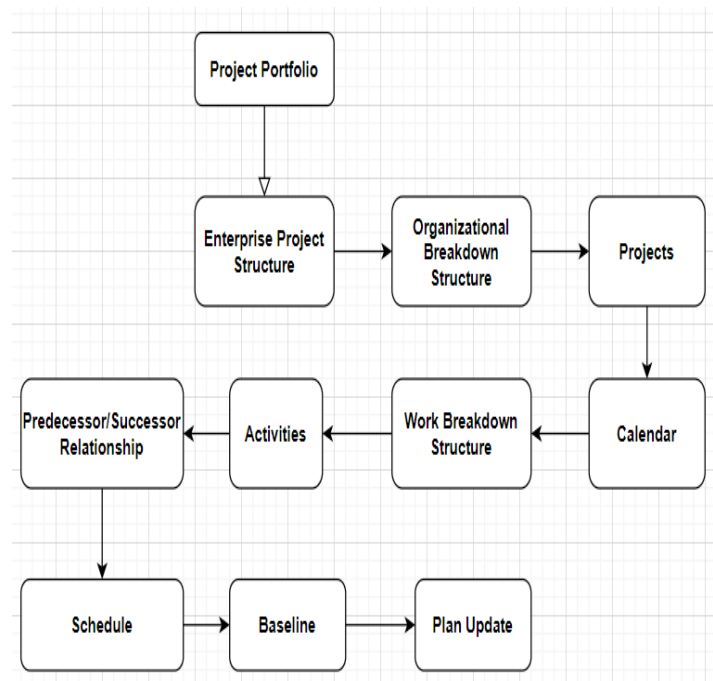


Fig -1: CPM Hierarchy

2. METHODOLOGY

PROJECT PORTFOLIO is a collection of projects where you can easily view data of 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 success. Project portfolio also allows reviewing the summary data and status information of an organization or a project.

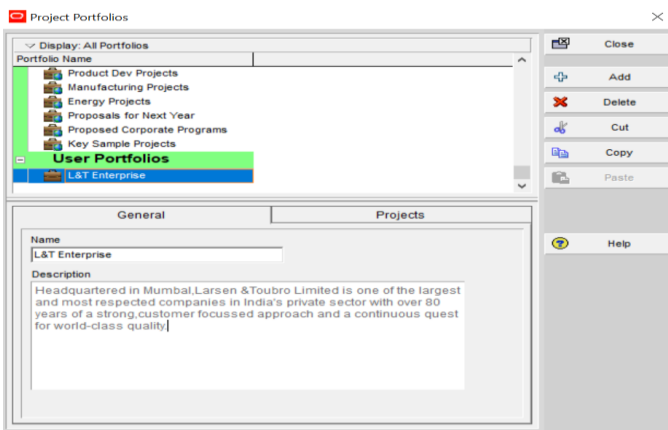


Fig -2: Project Portfolio

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.

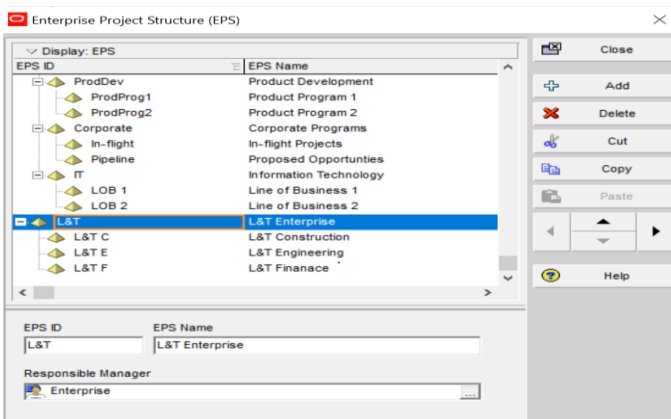


Fig -3: Enterprise Project Structure

ORGANIZATIONAL BREAKDOWN STRUCTURE(OBS) 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.

