

PERFORMANCE, EVALUATION AND REVIEW OF A MULTI-STOREY BUILDING USING BIM (BUILDING INFORMATION MODELLING)

Chandrika P¹, Vishnu S²Harish B N³, Shriya S Nair³, Varun S³, Yashwanth Kumar S³

³UG Students, Dept. of Civil Engineering, Cambridge Institute of Technology,

(Affiliated to Visvesvaraya Technological University), Basavanapura Main Road, Krishnarajapuram, Bengaluru-

^{1,2}Assistant Professors, Dept. of Civil Engineering, Cambridge Institute of Technology,

ABSTRACT: Traditional building design was majorly dependent on two dimensional (2D) drawings. BIM is one of the first software emerged in the 1970s for building modelling and designing. BIM give us three- dimensional (3D) model of the building (Length, breadth, and height), fourth dimensional (4D) model which included time and also the fifth dimensional model (5D) with cost estimation. In the recent conditions, the development has led to solving the weakness in the construction and also increasing the accuracy in the detailing of structures and its analysis. Building information modelling (BIM) is 3D modelling that gives an accurate insight of the building, and the tools to make an efficient plan, design and construct the building infrastructure and management. With BIM one can build a virtual model of the project and also, we can analysis it. BIM increases the accuracy and resolves or reduces the possible errors during the design stage.

The Aim of the project work is to examine or explore the BIM with respect to 5D (Fifth Dimensional Modelling) which includes time scheduling and cost estimation. The comparative study of overall construction project Time and Cost using datas obtained by using BIM software and Traditional method.

KEYWORDS: BIM; Three-Dimensional (3D); Fourth Dimensional (4D); Fifth dimensional Model (5D); Time Scheduling; Cost Estimation

INTRODUCTION:

Building information models (BIMs) are files (often but not always in proprietary formats and containing proprietary data) which can be extracted, exchanged or networked to support decision-making regarding a building or other built asset. Current BIM software is used by individuals, businesses and government agencies who plan, design, construct, operate and maintain diverse physical infrastructures, such as water, refuse, electricity, gas, communication utilities, roads, bridges, ports, tunnels, etc. Building Information Modelling (BIM) is a relatively new technology emerging in the construction industry as it offers many advantages over typical construction drawings.

It was developed at Georgia Institute of Technology in the late 1970s and grew rapidly after that. BIM design is equivalent to virtually designing a structure which shows virtual elements of actual building parts and pieces used to build a building. These virtual elements are digital prototype of physical building elements that allows us to simulate the building and understand its behavior in a computer environment way before actual construction starts. BIM provides a much better means of communication and distribution of information between clients, construction and architecture firms and legal authorities involved in project.

Until now, when construction managers establish a plan, they refer to historical data first. And then, they adjust somewhat by their own experiences. However, construction productivity changes dynamically every day. The fluctuation between a plan and execution brings cost overruns and duration extension on construction site. If production is greater than the expected, resources such as labors and equipment will be wasted and materials will be scarce. Thus, this situation leads to waste money from inputting unused resources such as labors, equipment, and time. On the other hand, if production is lesser than the expected, it also leads to problematic situations on construction site; materials will be remained, managerial cost from unused materials will increase, and delay will happen. Therefore, to decrease cost overruns and delay extension, the reliable prediction of productivity is required in construction management field.

Building information modeling (BIM) technology has been receiving an increasing attention in the architecture, engineering, and construction (AEC) industry. Unlike traditional computer aided design (CAD) technology, BIM technology allow storing both geometric information and rich semantic information of building models, as well as the relationships, to support lifecycle

data sharing. In terms of information technology (IT) adoption, BIM is a new trend in the AEC industry.

1 NEED OF BUILDING INFORMATION MODELLING (BIM):

1. Ensures improved access to information.
2. Makes repair and renovation work management easy and organized.
3. Facilitates lean construction and energy efficiency.
4. Improves efficiency, productivity.
5. Time consumed is less.
6. Cost saving modification in project design.
7. Enables effective handling of risk mitigation.
8. Supports effective facility management.

