Scheduling of Multi-Storey Hostel Building using Primavera P6

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Abstract*— Now a day's construction gets delayed in the site due to the factors such as inefficient management, design issues, economic variation, coordination failure between time schedule and execution etc. Poor scheduling of tasks is one of the main causes. Scheduling in construction project is the process of listing of tasks with a planned start and finish date. The scheduling is very important in construction projects and it cannot be neglected since it plays a crucial role in success of the project. Proper scheduling will ensure the completion of the project on time and within budget. It helps to outline the pace of the work and show how the tasks are executed. It also defines method and sequence in which materials are delivered. Overall, it permits adjustments to accommodate changes and unanticipated events. The big problem faced by the construction sector is not able to manage the fund allocated for the work and not able to complete the work in targeted days. This can be overcome by the implementation of effective scheduling in the construction field. Scheduling is a very important component of successful time management. Primavera is an enterprise project portfolio management software (EPPMS). It includes project management, scheduling, risk analysis, opportunity management, and resource management. This project report deals with scheduling of Boys Hostel building by using Primavera P6 software. Ongoing project is located at Rajkiya Engineering College, Mainpuri and manual scheduling data collected from the site. Project is under U.P. Rajkiya Nirman Nigam. Software uses CPM technique to schedule activities of the project. Cost required for the project execution is ultimately saved with proper scheduling process. For scheduling and creating WBS of the project, required steps are taken. We had created Gantt Chart view of the scheduling, allocated resources to activities and assigned roles to each resource and created calendar of the project based on the holidays in India. In this project by using Primavera P6 software we had properly created WBS, schedule the activities and properly utilized resources and thus reduced the actual duration of the project and ultimately finish the project economically.

Keywords: Scheduling, Primavera, Optimization, Dynamic, WBS, Execution, CPM, Resource, Management, Variation, Estimate, Economic.

INTRODUCTION

Almost every industry worries about how to manage large complicated project effectively. Millions in cost overruns have been wasted due to the poor planning of the project. Unnecessary delays have occurred due to poor scheduling and companies have gone bankrupt due to poor controls. Here comes the role of project management. Primavera P6 is a very powerful tool for project management. This software helps in planning, scheduling, controlling, monitoring and cost optimization of projects very efficiently. In our college boys' hostel 3 construction is proposed. The usual method of construction management is understanding plan and execute the work. But execution of the work requires careful monitoring and controlling. Human sometimes make mistake in maintaining the progress of project but software facilitates to minimize these errors. Project managers easily manage, monitor, and keep track records of each activities using this software. There is various such software like MS Project, Oracle Primavera, etc. In our project we use Oracle's Primavera P6 Version 20 and schedule the construction steps of RECM Boys Hostel Building.

DETAILS OF THE PROJECT

Our project name is "Scheduling of Rajkiya Engineering College Mainpuri Boys Hostel building using Primavera P6". In this Project we have scheduled total 225 activities performed in the construction. Construction started from 1 October 2020. This project is under U. P. Rajkiya Nirman Nigam.

Table No. 1: Details of the Project

Sr. No	Information	Project details
1	Location of the building	REC Mainpuri, U.P. India
2	Type of the building	Framed structure
3	Duration of the project	24 Months
4	No. of storeys	G+2
5	Cost of project	897.85lakhs
6	Construction start date	01 Oct 2020
7	Type of soil	Sandy Loam

SCHEDULING

Scheduling is the process of determining the sequential order of the planned activities, assigning realistic durations to each activity and planning the start and finish dates of each activity. A time schedule outlines the project work sequence, it is like a time table of our work and tells us that when and what to perform further.

PRIMAVERA P6

Primavera P6 make our project management work easy. It is helpful in construction activity planning for creating logical sequence of activities, controlling the delay of the project and help in effective resource management. Primavera is used to complete the project within specified time and cost. It is the application of skills, tools and techniques to project activities in order to fulfil the deadline of the project. Primavera

software is used to scheduling, controlling, estimating the cost, and risk management in the project.

DELAY IN CONSTRUCTION WORKS

Today large number of projects in India are going late. As per data of Ministry of statistics and programme implementation Projects Costing Rs. 150 crore & above January-March, 2020 65% projects are delayed.
Primary causes of delays in construction projects are:

1. Change In Project Scope (what to perform?)
2. Project Complexity
3. Inadequate Planning
4. Impropriate Project Schedule
5. Design Variation
6. Inefficient Material and Equipment Management
7. Inaccurate Engineering Estimate
8. Improper Post Execution Phase Management

LITERATURE REVIEW

S. Rajkumaar et.al (2020): Concluded that after scheduling the G+3 building construction project using primavera they able to optimize the resources used in the project. It was observed that after planning and scheduling, the time duration of the building completion was reduced by nearly 1 month and Contract period was 11 months.

OBJECTIVE

The primary objectives of this project are:

1. Find the construction sequence for a RECM boys hostel building construction.
2. To calculate the practical durations required to carry out the activities.
3. To schedule the REC Mainpuri Boys Hostel Building construction project using Primavera P6.
4. To create Gantt chart view.

WORK METHODOLOGY

Steps involved in the scheduling of REC Mainpuri boys hostel building using Primavera P6 are:

1. Creating Project
2. Creating WBS
3. Creating Activities
4. Activity Detail Form
5. Creating Project Calendar
6. Creating Resources
7. Creating Roles
8. Role assigns to Resources
9. Resources assign to Activities
10. Scheduling
11. Gantt Chart View

STEPS INVOLVED IN SCHEDULING

1. Creating new project:

In Primavera P6 software we have created our project with name “Scheduling of REC Mainpuri Boys Hostel” (Project Id- R-1) We have given anticipated project planned start date and finish date. Global, resource or project calendar is assigned to this project.

2. Creating EPS:

To create an ideal schedule for any project, first step is to Create the branches of enterprise under which project is made. So, we created the complete structure of the company with its branches, which is executing the project using primavera P6. This is called as Enterprise project structure (EPS).

