# Clash Detection using BIM for Efficient Construction Timeline

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***Abstract*: This project research focused on the impact of BIM in Construction industry using it during the construction phase of the project as well as after completion of the project. Our main objective is to understand BIM flow process for effective coordination, preparing 5D model of G+6 commercial building including cost, quantity, schedule and check BIM process for quality cost and scheduling of construction industry. A case study of project which has followed conventional methods for its project work is compared with BIM techniques for effective planning, visualization & sustainability of project. Using the methodology of modelling the 2D plan into 3D Revit model. After modelling appending it into Naviswork for reducing clashes, proper visualization of project with timeliner tool and a 4D model is prepared. Using Msp for effective planning of activities by assigning proper resources and timeliner. The project had studied element of BIM activities: 3D visualization, Coordination, Construction Planning Management and Monitoring, Record model Energy.**

***Keywords*- Building information modeling (BIM), BIM using Naviswork, 5D modelling, Comparative analysis using BIM, Clash detection, Building Timeliner.**

## 1.INTRODUCTION

This project is a study of the Performance of Autodesk BIM (Knowledge Building Model) New innovation for quality management as an urban think tank the old city infrastructure to create a BIM city model and provide organizational accuracy to residents. In view of the rapid urbanization that remains the basis for learning and planning the old city infrastructure, as well as working for and improving the quality of life of the people who build it, it is necessary to make the old urban infrastructure infrastructure smarter. and Technologies, BIM Technology is one of the advances that help in the efficient planning, reconstruction and infrastructure of the old city theme and buildings through various BIM strategies such as Infraworks 360, Navis function, Revit, etc.

The Indian Construction Business is an important indicator of development as it facilitates travel openings in various related areas. The development business contributed an average of $ 308 billion to national GDP for 2011-12 (about 19%).

BIM (Building Information Modeling) is an intelligent 3D-based system that provides engineering, construction, and development specialists (AEC) information and tools in all planning, construction, construction and professional management of buildings and foundations.

## 2.LITERATURE REVIEW

In this section a few analysis of the situation; The international diary focuses on understanding the establishment of BIM. By writing the review, it can be assumed that the BIM head should be made as the factory is built. Continuing BIM can overcome the barrier to the emergence of normal CAD.

1.Mr. Swapnesh.P. Raut' Improve the Productivity of Building Construction Project using Clash disclosure Application in Building Information Modeling 2017 e-ISSN: 2395 - 0056, p-ISSN: 2395-0072, Volume: 04 Issue: 03 | Mar - 2017. This appraisal in addition consolidates the plausibility of BIM, status of BIM in India. In that cut-off, it is important assessment of a private structure which including a planning, right hand and Mechanical, Electrical and Plumbing (MEP) BIM models and their subsequent battle disclosure. For this condition inspect, business programming, for example, Autodesk Revit 2016, Autodesk Navisworks Manage 2016 are utilized and in addition bases on streamlining and institutionalizing the technique for

BIM coordination utilizing Autodesk Navisworks programming.[1]

2.Dr. Rula Ali Al-Damen' The effect of Total Quality Management on hierarchical execution Case of Jordan Oil Petroleum Company' .

This test is expected to consider the impact of TQM performance on continuous performance. The audit was conducted at the Jordan Petroleum Refinery Company (JPRC), with an average of (103) chairpersons from various levels. Inspector relies on basic and optional data. The results show that TQM has a constructive effect on phase execution. Considering this disclosure, the examination provided a course of action for the proposals.[2]

3.Tom Rajan, Anju Paul, Implementation of Total Quality Management (Tqm) In Construction-A Review.

