RE-ENGINEERING OF HOSPITAL PROJECT USING BIM TECHNOLOGY FOR INTEROPERABILITY

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Abstract—

In this project, Autodesk Revit Structure and Architecture is used to explain the details and modelling of the hospital building. The BIM aids in accurately maintaining the design concept through documentation, design, and construction as well as capturing and analysing design concepts. It is crucial that the task is done precisely because it is a matter of people's lives, especially when the object, which was the main part of the labour for engineers prior to the production itself. Itself is a structure. Methods used to evaluate the capabilities and complexity of the programme included interviewing engineers who were working and using Revit software to create models.

Keywords— Building Information Modelling, Planning and Implementation of BIM, Advantages of BIM Technologies over non-BIM based technologies, one specific project.

I. INTRODUCTION

- For each structural and architectural element, Revit structure and architecture will provide a plan view, 3D elevation, detailed diagram, schedules, and with the ability to render, we can have a realistic view with high accuracy and efficiency.
- The process of developing a digital representation of a building's physical and functional attributes is known as "building information modelling."
- BIM provides information about the project design, its many viewpoints, scope, and numbers as needed. BIM can help designers as they create the building's architectural, structural, and MEP components.

II. LITERATURE REVIEW

A. *Design and modelling of G+5 commercial building by Revit Structure-E. Rakesh Reddy, S. Kailash (2019):*

The exact families of beam, footing, column, and slab, as well as the realistic depiction of buildings. A commercial building that is clearly designed and modeled, with effective structural and architectural plans. It offers a comprehensive understanding of material takeoff and scheduling quantities in the building model.

B. *Designing with Autodesk Revit-Pavel Eakhrutdinov (2018):*

In a field that demands such high levels of quality, it is crucial to employ modern methods. Although the previously employed methods are still effective, digitalization and automation are currently absorbing more work, which is why AUTOCAD was introduced, and the same is now true of REVIT.

C. *Modelling of three star hotel building in revit-G. Uma Maheshwari, B. T Shyamala (2017):*

Modelling of a three star hotel building and also providing reinforcement detailing for the structure. It also provided the quantity of the material with proper documentation and gave the realistic views also.

III. SUMMARY

- It gives plan, 3D, elevation, detailed diagram, and schedule for each structural member of the building with high efficiency.
- Create detailed reinforcement design and bar bending schedule.
- Produce more thorough documentation of the steel and concrete designs, with model components taken directly from building databases.
- While we are building the physical model in Revit, models can be exported to analytical and design software.

IV. OBJECTIVE

- To know what is building information modeling.
- Understand the user interface, parametric objects, families and templates.
- Create and modify levels and grids.
- Learn how to use dimensions and constraints.
- Learn the benefits of the software.
- How to use it effectively in the industry to become more employable.

V. METHODOLOGY

The methodology adopted for this work is as follows:

- **Site selection:** Hospital Project Gopalpur, Odisha.
- **Modelling:** It includes the modeling of the building using BIM technology.
- Report and sheet preparation.
- Schedules and Quantities.

A. *Modeling*

- Preparation of template.
- Preparation of elements.
- Creating grid.
- Placing elements.

B. *Software and code use*

- AutoCAD software bused for understanding and transforming 2D plan sheet into #d model.
- Revit structure is used to create 3D model.
- Code referred for design of reinforced concrete is IS 456:2000.

C. *Expected Outcome*

- To save the cost and time before making actual model by reducing errors in planning.
- Give 3D visualization of how the model will look after construction so that if any changes are required could be done within time.
- To check the clashes using Autodesk NAVISWORKS.

VI. BIM TECHNOLOGY CONCEPT

- Managing 3D building data throughout development is known as building information modelling. It features a multifunctional approach that incorporates suggestions from the team when creating a model that is used in building. It aims to reduce the time and expense of the project through teamwork, component visualization, and aids in modification during actual construction changes.
- BIM facilitates the design decision-making process. Additionally, it is capable of producing high-quality construction documentation, planning, performance forecasting, and cost estimation.