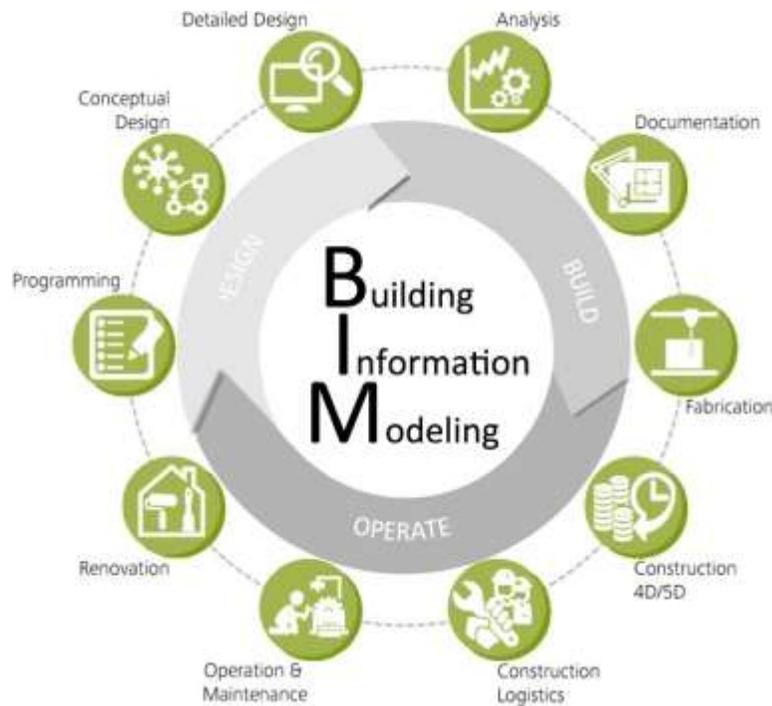


Fig 1.1 BIM Workflow

1.0 CLASSIFICATION OF BUILDING INFORMATION MODELLING:

1.0.1 BIM 3D – PARAMETRIC DATA IN A COLLABORATIVE MODEL:

It is the basic form of the BIM. Its use is constrained only to making building documentation with some material take offs or other schedules. BIM revolves around an integrated data model from which various stakeholders such as Architects, Civil Engineers, Structural Engineers, MEP System Engineers, Builders, Manufacturers and Project Owners can extract and generate

views and information according to their needs. 3D BIM's visualizations capabilities enables participants to not only see the building in three dimensions before ground is ever broken, but also to automatically update these views along the project life cycle, from earliest conception to demolition. BIM 3D helps participants to manage their multidisciplinary collaboration more effectively in modelling and analyzing complex spatial and structural problems. Furthermore because accurate data can be collected along the project life cycle, and stored in the Building Information Model, new value can be added to predictive models allowing to resolve issues proactively.

Benefits:

1. Improved visualization of the project, communication of design intent.
2. Improved multidisciplinary collaboration.
3. Reduced rework.

1.0.2 BIM 4D - SCHEDULING:

4D-BIM (four-dimensional building information modelling) is used for construction site planning related activities. The fourth dimension of BIM allows participants to extract and visualize the progress of their activities through the lifetime of the project. The utilization of 4D- BIM technology can result in improved control over conflict detection or over the complexity of changes occurring during the course of a construction project. 4D BIM provides methods for managing and visualizing site status information, change impacts as well as supporting communication in various situations such as informing site staff or warning about risks.

Benefits:

1. Integrating BIM with 4D CAD simulation models bring benefits to participants in terms of planning optimization.
2. Builders and manufacturers can optimize their construction activities and team coordination.

1.0.3 BIM 5D - ESTIMATING:

5D-BIM (fifth-dimensional building information modelling) is used for budget tracking and cost analysis related activities. The fifth dimension of BIM associated with 3D and 4D (Time) allows participants to visualize the progress of their activities and related costs over time. The utilization of 5D-BIM technology can result in a greater accuracy and predictability of project's estimates, scope changes and materials, equipment or manpower changes. 5D BIM provides methods for extracting and analyzing costs, evaluating scenarios and changes impacts.

Benefits:

1. Integrating BIM with 5D CAD simulation models enables the development of more efficient, cost- effective and sustainable constructions.

1.0.4 BIM 6D - SUSTAINABILITY:

6D-BIM (sixth-dimensional building information modelling) helps perform energy consumption analyses. The utilization of 6D-BIM technology can result in more complete and accurate energy estimates earlier in the design process. It also allows for measurement and verification during building occupation, and improved processes for gathering lessons learned in high performance facilities. Benefits:

1. Integrating BIM with 6D CAD simulation models leads to an overall reduction in energy consumption.

1.0.5 BIM 7D-FACILITYMANAGEMENT:

7D-BIM (seventh-dimensional building information modelling) is used by managers in the operation and maintenance of the

facility throughout its life cycle. The seventh dimension of BIM allows participants to extract and track relevant asset data such as component status, specifications, maintenance/operation manuals, warranty data etc. The utilization of 7D-BIM technology can result in easier and quicker parts replacements, optimized compliance and a streamlined asset life cycle management over time. 7D BIM provides processes for managing subcontractor/supplier data and facility component through the entire facility life cycle.

