

# G+3 STOREY RESIDENTIAL BUILDING USING BIM (BUILDING INFORMATION MODELING)

\*Shubham Bawankar,\*Samyak Parekar,

<sup>1</sup>Civil Engineering Department, G.H. Rasoni University, Saikheda, Madhya Pradesh

<sup>2</sup>Civil Engineering Department, G.H. Rasoni University, Saikheda, Madhya Pradesh

## Abstract:

The main objective of the project is to Planning, Design, Analyse, 3D Modeling, Scheduling and Costing a G+3-storey Residential building using BIM. The Architecture, Engineering and Construction (AEC) industries have long sought techniques to decrease project cost & time, increase productivity, manpower and quality, and reduce project delivery time. First of all, the planning is done using AutoCAD. Load calculations done manually and then the structure was analysed using ETAB19. Dead load, imposed load and wind load are calculated and applied to the structure. 3D model of a G+3 Residential Building project prepared on Revit structure, architecture, plumbing and MEP created 3d modal. After that use Primavera p6 (4D BIM) use for construction site planning related activities and scheduling process, Work Breakdown Structure is a key element in developing and controlling schedule of a project. Exporting 3D model from Revit to Naviswork and Exporting the schedule from Primavera P6 to Naviswork, Checking the relationship between 3D object and schedule.

## Keywords: S

Naviswork, 3d BIM model, 4d BIM and 5d BIM these functions are uses in BIM.

## 1. INTRODUCTION

Building Information Modeling (BIM) is the process of generating and managing building data during its life cycle, it manages the essential building design and data. Now a days due to the over population in the urban cities and high cost of the land, there is a need to accommodate in multi-storey building project will be delivered on time and within the budget. Building Information Modeling (BIM) is an emerging technology throughout the world in the Architecture, Engineering, and Construction (AEC) industries. Nowadays in construction industries to improve productivity and efficiency in construction, it then explains the uses of Scheduling and Cost Estimating in BIM respectively. BIM can be used for planning, design, construction, and operation of the facility. BIM increase the productivity with Structural Information of the project. it enables better project planning and there by ensure accuracy. 2d planning, ETAB Analysis,

The main objective of this project is to understand the concept and methodology of Building Information modeling (BIM). It is the faster and more effective process. We use this concept in an abstract and idealized sense to theorize potential directions of BIM's future development.

The concept of BIM has been in development since the 1970s, but it only became an agreed term in the early 2000s. Building Information Modeling has been part of the construction industry for some time now. BIM is a process supported by various tools, technologies and contracts. Building Information Model' first appeared in a 1992 paper by G.A. van Nederveen and F. P. Tolman.

The contribution in BIM programme to improve G+3 building construction save the time and cost and improve work efficiency and good quality result with the help of software's. we have made the dealing with the all the planning, structural analysis and 3d modelling of structures. The 3D models developed with Revit software would reduce co-ordination problems amongst the architects, structural engineers, contractors etc. The present project deals with the design & analysis of a multi storied residential building of G+3, and a change of workflows, methodologies, process, and relations.

## 2 LITERATURE REVIEW

During the last three decades the construction industry has seen drastic improvement of the use of IT. The latest and most promising in these developments is the use of Building Information Modeling (BIM). The use of BIM in a construction project has the potential benefit of both improving product quality and enabling more sustainable designs of buildings. This paper refers to Application of Revit as BIM for Integrated Project Delivery (IPD) for Building Construction Project.

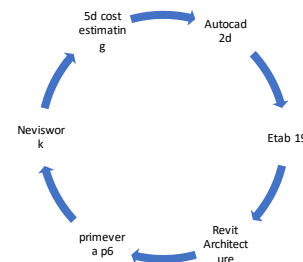
planning is an art and science of designing with economical, serviceable and durable structural. Analysis and design of G+4 story residential building structure by using IS Code method. Analysis and of entire structure have been complete by manually design and verifies by STADD Pro.

BIM model to analyse and plan the resource usage based on the most updated design, and even simulate the resource allocation. estimations on a construction project. BIM based 4D scheduling helps understanding of the construction, BIM provides time and cost savings and yields better quality construction products. Overall, Building Information Modeling is a great concept.

## 3.METHODOLY

Planning, Modeling Scheduling and Analysing of the study area on the basis for major parameter for residential building using BIM, the initial step of the project in the beginning is to get a site plan of project made in the conventional CAD format.