VII. DESCRIPTION

A. ***General***

- This chapter includes description of the software that is revit structure and revit architecture.

B. ***About Software***

1) *Model Elements*

- They depict the building's true 3D geometry.
- They are shown in the appropriate model views.

a) Types of model elements

- Hosts are typically constructed in specific locations at construction sites, example- structural wall or slab.
- Model components are any other types of element in the building model, such as beams and structural columns.

2) Datum Elements

- It aids in setting the project context, example- grid, levels and reference planes.

3) View-specific elements

- It only appears in the views in which it is inserted, and it aids in describing and documenting the model by, for instance, showing its dimensions and symbols.

a) Types of view-specific elements

- Annotation elements, such as dimension tags, are 2D elements that describe the model and preserve scale on paper.
- Details, such as detail lines and filled regions, are 2D objects that provide information about the building model in a specific perspective.

4) Category

- A category is a collection of components that we employ to represent or record a building, example- beam, column and footing.

5) Family

- Families are groups of items that belong to a category. a group of elements that are related by their use, graphical representation, and shared set of parameters. Various family members may have varying values for some or all properties, example- tapered footing and rectangular footing.

VIII. BUILDING DETAIL

A. Building description

- Project location- Hospital Project Gopalpur, Odisha, india
- Type of building- Medical
- No. of floors- G+3
- Floor to floor height- 3.0m
- No. of bed rooms in first floor- 22
- No. of OPD in ground floor- 14

B. Facilities provided

- 10 Bed emergency available in ground floor.
- Pathology laboratory, component lab, TTI lab, Hematology, Microbiology in second floor, conference room, Medicine Store.
- Lift available on all the floors.
- X-RAY Room, OPD Rooms, Nursing station, electrical room, I.C.U, MRI, CT Scan.
- CCTV cameras are also available.

C. Description of structure

- No. of columns in ground floor- 202
- No. of first floor beams- 138
- No. of second floor beams- 138
- No. of beams in third floor, roof - 107
- Slab thickness- 150mm