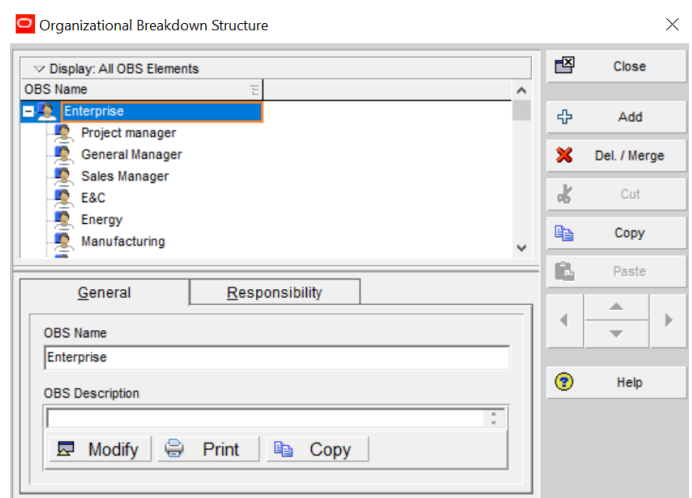


Fig -4: Organizational Breakdown Structure

PROJECTS 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.

Project ID	Project Name	Responsible Manager
CPM	Construction Project Management Enterprise	
RB	Residential Building	Enterprise
RB_	Multi Storey	Enterprise
R_	Multi Storey Building	Enterprise

Fig -5: Project

CALENDAR is assigned to activities and resources where they are used for scheduling activities and levelling resources. The Primavera P6 supports three types of calendars namely Global calendar, Project Calendar and Resource Calendar.

In this project we have used 6X8 Global Calendar.

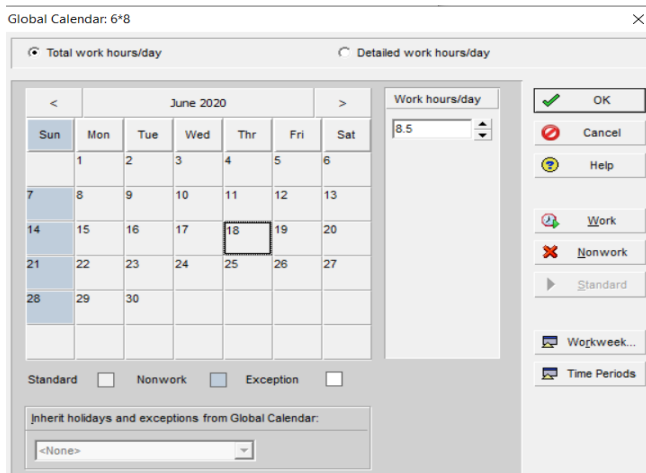


Fig-6: Calendar

WORK BREAKDOWN STRUCTURE OR 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.

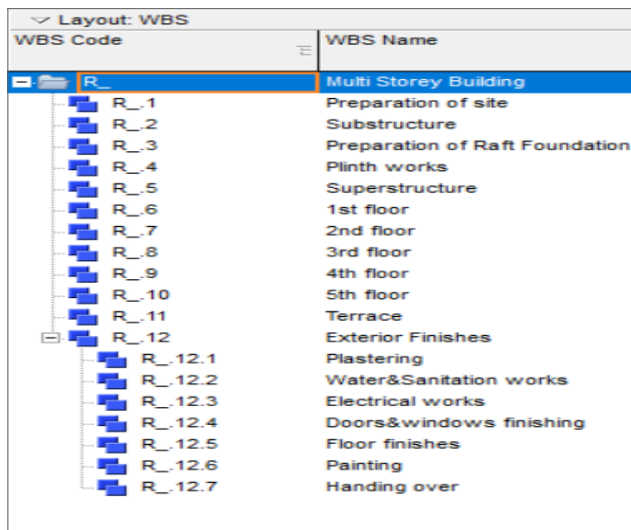


Fig-7: Work Breakdown Structure

ACTIVITIES also known as tasks, events or work packages. These are the lowest level of manageable work elements in a project or WBS. The completion of each activity will represent the progress of the entire project. Activities will give us clarity about the work flow in an organization.