In project there are the following methods of the planning of building and following types of software use in project such as-



### Planning of G+3 residential building using BIM technology and practically.

Total area of building 2000 sq. Ft and Built-up area 1800 sq. ft

Location of building: katol (Maharashtra)

Seismic Zone of building: II Nagpur Maharashtra

Zone factor: 0.10

Site type: soil type: II for Medium Soil as per Table 4 of IS 1893 (Part 1): 2016

Height of plinth – 0.5 m.

Depth of Footing – 2.3 m.

The main purpose of the planning of multistorey of residential building using BIM technology to help the control the project work time and cost. This G+3 residential building projects with the help of software to controlling the project cost, time and materials quantity

## 4. RESULT & DETAILS DESIGN

#### 4.1 AUTOCAD 2D

AutoCAD 2d is a computer-aided drafting (CAD) software, Since its original release in 1982. AutoCAD allows you to visually design and explore your conceptual design ideas, modify your designs using 3D design tools, generate intelligent model. The plan of the building was created using the AUTODESK AUTOCAD 2018 software with complete detailing of the structure and the column and beam orientation and also the slab. List of AUTOCAD plan prepared for G+3 residential building:

1. AUTOCAD Plan at Plinth Level.
2. Column Layout Plan.
3. Grid line and Centre Line Plan.
4. Beam Layout Plan.
5. Foundation plan.

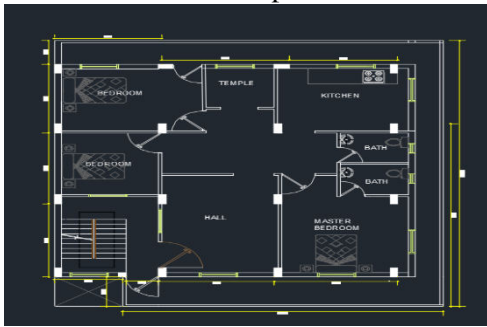


Fig1: First, Second & Third floor plan

#### 4.2 ETAB19

Etab19 is analysis software which is used for analysing and designing of structure by the structural engineers. Etab19 software is used for static or dynamic analysis for structures such as low rise or high-rise buildings.

The plan was imported to the ETABS19 software for the analysis and to determine if the structure is safe to take up the load coming on it. The analysis was done for earthquake load and wind load for Zone-II basis. The load which are consider for analysis Dead, live, earthquake and wind load. Permanent load is considered Dead load. and various types of load combination applied in

structure. Various types of IS code are applying in this structure. Design of footing is analysed in SAAP but we are assume based on soil type. IS 456:2000 used for RCC and IS 800-2007 used for steel reinforcement.

##### Basic Data of g+3 storey building

Type of building – Residential building.

Type of structure –multi storey RCC framed structure

No. of storey – 4 (G+3)

Floor to floor height – 3.0m.

External walls – 230 mm including plaster

Internal walls – 115 mm including plaster.

##### Analysis in ETAB software

Before the analysis the structure all the Load cases and load pattern Applying on the structure, load pattern dead, live, superimposed load, earthquake and wind load apply the structure considering the IS CODES and self-weight of load apply the structure. For wind load (IS875:2015) and seismic load (IS1893:2002) calculated the software automatically.

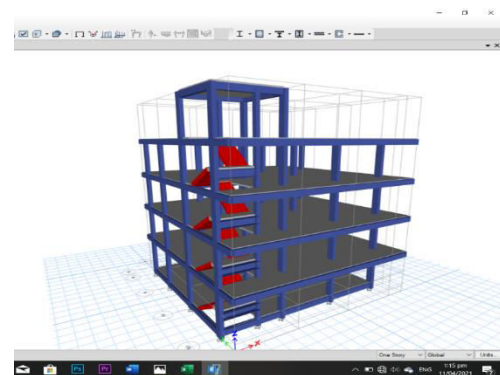


Fig 2. Analysing the RCC structure

#### 4.3 REVIT 3D MODAL

The model from ETAB is imported to AUTODESK REVIT ARCHITECTURE 2018 software. Revit software gave the 3D structure & Architecture

modal of the structure First step during the designing is creating the structural components i.e., beams, columns, slabs and stairs. Secondly create walls as per the thickness mentioned in the AutoCAD drawings.

