

4D Scheduling and Simulation of G+3 Storey Residential Building Using Power Project Software

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Abstract: *The report focuses on the attributes in which is try to explain our experience in a construction project using 4D Elecosoft power project software. The main aim of our project work is to design a G+3 residential building model using power project with 4D power project software. The knowledge which we have gained in our classes is helpful in designing and analyzing a construction project using 4D power project which makes the project easier to finish it and mark the delay of the construction and I gained lot of ideas regarding 4D power project software and their purpose in the recent era of construction projects. I have also found how a BIM or 4D power project software can make a project easier and earlier.*

Keywords: Power Project, Simulation, Scheduling, Baseline, Delays, Construction

I. INTRODUCTION

Power project is a cloud-based project management solution that helps users plan and design with 3D and 4D models while scheduling and monitoring the progress of tasks throughout construction. Key features include project planning, collaboration, expense tracking and resource management. Designed for construction companies of all sizes. Power project comes with a building information modeling (BIM) tool, which enables users to schedule tasks, identify problems and assess and track movement of solutions. It allows users to view projects at every level on Gantt charts, integrate changes and create tenders. Additionally, the project viewer allows enterprises to overlay, compare and analyze the progress of multiple Industry Foundation Classes (IFC) files. Power project supports more than 100,000 professionals worldwide in delivering successful projects by equipping organizations with the award-winning project, programme, and resource management tools necessary to bring their built asset to life, regardless of scale; whether a high-profile megaproject, single storey extension.

II. BENEFITS

- Power project allows us to develop multiple scenarios to explore the best outcome for our project; whether that is comparing different methods of construction or finding ways to accelerate project delivery.
- Cost and time both together in Power project, analyzing budgeted costs, planned costs and actual costs all against time. Model cost data using man-hours, quantity, fixed and variable rates.
- A built-in risk analysis tool assesses project risks to create more accurate and attainable schedules that keep to time and budget.
- Multiple progress period tracking and unlimited baselines make capturing and recording snapshots of actual progress against the original project plan possible over time and providing a complete picture of the projects evolution needed to overcome project performance challenges.

III. OBJECTIVES

- Create a project with activities and resources for G+3 storey building
- Calculate a schedule
- Analyze resource/cost data
- Risk Analysis of Schedule
- Linking IFC files in Power Project
- Compare current vs. target schedules

- Timeline Simulation between Planned and Actual model in 3D view.

IV. PRACTICE MODEL

4.1 Residential Building

- Floor: G + 3
- File format: IFC (.ifc file)
- Work done: Scheduling and Simulation
- Structure: Concrete structure

4.2 Step by Step Procedure

- Start a new project. File > construction template > Project title > Project report date.
- Create a new calendar go to Project view, right-click on Calendars > New calendars (exceptions working and non-working days are given).
- Import IFC model. File > BIM > New > Select New > IFC model > Open model.
- Tasks are created on the spreadsheet or drawn onto the Gantt chart.
- Select the bars above which we want to insert the summary task > Name dialog appears > Enter the name of the summary task.
- To link tasks on the chart, hold the ctrl button on keyboard, while clicking on line number the task which want to link. Home tab > Add/Delete links > Link tasks or Add a new column in the spreadsheet > logic > predecessor.
- After linking the tasks we have to reschedule the project. Home tab > Reschedule branch > Reschedule all.
- Select BIM tab > IFC model pane > IFC categories pane.
- Link the IFC model to the task of the project. Select the IFC category check box to display the objects with that category > BIM tab > Select Selection mode > Right click the IFC model > Select all visible products > press the right mouse button continuously and drop to the task which we want to add.
- Select Permanent resources from the folders on the left-side > right click and select new permanent resources > Type name field, available resource, cost > Enter Example: Carpenter (Name field), 4 (Available resource), 850 (cost) > Enter.
- Select Consumable resources from the folders on the left-side > right click and select new consumable resources > Type name field, units, cost > Enter.
- Both the Permanent and Consumable resources should be linked to the IFC model or every task of the project. Select the resources > press the right mouse button continuously and drag to the task which we want to add the resources.
- View tab > New Histogram, Here we can see Over-Allocation, Progress S curve, Monthly income, Baseline Vs. Current cost, Total man – days for all the permanent and consumable resources of the project.
- Set an Initial Baseline which records the initial project plan, including scheduled dates, task assignments, work and cost. Project tab > Baseline Manager > New > Name, Description, Issue date > All task in current view > Next > Finish.
- Now update the Baseline to the Project.
- Format tab > Baselines > Select the New baseline (to view the baseline in Gantt chart).
- BIM tab > Timeline settings > Timeline simulation uses lives project dates > Comparison simulation uses baseline dates > close (To run the Simulation between the IFC model and IFC comparison model to know the delay of project).
- After the creation of baseline, we should record its progress at regular intervals. View tab > Library explorer > Progress period > Open (update for multiple weeks) > right click each bars on the Gantt chart > Progress up to > specific week > View tab > Reschedule branch > Reschedule all > Specific week.
- To run risk analysis and quality checks. Project tab > Risk analysis > Quality checks.
- Duration and cost reports are produced from EVA Reporter as line graphs also known as S – curves.
- Reports were generated with default templates.