Investigators perceived diverse obstruction factors for executing TQM being developed communicating the isolated thought of the business as the most basic control. Studies have furthermore done in finding answer for the obstructions and draws out that banding together and BIM consolidated models can successfully execute TQM being developed Industry

4.Li Ling' Application Value Analysis of BIM in Fabricated Buildings'2017 ISSN: 2394-2630

The requirements of the headway of pre-collected improvement and considering BIM (Building Information Modeling Chinese elucidation: building information show) advancement at present, assessment and essential authority, BIM development in social event building plan, improvement, completing affirmation and errand and upkeep of the whole life cycle of utilization. Virtual improvement by BIM, check the arrangement hardship, held framework issues introduced significant pre-collected structures, advance multiplication, consistent watching, anticipate possible issues and make courses of action early, make incredible conditions for the control of the whole method. [4]

5.Allan F. Samuels,' Construction Facilities Audit: Quality System-Performance Control'2017

An instance of an improvement workplaces survey performed on occupant building field work environments by the Arizona Department of Transportation is presented, and the general advances are discussed. It is proposed that huge or consistent advancement programs use the improvement workplaces survey. Information about genuine structure execution as displayed by the improvement itself gives positive system control. Finding out about the real delayed consequences of a quality organization system is particularly fundamental when new quality undertakings are being actualized.[5]

3 STEPS FOR PLAN OF BUILDING MODEL

While different individuals naturally consider BIM programming, truly BIM is the way toward making and utilizing modernized models for outline, progression or possibly activities of building undertakings. Composing PC programs is fundamentally the section by which the BIM strategy is developed.

Stage 1: Collection of AutoCAD 2D drawings of work from site and business director.

Stage 2: Creation of 3D model by bringing in 2D drawings to the Revit System.

Stage 3: Conversion of the REVIT 3D model into a comprehensive site for Naviswork (.nwf) using the expansion device in Revit.

Stage 4: The structure design of business division and the production of work plan using a number of data from REVIT in Microsoft Project,

Stage 5: Creation of 5D model by importing and installing 3D model and MSP (Time and cost) programs in Naviswork software.

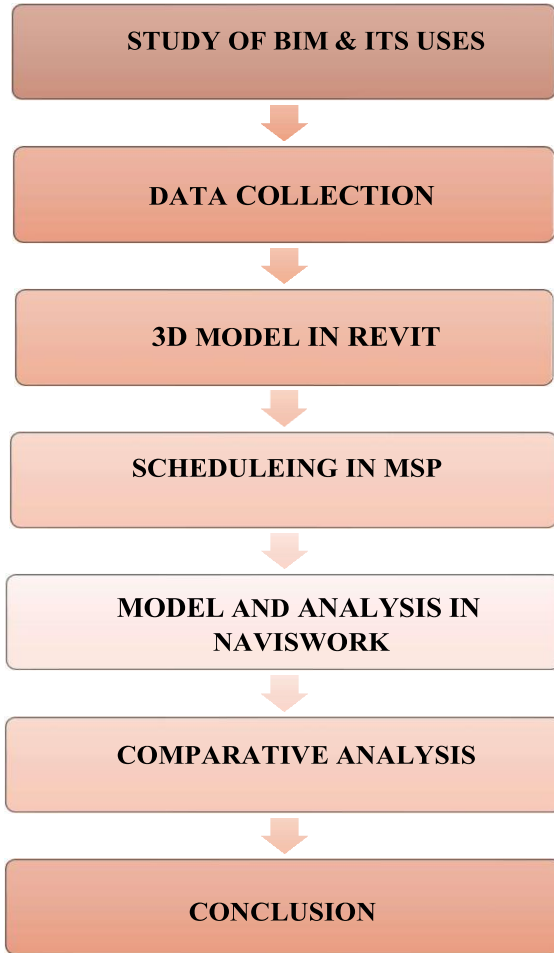Stage 6: Modelling and representation of 5D model in Naviswork Software.

4 METHODOLYGY

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┌─────────────────────────────┐
│   STUDY OF BIM & ITS USES    │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│      DATA COLLECTION         │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│     3D MODEL IN REVIT        │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│     SCHEDULEING IN MSP       │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│    MODEL AND ANALYSIS IN     │
│         NAVISWORK            │
└─────────────────────────────┘
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┌─────────────────────────────┐
│    COMPARATIVE ANALYSIS      │
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┌─────────────────────────────┐
│         CONCLUSION           │
└─────────────────────────────┘
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*Fig 1:- flow chart showing methodology*

4.1 CLASH DETECTION

There are 3 primary sorts of conflicts that conflict recognition searches out:

1. Hard Clash: when two items go through one another. Most BIM Modelling programming kills the probability for this utilizing conflict discovery rules dependent on inserted object information.

