Master of Building Information Modelling (BIM) Concept for Residential Building (G+4)

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Abstract - *Building Information Modelling (BIM) is becoming more widely used in large construction projects, but its use in smaller residential buildings and bungalows is still not fully explored. This paper looks at how BIM can be useful in residential construction. It focuses on how BIM improves design accuracy, helps better communication and coordination among everyone involved in the project, and makes the overall construction process more efficient.*

The study explains how BIM tools can be used to create detailed 3D models that include important information such as materials and specifications. These models make it easier to prepare clear and accurate construction drawings and documents. The paper also reviews previous studies and possible case examples to understand whether BIM is cost-effective for residential projects. It considers how BIM can help reduce mistakes, avoid rework, and save both time and money.

Overall, this research aims to highlight the importance and benefits of using BIM in residential building projects and to encourage its wider adoption in this field.

Key Words: **BIM, Revit, Modelling, AutoCAD, Navisworks, Clash Detection, Schedule of Openings, Quantity Take off.**

1. INTRODUCTION

1.1 General

Building Information Modelling (BIM) is a computerized, reliable, and three-dimensional virtual representation of a project that is developed before construction begins. It helps professionals make better design decisions, plan construction activities and schedules, estimate costs, and manage maintenance throughout the lifecycle of the building. As more contractors recognize the benefits of this technology, the demand for BIM solutions has increased significantly.

According to the National BIM Standard, a building information model is defined as a digital representation of the physical and functional characteristics of a facility. It also serves as a shared source of knowledge, providing essential

It provides a reliable basis for decision-making throughout the entire life cycle of a project, from its earliest concept to its eventual demolition. During this process, BIM is used by all key stakeholders, including contractors, owners, engineers, and designers.

Over time, the use of physical models has become less common. Making changes to physical models is often time-consuming and inefficient, especially when design modifications are required. BIM represents the next step beyond traditional CAD systems and is considered the future of the construction industry. It allows users to work with dynamic and intelligent 3D models that can be easily updated.

In the construction field, BIM is used for various purposes such as scheduling, quantity take off, and three-dimensional modeling. There are several software tools available to support BIM. For architectural and engineering design, commonly used software includes Graph soft ArchiCAD, Bentley Architecture, and Autodesk Revit Architecture. For structural analysis and design, tools such as Autodesk Revit Structure, Structural Modeller, STAAD, and ETABS are widely used. Additionally, MEP (mechanical, electrical, and plumbing) engineers also make use of Autodesk Revit to design and coordinate building systems effectively.

1.2 AutoCAD

Computer-Aided Design (CAD) is a technology widely used for design and drafting purposes. It allows designers and engineers to create drawings more efficiently by using the processing power of computers. Compared to traditional hand-drafted drawings, CAD drawings are faster to produce, more accurate, and of higher quality. This software is commonly used to prepare important construction drawings such as site plans and foundation plans for proposed projects, making the design process more efficient and reliable.

1.3 REVIT

The best software for the BIM process in the world is Autodesk Revit. Revit is a complete software program that facilitates every step of the building design and construction process, from project management and construction documentation to conceptual design. It enables users to produce intelligent 3D models that capture a building or structure's functional and physical attributes. Among the many uses for the models are construction documentation, analysis, and visualization. Among the many tasks this software completes is providing a 3D model with an architectural view. structural model that includes information on reinforcement, component scheduling to achieve quantity, and collision detection. The 3D model is the primary focus of this project.

1.3 Navis works

The architectural, engineering, and construction (AEC) sectors are the main users of Autodesk Navisworks, a potent 3D project review tool. Through visualization, it enhances BIM cooperation. integrating and evaluating design data, spotting conflicts, and supporting project review and simulation. Below is a summary of important details:

1. Aggregation of Models: With Navisworks, users may create a single, integrated project model by combining 3D models from different design programs (such as AutoCAD, Revit, and others).

2. Identifying Clashes: Its ability to identify conflicts or confrontations between various building systems (such as structural, mechanical, electrical, and plumbing) is an essential aspect. This lessens the chance of expensive construction mistakes.

3. 3D Modelling: Navisworks connects project schedules to the 3D model to enable 4D simulations. This facilitates planning and coordination by allowing the construction sequence to be visualized across time.