Activity Name	Remaining Duration	Original Duration	Start	Finish	Activity ID	Schedule % Complete
R_ Multi Storey Building	693	693	01-Jun-20	25-Aug-22		0%
Project Start	0	0	01-Jun-20	01-Jun-20	A1000	0%
R_1 Preparation of site	12	12	01-Jun-20	13-Jun-20		0%
Marking Boundaries	2	2	01-Jun-20	02-Jun-20	A1010	0%
Surveying	3	3	03-Jun-20	05-Jun-20	A1020	0%
Site office	1	1	06-Jun-20	06-Jun-20	A1030	0%
Water arrangements	1	1	08-Jun-20	08-Jun-20	A1040	0%
Electricity arrangements	1	1	09-Jun-20	09-Jun-20	A1050	0%
Steel yards and godown	2	2	10-Jun-20	11-Jun-20	A1060	0%
Main gate and fencing	2	2	12-Jun-20	13-Jun-20	A1070	0%
R_2 Substructure	25	25	15-Jun-20	13-Jul-20		0%
Building line out	3	3	15-Jun-20	17-Jun-20	A1080	0%
Excavation	7	7	18-Jun-20	25-Jun-20	A1090	0%
Preparation of PCC works-compactio of	4	4	26-Jun-20	30-Jun-20	A1100	0%
Soiling	5	5	01-Jul-20	06-Jul-20	A1110	0%
Shuttering for PCC	3	3	07-Jul-20	09-Jul-20	A1120	0%
Pouring of PCC	2	2	10-Jul-20	11-Jul-20	A1130	0%
Deshuttering	1	1	13-Jul-20	13-Jul-20	A1140	0%
R_3 Preparation of Raft Four	21	21	14-Jul-20	06-Aug-20		0%
Layout Marking	3	3	14-Jul-20	16-Jul-20	A1150	0%
Laying of Reinforcement	10	10	17-Jul-20	28-Jul-20	A1160	0%
Shuttering for raft foundation	3	3	29-Jul-20	31-Jul-20	A1170	0%
Pouring of concrete	2	2	01-Aug-20	03-Aug-20	A1180	0%
Deshuttering	3	3	04-Aug-20	06-Aug-20	A1190	0%
R_4 Plinth works	24	24	07-Aug-20	03-Sep-20		0%
Setting up level for plinth	2	2	07-Aug-20	08-Aug-20	A1200	0%
Plinth beam bottom shuttering	3	3	10-Aug-20	12-Aug-20	A1210	0%
Laying of reinforcement	4	4	13-Aug-20	17-Aug-20	A1220	0%
Side shuttering for beams	2	2	18-Aug-20	19-Aug-20	A1230	0%
Pouring of concrete	2	2	20-Aug-20	21-Aug-20	A1240	0%

Activity Name	Remaining Duration	Original Duration	Start	Finish	Activity ID	Schedule % Complete
Deshuttering	2	2	22-Aug-20	24-Aug-20	A1250	0%
Backfilling upto plinth beam bottom	2	2	25-Aug-20	28-Aug-20	A1260	0%
Compaction of soil	3	3	27-Aug-20	29-Aug-20	A1270	0%
Laying of PCC	2	2	31-Aug-20	01-Sep-20	A1280	0%
Laying of DPC	2	2	02-Sep-20	03-Sep-20	A1290	0%
R_5 Superstructure	64	64	04-Sep-20	18-Nov-20		0%
Staircase shuttering	2	2	04-Sep-20	05-Sep-20	A1300	0%
Staircase barbanding	2	2	07-Sep-20	08-Sep-20	A1310	0%
Staircase waist slab concrete	2	2	09-Sep-20	10-Sep-20	A1320	0%
Column raising upto roof level	8	8	11-Sep-20	19-Sep-20	A1330	0%
Roof shuttering	9	9	21-Sep-20	30-Sep-20	A1340	0%
Roof barbanding	8	8	01-Oct-20	09-Oct-20	A1350	0%
Roof concrete	3	3	10-Oct-20	13-Oct-20	A1360	0%
Deshuttering	6	6	14-Oct-20	20-Oct-20	A1370	0%
Ceiling plastering	8	8	21-Oct-20	29-Oct-20	A1380	0%
Brickwork upto lintel level	10	10	30-Oct-20	10-Nov-20	A1390	0%
Rubble Soiling	2	2	11-Nov-20	12-Nov-20	A1400	0%
Laying of PCC	3	3	13-Nov-20	16-Nov-20	A1410	0%
Laying of DPC	2	2	17-Nov-20	18-Nov-20	A1420	0%
R_6 1st floor	64	64	19-Nov-20	25-Feb-21		0%
Column raising upto roof level	8	8	19-Nov-20	27-Nov-20	A1430	0%
Staircase shuttering	2	2	28-Nov-20	30-Nov-20	A1440	0%
Staircase barbanding	2	2	01-Dec-20	02-Dec-20	A1450	0%
Staircase waist slab concrete	2	2	03-Dec-20	04-Dec-20	A1460	0%
Roof shuttering	9	9	05-Dec-20	15-Dec-20	A1470	0%
Roof barbanding	8	8	16-Dec-20	24-Dec-20	A1480	0%
Roof concrete	3	3	25-Dec-20	28-Dec-20	A1490	0%
Deshuttering	6	6	29-Dec-20	04-Jan-21	A1500	0%
Ceiling Plastering	8	8	05-Jan-21	13-Jan-21	A1510	0%
Brickwork upto lintel level	10	10	14-Jan-21	25-Jan-21	A1520	0%