2. Delicate Clash: work to identify conflicts that occur when objects override geometric resistance in different articles (for example, an overly exposed structure near a strong holding wire).

3. 4D/Workflow Clash: Conflict Resolves Book Conflicts and Disruption just as there is a transport conflict.

5 DATA COLLECTION

PRIDE PURPLE SQUARE

About 19 years ago, we embarked on an effort to redefine the knowledge of Pune's luxury and luxury homes. With the impetus for building and providing modern projects in Pune, we are focused on providing accommodation that is commensurate with future trends and standards. While there, we were constantly developing new ways to integrate a sense of full public life into the citizens of Pride Purple. With a solid foundation in the world of apartments, apartment houses, bungalows, commercial plazas, conference centers and hotels, today, we are like a comfortable and luxurious life

SPECIFICATIONS:
- Large floor
- Large column grid
- High speed elevators
- Designer entrance lobby
- 100% power back-up
- In parking and common area Fire and smoke detectors provided
- Ample parking space

AMENITIES:
- large floor
- large column gride
- high speed elevators
- designer entrance lobby
- 100% power backup



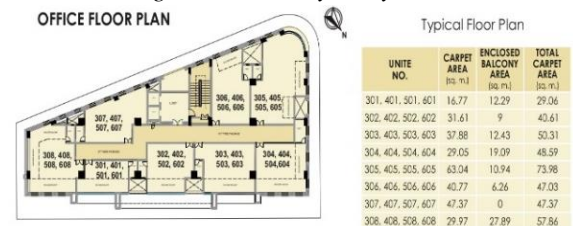*Fig 2:- Case Study 3d eye view*



*Fig 3:- Floor Plan of Pride Purple*

Fig 4:- Shop Floor Plan of Pride Purple

## 6 EXPERIMENTAL ANALYSIS

### 6.1 BIM IMPLEMENTATION FOR BUILDING CONSTRUCTION:

Our project has two aspects one is to rehabilitate the city for urban versatility and second is to contemplate the adequacy of BIM in Quality administration in development industry. for the advancement of building model, we have utilized the Revit programming alongside the Navisworks programming for planning and time estimation.
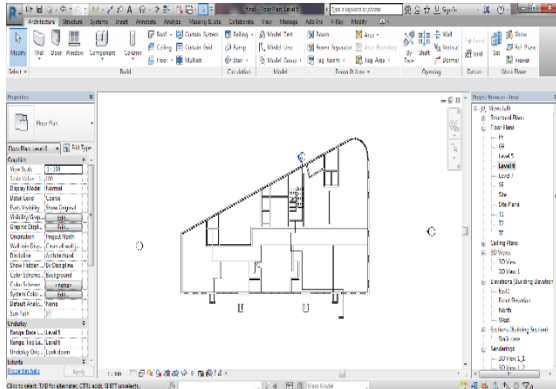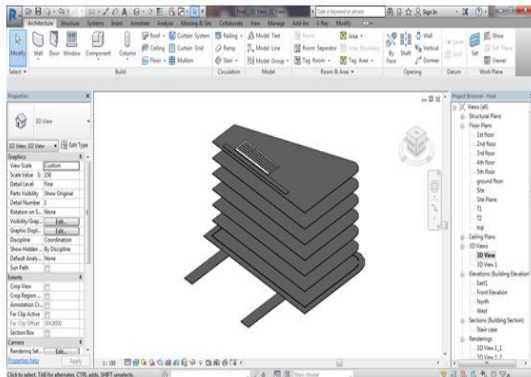