2. LITERATURE REVIEW

1) Farhan Shaikh : This study highlights three important areas for the future development of BIM technology. First, as BIM continues to evolve, models will achieve higher Levels of Detail (LOD), making them more accurate and informative. Second, time and cost parameters can be integrated with BIM components, allowing for better scheduling and financial analysis. Third, resource allocation can be effectively managed using 4D BIM models, which help in planning and simulating resource usage based on updated designs. The study also concludes that once a BIM model is created, it becomes easier to generate quantity take offs for estimating construction costs.

2) Yatish Gode : This study explains how modern construction practices are shifting from traditional 2D drawings to integrated 3D digital models. The research focuses on an existing G+4 residential building The building includes two bedrooms on the ground floor and two bedrooms on the first floor, along with a bathroom connected to the terrace. The study demonstrates how BIM can be applied effectively to such residential structures.

3) Sushant Borkar : The main objective of this study is to demonstrate the benefits of implementing BIM in residential projects before construction begins. A residential project as a case study. Through 3D and 4D BIM, eight potential errors were identified that could have been avoided if BIM had been used earlier. The cost of developing the BIM model clearly showing the advantages of using BIM in construction projects.

4) Monish Fegade : This case study focuses on a residential building. The aim is to develop an intelligent BIM model using tools for design, analysis, planning, , clash detection. BIM helps manage the complex requirements of both designers and contractors. The study presents a detailed 3D model, along with a complete design report, accurate scheduling and cost estimation, and identification of potential conflicts during the construction process.

3. METHEDOLOGY

1. To research and comprehend how BIM is used in residential buildings.

2. To investigate the Building Information Modelling technique

3. To improve building performance, create a better design solution, and effectively coordinate throughout the project.

4. To provide an enhanced and better workflow for the system.

5. To improve the consistency and accuracy of data.

6. To lessen mistakes and disputes.

7. Projects having a smaller environmental impact can be completed more quickly and affordably.

8. Put design concepts into visual form.

9. Boost output time and cost savings through better cooperation

4. Revit 3D Model

A highly detailed three-dimensional representation of the building design is produced by 3D modelling, which makes use of the architectural BIM concept. It guarantees a well-calculated and precise version of the plan that can be reproduced exactly as it is when it takes shape. To fully comprehend the construction, it is done in two ways. It displays the 3D model in both structural and architectural views.

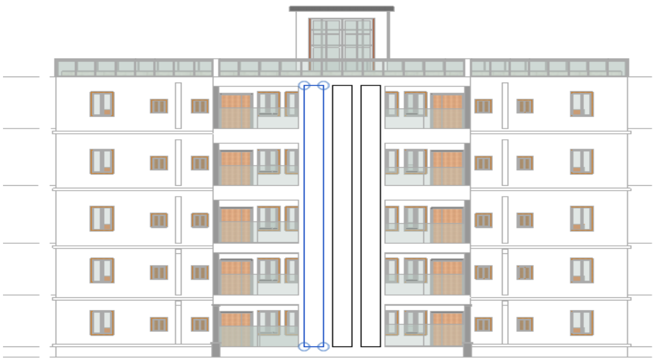

Fig -4.1: Revit 3D Model

4.1 3D Modelling in Architectural view:

Fig -4.2: Architectural 3D Model

The technique of visualizing a design using digital tools to replicate the real built form for a three-dimensional user experience is known as 3D architectural modelling

Fig -4.3 : Elevation-South

Fig -4.4: Elevation-East

<Door Schedule 2>

A	B	C	D	E	F
Count	Family and Type	Height	Width	Thickness	Sill Height
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Uneven-Flush: 1350 x 200	6' - 6 1/2"	4' - 5"	0' - 2"	0' - 0"
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Uneven-Flush: 1350 x 200	6' - 6 1/2"	4' - 5"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 9	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 9	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Uneven-Flush: 1350 x 200	6' - 6 1/2"	4' - 5"	0' - 2"	0' - 0"
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Single-Flush: 0915 x 2134mm	6' - 10 1/2"	2' - 5 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"
1	M_Door-Passage-Single-Vision_Two_Lite: 7	6' - 10 1/2"	2' - 11 1/2"	0' - 2"	0' - 0"