3. Work breakdown structure

Work breakdown structure (WBS) is a process of breaking the project into easily identifiable major systems, their sub systems and discrete activities. WBS is a hierarchy of any project work that must be accomplished to complete a construction project.

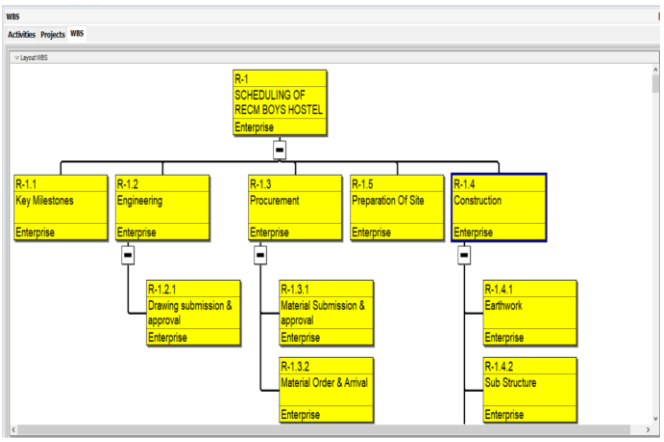


Figure No.1: Flow chart view of our WBS

4. Defining activity

The smallest unit of a project that is the fundamental and key work elements of a project. The activity details include Activity like ID, activity name, start and finish dates, activity calendar, activity codes, activity type, constraints, expenses, predecessor and successor relationships, resources, roles etc.

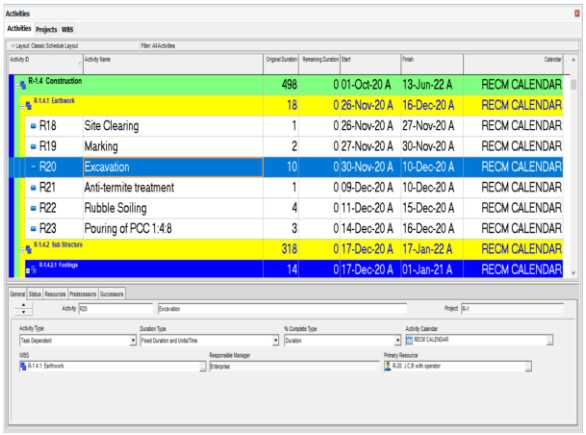


Figure No.2: Activity Detail form for excavation (general, status, resource, predecessors, successors tabs)

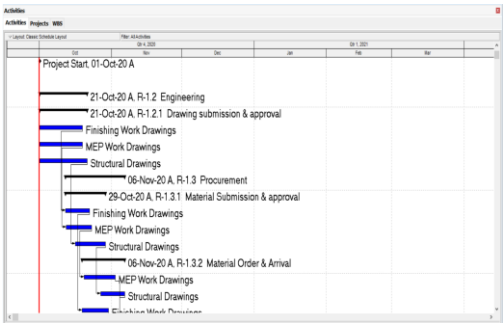


Figure No.3: Gantt chart view of activities

5. Relationship between activity

By assigning succeeding, preceding activities with significant relationship to the overall project activities, form a logical sequence of activities, after scheduling the activities will be connected to each other. Types of relationships are:

1. Finish to start (FS) relationship
2. Start to start (SS) relationship
3. Finish to finish (FF) relationship
4. Start to finish (SF) relationship

6. Creating a calendar

The calendar is created and assign to each activity before scheduling, it shows working and non-working days during project execution. These calendars define the available work hours in each calendar days. Also specify national holidays, organizations.

7. Creating baseline

A complete copy of the original schedule of the project is a simple baseline plan which provides a target against which a project's performance is tracked. Daily updates to be updated in Primavera P6. Tick mark finished if the activity has been finished and select the finish date. So, it is helpful in monitoring and controlling during execution of the project.

8. Relationships

Activities must relate to another activity in logical way. Relationship tells is which activity to be performed next?
Types of relationships:

1. Finish to Start
2. Start to Start
3. Finish to Finish
4. Start to Finish

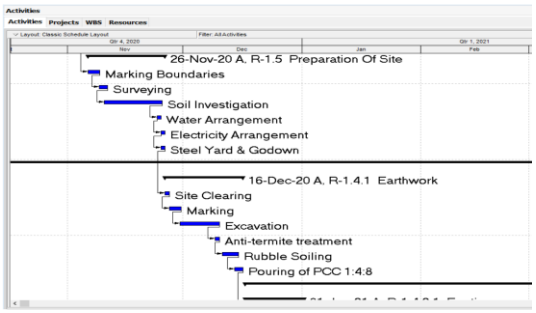


Figure No.4: Relationships in the project

9. Roles

Roles are personnel job titles or skills. Roles are assigned to specific resources to identify the resource's skills. For example, plastering, concreting, plumbing, fitting work, carpentry, etc.

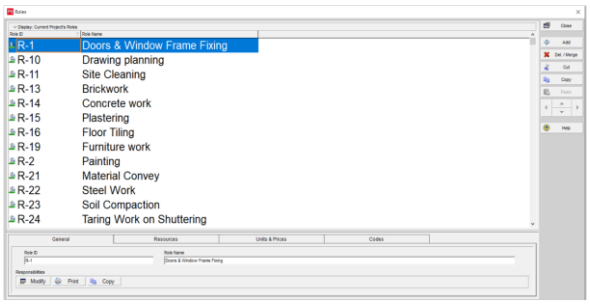


Figure No.5: Roles created in our Project

10. Resources

P6 defines resources as anything used to complete a schedule activity; specifically, labour, non-labour, and material. Types of resources:

1. Labor- Man-power
2. Non-labor- Equipment, machines, tools etc.
3. Material- Cement, sand, steel, bricks etc.

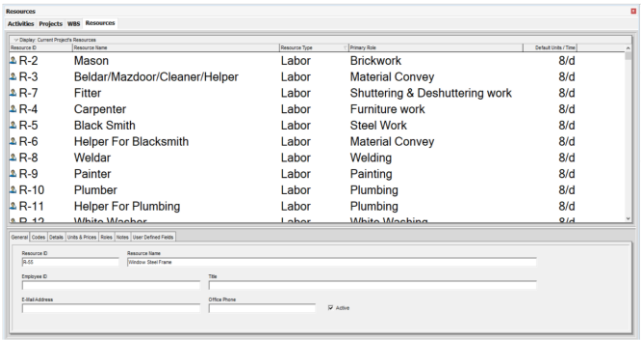


Figure No.6: Resources created in our Project

11. Role assigns to Resources

We have to assign role to the resources. For example, in plastering (role) assign to mason (resource).