Fig 5:- Revit Layout Plan



Fig 6:- Revit Floor Layout
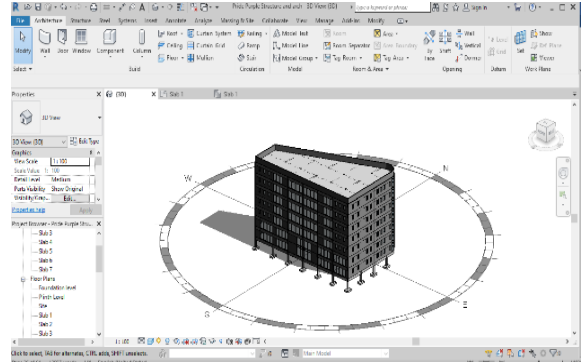


Fig 7:- 3D View of model with windows & Wall
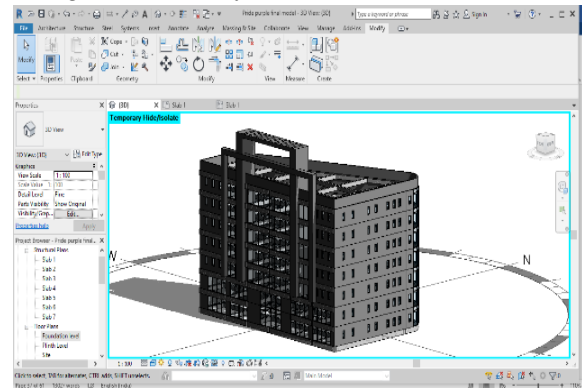


Fig 8:- Final model of elevation view



Fig 9:- 3D Render view of model

### 6.2 Scheduling Using Microsoft Project i.e. (MSP):

Microsoft Project is available in standard and professional editions, depending on our needs of project. The Microsoft Project file format is .mpp.

- Design plans
- Set sound goals
- Defining resources
- Assignment of tasks
- Recording progress and finances
- Performance monitoring
- Organizing meetings
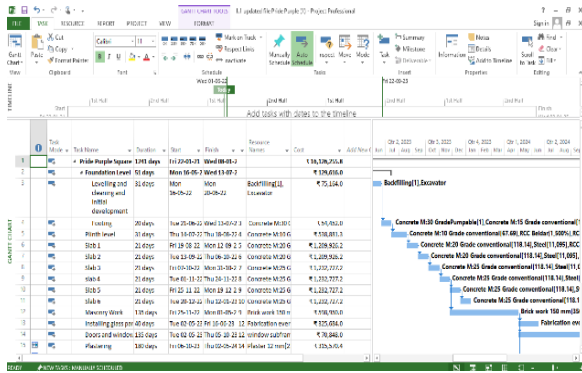
*Fig 10:- Preparing schedule in MSP*

6.3 MODEL IMPROVEMENT IN 6D USING NAVISWORK: Autodesk Naviswork Manage software is a complete review solution for project analysis, simulation, and communication of project information. Multi-sector design data can be combined into a single integrated project model for conflict management and conflict detection. Naviswork Manage helps design and construction professionals to anticipate and avoid potential problems before construction.

6.3.1 Introduction of Autodesk Naviswork:
Autodesk Navisworks faithfully shares, compiles and updates detailed 3D design models from a variety of file formats. Conflict Detection Tools allow you to analyze bugs in a single model environment to detect errors before they become problems..

6.3.2 Architecture, Engineering & Construction Overview:
By combining high quality 3D design data created with AutoCAD software, Revit-based applications, and Autodesk Inventor software with geometry and data from other design tools, Autodesk Navisworks project update products enable real-time flexibility, project all. view: Active 3D communication, 4D analysis, editing simulations Accurate photo realistic visualization.

6.3.3 Autodesk Naviswork Manage:
Autodesk Navisworks Manage software is a complete solution for project design reviews, engineering, and construction management professionals who need solid insights and forecasts to improve productivity and quality.

6.3.4 Autodesk Naviswork Simulation:

Autodesk Navisworks Simulate software adds the flexible power of 4D editing and photorealism to the Autodesk Navisworks Revie software. The amount of existing design data is expanded to create a clear definition that reflects the purpose of the design and to simulate construction to improve comprehension and prediction.