Fig -4.5: Door Schedule

<Window Schedule>

A	B	C	D	E	F
Count	Family and Type	Height	Width	Visual Light Transm	Sill Height
1	Slider with Trim: 36" x 48"	2' - 5 1/2"	1' - 11 1/2"	0.9	3' - 0"
1	Slider with Trim: 36" x 48"	2' - 5 1/2"	1' - 11 1/2"	0.9	3' - 0"
1	Slider with Trim: 36" x 48"	2' - 5 1/2"	1' - 11 1/2"	0.9	3' - 0"
1	Slider with Trim: 36" x 48"	2' - 5 1/2"	1' - 11 1/2"	0.9	3' - 0"
1	Slider with Trim: 36" x 48"	2' - 5 1/2"	1' - 11 1/2"	0.9	3' - 0"
1	Slider with Trim: 36" x 48"	2' - 5 1/2"	1' - 11 1/2"	0.9	3' - 0"
1	Slider with Trim: 36" x 48"	2' - 5 1/2"	1' - 11 1/2"	0.9	3' - 0"
1	Slider with Trim: 36" x 48"	2' - 5 1/2"	1' - 11 1/2"	0.9	3' - 0"
1	Slider with Trim: 36" x 48"	2' - 5 1/2"	1' - 11 1/2"	0.9	3' - 0"
1	Slider with Trim: 36" x 48"	2' - 5 1/2"	1' - 11 1/2"	0.9	3' - 0"
1	M_Window-Awning-Variable: 1800 x 1350mm	9' - 0"	9' - 0"	0.81	0' - 1"
1	M_Window-Awning-Variable: 1800 x 1350mm	9' - 0"	9' - 0"	0.81	0' - 1"
1	M_Window-Awning-Variable: 1800 x 1350mm	9' - 0"	9' - 0"	0.81	0' - 1"
1	M_Window-Awning-Variable: 1800 x 1350mm	9' - 0"	9' - 0"	0.81	0' - 1"
1	M_Window-Awning-Variable: 1800 x 1350mm	9' - 0"	9' - 0"	0.81	0' - 1"
1	M_Window-Awning-Variable: 1800 x 1350mm	9' - 0"	9' - 0"	0.81	0' - 1"
1	M_Window-Awning-Variable: 1800 x 1350mm	9' - 0"	9' - 0"	0.81	0' - 1"
1	M_Window-Awning-Variable: 1800 x 1350mm	9' - 0"	9' - 0"	0.81	0' - 1"
1	M_Window-Awning-Variable: 1800 x 1350mm	9' - 0"	9' - 0"	0.81	0' - 1"
1	M_Window-Awning-Variable: 1800 x 1350mm	9' - 0"	9' - 0"	0.81	0' - 1"
1	M_Window-Casement-Triple-Middle-Transom: 1800 x 1350mm	7' - 0"	8' - 0"	0.81	1' - 0 1/2"
1	M_Window-Casement-Triple-Middle-Transom: 1800 x 1350mm	7' - 0"	8' - 0"	0.81	1' - 0 1/2"
1	M_Window-Casement-Triple-Middle-Transom: 1800 x 1350mm	7' - 0"	8' - 0"	0.81	1' - 0 1/2"
1	M_Window-Casement-Triple-Middle-Transom: 1800 x 1350mm	7' - 0"	8' - 0"	0.81	1' - 0 1/2"
1	M_Window-Casement-Triple-Middle-Transom: 1800 x 1350mm	7' - 0"	8' - 0"	0.81	1' - 0 1/2"
1	M_Window-Casement-Triple-Middle-Transom: 1800 x 1350mm	7' - 0"	8' - 0"	0.81	1' - 0 1/2"
1	M_Window-Casement-Triple-Middle-Transom: 1800 x 1350mm	7' - 0"	8' - 0"	0.81	1' - 0 1/2"
1	M_Window-Casement-Triple-Middle-Transom: 1800 x 1350mm	7' - 0"	8' - 0"	0.81	1' - 0 1/2"
1	M_Window-Casement-Triple-Middle-Transom: 1800 x 1350mm	7' - 0"	8' - 0"	0.81	1' - 0 1/2"
1	M_Window-Casement-Triple-Middle-Transom: 1800 x 1350mm	7' - 0"	8' - 0"	0.81	1' - 0 1/2"
1	M_Window-Casement-Triple-Middle-Transom: 1800 x 1350mm	7' - 0"	8' - 0"	0.81	1' - 0 1/2"