Activity Name	Remaining Duration	Original Duration	Start	Finish	Activity ID	Schedule % Complete
Lintel&Sunshade shuttering work	6	6	26-Jan-21	01-Feb-21	A1530	0%
Lintel&Sunshade barbanding work	6	6	02-Feb-21	08-Feb-21	A1540	0%
Lintel&Sunshade concrete	4	4	09-Feb-21	12-Feb-21	A1550	0%
Brickwork upto roof level	8	8	13-Feb-21	22-Feb-21	A1560	0%
Fixing of door & window frames	3	3	23-Feb-21	25-Feb-21	A1570	0%
R_7 2nd floor	83	83	26-Feb-21	03-Jun-21		0%
Column raising upto roof level	8	8	26-Feb-21	06-Mar-21	A1580	0%
Staircase shuttering	3	3	08-Mar-21	10-Mar-21	A1590	0%
Staircase barbanding	2	2	11-Mar-21*	12-Mar-21	A1600	0%
Staircase waist slab concrete	2	2	13-Mar-21	15-Mar-21	A1610	0%
Roof shuttering	8	8	16-Mar-21	24-Mar-21	A1620	0%
Roof barbanding	8	8	25-Mar-21	02-Apr-21	A1630	0%
Roof concrete	3	3	03-Apr-21	06-Apr-21	A1640	0%
Deshuttering	6	6	07-Apr-21	13-Apr-21	A1650	0%
Ceiling Plastering	8	8	14-Apr-21	22-Apr-21	A1660	0%
Brickwork upto lintel level	10	10	23-Apr-21	04-May-21	A1670	0%
Lintel&Sunshade shuttering work	6	6	05-May-21	11-May-21	A1680	0%
Lintel&Sunshade barbanding work	6	6	12-May-21	18-May-21	A1690	0%
Lintel&Sunshade concrete	4	4	19-May-21	22-May-21	A1700	0%
Brickwork upto roof level	7	7	24-May-21	31-May-21	A1710	0%
Fixing of door & window frames	3	3	01-Jun-21	03-Jun-21	A1720	0%
R_8 3rd floor	83	83	04-Jun-21	09-Sep-21		0%
Column raising upto roof level	8	8	04-Jun-21	12-Jun-21	A1730	0%
Staircase shuttering	3	3	14-Jun-21	16-Jun-21	A1740	0%
Staircase barbanding	2	2	17-Jun-21*	18-Jun-21	A1750	0%
Staircase waist slab concrete	2	2	19-Jun-21	21-Jun-21	A1760	0%
Roof shuttering	8	8	22-Jun-21	30-Jun-21	A1770	0%
Roof barbanding	8	8	01-Jul-21	09-Jul-21	A1780	0%
Roof concrete	3	3	10-Jul-21	13-Jul-21	A1790	0%
Deshuttering	6	6	14-Jul-21	20-Jul-21	A1800	0%