6.3.5 NAVISWORK MANAGE:
Autodesk Navisworks Review software expands access to existing design data for real-time viewing and shared updates, regardless of file size or format.
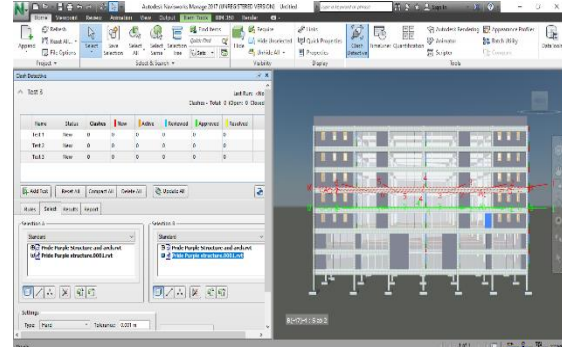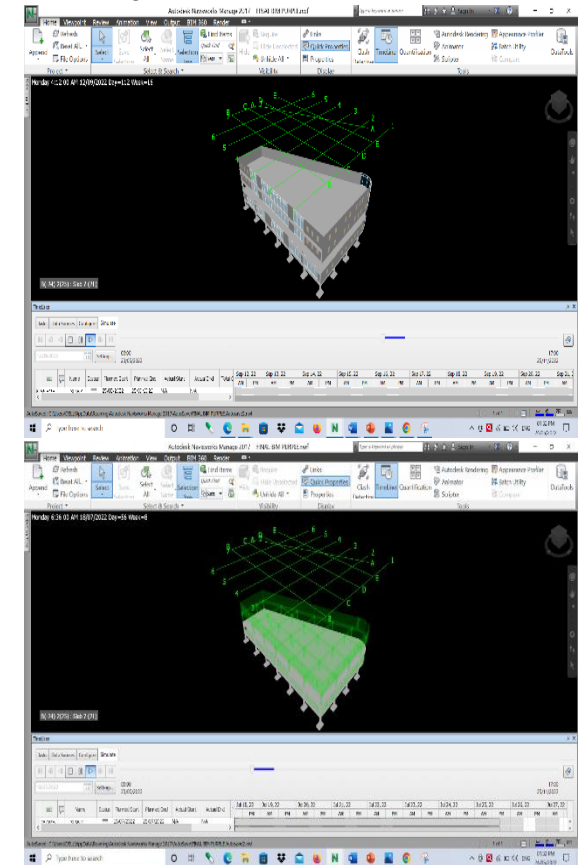

*Fig 10:- Navisworks clash detection*


*Fig 11:- Navisworks timeliner*

## 6.4 ESTIMATE WORK IN EXCEL:

In EXCEL quantity of concrete is measured, all concrete slab, beam, column, foundation is measured After calculating concrete quantity for external finishes door schedules, windows schedule and door schedules are worked out