12. Assign Resource to Activity

We have to assign resources to the activities. For example, in excavation (activity) resources are JCB Machine, its operator, and worker (resources).

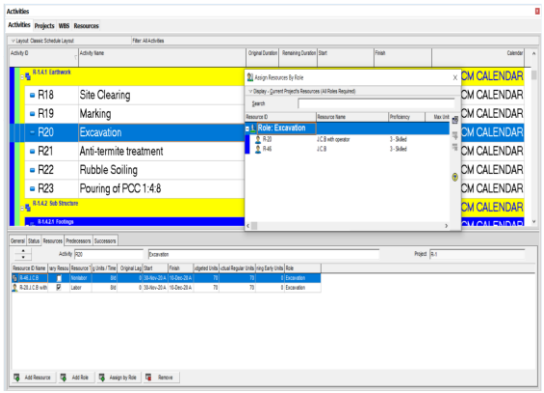


Figure No.7: Assign resource to excavation

13. Scheduling

Scheduling helps to organize and complete projects in a timely, quality and financially responsible manner. The use of the critical path mathematical process allows scheduling to assign dates to activities, calculate project finish dates and reveal the critical path and activities of the project. After scheduling total duration of the project is 498 days as shown in figure below.

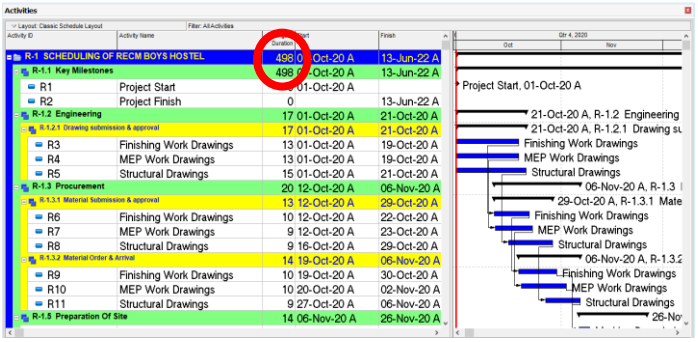


Figure No.8: Scheduling of the project

14. Gantt Chart View

A Gantt chart is a graphical depiction of our project schedule. It's a type of bar chart showing the start and finish dates of a project's elements such as resources, planning and dependencies (relationships).

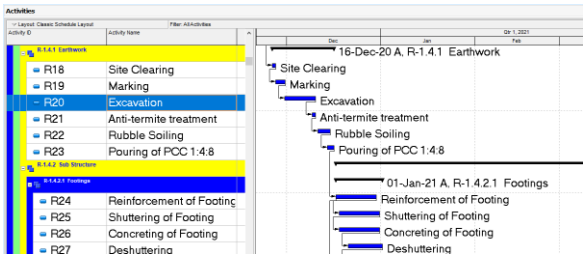
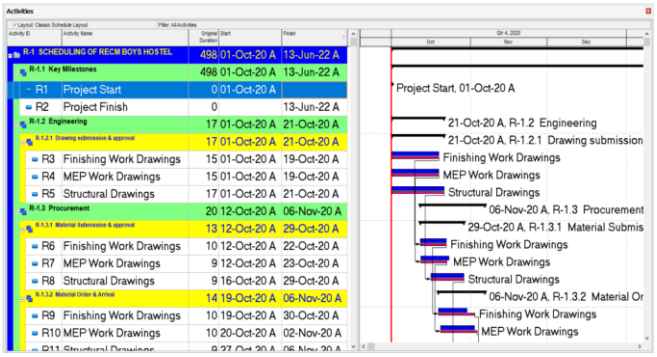
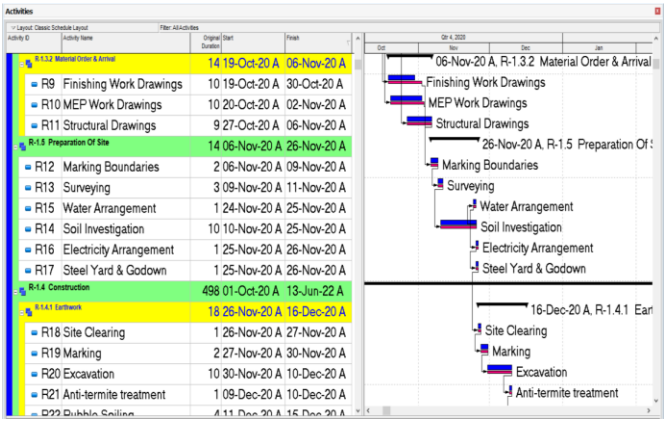
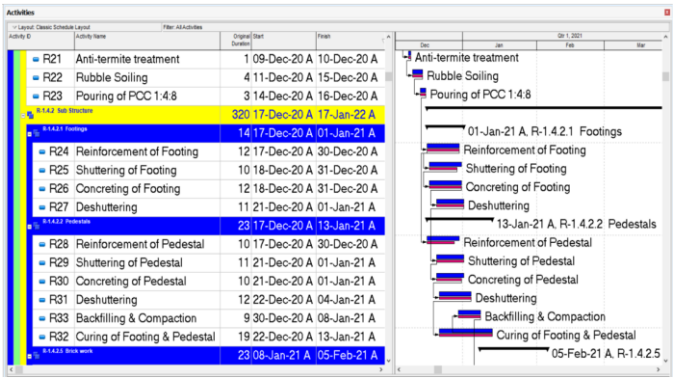