V. RESULTS AND DATA

5.1 Project Information and Calendar

Calendars define the working and non-working time within a project. The Calendar consists of a planned pattern of work to which exceptions can be added. An exception is any day which does not conform to the planned pattern of work, e.g., holidays or overtime. The Construction and Housing templates both contain Calendars which cover the most common working patterns. Customized templates may have Calendars tailored to your individual requirements.

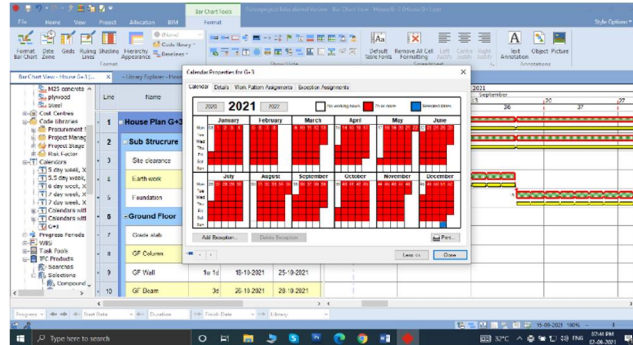


Figure 1: Creation of Calendar

5.2 Scheduling

When you have linked your tasks you can reschedule the project and identifies any constraints which have been exceeded & calculates the earliest project end date.

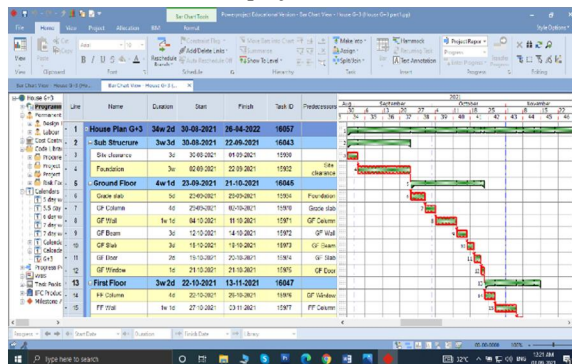


Fig. 2.a List of Activities and Gantt chart

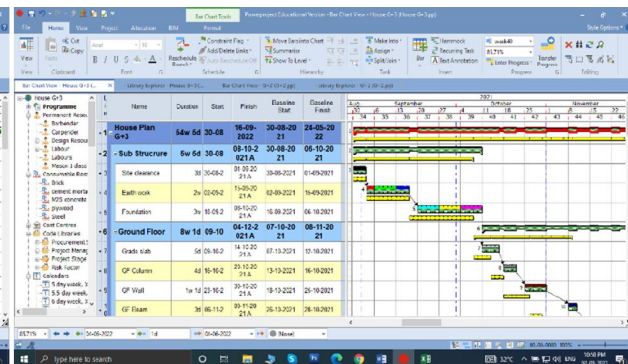


Fig. 2.b List of Activities and Gantt chart

5.3 4D Scheduling

After linking the tasks schedule the project, link the IFC model to the task of the project. Select the IFC category check box to display the objects.