IX. MODELING AND DETAILING

A. Structure

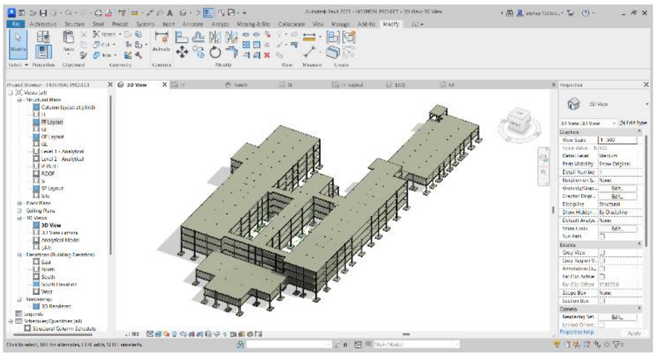


Fig: 3D View

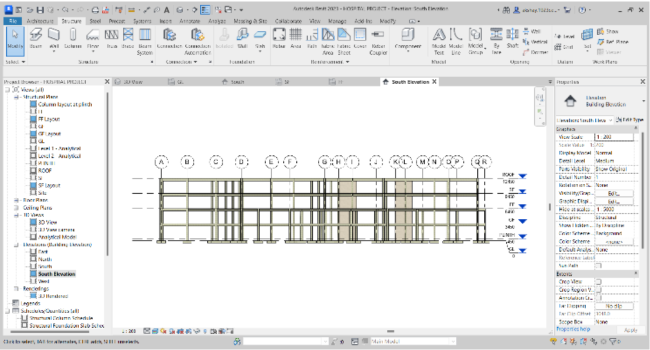


Fig: South Elevation

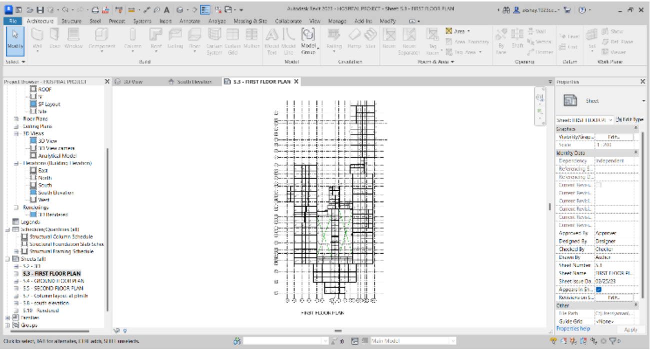
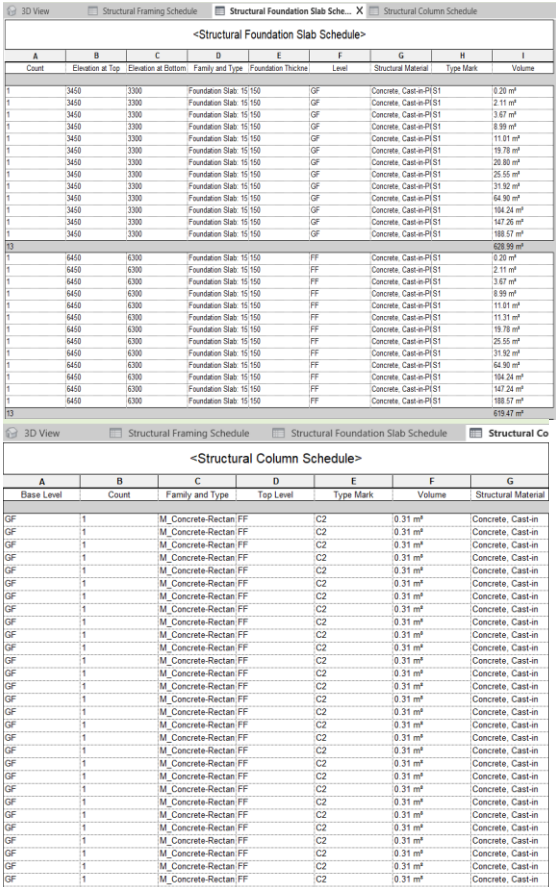


Fig: Floor Plan



<Structural Foundation Slab Schedule>

A	B	C	D	E	F	G	H	I
Count	Elevation at Top	Elevation at Bottom	Family and Type	Foundation Thickne	Level	Structural Material	Type Mark	Volume
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	0.20 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	2.11 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	3.67 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	8.99 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	11.01 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	19.78 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	20.80 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	25.55 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	31.92 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	64.90 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	104.24 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	147.26 m³
1	3450	3300	Foundation Slab: 15	150	GF	Concrete, Cast-in-Pl	S1	188.57 m³
13								628.99 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	0.20 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	2.11 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	3.67 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	8.99 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	11.01 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	11.31 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	19.78 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	25.55 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	31.92 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	64.90 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	104.24 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	147.24 m³
1	6450	6300	Foundation Slab: 15	150	FF	Concrete, Cast-in-Pl	S1	188.57 m³
13								619.47 m³

<Structural Column Schedule>

A	B	C	D	E	F	G
Base Level	Count	Family and Type	Top Level	Type Mark	Volume	Structural Material
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in
GF	1	M_Concrete-Rectan	FF	C2	0.31 m³	Concrete, Cast-in