Activity Name	Remaining Duration	Original Duration	Start	Finish	Activity ID	Schedule % Complete
Ceiling Plastering	8	8	21-Jul-21	29-Jul-21	A1810	0%
Brickwork upto lintel level	10	10	30-Jul-21	10-Aug-21	A1820	0%
Lintel&Sunshade shuttering work	6	6	11-Aug-21	17-Aug-21	A1830	0%
Lintel&Sunshade barbanding work	6	6	18-Aug-21	24-Aug-21	A1840	0%
Lintel&Sunshade concrete	4	4	25-Aug-21	28-Aug-21	A1850	0%
Brickwork upto roof level	7	7	30-Aug-21	06-Sep-21	A1860	0%
Fixing of door & window frames	3	3	07-Sep-21	09-Sep-21	A1870	0%
R_9 4th floor	83	83	10-Sep-21	16-Dec-21		0%
Column raising upto roof level	8	8	10-Sep-21	18-Sep-21	A1880	0%
Staircase shuttering	3	3	20-Sep-21	22-Sep-21	A1890	0%
Staircase barbanding	2	2	23-Sep-21*	24-Sep-21	A1900	0%
Staircase waist slab concrete	2	2	25-Sep-21	27-Sep-21	A1910	0%
Roof shuttering	8	8	28-Sep-21	06-Oct-21	A1920	0%
Roof barbanding	8	8	07-Oct-21	15-Oct-21	A1930	0%
Roof concrete	3	3	16-Oct-21	19-Oct-21	A1940	0%
Deshuttering	6	6	20-Oct-21	26-Oct-21	A1950	0%
Ceiling Plastering	8	8	27-Oct-21	04-Nov-21	A1960	0%
Brickwork upto lintel level	10	10	05-Nov-21	16-Nov-21	A1970	0%
Lintel&Sunshade shuttering work	6	6	17-Nov-21	23-Nov-21	A1980	0%
Lintel&Sunshade barbanding work	6	6	24-Nov-21	30-Nov-21	A1990	0%
Lintel&Sunshade concrete	4	4	01-Dec-21	04-Dec-21	A2000	0%
Brickwork upto roof level	7	7	06-Dec-21	13-Dec-21	A2010	0%
Fixing of door & window frames	3	3	14-Dec-21	16-Dec-21	A2170	0%
R_10 5th floor	83	83	17-Dec-21	24-Mar-22		0%
Column raising upto roof level	8	8	17-Dec-21	25-Dec-21	A2020	0%
Staircase shuttering	3	3	27-Dec-21	29-Dec-21	A2030	0%
Staircase barbanding	2	2	30-Dec-21*	31-Dec-21	A2040	0%
Staircase waist slab concrete	2	2	01-Jan-22	03-Jan-22	A2050	0%
Roof shuttering	8	8	04-Jan-22	12-Jan-22	A2060	0%
Roof barbanding	8	8	13-Jan-22	21-Jan-22	A2070	0%
Roof concrete	3	3	22-Jan-22	25-Jan-22	A2080	0%