Fig. 3.a Front IFC model

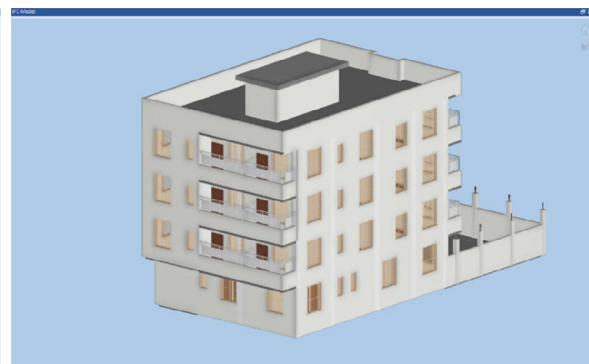


Fig. 3.b Back IFC model

5.4. Resource Management

Both permanent and consumable resources can be recorded on the project, however for Penn DOT construction jobs, only permanent resources are required to be tracked if the contract dictates a resource loaded schedule.

- A Permanent Resource is a type of resource that is reusable (for example, labour and equipment).
- Consumable Resources are consumed by or supplied to tasks in a project (for example, materials, components, etc.).

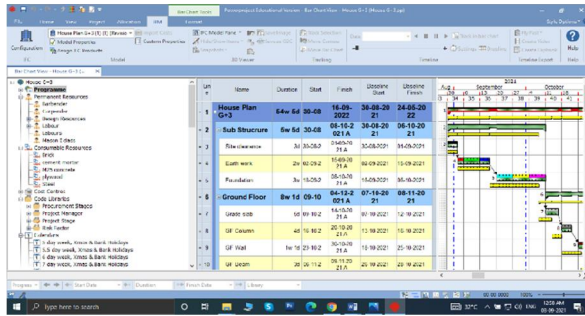


Fig. 4.a List of Permanent and Consumable Resources

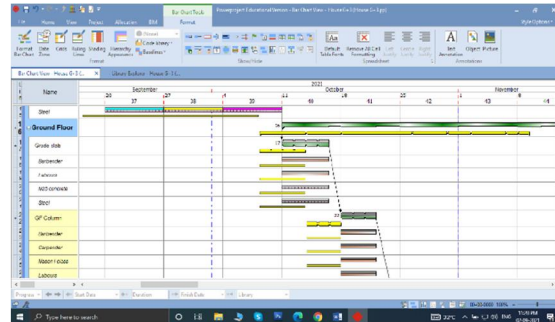


Fig. 4.b Gantt chart resources

5.5. Histogram

The resource histogram is specifically a bar chart used for displaying the specific amounts of time that a particular resource is scheduled to be worked on over a predetermined and specific time.

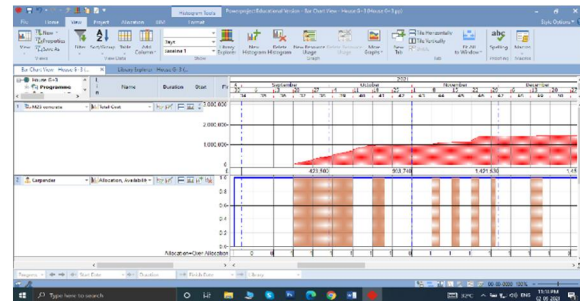


Fig. 5.a M25 Concrete over Total cost & Carpenters Over Allocation histogram

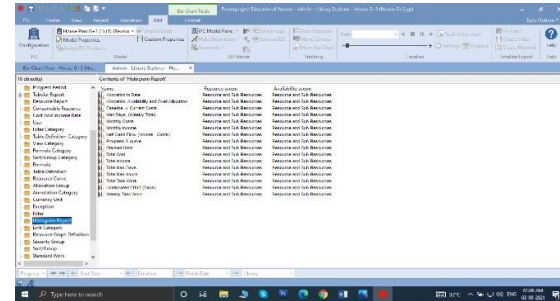


Fig. 5.b Histogram report

5.6. Baseline

Baselines are created to record the project at a particular point in time, this allows you to compare current information with planned information.

