IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

BIM-Driven Architectural and Structural Analysis and Design of Residential Building

Dr. S. B. Kandekar, Nitin Shivaji Bhanuse, Prasad Tatu Jagtap
Sujata Vijaykumar Kagne, Pratidnya Sanjay Gavande
Department of Civil Engineering,
Amrutvahini College of Engineering, Sangamner, India

Abstract: *The use of Building Information Modeling (BIM) can be a useful platform for structural engineers to analysis and design. The current state of project is analyzed by giving a general data on how architectural, structural consultation firms are providing regulation on their projects to improve stability of structure. The capability of BIM to proceed structural process is discussed with dynamic system, and how it impacts design and progress workflow. The benefits of using BIM in structural engineering are, in the areas of productivity, coordination, and visualization. Study is developed to test the defection throughout process for all three-discipline structure architecture and Mechanical, Electrical, Plumbing and Fire (MEPF).*

The aim of this study provides useful information for everyone interested in increasing their knowledge on BIM technology in structural engineering. For the project AutoCAD is used for drafting plan. STAAD PRO is used for design and analysis for stability of structure. Revit is used for modeling and making schedules of structural quantities also detail section used for Good For Construction GFC drawings. Clash detection is necessary for clash free model which ID's done on Navisworks..

Keywords: Building Information Modeling

I. INTRODUCTION

Structural Engineers are using new methods and software's now a days to stay competitive. There are some new ways to improve on today's economy, meeting critical points in work like productivity, coordination and problem-solving Engineers are constantly looking forward to it. To help with these important aspects, building information modeling (BIM) is potentially useful. The ability to integrate intelligent objects in the model is the core feature of BIM. These intelligent objects have all the data regarding a specific component, from geometric characteristics to the way they link with other components, to make the entire model full of information.

Engineering and construction industry has developed BIM to apply this same principle to infrastructure and building projects in architecture. creating too similar to when other technologies, like computer aided design (CAD), where adopted in the industry in the past 50 years is the environment of BIM adoption is. BIM has the potential to do the same like the architects and designers switched their methodology and started using 2D CAD changed the way we work. As the BIM model can be constantly updated with any changes in the design or general specifications, structural engineers can take Advantage of that. Some of the most important contributions of BIM for structural engineering activities with keeping all the data as accurate as possible, like conceptual design, structural analysis layout and detailing are: reduction of design errors and drafting errors as is directly affect costs as a result of improved productivity. It also useful for accurate analysis of situations by simulation. picture lets one identify potential design issues, and come up with advanced and creative ways to tackle problems. This paper will focus on the stages and step include in building information modeling and by that dynamic system influence in structural engineering. The benefits that Building information modeling represents for structural engineering in the areas of productivity, coordination and accuracy of data, and visualization and simulation are also analyzed, all this with the objective of obtaining a clear idea of the impact that Building information modeling has in structural engineering.

DOI: 10.48175/568

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

Many powerful and practical building information modeling tools for analysis has been found by extensive research and development in academic and industry, design and detailing. Within a BIM, different disciplines can include their data, from the Structural, architectural and MEP. Details such as finishes, like specification of material, pricing, can be included as digital data in BIM. This information is available prior, during and after the construction. All this information can be access by everyone using BIM, not Maintaining the data more consistent and coordinated around the different disciplines and facilitating the process of sharing the information can be done by BIM.

Software is more efficient to the process to prepare a project to input it into structural analysis, since all the data can be directly transferred from the building model. It becoming easily available for the detailing process by storing the data in Building information modeling. With the help of BIM Elements like steel and precast concrete can be coordinated more easily. Managing its delivery and installation and handling, with less storage. To help with these important aspects, building information modeling (BIM) is potentially useful and time saving process. The benefits of using BIM in structural engineering are analyzed in areas like productivity, coordination and visualization. Useful information for everyone interested in increasing their knowledge of BIM in structural engineering.