Fig -4.6: Window Schedule

<Wall Schedule 2>

A	B	C	D	E	F
Count	Family and Type	Length	Width	Volume	Base Constraint
1	Basic Wall: Generic - 200mm	30' - 1"	0' - 9"	4.63 m^3	NGL
1	Basic Wall: Generic - 200mm	33' - 4 1/2"	0' - 9"	7.36 m^3	NGL
1	Basic Wall: Generic - 200mm	22' - 10 1/2"	0' - 9"	3.32 m^3	NGL
1	Basic Wall: Generic - 200mm	36' - 8"	0' - 9"	2.79 m^3	NGL
1	Basic Wall: Generic - 200mm	20' - 10"	0' - 9"	4.16 m^3	NGL
1	Basic Wall: Generic - 200mm	12' - 10 1/2"	0' - 9"	2.58 m^3	NGL
1	Basic Wall: Generic - 200mm	22' - 10 1/2"	0' - 9"	5.05 m^3	NGL
1	Basic Wall: Generic - 200mm	26' - 10"	0' - 9"	5.74 m^3	NGL
1	Basic Wall: Generic - 200mm	12' - 6 1/2"	0' - 9"	2.96 m^3	NGL
1	Basic Wall: Generic - 200mm	12' - 6 1/2"	0' - 9"	2.47 m^3	NGL
1	Basic Wall: Generic - 200mm	9' - 11"	0' - 9"	1.70 m^3	NGL
1	Basic Wall: Generic - 200mm	12' - 6 1/2"	0' - 9"	2.96 m^3	NGL
1	Basic Wall: Generic - 200mm	12' - 10 1/2"	0' - 9"	3.04 m^3	NGL
1	Basic Wall: Generic - 200mm	5' - 8"	0' - 9"	0.88 m^3	NGL
1	Basic Wall: Generic - 200mm	10' - 4"	0' - 9"	1.51 m^3	NGL
1	Basic Wall: Generic - 200mm	13' - 10 1/2"	0' - 9"	2.00 m^3	NGL
1	Basic Wall: Generic - 200mm	1' - 7 1/2"	0' - 9"	0.41 m^3	NGL
1	Basic Wall: Generic - 200mm	1' - 7 1/2"	0' - 9"	0.23 m^3	NGL
1	Basic Wall: Generic - 200mm	1' - 7 1/2"	0' - 9"	0.41 m^3	NGL
1	Basic Wall: Generic - 200mm	1' - 7 1/2"	0' - 9"	0.23 m^3	NGL
1	Basic Wall: Generic - 200mm	30' - 1"	0' - 9"	4.63 m^3	NGL
1	Basic Wall: Generic - 200mm	33' - 4 1/2"	0' - 9"	7.36 m^3	NGL
1	Basic Wall: Generic - 200mm	82' - 5"	0' - 9"	11.81 m^3	NGL
1	Basic Wall: Generic - 200mm	22' - 10 1/2"	0' - 9"	3.32 m^3	NGL
1	Basic Wall: Generic - 200mm	20' - 10"	0' - 9"	4.16 m^3	NGL
1	Basic Wall: Generic - 200mm	12' - 10 1/2"	0' - 9"	2.58 m^3	NGL
1	Basic Wall: Generic - 200mm	22' - 10 1/2"	0' - 9"	5.05 m^3	NGL
1	Basic Wall: Generic - 200mm	26' - 10"	0' - 9"	5.74 m^3	NGL
1	Basic Wall: Generic - 200mm	12' - 6 1/2"	0' - 9"	2.96 m^3	NGL
1	Basic Wall: Generic - 200mm	12' - 6 1/2"	0' - 9"	2.47 m^3	NGL
1	Basic Wall: Generic - 200mm	9' - 11"	0' - 9"	1.70 m^3	NGL
1	Basic Wall: Generic - 200mm	12' - 6 1/2"	0' - 9"	2.96 m^3	NGL

Fig -4.7: Wall Schedule

5. Revit Structural Analysis

Autodesk Revit is a very useful software in structural engineering, mainly used for Building Information Modeling (BIM). It helps engineers create detailed 3D models of buildings, making it easier to understand the structure before construction begins. One of the biggest advantages of Revit is that it combines design, and documentation in a single platform. This means any changes made in the model are automatically updated everywhere, saving time and reducing errors. It also improves coordination between architects and structural engineers, ensuring that the final design is accurate and well-organized.