Benefits:

1. Integrating BIM with 7D CAD simulation models optimizes asset management from design to demolition

1.3 ADVANTAGES:

- It captures reality in a way that 2D drawings are not able to capture. With the availability of various mapping tools, aerial imagery and laser scans of existing infrastructure have turned out to be the starting point of a project. This information can be integrated with the BIM model.
- It has a multidisciplinary approach to design. The design parameters from all the disciplines are assimilated in the model which results in a better coordinated design.
- It facilitates synchronization between all the drawings such as plans, elevations, sections, perspective etc. as all these drawings are extracted from the model. Any change in the design is incorporated in the model. This change is automatically updated in all the drawings that are extracted.
- Lot of labor and time is saved when deriving quantities from BIM model with the use of tools such as element counts, volumes, areas, etc.
- Simulation tools in BIM software allows designers to visualize various parameters. It also allows the designers to do much more analysis with the click of a button.
- The BIM toolset helps in resolving conflicts between elements of different disciplines that arise in the design. For e.g. it can resolve clashes that arise when an electrical conduit runs into a beam.

2.0 METHODOLOGIES:

The main purpose of this project is to conduct understand and use of BIM to help control the project's time and cost. The objectives of this study are:

- (1) To examine the benefits of using BIM for project time and cost control and
- (2) To study the challenges of applying BIM to a case project during its life cycle. This project is being achieved by introducing Autodesk Revit Architecture as the BIM software to develop project control and analysis.

2.1 PROJECT SCHEDULING:

A job progress schedule was probably prepared when the job was being estimated. Its purpose at that time was primarily to determine the duration of construction so that an estimate of general conditions or general requirements containing time-related could be prepared. Now that the project has become a reality, the job progress schedule needs to be reviewed and refined for further purposes.

2.1.1 SCHEDULING PHASE:

This phase follows the planning phase and concerns with time estimates of individual activities and the project as a whole.

These time estimates represent normal duration, which would be expected to result if work was done at lowest direct cost for the activities. No unexpected delays or contingencies like fire, floods, strikes etc. are considered while making these estimates. The next step is to assign the activity times to the network and make computations for earliest and latest start and finish times of each activity. The earliest completion time of the last activity of the network gives the shortest completion time for the whole project. This time can be identified as the longest path of activities through the network from its start node to its finish node. This path is called critical path, and timely completion of project depends upon the timely completion each of the activities lying on this path. These activities are called as critical activities. An identification of critical activities helps management to pay due attention to the timely completion of these activities so that the project is completed in time.

At this stage, a time grid diagram can be developed in which the network is drawn on a time scale. The lengths of arrows are all drawn now indicate the duration of the activities. The arrows are all drawn horizontally with the tail of an arrow starting at the head of the arrow immediately preceding activity. The floats of these activities are now represented as horizontal broken lines and this helps in alternate plans. Also, it is possible to show the calendar dates for activities, if the starting date and holiday dates are known. This information is very useful in day to day control of the progress of construction. So scheduling deals with the time order in which these activities are to take place, as also the manpower, material etc. required at every stage of production should be shown in the scheduling.

2.1.2 SCHEDULING STEPS:

Construction scheduling is a graphical representation which gives the phasing rate of construction activities with starting and completion dates and the sequential relationship among the various activities or operations of the project so that work can be carried out in an orderly and effective manner. The steps involved in preparation of the construction schedules are as follows:

- The project is divided into number of operations and the sequence of these operations can be derived after knowing their relationship properly.
- Quantity of work involved in each operation has to be calculated.
- Finally, the time required for completion of project as well as the different activities are to be calculated. This can be done from the quantity of work involved and the rate of performing each work.

3.0 ANALYSIS PROCESS:

3.1. Preparation of AutoCAD Plans:



As per the preliminary data and the journals was collected and all the required data was taken into considerations. The plan of the building was created using the

AUTODESK AUTOCAD 2016 software with complete detailing of the interior structure and the column and beam orientation and also the slab.

List of AutoCAD Plan Prepared:

1. Plan at Sill Level.
2. Column Layout Plan.
3. Grid line and Center Line Plan.
4. Slab Layout Plan.
5. Beam Layout Plan.
6. Section Plan at Foundation.



Fig 3.1 AutoCAD Plan at SILL Level

3.2. Exporting the AutoCAD .dwg format to .dxf format:3



Converting the architectural plan created in DWG format in AutoCAD to DXF file, Because Etabs software compatible with only DXF file of AutoCAD.

3.3. Etabs Analysis:

➤ Modeling in Etabs:

Once the complete plan was prepared and exported to .dxf file, the plan was imported to the ETABS 2016 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 and wind for Zone-II basis. The analysis was found to be safe and the further process was carried on.