BIM technology is used to manage information on a construction project across the project lifecycle. It is the digital description of every aspect of the built asset, and provides modelling and management information which enables all the parties to work to the same standard and to be kept in the loop regarding any updates and changes. Additional benefits include, better project coordination and collaboration with stakeholders, efficient workflows, 3D virtualizations, and overall improved project outcome. BIM brings together all the information about each individual component of a building, in one easily accessible place. This makes it possible for anyone to access that information for any purpose and to integrate different aspects of the design more effectively. This results in mistakes and abortive costs being minimized.

Various projects use different levels of BIM, with each level catering to a different set of criteria. The levels start at 0 and go up to 4D, 5D, and even 6D BIM, and each level is determined by how much information is shared and managed throughout the process. Take a look at the criteria needed to determine which level you are working at for levels 0-3D

II. RESEARCH GOAL

Research goal of this paper is depended on Construction Industry which is second largest industry of the country after Agriculture field. It makes a significant contribution to the nation's economy and provides employment to large number of people. Considering the nature of construction industry 80% stockholders are still practicing with old and lengthy techniques. We can find that there is a lack of coordination and communication between team involved in process. Teams often find themselves working with outdated data and plans that are riddled errors and omissions. Timely delivery of project is the key factor in construction industry, but because of old methods project gets lengthy and consume more time without any coordination. Using the old software and techniques stockholders are unable to get exact specification sand quantities of materials which directly effects on the cost of project. The interconnected nature of Building information modeling (BIM) can overcome all issues. Aim is to study site independent BIM Technology with structural engineering system which could be used for construction project. To identify the challenges of BIM integration with Structural engineering in construction projects. To study the benefits and potentials of BIM integration with in construction project.

III. METHODOLOGY

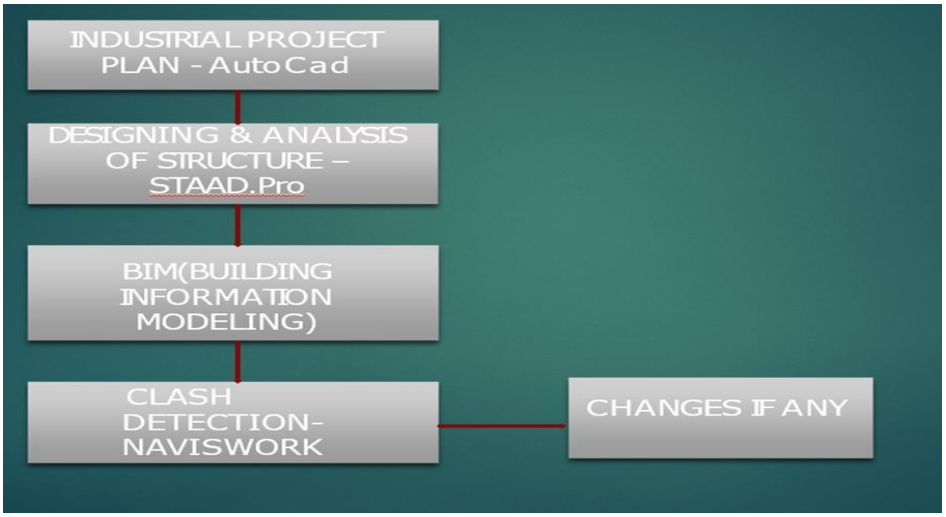
As BIM is process which have to flowed in sequence wise the first step is as drafting and finalizing AutoCAD plan by the architectures, then next pressure is analysis and design the structural member by structural engineer. after the project reaches its sanctioning phase BIM is introduced so that one could understand the defect coordination part. The clash free model or work flow is principal of BIM process hence Navisworks used for clash detection. If any clash found can be taken to respected discipline than after resolution of hard clash model can clash free and proceed for GFC file. By using Building Information Modeling methodology of design that is based on data rich object forms a model that is used in engineering, architecture and construction. Part of the central system of BIM which allows all the objects that are integral part of it have their database that can correlate to other objects within the model. The National BIM

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

Standard defines BIM as "a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a service forming a trustable basis for decisions during its life-cycle from inception onward. The BIM is a shared digital representation founded on open standards for instructiveness.