Fig: Schedule or quantity

B. *Architecture*

Fig: 3D View

Fig: CAM View

Fig: Elevation

Fig: 3D Rendered

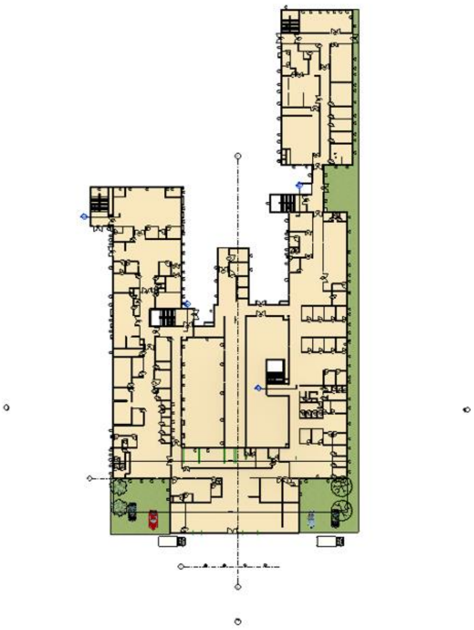


Fig: Ground Floor Plan View

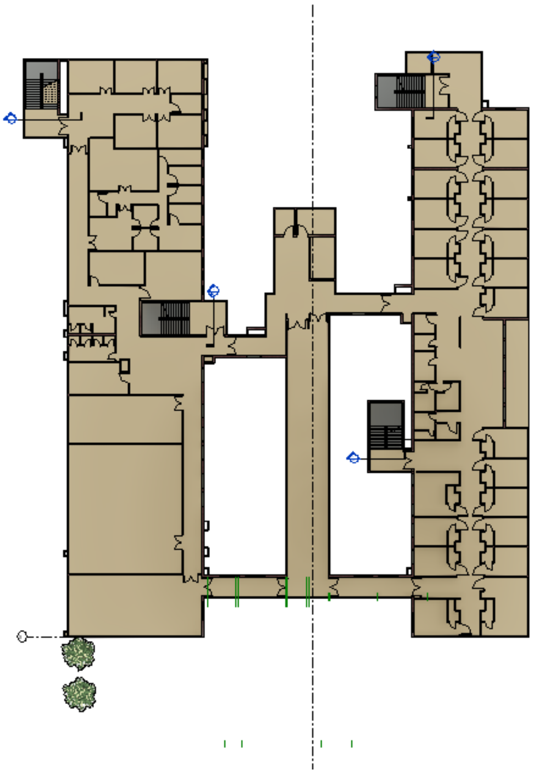


Fig: Second floor Plan View

Fig: Staircase Section

X. CLASH DETECTION

- A crucial step in the integrated BIM modelling process is clash detection. BIM modelling entails building a through master model that incorporates design models from several engineering design disciplines. The market's best BIM-adopted software for clash detection and report generation is Navisworks.
- By detecting conflicts between various models early in the design process, clash detection through Building Information Modelling (BIM) aids in project acceleration by assisting architects and contractors in removing the possibility of multi-level design changes that could lead to budget overruns and delays in project completion.

XI. SCOPE

- Using 3D models, Revit offers a distinctive approach to designing interiors and structures.
- It allows better visualization of the structure.
- Revit provides a variety of tools and features to make designing easier and move more quickly.

- Revit eliminates the risk of misunderstanding between different team members.
- Revit provides team collaboration tools so they can work on a single file together.
- A no. of team members can simultaneously work on the same project.

XII. CONCLUSION

1. The advancement of Revit or BIM technology over non-BIM based technology tools like AutoCAD, MicroStation, and AutoCAD MEP is demonstrated by the discussion of BIM technology.
2. BIM utilizes activities like visualization, 3D coordination and construction planning.
3. It is simple to create a quantity take off to estimate the cost of a construction project.
4. Trade conflits and clashes were found and eliminated using 3D coordination.
5. It offers improved coordination between Architecture, Structure, and MEP members, bridging the gap between the production and construction sectors.
6. The cost could be reduced up to 30% and productivity could be increased by 40%.
7. It creates analytical model simultaneously with structure model and it can be exported in any analysis and designing application like ETABS and STAAD-PRO.
8. It makes different views like elevation, plan, and section detailed diagrams simultaneously.
9. This model can be exported in Autodesk NAVISWORKS to check clashes.

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