➤ **Properties Used:**

i. Materials:

Table 3.2.1 Materials used

NAME	TYPE	E(MPa)	UNIT WEIGHT(KN/m ³)	DESIGN STRENGTHS
HYSD415	Rebar	200000	76.9729	Fy=415MPa, Fu=485MPa
M25	Concrete	25000	24.9926	Fc=25MPa
M30	Concrete	25000	24.9926	Fc=30MPa

ii. Shell Sections:

Table 3.2.2 Shell section

NAME	DESIGN TYPE	ELEMENT TYPE	MATERIAL	TOTAL THICKNESS
Shear wall	Wall	Shell-Thin	M25	230
Slab150mm	Slab	Shell-Thin	M25	150
Staircase200mm	Slab	Membrane	M25	200

iii. Reinforcement Sizes:

Table 3.2.3 Reinforcement Sizes

NAME	DIAMETER(mm)	AREA(mm ²)
18	18	255

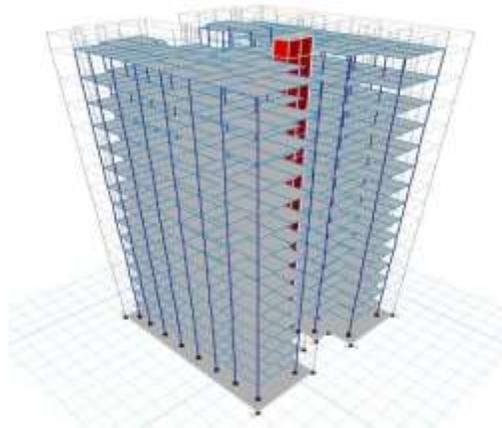
iv. Frame Sections:

Table 3.2.4 Frame sections

NAME	MATERIAL	SHAPE
Beam 350 x 550	M25	Concrete Rectangular
Beam 350 x 450	M25	Concrete Rectangular
Column 350 x 1000	M25	Concrete Rectangular
Column 350 x 1200	M25	Concrete Rectangular
Column 350 x 1300	M25	Concrete Rectangular
Column 350 x 1400	M25	Concrete Rectangular
Column 350 x 1500	M25	Concrete Rectangular
Column 1000 x 350	M25	Concrete Rectangular
Column 1500 x 350	M25	Concrete Rectangular

Framing of model:

Fig 3.2.1 Etabs Framed



➤ **Analysis in Etabs:**

i. Load patterns:

Table 3.2.5 Load patterns

NAME	TYPE	SELF WEIGHT	AUTO LOAD
DEAD	Dead	1	
LIVE	Live	0	
SUPERIMPOSED DEAD	Superimposed dead	0	
EQx	Seismic	0	IS1893 2002
EQy	Seismic	0	IS1893 2002
WQx	Wind	0	IS875 2015
WQy	Wind	0	IS875 2015

ii. Load Cases:

Table 3.2.6 Load cases

NAME	TYPE
DEAD	Linear Static
LIVE	Linear Static
SUPERIMPOSED DEAD	Linear Static
EQx	Linear Static
EQy	Linear Static
WQx	Linear Static
WQy	Linear Static

Table 3.2.7(b) Load Combinations

Name	Load Case/Combo	Scale Factor	Type	Auto
0.9DL+1.5EQY	TDL	0.9	Linear Add	No
0.9DL+1.5EQY	Eqy	-1.5		No
0.9DL+1.5EQY	TDL	0.9	Linear Add	No
0.9DL+1.5EQY	Eqy	1.5		No
ENVELOPE	1.5(DL+HL)	1	Envelope	No
ENVELOPE	1.2(DL+HL+EQX)	1		No
ENVELOPE	1.2(DL+HL+EQX)	1		No
ENVELOPE	1.2(DL+HL+EQY)	1		No
ENVELOPE	1.2(DL+HL+EQY)	1		No
ENVELOPE	1.5(DL+EQX)	1		No
ENVELOPE	1.5(DL+EQX)	1		No
ENVELOPE	1.5(DL+EQY)	1		No
ENVELOPE	1.5(DL+EQY)	1		No
ENVELOPE	0.9DL+1.5EQX	1		No
ENVELOPE	0.9DL+1.5EQX	1		No
ENVELOPE	0.9DL+1.5EQY	1		No
ENVELOPE	0.9DL+1.5EQY	1		No
ENVELOPE	0.9DL+1.5WY	1		No
ENVELOPE	0.9DL+1.5WY	1		No
ENVELOPE	1.2(DL+HL+WY)	1		No
ENVELOPE	1.2(DL+HL+WY)	1		No
ENVELOPE	1.5(DL+WY)	1		No
ENVELOPE	1.5(DL+WY)	1		No
ENVELOPE	1.5(DL-WY)	1		No
ENVELOPE	1.5(DL-WY)	1		No
ENVELOPE	0.9DL+1.5WY	1		No
ENVELOPE	0.9DL+1.5WY	1		No
ENVELOPE	1.2(DL+HL+WY)	1		No
ENVELOPE	1.2(DL+HL+WY)	1		No
DCOn1	Dead	1.5	Linear Add	Yes
DCon1	SuperDead	1.5		No
DCon2	Dead	1.5	Linear Add	Yes
DCon2	Live	1.5		No
DCon2	SuperDead	1.5		No
DCon3	Dead	1.2	Linear Add	Yes
DCon3	Live	1.2		No
DCon3	SuperDead	1.2		No
DCon3	Wx	1.2		No
DCon4	Dead	1.2	Linear Add	Yes
DCon4	Live	1.2		No
DCon4	SuperDead	1.2		No
DCon4	Wx	-1.2		No
DCon5	Dead	1.2	Linear Add	Yes
DCon5	Live	1.2		No
DCon5	SuperDead	1.2		No
DCon5	Wy	1.2		No
DCon6	Dead	1.2	Linear Add	Yes
DCon6	Live	1.2		No
DCon6	SuperDead	1.2		No