Many powerful and practical building information modeling tools for analysis has been found by extensive research and development in academic and industry, design and detailing. Within a BIM, different disciplines can include their data, from the Structural, architectural and MEP. Details such as finishes, like specification of material, pricing, can be included as digital data in BIM. This information is available prior, during and after the construction. All this information can be access by everyone using BIM, not Maintaining the data more consistent and coordinated around the different disciplines and facilitating the process of sharing the information can be done by BIM.

The use of BIM can make significant impact on the way infrastructure projects are executed, developed and managed. The starting of BIM was to focus in architectural area, but as part of the evolution and of different industries, to address the needs of structural engineers for offering better tools that increase its use in the field the evaluation of BIM is constantly happening. buildings are modeled using separate components instead of drawn is one of the big differences between BIM and CAD. BIM skips the 2D design of its CAD and gets directly into modeling the structure. As a result, drawings are of second importance and no longer the first thing for design information, Reports of design information which are created automatically with the help of BIM mode. Use of building information modeling has made the considerable impact on design and built of project which can be seen in figure 1. A report from a study delivered by McGraw Hill Construction related the level of BIM implementation in infrastructure in the recent years shows that, how use of BIM has been increasing.



IV. STRUCTURAL DESIGN PROCESS

The first step in the structural design process of a project following the traditional way is to in expert the architectural plans. This gives the structural engineer an idea of the design and set the foundation to create the analytical model that will be used in the structural design and analysis software to analyze the project as per the requirements such as gravity check, seismic analysis, dynamic or wind pressure. At the same time, usually drafters start the drawing part, creating a representation of the building and initiating the construction documents.

This causes the creation of multiple drawings that contain the same information. The fact that are different models of different discipline being working on the same project to reduces the error that need to be put in coordination, and opening the opportunity for errors.

The structural engineer made to analyses in the design, if changes are made during analysis process, that change is not updated by the drafter the documents become out of sync, and that affect the validity of the design. While using a

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

building information model, all data in project file which contains the information used in the analysis applications, and analytical information, which is the model used in the structural analysis, are interconnected in the same place, allowing for its use not only in the structural analyses of the project, but also to produce the construction documents. The structural engineer made to analyses in the design, if changes are made during analysis process, that change is not updated by the drafter the documents become out of sync, and that affect the validity of the design.

While using a building information model, all data in project file which contains the information used in the analysis applications, and analytical information, which is the model used in the structural analysis, are interconnected in the same place, allowing for its use not only in the structural analyses of the project, but also to produce the construction documents.

V. STRUCTURAL WORKFLOWS FOR BIM

When compared to the traditional way to work, the benefits of using BIM in the structural design are obvious, especially when analyzing the workflow. 12 Time constrains usually dictate that structural design and construction documents production start parallel, so as the structural engineers begin their analyses on structural software, and the structural drafters begin drafting the documentation set like structural framing plans, elevations, typical details for particular area, section).

The multiple discipline for models, models that are not coordinated with each other or the documentation, requires a manual effort to keep documentation records synchronized with to the maintain firm's efficiency and quality. Whereas the use of building information model that drives analysis, coordination and documentation reduces these problems. Although for BIM process, referring the architectural plans is still the first step to do model. But instead of creating several models, there is just one model, a single integrated structural model that includes both a physical representation that drives documentation and coordination and an analytical representation used for multiples analyses.

For BIM process it is important to flow the above process so that record of all documentation can be synchronized with all discipline can be possible. In any process of construction is a came to finalizes initial plan of project, after finalizing plan on, the step is to planning the next phase for project standards where BIM plays important role. the next step is execution of plan by using BIM sheets and section detail also time line for project.