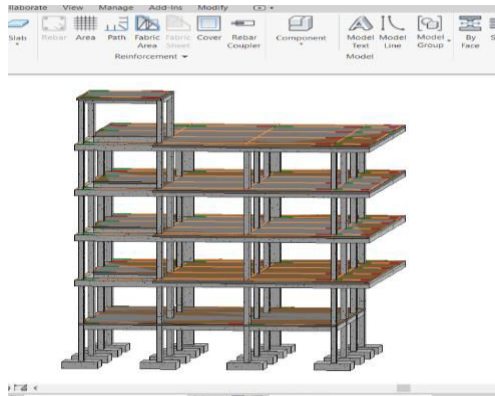


Fig3. Revit structure modal

Revit software and the following plan was made at level 1 to level 6, Fig4. is of the ground level or base level of the pilot project modified on Revit 2018. It is the level 1 floor plan of the construction site. the elevation plan consisting of the elevation of the site namely level 1, level 2, level 3 level 5, level6 from the side view.

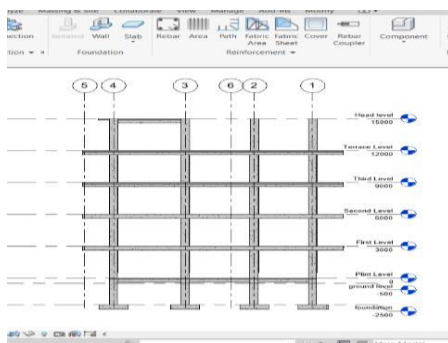


Fig4. Building height & level

The following Fig5 shows the realistic view of the site in 3 dimensions. These three steps helped create a 3D model. Conceptual design, working drawings and material specification were generated from the 3D model. In 3d modal proper scheduling that is door, windows, curtain wall and all other.



Fig5. 3D modal view

## SCHEDULING OF VARIOUS MEMBER OF SITE

the schedule of doors to be inserted in the project along with their dimensions and count. All the level 11 no of doors in building

M\_Door-Interior-Single-1\_Panel-Wood : 900 x 2100mm

M\_Door-Overhead-Rolling : 3000mm\*3000mm

M\_Door-Interior-Double-Full Glass-Wood : 1500 x 2000mm

DOOR SCHEDULE			
Name	count	level	total door
M_Single 1 interior panel wood -: 900x 2000mm	7*3	firstfloor to third floor	21
M_DOOR- overhead rolling 3000mm*3000mm		2 ground floor	2
M_door - double full glass wood 1500*2000		3 firstfloor to third floor	3

schedule of windows along with their level and dimensions. total no of window 21.

M\_Window-Casement-Triple-Middle-Transom : 1550 x 1200mm

the schedule of the rooms with their level and dimensions.

Room Schedule		
Name	Level	Area
Living room	F2 to F5	19.2 m <sup>2</sup>
Bedroom	F2 to F6	14m <sup>2</sup>
master bedroom	F2 to F7	20m <sup>2</sup>
bathroom and WC	F2 to F8	3.35m <sup>2</sup>
Kitchen	F2 to F9	15.29m <sup>2</sup>
Shop	F1	12.2m <sup>2</sup>
Staircas	F1 to f6	14.3m <sup>2</sup>
godown	F1	25.9m <sup>2</sup>
parking	F1	60.5m <sup>2</sup>

model is a frame structure consist of a one residential building. The building consists of floor such as Ground Floor, First floor, Third floor & Terrace Floor and staircase level.

#### 4.4 PRIMAVERA P6

Primavera P6 4D-BIM (four-dimensional building information modelling) is used for construction site planning related activities and time scheduling process. Projects in India are generally scheduled using PERT or CPM at present, but there are certain limitations of using these methods.

##### Planning of work

This project is based on planning and scheduling of G+3 storey residential building. Construction was started date 06 -jan-2021 and built-up area of project 1800 sq. feet Planning involves the breakdown of the project into definable, measurable, and identifiable tasks/activities. The Primavera gives us the complete schedule of work with the number of days required for each work. Total 368 days of construction work.

##### Work breakdown structure:

The work breakdown structure (WBS) is a hierarchical system that represents a construction project in increasing levels of detail to define

work plan on a calendar basis and provides the base against which all progress is measured. After WBS we are add activity and put name of activity and which time period add different types of activity completed than all project does scheduling.

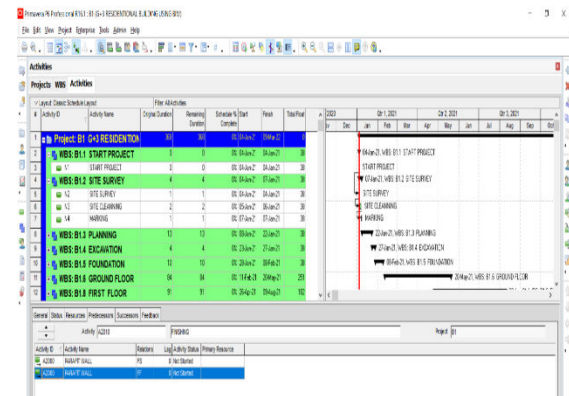


Fig7. Scheduling of work

In the bar chart method, the bar against each activity represents its schedule of work. The start of the bar marks the commencement of the activity and the end of the bar.