iii. Load Combinations

Table 3.2.7(a) Load Combinations

Name	Load Case/Combo	Scale Factor	Type	Auto
TDL	Dead	1	Linear Add	No
TDL	SuperDead	1		No
1.5(DL+HL)	TDL	1.5	Linear Add	No
1.5(DL+HL)	Live	1.5		No
1.2(DL+HL+EQX)	TDL	1.2	Linear Add	No
1.2(DL+HL+EQX)	Live	1.2		No
1.2(DL+HL+EQX)	Eqx	1.2		No
1.2(DL+HL+EQX)	TDL	1.2	Linear Add	No
1.2(DL+HL+EQX)	Live	1.2		No
1.2(DL+HL+EQX)	Eqx	-1.2		No
1.2(DL+HL+EQY)	TDL	1.2	Linear Add	No
1.2(DL+HL+EQY)	Live	1.2		No
1.2(DL+HL+EQY)	Eqy	1.2		No
1.2(DL+HL+EQY)	TDL	1.2	Linear Add	No
1.2(DL+HL+EQY)	Live	1.2		No
1.2(DL+HL+EQY)	Eqy	-1.2		No
1.5(DL+EQX)	TDL	1.5	Linear Add	No
1.5(DL+EQX)	Eqx	1.5		No
1.5(DL+EQX)	TDL	1.5	Linear Add	No
1.5(DL+EQX)	Eqx	-1.5		No
1.5(DL+EQY)	TDL	1.5	Linear Add	No
1.5(DL+EQY)	Eqy	1.5		No
1.5(DL+EQY)	TDL	1.5	Linear Add	No
1.5(DL+EQY)	Eqy	-1.5		No
0.9DL+1.5EQX	TDL	0.9	Linear Add	No
0.9DL+1.5EQX	Eqx	1.5		No
0.9DL+1.5EQX	TDL	0.9	Linear Add	No
0.9DL+1.5EQX	Eqx	-1.5		No

iv. Load calculations:

➤ Dead loads:

The dimensions of the cross section are to be assumed initially which enable to estimate the dead load from the known weights of the structure. The values of the unit weights of the structure and the values of the unit weight of the materials are specified in IS 875:1987(Part-I) As per IS 875: 1987 (part I)

- Unit weight of brick = 19.1kN/m³
- Unit weight of concrete = 25kN/m³

➤ Wall load:

a) Main wall load 230 mm

Wall Load = unit weight of brick x thickness of wall x (floor height – beam depth) = 19.1 x 0.230 x (3.358 - 0.55) =
13.649 kN/m

b) Partition wall load 150 mm

Wall Load = 19.1 x 0.150 x (3.3528 - 0.45) =
8.902 kN/m

c) Parapet wall load 100 mm

Wall Load = 19.1 x 0.10 x 1.5 = 2.865 kN/m

v. Earthquake Forces:

Earthquakes generate waves which move from the origin of its location with velocities depending on the intensity and magnitude of the earthquake. The impact of earthquake on the structures depends on the stiffness of the structure, stiffness of the soil media, height and location of the structure, etc. the earthquake forces are prescribed in IS 1893:2002 (part-I).

The base shear or total design lateral force along any principle direction shall be determined by the following expression:

$$V_B = A_h \times W$$

Where,

V_B = Design base shear.

A_h = Design horizontal seismic coefficient based on fundamental natural period, and type of soil.

W = Seismic weight of the building.