Coordination:

Good coordination in a project is essential to get the most out of BIM. A single building information model is used for both the analysis and the documentation phases, contributing to better coordination between the structural analysis results and the overall design, increasing consistency throughout the entire project. Structural engineers can easily

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 6, May 2025 Impact Factor: 7.67

spend more time coordinating a project than performing the structural analysis. With the use of BIM, the time spent in coordination is reduced, allowing structural engineers to focus all their efforts in solving problems, instead of having to constantly be checking for errors or coordinating changes made. The documentation phase of a project is positively impacted by the use of BIM as well. Using the building information model not only able to produce of construction documents, but it also gives as a base to present the results from the structural analysis and design in an easy sharable way, keeping all the information regarding the analysis, design and documentation of a structural project place.

Software Selection:

The software selection is mostly determined by the structural engineering firm. Structural engineers are usually familiar with different structural analysis programs; therefor the initial selection of BIM and structural engineering software is based on the software that the engineering firm is currently using.

The Autodesk Revit Suite has a bi-directional link that grants the ability to easily transfer information with the most used structural analysis software in the industry, such as RISA Floor and RISA 3D by RISA, ETABS and SAP2000 by CSI, and RAM Structural System by Bentley that is STAAD PRO.

Revit Link:

Autodesk has premier partners, like RISA, that have a technical staff available to interact with Autodesk personnel. This teamwork ensures that the link between the Autodesk Revit Structure and the RISA Floor and RISA 3D is constantly optimized. When the link between Revit Structure and RISA Floor and RISA 3D is habilitated it adds a toolbar that facilitate both the exporting to and importing form RISA models. The link offers an exchange file. so that link of Revit file can be possible. Also, one can link Revit file with each other but the only rule is both files from same version of Revit. The work set from Revit file prevent the unnecessary work load combination by just clicking to work set off button from visual graphics setting. Multiple numbers of Revit file can be attached to each other without been lack in programing work set. Hence to choose correct software to link all disciplines with each other like, structure architecture and MEPF.

VI. PROPOSED BIM BASED DYNAMIC FRAMEWORK

The aim is to produce a dynamic System in structural engineering y coordinating with BIM So that it will be used for onsite and offsite structural engineering issues and for these solutions.

- Aim of the study is to propose a dynamic system in structural engineering with the help of BIM.
- After studying and understanding the impact of BIM on structural engineering, The Framework will be on Industrial Project.
- To understand the coordination between structural elements and to resolve clashes between elements, Detail Study of Software like Navisworks will be shown.
- In next chapter we will study the use of STADD pro which helps structural engineers to automate their tasks by removing the tedious and long procedures of the manual
- Methods. it provides a flexible modeling environment, fluent data collaboration, and advanced features

A live case will be proposed on the basis of detailed study of Navisworks and STADD. Project that it will be used for onsite and offsite related issues and their solutions as well as to Improve productivity, coordination and consistency of data and its visualization in Structural engineering practice

Working Structural Drawing

Working drawing drafted on AutoCAD 2020.The drawing includes ground floor plan, centerline plan with dimension which shows the column grid with proper labeling and spacing dimensions it also indicates the placement of column, beam and load paths. and it also includes structural plan which gives positions of beams, columns.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 6, May 2025 Impact Factor: 7.67