Activity Name	Remaining Duration	Original Duration	Start	Finish	Activity ID	Schedule % Complete
Deshuttering	6	6	26-Jan-22	01-Feb-22	A2090	0%
Ceiling Plastering	8	8	02-Feb-22	10-Feb-22	A2100	0%
Brickwork upto lintel level	10	10	11-Feb-22	22-Feb-22	A2110	0%
Lintel&Sunshade shuttering work	6	6	23-Feb-22	01-Mar-22	A2120	0%
Lintel&Sunshade barbanding work	6	6	02-Mar-22	08-Mar-22	A2130	0%
Lintel&Sunshade concrete	4	4	09-Mar-22	12-Mar-22	A2140	0%
Brickwork upto roof level	7	7	14-Mar-22	21-Mar-22	A2150	0%
Fixing of door & window frames	3	3	22-Mar-22	24-Mar-22	A2160	0%
R_11 Terrace	10	10	25-Mar-22	05-Apr-22		0%
Laying of stub column reinforcement	3	3	25-Mar-22	28-Mar-22	A2180	0%
Stub column shuttering	2	2	29-Mar-22	30-Mar-22	A2190	0%
Pouring of concrete	2	2	31-Mar-22	01-Apr-22	A2200	0%
Deshuttering	2	2	02-Apr-22	04-Apr-22	A2210	0%
Fixing of terrace door frame	1	1	05-Apr-22	05-Apr-22	A2220	0%
R_12 Exterior Finishes	121	121	06-Apr-22	25-Aug-22		0%
R_12.1 Plastering	30	30	06-Apr-22	10-May-22		0%
Erection of scaffolding	4	4	06-Apr-22	09-Apr-22	A2230	0%
Wall plastering	26	26	11-Apr-22	10-May-22	A2240	0%
R_12.2 Water & Sanitation works	28	28	11-May-22	11-Jun-22		0%
Water proofing	8	8	11-May-22	19-May-22	A2250	0%
Pipe works	14	14	20-May-22	04-Jun-22	A2260	0%
Terrace looping	6	6	06-Jun-22	11-Jun-22	A2270	0%
Sanitaryware fixtures	10	10	20-May-22	31-May-22	A2280	0%
R_12.3 Electrical works	20	20	11-May-22	02-Jun-22		0%
Wiring	7	7	11-May-22	18-May-22	A2290	0%
Installation of panels	5	5	19-May-22	24-May-22	A2300	0%
Earthing	4	4	25-May-22	28-May-22	A2330	0%
Switches and Fixtures	4	4	30-May-22	02-Jun-22	A2340	0%
R_12.4 Doors&windows finishing	5	5	11-May-22	16-May-22		0%
Doors&windows shutter fixing	5	5	11-May-22	16-May-22	A2310	0%
Fixing of staircase railing	4	4	11-May-22	14-May-22	A2320	0%
R_12.5 Floor finishes	34	34	03-Jun-22	12-Jul-22		0%
Levelling of floor	5	5	03-Jun-22	08-Jun-22	A2350	0%
Laying of tiles	14	14	09-Jun-22	24-Jun-22	A2370	0%
Polishing	15	15	25-Jun-22	12-Jul-22	A2380	0%
Laying of mortar bed	14	14	09-Jun-22	24-Jun-22	A2360	0%
R_12.6 Painting	49	49	25-Jun-22	22-Aug-22		0%
Applying putty on joints	8	8	25-Jun-22	04-Jul-22	A2390	0%
Applying primer	12	12	05-Jul-22	18-Jul-22	A2400	0%
Applying 1st coat of paint	15	15	19-Jul-22	04-Aug-22	A2410	0%
Applying 2nd coat of paint	15	15	05-Aug-22	22-Aug-22	A2420	0%
R_12.7 Handing over	3	3	23-Aug-22	25-Aug-22		0%
Site Clearance	2	2	23-Aug-22	24-Aug-22	A2430	0%
Handing over to client	1	1	25-Aug-22	25-Aug-22	A2440	0%