The design horizontal seismic coefficient:

$$A_h = \frac{ZISa}{RSg}$$

RSg

d) Floor finish = 1.25kN/m² (as per IS] 875 (Part 1)

➤ **Live Load: (As Per IS-875 Part-2)**

Table 3.2.8 Live Loads

AREA	LIVE LOAD
All Rooms and Kitchens	2
Toilets and Bathrooms	2
Corridors, Passages, Staircases	3
Balconies	3
Parking	5
Electrical Room	5
Machine Room	5

Where,

Z = Zone factor, for the maximum considered earthquake (MCE) and service life of the structure in a zone. The factor 2 in the denominator is used so as to reduce the MCE zone factor to the factor for design basic earthquake (DBE)

I = Importance factor, depending upon the functional use of structures, characterized by hazardous consequences of failure, post-earthquake functional needs, historical value or economic importance (Table 6 of IS 1893 (Part 1):

2002).

R = Response reduction factor, depending on the perceived seismic damage

performance of the structure, characterized by ductile or brittle deformations. However, the ratio (I/R) shall not be greater than 1.0. The value for buildings is given in IS 1893 (Part 1): 2002.

Sa/g = Average response acceleration coefficient. Sa/g is determined on the basis of approximate fundamental natural period of vibration on both the directions.

➤ **Natural Period of Vibration,**

$$A_h = ZISg/2Rg \quad V_{Bx} = A_h \times W \quad T_a = 0.09h/\sqrt{d_a}$$

$$T_{ax} = 0.09 \times 52.596 / \sqrt{24.4604} = 0.9571 \text{sec} \quad T_{ay} = 0.09 \times 52.596 / \sqrt{25.15} = 0.9439 \text{sec} \quad S_a/g = 1.36 / T_x = 1.36 / 0.9571 = 1.4209$$

$$A_{hx} = ZISg/2RgR = (0.1 \times 1 \times 1.4209) / (2 \times 3) = 0.0236$$

$$S_a/g = 1.36 / T_y = 1.36 / 0.9439 = 1.4408$$

$$A_{hy} = ZISg/2Rg = (0.1 \times 1 \times 1.4408) / (2 \times 3) = 0.02401$$

Table 3.2.10 Story shear along X-direction

Story	Elevation m	X-Dir kN	Y-Dir kN
LIFT SLAB	52.5968	4.7232	0
OPEN TERRACE	50.5968	93.7294	0
Story14	46.9392	138.0316	0
Story13	43.5864	118.0214	0
Story12	40.2336	100.5627	0
Story11	36.8808	84.5006	0
Story10	33.528	69.8352	0
Story9	30.1752	56.5665	0
Story8	26.8224	44.6945	0
Story7	23.4696	34.2192	0
Story6	20.1168	25.1407	0
Story5	16.764	17.4588	0
Story4	13.4112	11.1736	0
Story3	10.0584	6.2852	0
Story2	6.7056	2.7934	0
Story1	3.3528	0.6984	0
Base	0	0	0

Table 3.2.9 Base shear along X-direction

Direction	Period Used (sec)	W (kN)	V _b (kN)
X	950.015	142664.8818	808.4343
X + Ecc. Y	950.015	142664.8818	808.4343
X - Ecc. Y	950.015	142664.8818	808.4343

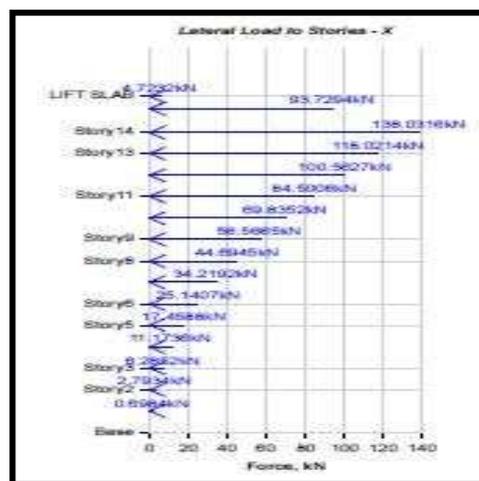


Fig 3.2.2 Lateral load of stories-X

Table 3.2.11 Base shear along Y-direction

Direction	Period Used (sec)	W (kN)	V _b (kN)
Y	950.015	142664.8818	808.4343
Y + Ecc. X	950.015	142664.8818	808.4343
Y - Ecc. X	950.015	142664.8818	808.4343

Table 3.2.12 Story shear along Y-direction

Story	Elevation m	X-Dir kN	Y-Dir kN
LIFT SLAB	52.5968	0	4.7232
OPEN TERRACE	50.5968	0	93.7294
Story14	46.9392	0	138.0316
Story13	43.5864	0	118.0214
Story12	40.2336	0	100.5627
Story11	36.8808	0	84.5006
Story10	33.528	0	69.8352
Story9	30.1752	0	56.5665
Story8	26.8224	0	44.6945
Story7	23.4696	0	34.2192
Story6	20.1168	0	25.1407
Story5	16.764	0	17.4588
Story4	13.4112	0	11.1736
Story3	10.0584	0	6.2852
Story2	6.7056	0	2.7934
Story1	3.3528	0	0.6984
Base	0	0	0