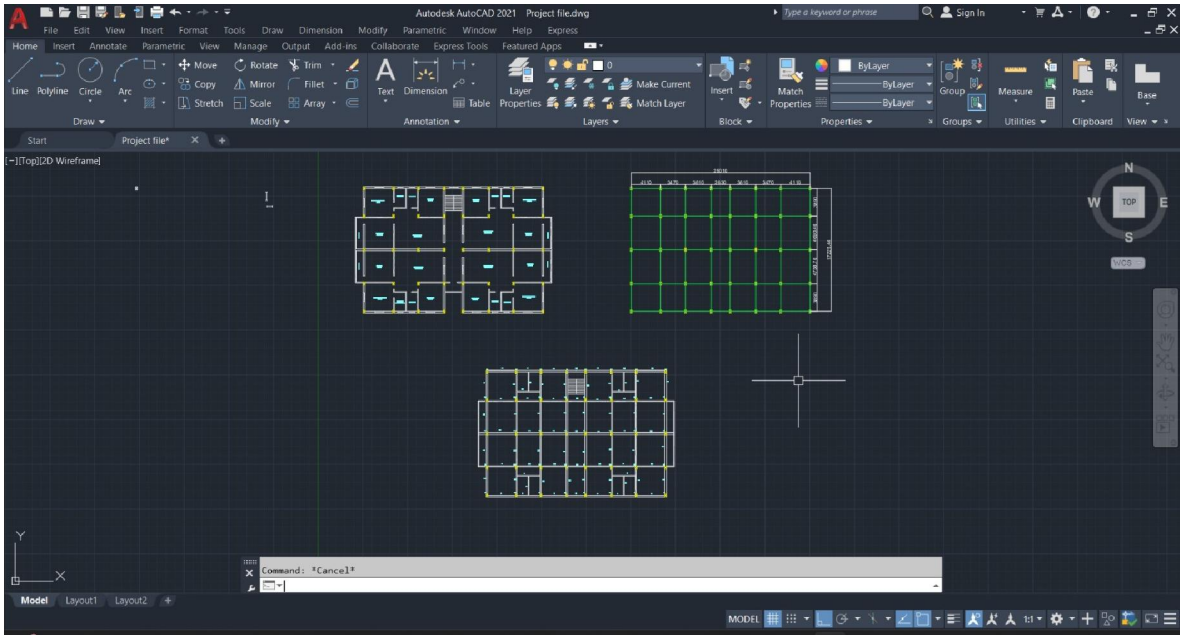


Fig (8): working drawing on AutoCAD

It is important to draw a centerline before start any construction on site, centerline plan is very important on site for column and footing position. Hence finalized center line plan then draft is firstly by then all other plans are drafted as ground floor plan, structural plan with structural beam and column nomenclature.

Load Combination

Considering project location and use of site area Loades can be form by application of all factors of safety. load are as follows

- Dead load (asper IS875 part-1 code)
- Live load (asper IS875 part-2 code)
- earthquake load (asper IS1893 code)
- Wind load (asper IS875 Part-3 code)

Minimum load combination considers for structure is = 0.9 x dead load

Maximum load combination consider for structure is = 1.5x (dead load x live load)