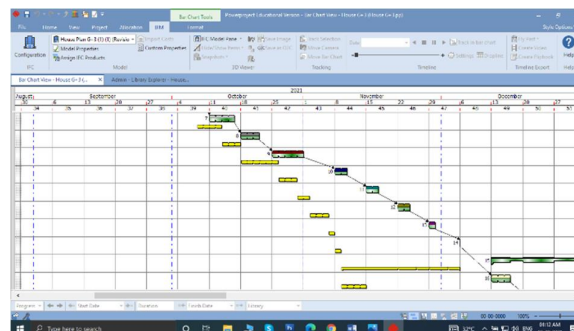


Fig. 6 Baseline update

5.7. Progress Period

Project is underway and an initial baseline is created, we should record its progress at regular intervals.

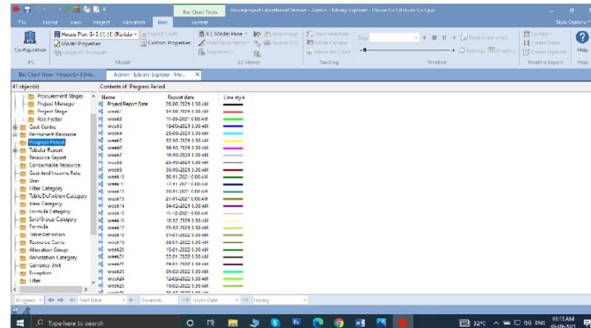


Fig. 7 Progress period

5.8. Planned Vs Actual through 4D BIM

To show planned and actual start and finish dates of the tasks in your project ensure each column looks at the Current Baseline instead of the live data.

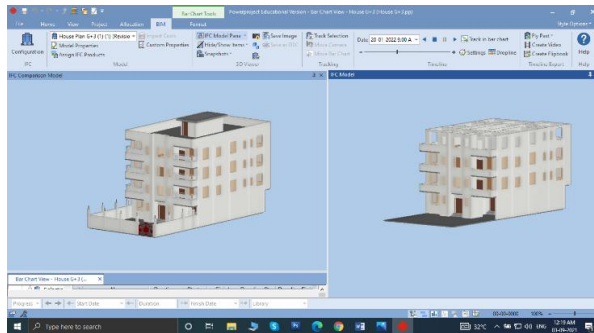


Fig. 8.a Simulation between IFC model and comparison model

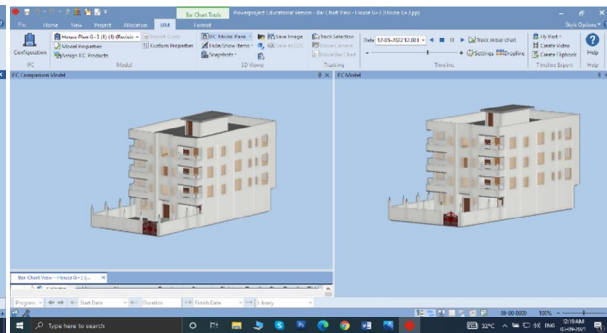


Fig. 8.b Simulation between IFC model and comparison model

5.9. Risk Analysis, Schedule check, Earned value

Risk Analysis is a powerful analytical tool that you can use to assess and identify risks within your Power project projects.

- Create more accurate and attainable schedules that are more likely to be on time and within budget – i.e., projects that are more likely to succeed.
- Analyse risk in any Power project. If you manage programmes of projects, you can choose to analyse risk across the entire programme or in discrete areas of the programme as required.
- Identify the tasks within your projects that are most likely to cause delays or cost overruns if they are allowed to slip, which enables you to identify those tasks that you need to monitor most closely.
- Assess the likelihood of a project finishing on a particular date, of costing a certain amount or of generating a certain amount of income.