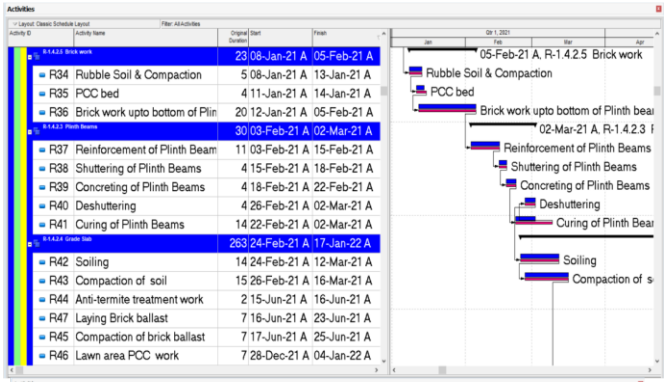
Figure No.9: Gantt Chart of the project

PRIMAVERA P6 PROJECT FINAL OUTPUT








R34 Rubble Soil & Compaction 5 08-Jan-21 A 13-Jan-21 A
R35 PCC bed 4 11-Jan-21 A 14-Jan-21 A
R36 Brick work upto bottom of Plin 20 12-Jan-21 A 05-Feb-21 A
R37 Reinforcement of Plinth Beam 11 03-Feb-21 A 15-Feb-21 A
R38 Shuttering of Plinth Beams 4 15-Feb-21 A 18-Feb-21 A
R39 Concreting of Plinth Beams 4 18-Feb-21 A 22-Feb-21 A
R40 Deshuttering 4 26-Feb-21 A 02-Mar-21 A
R41 Curing of Plinth Beams 14 22-Feb-21 A 02-Mar-21 A
R42 Soiling 14 24-Feb-21 A 12-Mar-21 A
R43 Compaction of soil 15 26-Feb-21 A 16-Mar-21 A
R44 Anti-termite treatment work 2 15-Jun-21 A 16-Jun-21 A
R47 Laying Brick ballast 7 16-Jun-21 A 23-Jun-21 A
R45 Compaction of brick ballast 7 17-Jun-21 A 25-Jun-21 A
R46 Lawn area PCC work 7 28-Dec-21 A 04-Jan-22 A
05-Feb-21 A, R-1.4.2.5 Brick work
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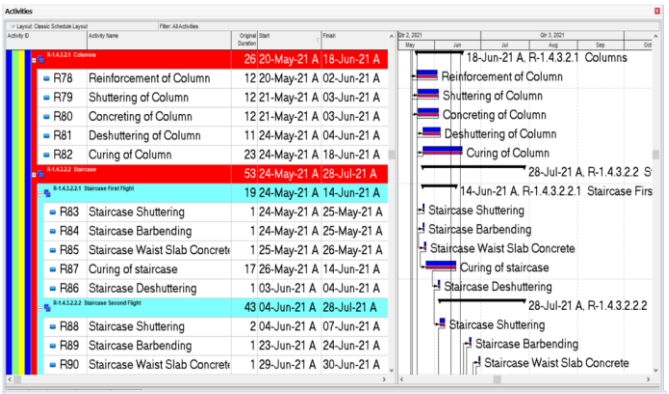
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R80 Concreting of Column 12 21-May-21 A 03-Jun-21 A
R81 Deshuttering of Column 11 24-May-21 A 04-Jun-21 A
R82 Curing of Column 23 24-May-21 A 18-Jun-21 A
R83 Staircase Shuttering 1 24-May-21 A 25-May-21 A
R84 Staircase Barbending 1 24-May-21 A 25-May-21 A
R85 Staircase Waist Slab Concrete 1 25-May-21 A 26-May-21 A
R87 Curing of staircase 17 26-May-21 A 14-Jun-21 A
R86 Staircase Deshuttering 1 03-Jun-21 A 04-Jun-21 A
R88 Staircase Shuttering 2 04-Jun-21 A 07-Jun-21 A
R89 Staircase Barbending 1 23-Jun-21 A 24-Jun-21 A
R90 Staircase Waist Slab Concrete 1 29-Jun-21 A 30-Jun-21 A
18-Jun-21 A, R-1.4.3.2.1 Columns
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Concreting of Column
Deshuttering of Column
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28-Jul-21 A, R-1.4.3.2.2 S
14-Jun-21 A, R-1.4.3.2.2.1 Staircase Firs
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Staircase Barbending
Staircase Waist Slab Concrete
Curing of staircase
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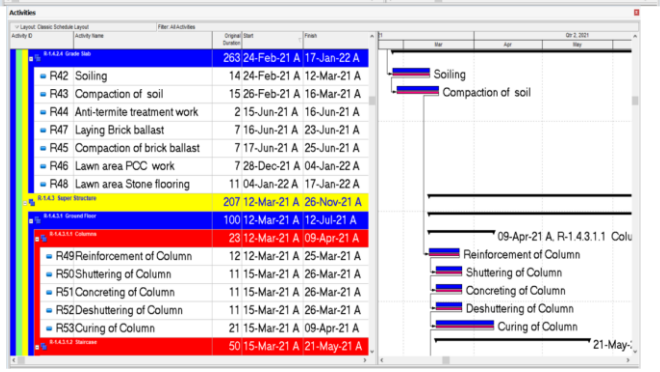
Staircase Barbending
Staircase Waist Slab Concrete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R43 Compaction of soil 15 26-Feb-21 A 16-Mar-21 A
R44 Anti-termite treatment work 2 15-Jun-21 A 16-Jun-21 A
R47 Laying Brick ballast 7 16-Jun-21 A 23-Jun-21 A
R45 Compaction of brick ballast 7 17-Jun-21 A 25-Jun-21 A
R46 Lawn area PCC work 7 28-Dec-21 A 04-Jan-22 A
R48 Lawn area Stone flooring 11 04-Jan-22 A 17-Jan-22 A
R49 Reinforcement of Column 12 12-Mar-21 A 25-Mar-21 A
R50 Shuttering of Column 11 15-Mar-21 A 26-Mar-21 A
R51 Concreting of Column 11 15-Mar-21 A 26-Mar-21 A
R52 Deshuttering of Column 11 15-Mar-21 A 26-Mar-21 A
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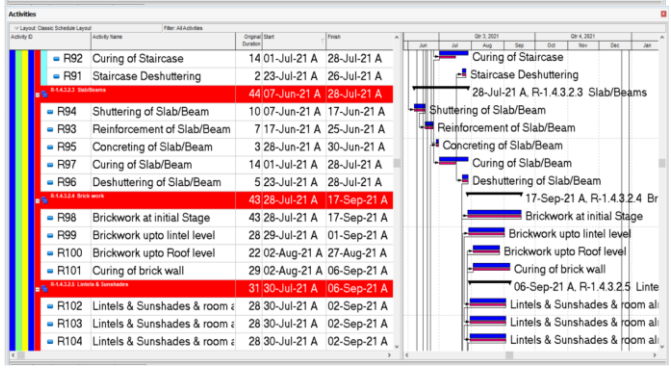