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

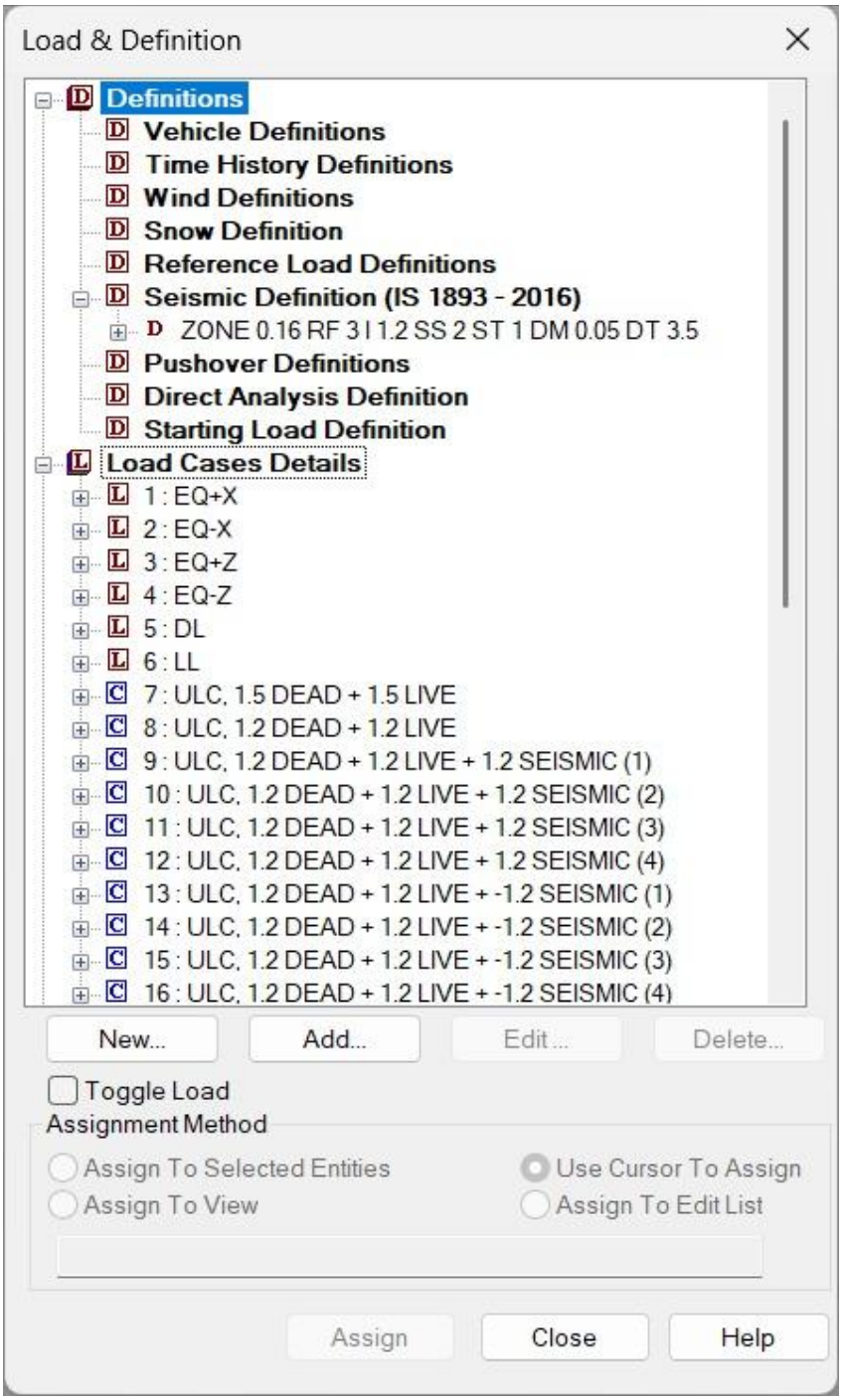


Fig (9): load case detail on STAAD PRO

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

Analysis and Design of Structure

After considering all literature review the best and suitable software for design and analysis is STAAD PRO. The result given by STAAD PRO analysis the member specifications were import. None of the member is failing for given load condition. The next fig shows analysis of structure for max load combination. Finger shows maximum deflection of member at mid span of each beam.

Although STAAD PRO shows beams and column are not failed for maximum loading condition. Hence structural members are ready and correct for given load combination and can be used for next process which is BIM application by using Revit. Although Revit required detail and clear AutoCAD plan as it would import to Revit floor plans for respected floor.

The size of columns and beams depends on span and loading. Generally, the depth of beam varies between span /10 to span/12.Width of beam should be less than width of columns to avoid overhang in beam. Supports are assigned at the base of the columns of the frame. Generally fixed supports are assigned so that columns will be fixed in its position. A fixed support has restrained against all direction of the moment.