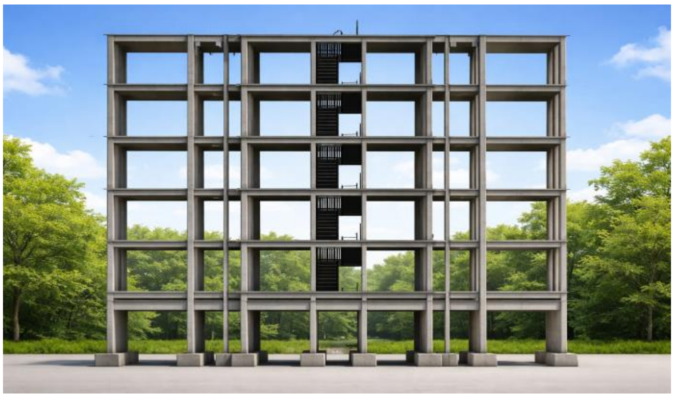

Fig -5.1: Revit 3D Structure Model

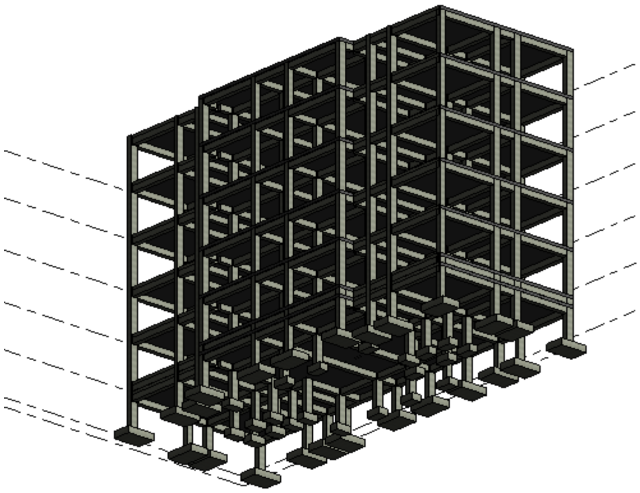

Fig -5.2: Revit 3D Structure Down View

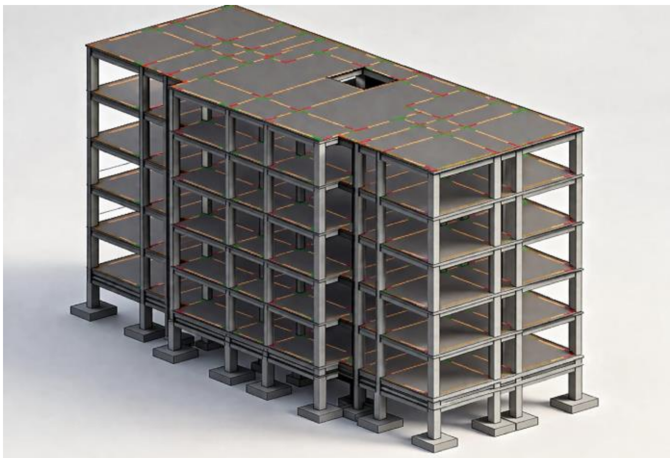

Fig -5.2: Structure Model

5.1 3D Modelling in Structure view

Concrete elements such as beams, columns, slabs, and foundations can be modeled precisely in Revit. The software allows users to assign material properties like strength, density, and elasticity to simulate real-world behavior.

5.2 Structure Rebar view

Revit makes reinforcement detailing much easier and more efficient when working with concrete structures. Engineers can place rebars inside beams, columns, slabs, and foundations with accurate spacing, size, and shape, just like in real construction. This helps in creating a clear and realistic model of how the reinforcement will actually be built.