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R94 Shuttering of Slab/Beam 10 07-Jun-21 A 17-Jun-21 A
R93 Reinforcement of Slab/Beam 7 17-Jun-21 A 25-Jun-21 A
R95 Concreting of Slab/Beam 3 28-Jun-21 A 30-Jun-21 A
R97 Curing of Slab/Beam 14 01-Jul-21 A 28-Jul-21 A
R96 Deshuttering of Slab/Beam 5 23-Jul-21 A 28-Jul-21 A
R98 Brickwork at initial Stage 43 28-Jul-21 A 17-Sep-21 A
R99 Brickwork upto lintel level 28 29-Jul-21 A 01-Sep-21 A
R100 Brickwork upto Roof level 22 02-Aug-21 A 27-Aug-21 A
R101 Curing of brick wall 29 02-Aug-21 A 06-Sep-21 A
R102 Lintels & Sunshades & room a 28 30-Jul-21 A 02-Sep-21 A
R103 Lintels & Sunshades & room a 28 30-Jul-21 A 02-Sep-21 A
R104 Lintels & Sunshades & room a 28 30-Jul-21 A 02-Sep-21 A
Curing of Staircase
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Reinforcement of Slab/Beam
Concreting of Slab/Beam
Curing of Slab/Beam
Deshuttering of Slab/Beam
17-Sep-21 A, R-1.4.3.2.4 Br
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Brickwork upto lintel level
Brickwork upto Roof level
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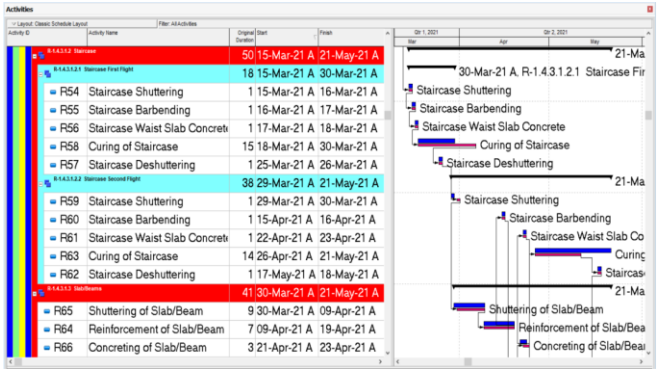
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R55 Staircase Barbending 1 16-Mar-21 A 17-Mar-21 A
R56 Staircase Waist Slab Concrete 1 17-Mar-21 A 18-Mar-21 A
R58 Curing of Staircase 15 18-Mar-21 A 30-Mar-21 A
R57 Staircase Deshuttering 1 25-Mar-21 A 26-Mar-21 A
R59 Staircase Shuttering 1 29-Mar-21 A 30-Mar-21 A
R60 Staircase Barbending 1 15-Apr-21 A 16-Apr-21 A
R61 Staircase Waist Slab Concrete 1 22-Apr-21 A 23-Apr-21 A
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R62 Staircase Deshuttering 1 17-May-21 A 18-May-21 A
R65 Shuttering of Slab/Beam 9 30-Mar-21 A 09-Apr-21 A
R64 Reinforcement of Slab/Beam 7 09-Apr-21 A 19-Apr-21 A
R66 Concreting of Slab/Beam 3 21-Apr-21 A 23-Apr-21 A
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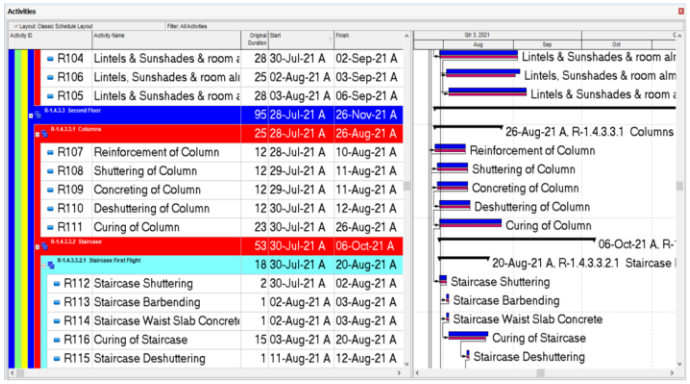
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R105 Lintels & Sunshades & room a 28 03-Aug-21 A 06-Sep-21 A
R107 Reinforcement of Column 12 28-Jul-21 A 10-Aug-21 A
R108 Shuttering of Column 12 29-Jul-21 A 11-Aug-21 A
R109 Concreting of Column 12 29-Jul-21 A 11-Aug-21 A
R110 Deshuttering of Column 12 30-Jul-21 A 12-Aug-21 A
R111 Curing of Column 23 30-Jul-21 A 26-Aug-21 A
R112 Staircase Shuttering 2 30-Jul-21 A 02-Aug-21 A
R113 Staircase Barbending 1 02-Aug-21 A 03-Aug-21 A
R114 Staircase Waist Slab Concrete 1 02-Aug-21 A 03-Aug-21 A
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R115 Staircase Deshuttering 1 11-Aug-21 A 12-Aug-21 A
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Shuttering of Column
Concreting of Column
Deshuttering of Column
Curing of Column