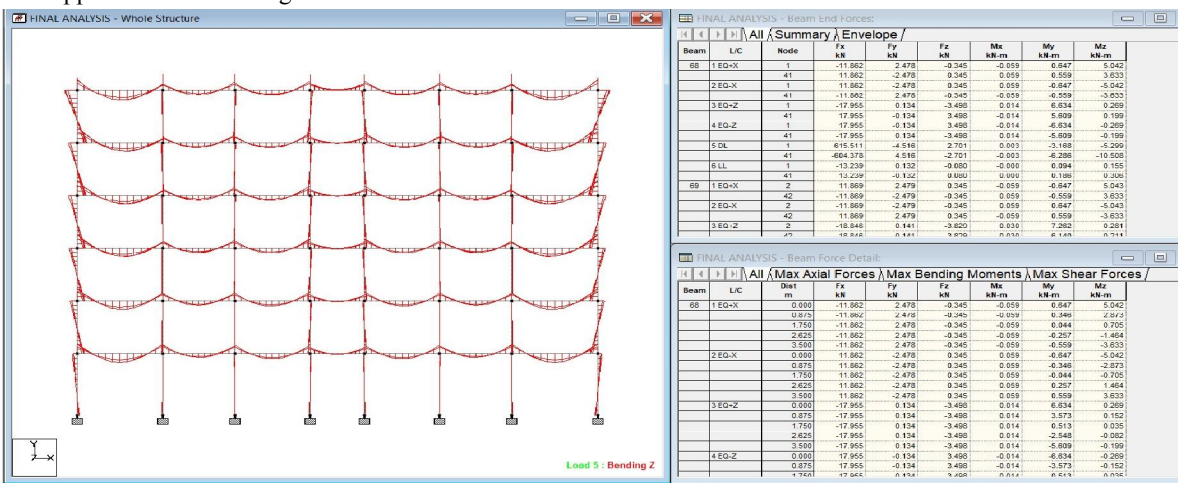


Fig:(10) analysis of structure on STAAD PRO

Structural Design Report by STAAD PRO

As skeleton working done on STAAD PRO the result output is in the STAAD PRO report format which is used for illegal information about structural member during construction phase. STAAD PRO repost shows column design for working load combinations as well as beam for the same working load combination. Report shows reinforcement detail for each member used in design phase.

DOI: 10.48175/568

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

```
BEAM

             ====================================================
             IS 456 - 2000  B E A M   D E S I G N   R E S U L T S
             ====================================================


 ============================================================================
                IS-456    L I M I T    S T A T E    D E S I G N
               B E A M  N O.     108   D E S I G N  R E S U L T S

       M30                    Fe500 (Main)              Fe415 (Sec.)

     LENGTH:  4110.0 mm      SIZE:   300.0 mm X  600.0 mm   COVER: 30.0 mm


                      SUMMARY OF REINF. AREA (Sq.mm)
 ----------------------------------------------------------------------------
 SECTION      0.0 mm     1027.5 mm     2055.0 mm     3082.5 mm     4110.0 mm
 ----------------------------------------------------------------------------
  TOP          288.15        288.15        288.15        288.15        288.15
 REINF.       (Sq. mm)      (Sq. mm)      (Sq. mm)      (Sq. mm)      (Sq. mm)

 BOTTOM       288.15        288.15        288.15        288.15        288.15
 REINF.       (Sq. mm)      (Sq. mm)      (Sq. mm)      (Sq. mm)      (Sq. mm)
 ----------------------------------------------------------------------------


                      SUMMARY OF PROVIDED REINF. AREA
 ----------------------------------------------------------------------------
 SECTION      0.0 mm     1027.5 mm     2055.0 mm     3082.5 mm     4110.0 mm
 ----------------------------------------------------------------------------
  TOP         4-10d         4-10d         4-10d         4-10d         4-10d
 REINF.    1 layer(s)    1 layer(s)    1 layer(s)    1 layer(s)    1 layer(s)

 BOTTOM      4-10d         4-10d         4-10d         4-10d         4-10d
 REINF.    1 layer(s)    1 layer(s)    1 layer(s)    1 layer(s)    1 layer(s)
```