*Table 1:- Estimate Work in Excel*

| Sr no | description | no | size | | | quantity |
|---|---|---|---|---|---|---|
| | | | B | W | D | |
| 1 | C1 | 1 | 1.95 | 2.15 | 0.15 | 0.628875 |
| 2 | C2 | 1 | 2.2 | 2.75 | 0.15 | 0.9075 |
| 3 | C3 | 1 | 2.8 | 3.2 | 0.15 | 1.344 |
| 4 | C4,17 | 2 | 3.55 | 4 | 0.15 | 4.26 |
| 5 | C5,18 | 2 | 3.5 | 4.4 | 0.15 | 4.62 |
| 6 | C6,7 | 2 | 2.9 | 3.3 | 0.15 | 2.871 |
| 7 | C8,62 | 2 | 2.75 | 3.2 | 0.15 | 2.64 |
| 8 | C9 | 1 | 2.8 | 3.3 | 0.15 | 1.386 |
| 9 | C10 | 1 | 3.5 | 3.5 | 0.15 | 1.8375 |
| 10 | C11,22 | 2 | 2.9 | 2.9 | 0.15 | 2.523 |
| 11 | C14,15 | 2 | 2.5 | 2.8 | 0.15 | 2.1 |
| 12 | C16,45,66,63 | 4 | 2.6 | 3.1 | 0.15 | 4.836 |
| 13 | C21 | 1 | 3.8 | 3.8 | 0.15 | 2.166 |
| 14 | C23 | 1 | 3.1 | 3.1 | 0.15 | 1.4415 |
| 15 | C24,43 | 2 | 3 | 3 | 0.15 | 2.7 |
| 16 | C25,44,69,70 | 4 | 2.7 | 3 | 0.15 | 4.86 |
| 17 | C26,35 | 2 | 2.6 | 2.6 | 0.15 | 2.028 |
| 18 | C27,36 | 2 | 3.1 | 3.1 | 0.15 | 2.883 |
| 19 | C28,29,37,38 | 4 | 2.6 | 2.6 | 0.15 | 4.056 |
| 20 | C30,31,32,33,39,40,41,42 | 8 | 1.9 | 1.9 | 0.15 | 4.332 |
| 21 | C34 | 1 | 2.9 | 2.9 | 0.15 | 1.2615 |
| 22 | C46 | 1 | 3 | 3.6 | 0.15 | 1.62 |
| 23 | C47 | 1 | 2.4 | 3.3 | 0.15 | 1.188 |
| | | | | | Total | 58.489875 |

*Table 2: No. of days BIM- Convectional*

| | BIM METHOD | CONVENTIONAL |
|---|---|---|
| DAYS | 1241 | 1375 |



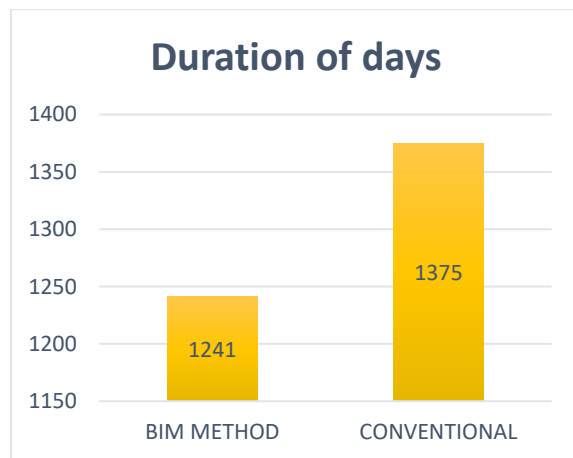*Fig 12 : No of days BIM- Convectional Graph*

*Table 3: Cost Comparison BIM and Convectional*

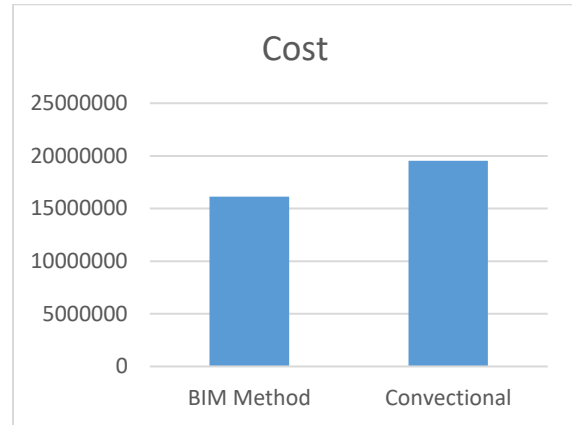| | BIM Method | Convectional |
|---|---|---|
| Cost | 16126255.8 | 19539320.1 |



*Fig 13: Cost Comparison BIM and Convectional Graph*

*Table 4: Comparison*

| Conventional Analysis | BIM Analysis |
|---|---|
| Time duration- 1313 | Time Duration- 1123(Approx) |
| Cost – Rs. 11.76 Cr | Cost- Rs 11.50 Cr |
| Need of rework due to clashes | Rework was avoiding due to clash detection in Naviswork |
| As clashes form requires more time and cost | During pre-construction stages clashes are been identified so indirectly time and cost reduces |
| No Visualisation | Proper Visualisation using Timeliner in Naviswork by attaching task to each element |