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20-Aug-21 A, R-1.4.3.3.2.1 Staircase
Staircase Shuttering
Staircase Barbending
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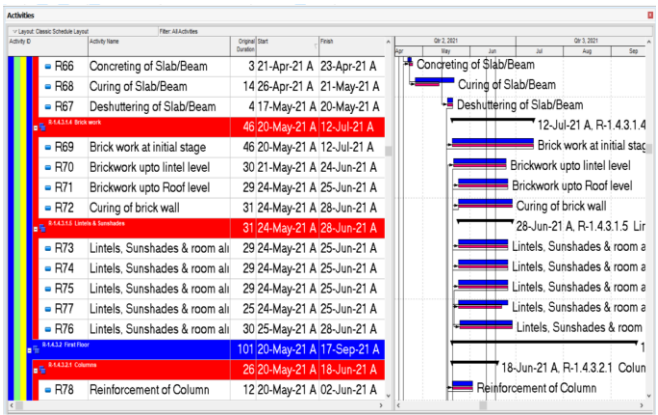
Curing of Staircase
Staircase Deshuttering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R68 Curing of Slab/Beam 14 26-Apr-21 A 21-May-21 A
R67 Deshuttering of Slab/Beam 4 17-May-21 A 20-May-21 A
R69 Brick work at initial stage 46 20-May-21 A 12-Jul-21 A
R70 Brickwork upto lintel level 30 21-May-21 A 24-Jun-21 A
R71 Brickwork upto Roof level 29 24-May-21 A 25-Jun-21 A
R72 Curing of brick wall 31 24-May-21 A 28-Jun-21 A
R73 Lintels, Sunshades & room ali 29 24-May-21 A 25-Jun-21 A
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R76 Lintels, Sunshades & room ali 30 25-May-21 A 28-Jun-21 A
R78 Reinforcement of Column 12 20-May-21 A 02-Jun-21 A
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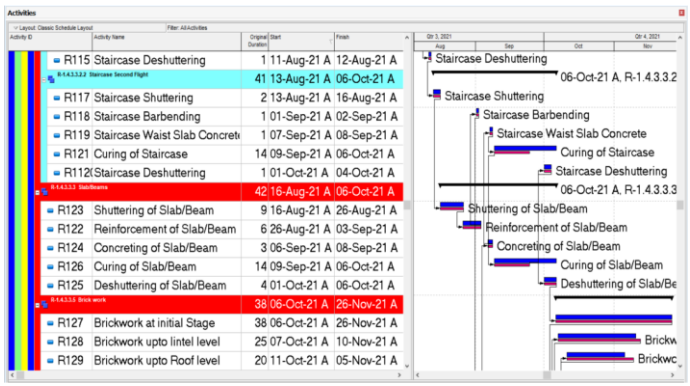
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R119 Staircase Waist Slab Concrete 1 07-Sep-21 A 08-Sep-21 A
R121 Curing of Staircase 14 09-Sep-21 A 06-Oct-21 A
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R123 Shuttering of Slab/Beam 9 16-Aug-21 A 26-Aug-21 A
R122 Reinforcement of Slab/Beam 6 26-Aug-21 A 03-Sep-21 A
R124 Concreting of Slab/Beam 3 06-Sep-21 A 08-Sep-21 A
R126 Curing of Slab/Beam 14 09-Sep-21 A 06-Oct-21 A
R125 Deshuttering of Slab/Beam 4 01-Oct-21 A 06-Oct-21 A
R127 Brickwork at initial Stage 38 06-Oct-21 A 26-Nov-21 A
R128 Brickwork upto lintel level 25 07-Oct-21 A 10-Nov-21 A
R129 Brickwork upto Roof level 20 11-Oct-21 A 05-Nov-21 A
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Staircase Shuttering
Staircase Barbending
Staircase Waist Slab Concrete
Curing of Staircase
Staircase Deshuttering
06-Oct-21 A, R-1.4.3.3.3
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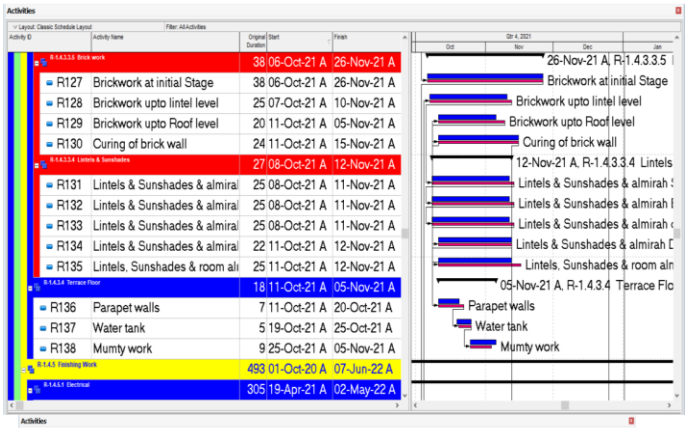
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R130 Curing of brick wall 24 11-Oct-21 A 15-Nov-21 A
R131 Lintels & Sunshades & almiral 25 08-Oct-21 A 11-Nov-21 A
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R136 Parapet walls 7 11-Oct-21 A 20-Oct-21 A
R137 Water tank 5 19-Oct-21 A 25-Oct-21 A
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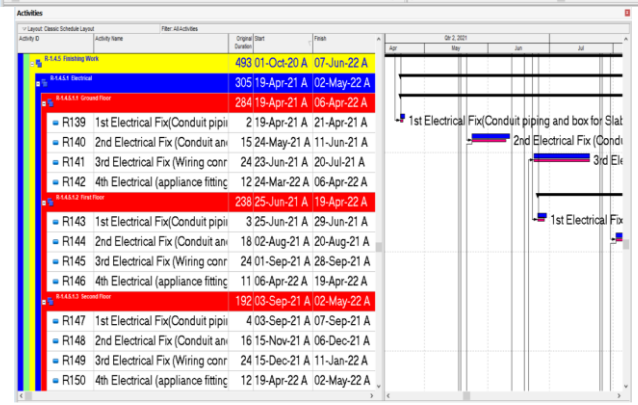
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R142 4th Electrical (appliance fittinç 12 24-Mar-22 A 06-Apr-22 A
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R146 4th Electrical (appliance fittinç 11 06-Apr-22 A 19-Apr-22 A
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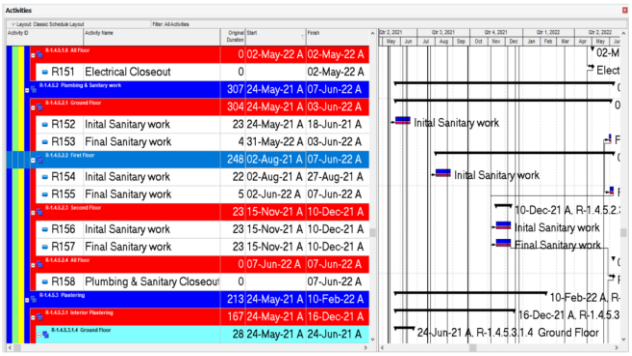
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R155 Final Sanitary work 5 02-Jun-22 A 07-Jun-22 A
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R157 Final Sanitary work 23 15-Nov-21 A 10-Dec-21 A