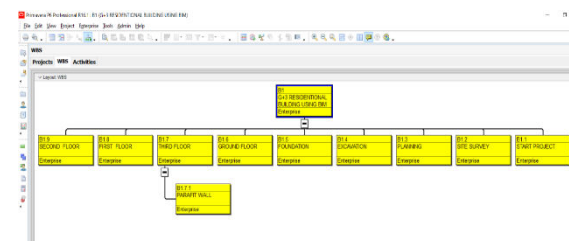


Fig9.Bar chart

#### 4.5 NAVISWORK

Autodesk Naviswork Manage 2018 It is project review software that supports intelligent 3D model-based design with scheduling, visualization, and collaboration tools. Exporting 3D model from Revit to Naviswork and Exporting the schedule from Primavera P6 to Naviswork.

##### Establishing a 4D model

A construction schedule was created using Primavera P6. The schedule provided activity durations and relationship between activities. The

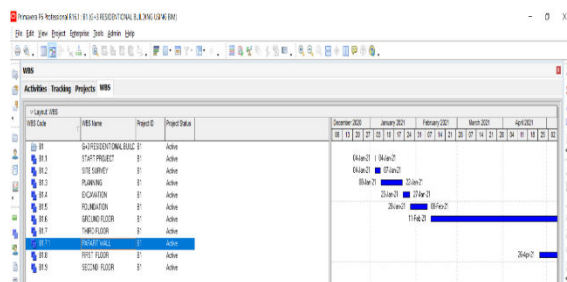


Fig6. Work Breakdown structure

#### SCHEDULING

Time scheduling process of developing a work program. It implies programming of the chosen



scheduled data from Primavera P6 and a 3D model from Autodesk Revit were exported separately to Autodesk NavisWork Manage. Then the 4D model is developed by the linking of the 3d object in the model to the activities in time Schedule.

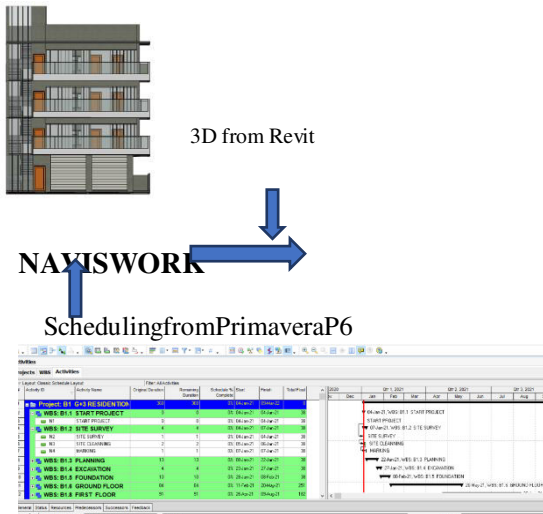


Fig10. Naviswork manage

## 5.CONCLUSION

This project is running in aim at the performance of a G+3 storey building using BIM. The main objective of this project was to understand the concept and methodology of Building Information modeling (BIM) The use of BIM has made the project easier to handle and better understanding, as per our project we mainly took up the major parameters of structure, 3D modal and project management i.e., time scheduling., All the structural components were designed manually and detailed using ETAB. The analysis and design were done according to standard specifications using ETAB, REVIT, PRIMEVERA P6, AUTOCAD, NEVISWORK. And BIM provides time and cost savings and yields better quality construction products.

## REFERENCES

[1] Allen, C., & Smallwood, J. (2008). Improving construction planning through 4D planning. Journal

of Engineering, Design and Technology, 6 (1), 7-20.

[2] Building SMART. (2010). Constructing the business case: Building information modelling. London: British Standards Institution.

[3] Dixit, V. C. (2007). 4D Modeling: Adding a New Dimension to CPM Scheduling. AACE International Transactions, PS101-PS108.

[4] Bhuskade, Shrikant. "Building Information Modeling (BIM)." International Research Journal of Engineering and Technology (IRJET) 2.2 (2015): 834-841.

## IS CODES

1. IS 456:2000; Code of practices Reinforce concrete.
2. SP 34; concrete reinforce & detailing.
3. IS 875 (Part 3)-2015: Design load for building and structure.
4. IS 1893 (Part 1)-2002: Earthquake Resistance Design of Structures.