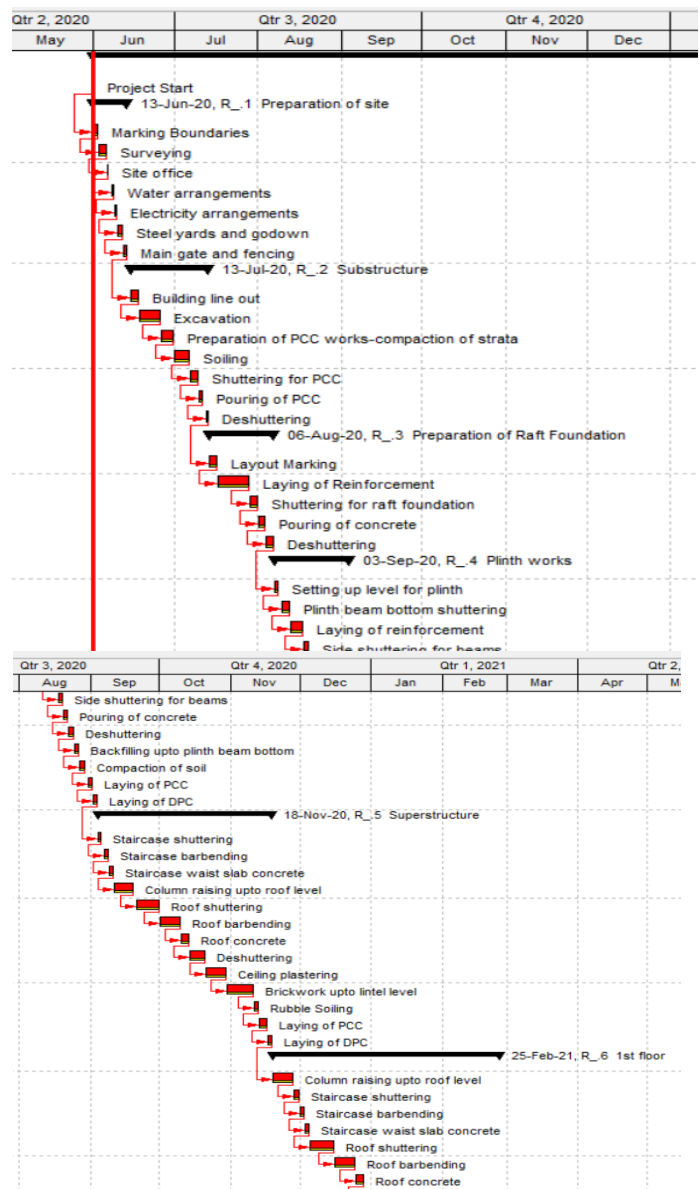
Fig -8: Activities

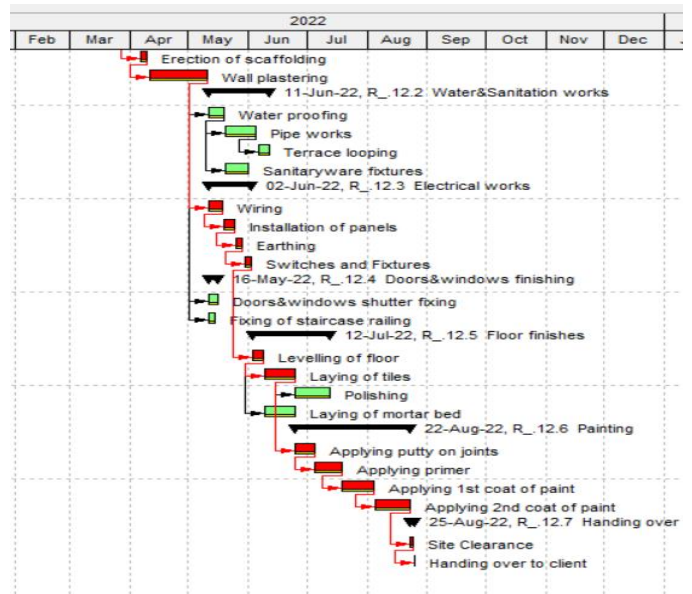
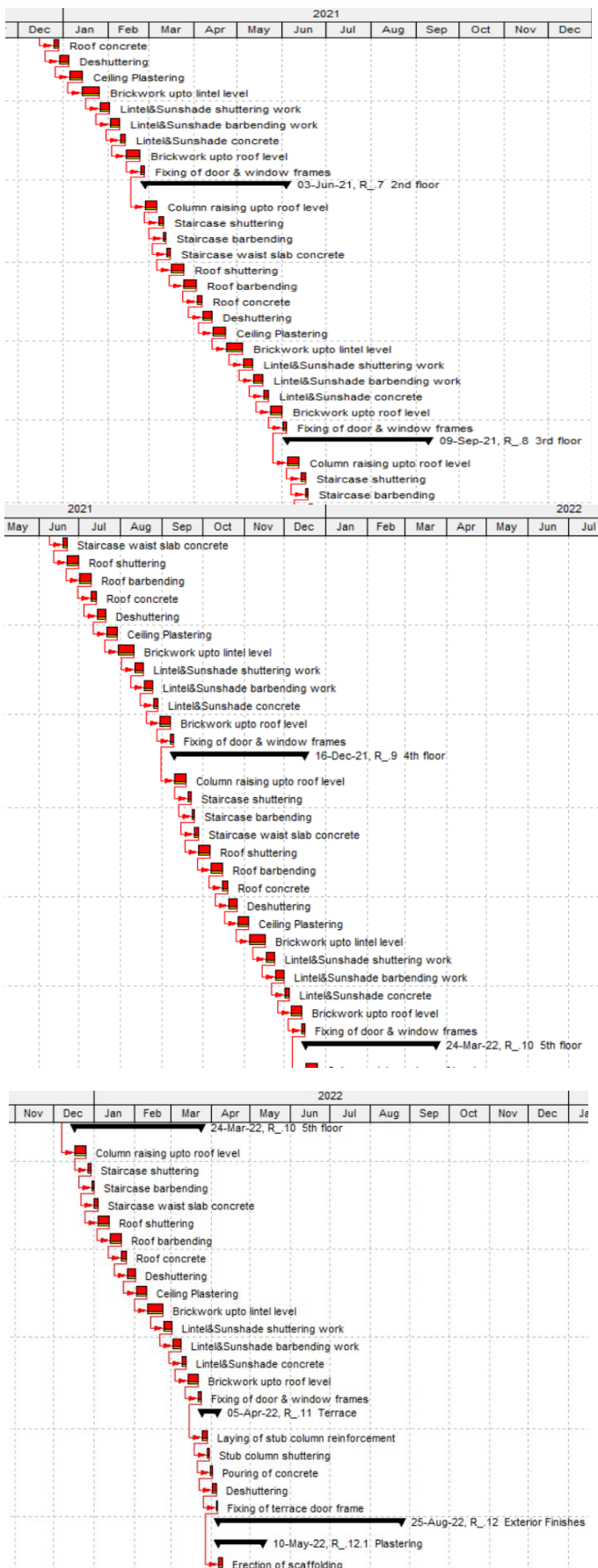
PREDECESSOR/SUCCESSOR RELATIONSHIP