## 6.5 Google form Survey:

https://docs.google.com/forms/d/e/1FAIpQLScNMyno8QwPhwSRJuRYW6fceI4xaICwK2VgsFERL7WIMLv5gg/viewform?usp=pp_url

A google form was circulated among the stakeholders to get a brief idea about the implementation of BIM on the construction site the responses are shown below in the terms of graphs.
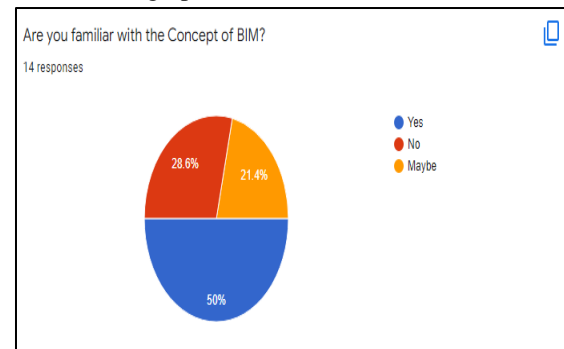


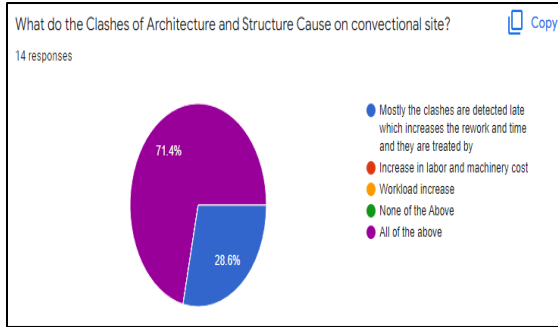*Fig 14:- Graph of questionnaire response 1*

*Fig 15:- Graph of questionnaire response 2*



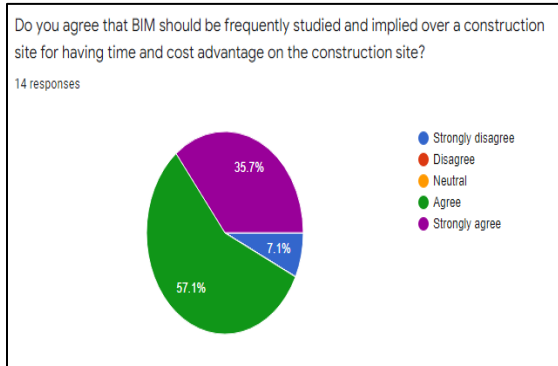*Fig 16:- Graph of questionnaire response 3*

6.6 Quality Norms Satisfied from Using BIM

The building is set out correctly on the site (demarcation w.r.t. layout plan/) For this norms clash detection test at ground level is conducted and after clearing test execution should be started

Quality Norms Which Can Not Be Satisfied With Bim For ISO quality norms concrete formwork and materials used cannot be verified with BIM as it has limitation of not having modelled formwork and specific material in software

Summary: The Research and Development based on questionnaire survey and case study are included in this Chapter. The conclusions are given in next Chapter.

## 7 CONCLUSION

The 6D model of the G + 6 structure is modified according to the BIM system as mentioned which includes 3D models, layout, value and cost.

Using the methodology of modelling the 2D plan into 3D revit model .After modelling appending it into Naviswork for reducing clashes, proper visualization of project with timeliner tool and a 4D model is [prepared. Using Msp for effective planning of activities by assigning proper resources and timeliner. With the help of msp data we had attached it to our model which helps us to visualize the way time of particular activities complete.

From comparison with labour cost it can be seen that cost of activity can be reduced by 20% as number of days are saved by 190 days in which labour daily wages, engineers salary, RCC contractor charges can be rescued.

Accepting BIM work flow will lead to better architectural functions..

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