R158 Plumbing & Sanitary Closeout 0 07-Jun-22 A 07-Jun-22 A
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10-Dec-21 A, R-1.4.5.2.
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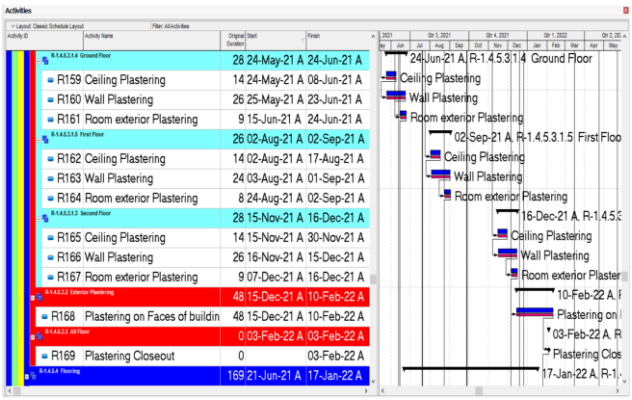
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R162 Ceiling Plastering 14 02-Aug-21 A 17-Aug-21 A
R163 Wall Plastering 24 03-Aug-21 A 01-Sep-21 A
R164 Room exterior Plastering 8 24-Aug-21 A 02-Sep-21 A
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R167 Room exterior Plastering 9 07-Dec-21 A 16-Dec-21 A
R168 Plastering on Faces of buildin 48 15-Dec-21 A 10-Feb-22 A
R169 Plastering Closeout 0 03-Feb-22 A 03-Feb-22 A
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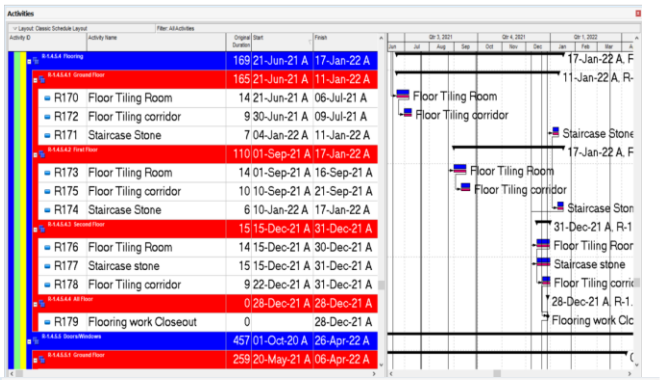
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R175 Floor Tiling corridor 10 10-Sep-21 A 21-Sep-21 A
R174 Staircase Stone 6 10-Jan-22 A 17-Jan-22 A
R176 Floor Tiling Room 14 15-Dec-21 A 30-Dec-21 A
R177 Staircase stone 15 15-Dec-21 A 31-Dec-21 A
R178 Floor Tiling corridor 9 22-Dec-21 A 31-Dec-21 A
R179 Flooring work Closeout 0 28-Dec-21 A
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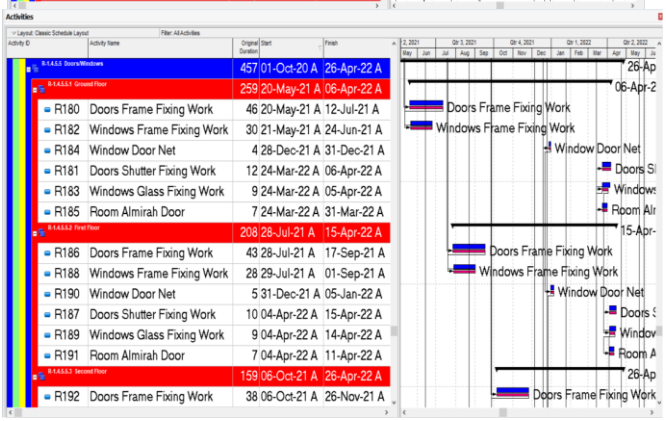
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R184 Window Door Net 4 28-Dec-21 A 31-Dec-21 A
R181 Doors Shutter Fixing Work 12 24-Mar-22 A 06-Apr-22 A
R183 Windows Glass Fixing Work 9 24-Mar-22 A 05-Apr-22 A
R185 Room Almirah Door 7 24-Mar-22 A 31-Mar-22 A
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R190 Window Door Net 5 31-Dec-21 A 05-Jan-22 A
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R189 Windows Glass Fixing Work 9 04-Apr-22 A 14-Apr-22 A
R191 Room Almirah Door 7 04-Apr-22 A 11-Apr-22 A
R192 Doors Frame Fixing Work 38 06-Oct-21 A 26-Nov-21 A
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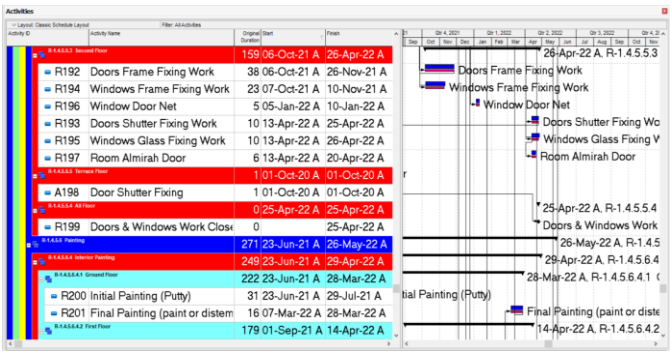
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R197 Room Almirah Door 6 13-Apr-22 A 20-Apr-22 A
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R199 Doors & Windows Work Close 0 25-Apr-22 A
R200 Initial Painting (Putty) 31 23-Jun-21 A 29-Jul-21 A
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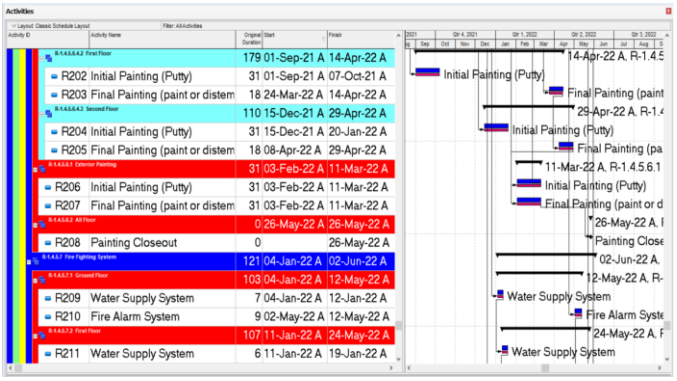
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R205 Final Painting (paint or distem 18 08-Apr-22 A 29-Apr-22 A
R206 Initial Painting (Putty) 31 03-Feb-22 A 11-Mar-22 A
R207 Final Painting (paint or distem 31 03-Feb-22 A 11-Mar-22 A
R208 Painting Closeout 0 26-May-22 A
R209 Water Supply System 7 04-Jan-22 A 12-Jan-22 A
R210 Fire Alarm System 9 02-May-22 A 12-May-22 A
R211 Water Supply System 6 11-Jan-22 A 19-Jan-22 A
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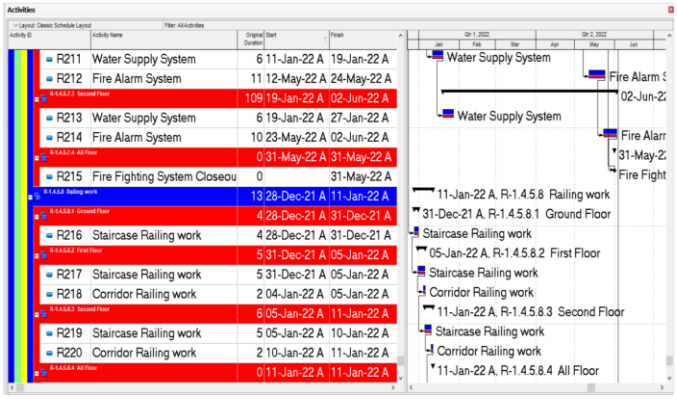