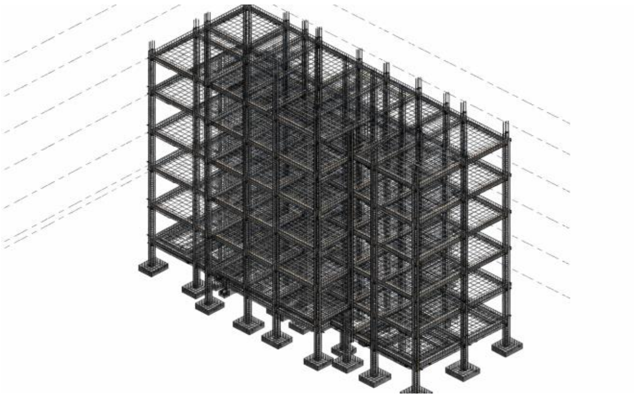

Fig -5.3: Structure Rebars Model

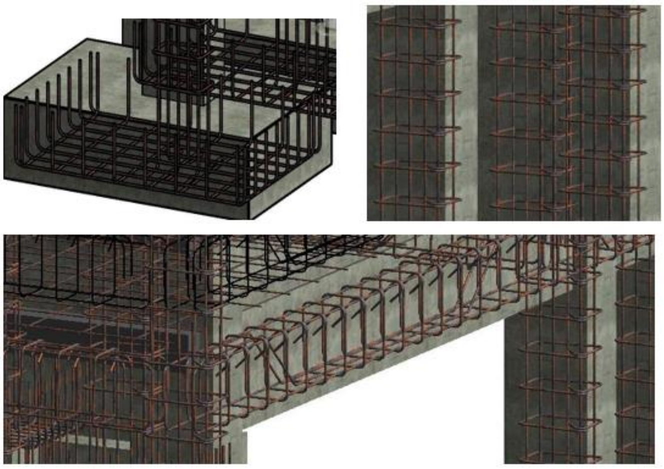

Fig -5.4: Structure Rebars in Footing, Column and Beam

5.3: Structure Rebars In Footing, Column and Beam

Another useful feature is that Revit can automatically create bar bending schedules (BBS). These schedules show the details of each rebar, such as length, shape, and quantity, which are very important for site work. This saves time, reduces manual errors, and helps ensure everything is properly planned before construction begins.

5.4 Scheduling of Structure through Revit

Scheduling of structure in Autodesk Revit helps engineers easily manage and organize construction data through automatic schedules. It allows users to create clear schedules for elements like beams, columns, slabs, and reinforcement by directly taking information from the 3D model. Whenever any change is made in the model, it automatically updates in the schedule, which reduces mistakes and saves time. Revit also helps in calculating quantities, tracking materials, and preparing bar bending schedules (BBS), making planning and cost estimation easier. Overall, it improves coordination and makes the whole construction process more efficient.

<Multi-Category Material Takeoff 2>

A	B	C	D	E	F	G	H	I
Count	Category	Family and Type	Material: Area	Material: Description	Material: Name	Material: Unit weigh	Material: Volume	OmniClass Title
1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
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1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
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1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
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1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1800 x 1200 x 450	7 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.97 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1000x600x450 2F2	3 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.27 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1000x600x450 2F2	3 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.27 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1000x600x450 2F2	3 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.27 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1000x600x450 2F2	3 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.27 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1000x600x450 2F2	3 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.27 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1000x600x450 2F2	3 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.27 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1000x600x450 2F2	3 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.27 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1000x600x450 2F2	3 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.27 m³	Shallow Foundation
1	Structural Foundations	M_Footing-Rectangular: 1000x600x450 2F2	3 m²	Cast-in-place concrete	Concrete, Cast-in-Pl	23.6 kN/m³	0.27 m³	Shallow Foundation

Fig -5.5: Multicategory Material Schedule

<Rebar Schedule 2>

A	B	C	D	E	F	G	H	I	J	K
Bar Diameter	Bar Length	Bend Diameter	Family and Type	Host Category	Material	Phase Created	Quantity By Rebar	Reinforcement Volu	Shape	Style
16 mm	2350 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3732.86 cm³	M_17	Standard
16 mm	1740 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2763.91 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1740 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2763.91 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1740 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2763.91 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1740 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2763.91 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1750 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2779.79 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1750 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2779.79 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1740 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2763.91 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1740 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2763.91 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1740 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2763.91 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1740 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2763.91 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1740 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2763.91 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1740 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2763.91 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1740 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2763.91 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1670 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2652.71 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard
16 mm	1670 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	2652.71 cm³	M_17	Standard
16 mm	2300 mm	95 mm	Rebar Bar: 16M	Structural Foundatio	Rebar - ASTM A	New Construction	8	3653.44 cm³	M_17	Standard

Fig -5.6: Rebar Schedule

6. Revit MEP (Mechanical, Electrical, Plumbing)

Mechanical: Revit helps design HVAC systems like ducts, air conditioning, and ventilation with accurate 3D modeling and airflow analysis. Electrical: It is used to plan lighting, power distribution, wiring, and electrical panels with proper load calculations and layouts. Plumbing: Revit allows modeling of water supply, drainage, and piping systems with correct flow direction and connections for efficient design.