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.

GANTT CHART





SCHEDULE

Critical Path Methodology scheduling assigns dates to project activities, calculates project’s finish date and also reveals the project’s critical path.

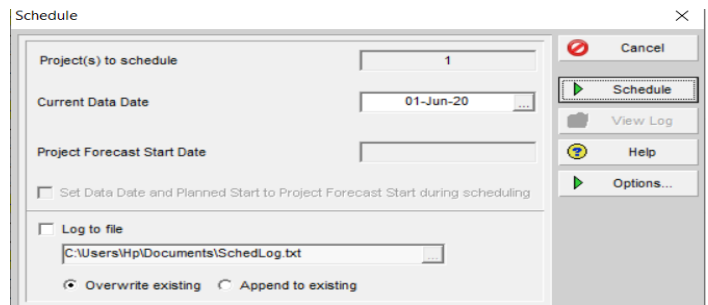


Fig -9: Schedule

BASELINES are snapshots of a project plan against which the project’s schedule (original dates, durations), costs and performance can be measured.

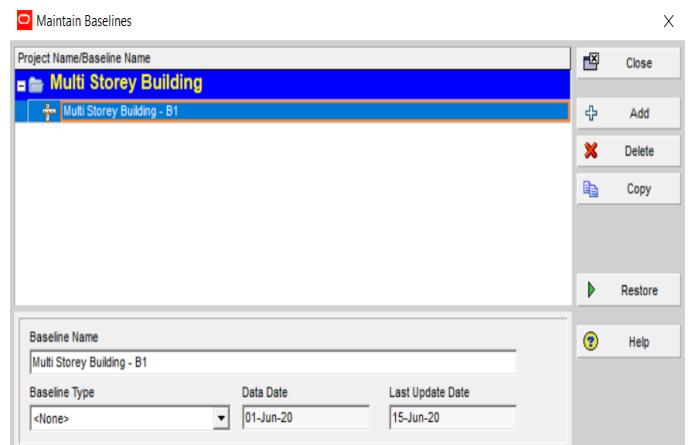


Fig -10: Baseline

PLAN UPDATE

Most projects contain some activities that progress as planned and some which do not. In this case, combine the two updating methods. Calculate your project whether it's progressing exactly as planned, and then individually update those activities and resources that have deviated from the plan.

3. CONCLUSIONS

Planning and scheduling helps to forecast and understand the progress of a construction project and it also keeps a track on the risks arising during the process. The methodology to implement construction management of a building can be explained with respect to planning, scheduling, resource allocation and levelling. Proper resource optimization is feasible during levelling of resources based on the required conditions and constraints. Primavera serves as an effective tool for generating Gantt chart for planning and scheduling a real time Multi-storey construction project. With the help of Primavera, the user can effectively:

1. Link all the activities involved in the construction of the project.
2. Determine the total duration required for the project construction.
3. Determine the Critical Path for the project schedule.
4. Keep a track of the scheduled and the on-site construction.
5. Assign the resources in a way that helps in reducing the time duration and cost of the project that makes it economical.

The project has been completed in an efficient manner with the understanding of proper scheduling using Primavera P6 software.

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