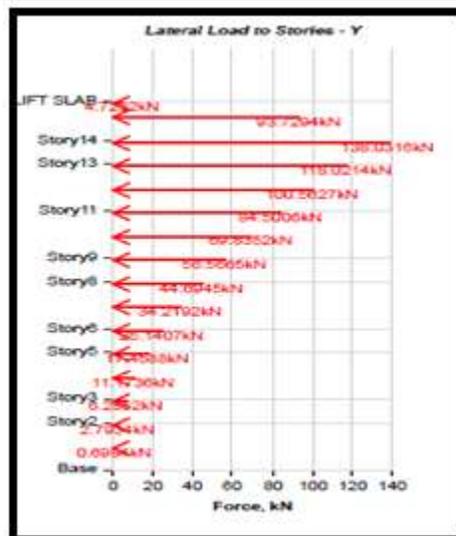


Fig 3.2.3 Lateral loads of stories-Y

Modelling in E-Tabs

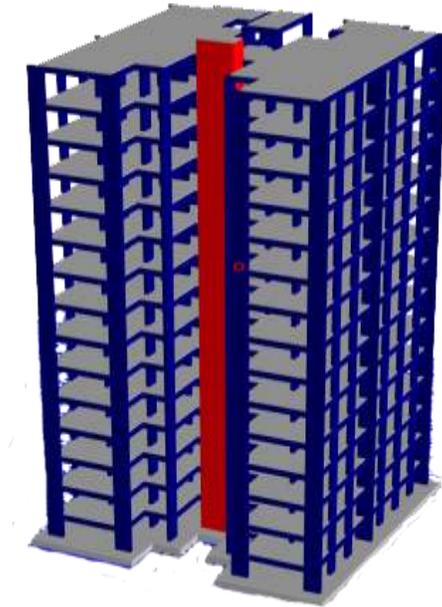


Fig 3.2.4 E-Tabs 3D Model

3.4 SAFE 2016 Mat foundation Modelling and Analysis:

The foundation was designed as a MAT foundation as there are number of columns and the load that comes on it is more. Therefore, Mat foundation is used as it gives a very low contact pressure to the soil beneath it. The foundation was analyzed using the SAFE software and the analysis was found to safe.

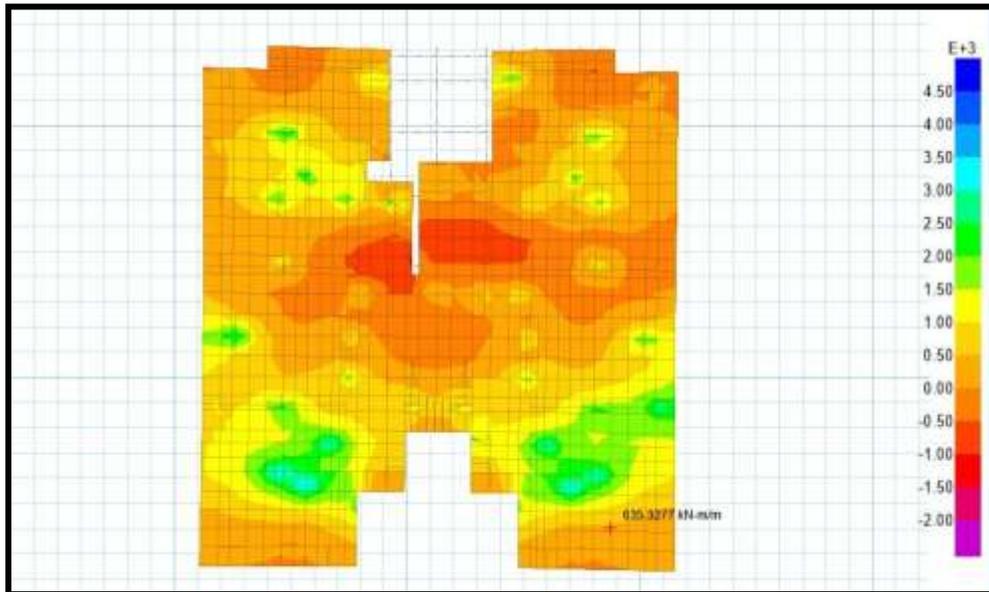


Fig 3.4 Mat Foundation

3.5 Autodesk Revit Architecture:

The model from Etabs is imported to AUTODESK REVIT ARCHITECTURE 2018 software. This gave us the 3D model of the structure. This gives use the rebaring details of the structure as well.