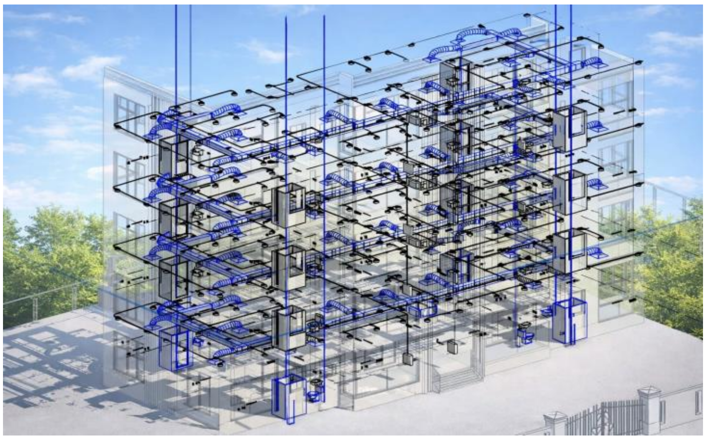

Fig -6.1: MEP 3D Model

6.1 Mechanical Analysis View

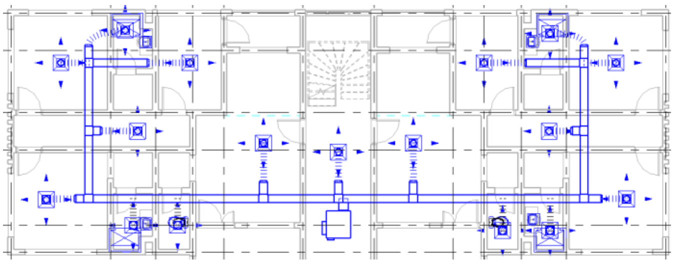

Fig -6.2: Mechanical Top View

Mechanical design is used to create HVAC systems like ducts, ventilation, and air conditioning in a 3D model. It helps engineers check airflow and choose the right system size for better performance. Revit also has clash detection, which makes sure these systems don't collide with other building parts, helping improve coordination and accuracy.

6.2 Electrical Analysis View

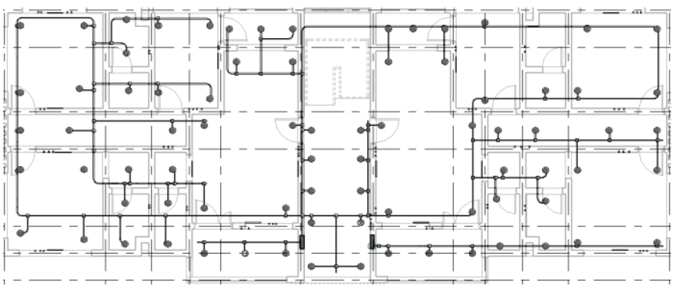

Fig -6.3: Electrical Top View

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Electrical design is used for planning lighting and power distribution layouts in a building. It helps engineers calculate electrical loads and manage circuits efficiently, ensuring safe and proper functioning. Revit also makes it easier to place electrical fixtures and panels accurately, improving overall design and coordination.

6.3 Plumbing Analysis View

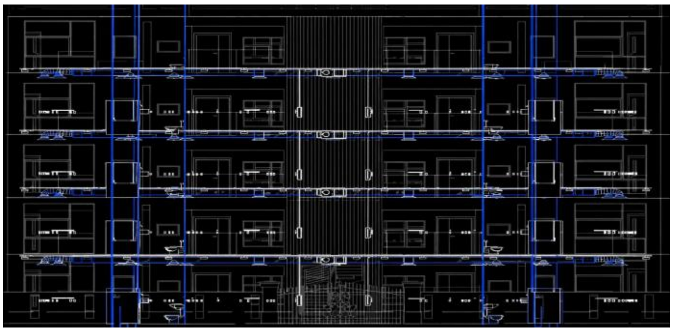

Fig -6.4: Plumbing Front View

Plumbing design is used to model water supply and drainage systems in a simple and clear way. It helps ensure proper pipe connections and correct flow direction for smooth operation. Revit also supports better coordination by allowing clash-free routing, so plumbing systems do not interfere with other building elements.