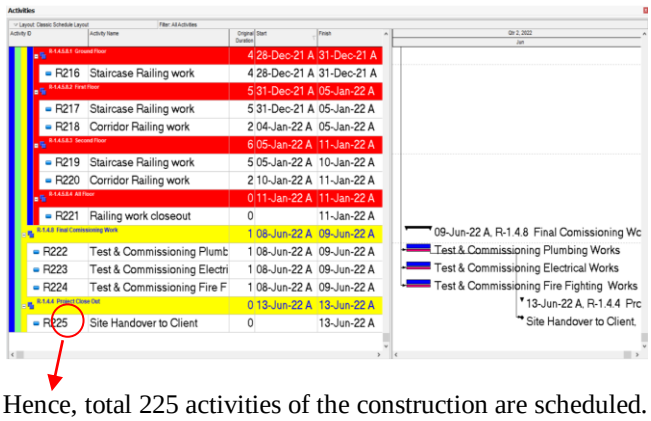

Hence, total 225 activities of the construction are scheduled.

OBSERVATION

It was observed that after planning and scheduling of REC Mainpuri Boys Hostel building using Primavera P6 the time duration was reduced by nearly 3.5 months. Hence after careful studying this software one can control the time duration of a project which ultimately save the cost.

RESULT

In our project **"**Scheduling of REC Mainpuri Boys Hostel Building Using Primavera P6" we finally save 3.5 months from estimated duration of the project. So, the final result is summarized below:

Table No. 2: Result of the Project

Estimated project duration	24 months
Project duration after using Primavera	20.5 months
No. of months saved	3.5 months

CONCLUSION

Primavera P6 in a construction project helps us to understand the role of scheduling before execution of the project and monitoring and control of the progress of a construction project. This objective was achieved through careful planning, proper scheduling and effective resource utilization and project management skills. Results of this study highlights the present construction project delays. An efficient and proper planning is necessary to minimize unnecessary delays.

ACKNOWLEDGMENT

It gives us a great sense of pleasure to present the research paper. We owe a special debt of gratitude to Mr. Surendra Pratap Singh, Asst. Prof. Department of Civil Engineering, Rajkiya Engineering College, Mainpuri, we would also like to express our gratitude and sincere thanks to our teacher, Professor Baljeet Yadav, Asst. Prof. Head of the Department of Civil Engineering, Rajkiya Engineering College, Mainpuri, for his full support and assistance during the development of the project. We also do not like to miss the opportunity to acknowledge the contributions of all faculty members of the department for their kind assistance and cooperation during the development of our project. Finally, we acknowledge our team members for their sincere contribution to the completion of the project.

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