The detailing of the complete structure was also done with it.



Fig. 3.5 Rendered Revit Model

3.6 Naviswork 4D Modeling and Primavera:

The model from Revit is imported to Naviswork and the schedule of work is imported from Primavera for the final 4D model. The Primavera gives us the complete schedule of work with the number of days required for each work. By the use of this, the Naviswork gives the 4D model. The 4D model obtained is nothing but the 3D model with time scheduling as per BIM.

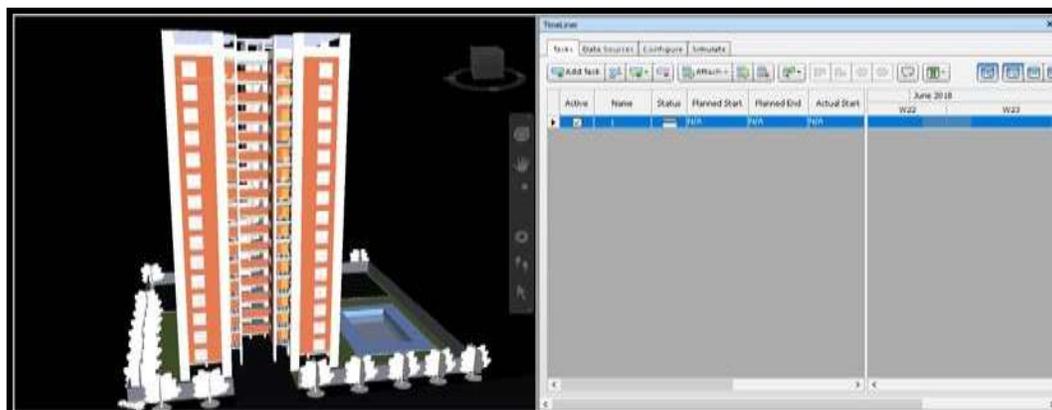


Fig. 3.6.1 Naviswork 4D model



Fig. 3.6.2 Primavera Scheduling

The manual design is also done for analysis and validation purpose.

4.0 RESULT AND CONCLUSION:

As discussed earlier, this project was done in aiming at the performance evaluation and review of a multi- storey building BIM. The use of BIM has completely taken up the construction industry into a different level. The use of BIM has made the project easier to handle and better understanding. As per our project study, we mainly took up the major two parameters of project management, i.e., Cost Analysis and Time Scheduling.

Our main objective was to compare the traditional method of project management and the BIM method of project management by taking up only two parameters into consideration. This comparative study would show how productive and efficient would the use of BIM be.

As per the analysis, the cost was found to be 8.26% lesser and the time consumed was 10% lesser when compared to the normal methods used. Thus, the use of BIM will thereby increase the totally productivity of the complete project and it more effective in the construction field.

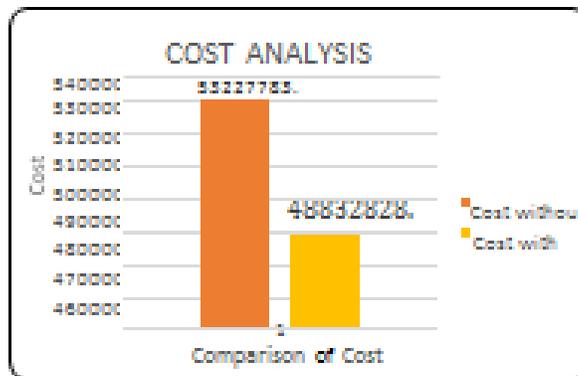


Fig 4.1 Cost Analysis

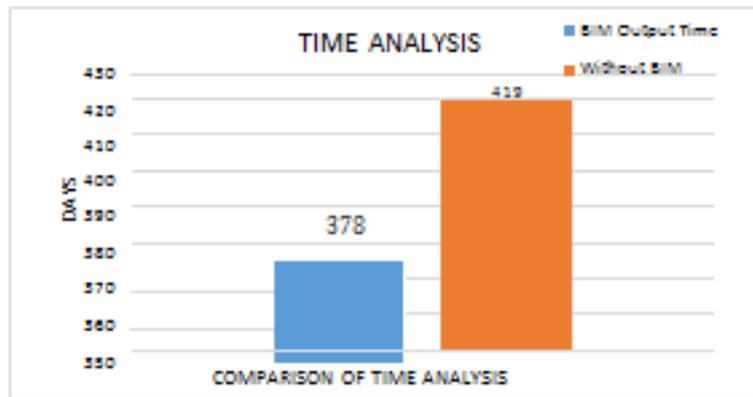


Fig 4.2 Time Analysis

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