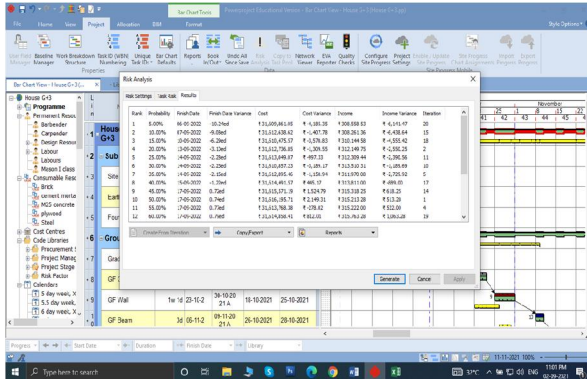


Fig. 9.a Risk Analysis

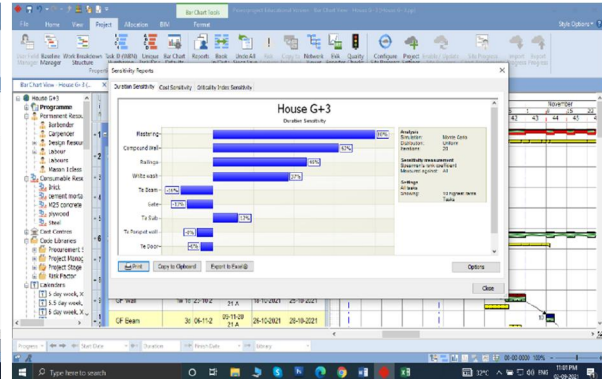


Fig. 9.b Duration sensitivity report

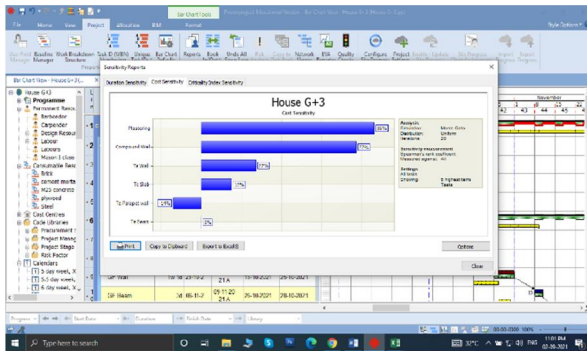


Fig. 9.c Cost sensitivity

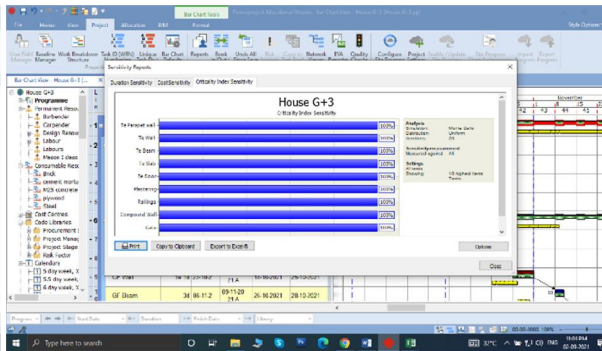


Fig. 9.d Criticality index sensitivity

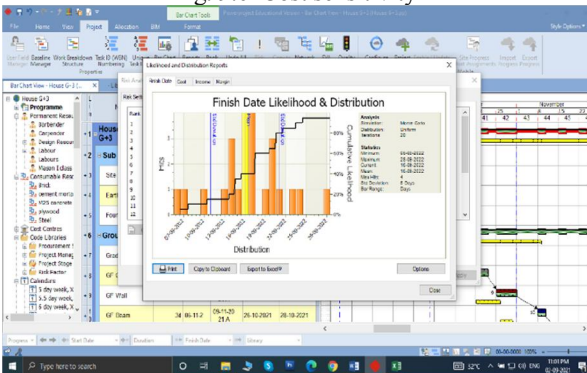


Fig. 9.e Likelihood and distribution reports on Finish date

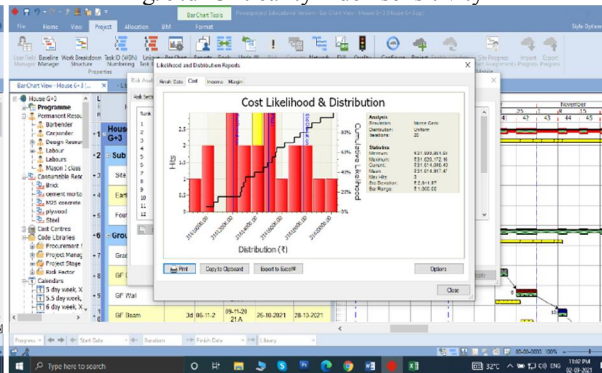


Fig. 9.f Likelihood and distribution reports on Cost

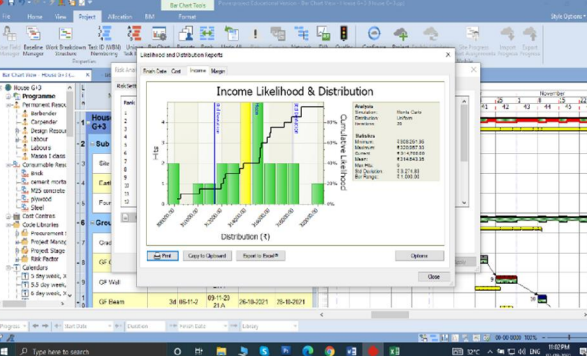


Fig. 9.g Likelihood and distribution reports on Income

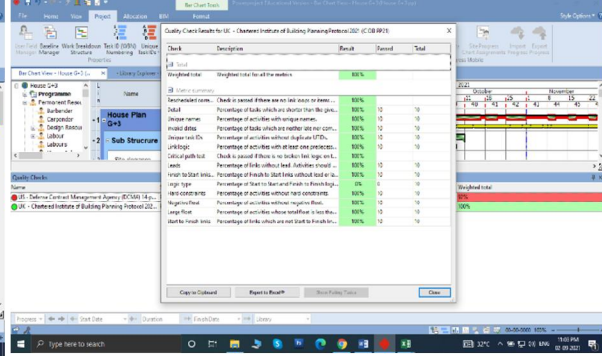


Fig. 9.h Quality check result

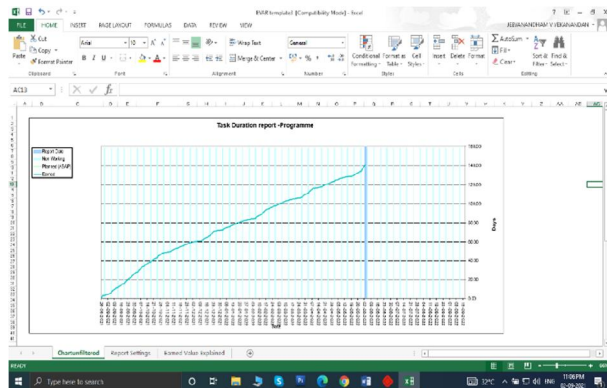


Fig. 9.i EVA Report on Duration

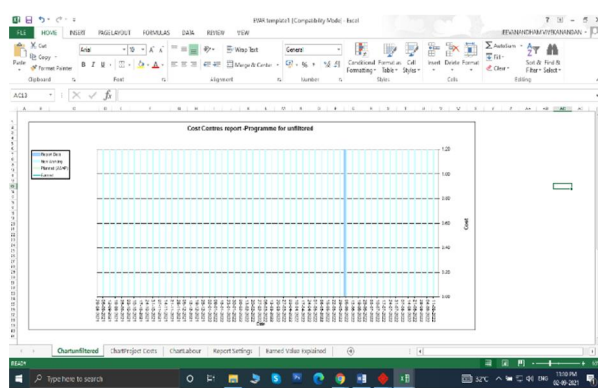


Fig. 9.j EVA Report on Cost

VI. CONCLUSION

From this I have created a scheduled of 34 weeks(8.5 months) and simulation for G+3 Residential building using Power project software. The actual project delays by five months were founded from the baseline of the project due to the stop of work by seeing the Simulation between IFC model and comparison model, to calculate actual project ends duration which is exceeded upto 54 weeks(13.5 months approx.). Both the Risk analysis and Quality checks were feasible and the Graph from the EVA Reporter against duration and cost is attached. From this, I have learnt the power project software its helpful to understand the fundamentals of BIM, 4D BIM scheduling concept, Resource management, Risk analysis, Tracking and forecasting project with Earned value management concept based on management concept.

REFERENCES

- [1]. <https://planningengineer.net/wp-content/uploads/2016/08/158858802-ASTA-Introduction-to-ASTA-Powerproject-V12.pdf>.
- [2]. <https://elecosoft.com/wp-content/uploads/2021/04/Powerproject-Service-Level-Agreement.pdf>
- [3]. <https://www.jetir.org/papers/JETIRES06043.pdf>.
- [4]. <https://www.elecosoft.nl/downloads/14-Reasons-to-use-Asta-Powerproject-International.pdf>.
- [5]. <https://www.dot.state.pa.us/public/pubsforms/Publications/PUB%20615.pdf>.

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