6.4 Scheduling of MEP Through Revit

<Mechanical Equipment Schedule>

A	B	C	D	E	F	G
Count	Family and Type	Level	System Name	Elevation from Level	OmniClass Title	System Classification
1	VAV Unit - Parallel Fan Powered:	Mechanical 1	Mechanical Supply Air 1	11' - 0"	Variable Volume Air Terminal Units	Supply Air,Return Air,Power
1	VAV Unit - Parallel Fan Powered:	Mechanical 2		11' - 0"	Variable Volume Air Terminal Units	Supply Air,Return Air,Power
1	VAV Unit - Parallel Fan Powered:	Mechanical 3		11' - 0"	Variable Volume Air Terminal Units	Supply Air,Return Air,Power
1	VAV Unit - Parallel Fan Powered:	Mechanical 4		11' - 0"	Variable Volume Air Terminal Units	Supply Air,Return Air,Power

Fig -6.5: Mechanical Schedule

<Electrical Equ

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Apparent Load Pha	Branch Circuit Appa	Branch Circuit Curre	Branch Circuit Curre	Count	Current Phase A	Electrical Data	Elevation from Level	Enclosure	Family and Type	Level	Lighting - Dwelling	Lighting - Dwelling	Lighting - Dwelling	Lighting - Dwelling	Lighting - Dwelling
2065 VA	2065 VA	17 A	0 A	1	17 A	208 V/3-0 VA	4' - 0"	Type 1	Lighting and Applian	Mechanical 1	2065 VA	6 A	100.00%	2065 VA	6 A
0 VA	0 VA	0 A	0 A	1	0 A	208 V/3-0 VA	4' - 0"	Type 1	Lighting and Applian	Mechanical 1					
0 VA	0 VA	0 A	0 A	1	0 A	208 V/3-0 VA	0' - 0"	Type 1	Lighting and Applian						
0 VA	0 VA	0 A	0 A	1	0 A	208 V/3-0 VA	0' - 0"	Type 1	Lighting and Applian						
0 VA	0 VA	0 A	0 A	1	0 A	208 V/3-0 VA	0' - 0"	Type 1	Lighting and Applian						
0 VA	0 VA	0 A	0 A	1	0 A	208 V/3-0 VA	0' - 0"	Type 1	Lighting and Applian						
0 VA	0 VA	0 A	0 A	1	0 A	208 V/3-0 VA	0' - 0"	Type 1	Lighting and Applian						
0 VA	0 VA	0 A	0 A	1	0 A	208 V/3-0 VA	0' - 0"	Type 1	Lighting and Applian						

Fig -6.6: Electrical Schedule

ment Schedule>

Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF
Mains	Mark	Max #1 Pole Break	MCB Rating	Mounting	Neutral Bus	Number of Phases	Number of Wires	OmniClass Number	OmniClass Title	Phase Created	Phase Demolished	Total Connected	Total Connected Cu	Total Demand Facto	Total Estimated De
100 A	1	12	1 A	Recessed		3	4	23.80.30.11.17	Distribution Boards	New Construction	None	2065 VA	6 A	100.00%	2065 VA
100 A	2	12	1 A	Recessed		3	4	23.80.30.11.17	Distribution Boards	New Construction	None	0 VA	0 A	100.00%	0 VA
100 A	3	12	1 A	Recessed		3	4	23.80.30.11.17	Distribution Boards	New Construction	None	0 VA	0 A	100.00%	0 VA
100 A	4	12	1 A	Recessed		3	4	23.80.30.11.17	Distribution Boards	New Construction	None	0 VA	0 A	100.00%	0 VA
100 A	5	12	1 A	Recessed		3	4	23.80.30.11.17	Distribution Boards	New Construction	None	0 VA	0 A	100.00%	0 VA
100 A	6	12	1 A	Recessed		3	4	23.80.30.11.17	Distribution Boards	New Construction	None	0 VA	0 A	100.00%	0 VA
100 A	7	12	1 A	Recessed		3	4	23.80.30.11.17	Distribution Boards	New Construction	None	0 VA	0 A	100.00%	0 VA
100 A	8	12	1 A	Recessed		3	4	23.80.30.11.17	Distribution Boards	New Construction	None	0 VA	0 A	100.00%	0 VA

Fig -6.7: Electrical Schedule

6.5 Conflict Report:

Using HTML, XML, PDF, or another format, a conflict report is a document distributed to project stakeholders. It takes more effort to set up and monitor problem-solving over time, and it is the "traditional" method of communicating issues discovered.

7. CONCLUSIONS

Visualization for clients before actual construction. Schedule adherence by linking time with design. Cost savings through better coordination. The planning and 3D modelling of a G+4 residential building was successfully completed using Autodesk Revit software. Revit enabled the seamless conversion of 2D plans into detailed 3D models, enhancing visualization and presentation. The project demonstrated how Building Information Modeling (BIM) improves:

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