Overall Structural Design Report by STAD PRO

```
      **************  CONCRETE  TAKE OFF  **************
            (FOR BEAMS, COLUMNS AND PLATES DESIGNED ABOVE)
 NOTE: CONCRETE QUANTITY REPRESENTS VOLUME OF CONCRETE IN BEAMS, COLUMNS, AND PLATES DESIGNED ABOVE.
       REINFORCING STEEL QUANTITY REPRESENTS REINFORCING STEEL IN BEAMS AND COLUMNS DESIGNED ABOVE.
       REINFORCING STEEL IN PLATES IS NOT INCLUDED IN THE REPORTED QUANTITY.

      TOTAL VOLUME OF CONCRETE =       383.8 CU.METER

                    BAR DIA         WEIGHT
                    (in mm)        (in New)
                   --------        --------
                        8             66383
                       10             65934
                       12             87844
                       16              5946
                                  ------------
                     *** TOTAL=       226107

 375. FINISH
```

Fig:(13) schedule of steel quantity on STAAD PRO

The fig above shows the total steel quantity used in overall structure. Which again differentiated between bar diameter used on whole structure.

DOI: 10.48175/568

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

BAR DIA (MM)	WEIGHT (N)
8	66383
10	65834
12	87844
16	5946
TOTAL	226107

Visualization by BIM

• To fulfill the purpose of project, structural modeling done on Revit 2021.
• By creating new levels on blank model which are foundation level, ground level, roof level.
• Then Autocad plan for sepret level are inserted on respected levels.
• By crating all level beam and columns placing with accurate alignment is done.
• After all these process 3D view of respected model is shown below.

Although Revit required detail and clear AutoCAD plan as it would import to Revit floor plans for respected floor as mention above in point (6.3). In this model all levels of floor are cleared but not the position of all structural element and project base point.

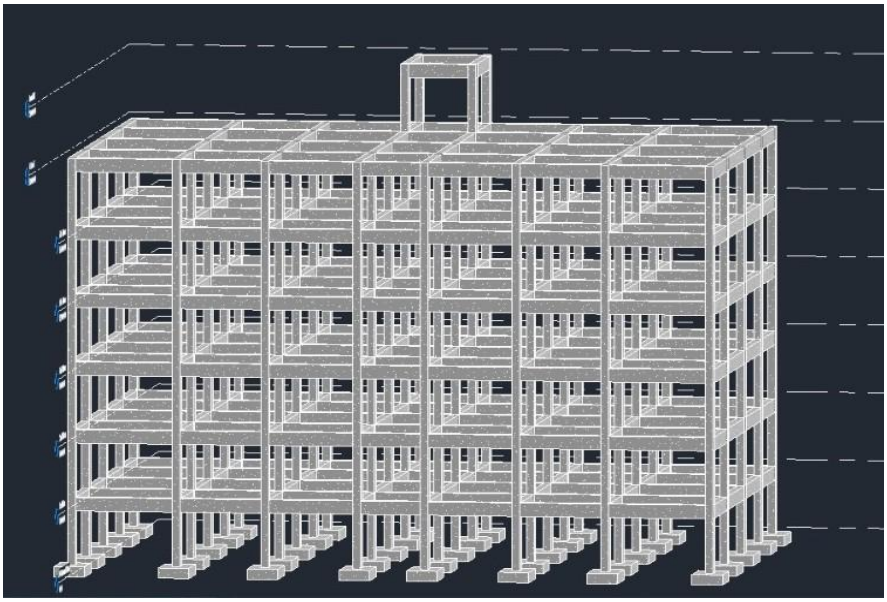


Fig:(14) (R0) 3D model on REVIT2020

Modeling On Revit 2021

• To fulfill the purpose of project, structural modeling done on Revit 2021.
• By creating new levels on blank model which are foundation level, ground level, roof level.
• Then autocad plan for sepret level are inserted on respected levels.
• By creating all level grids are placing with accurate alignment is done. by then foundation given with dimension are model considering centerline plan
• After all these process 2D view of centerline of respected foundation is shown below.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

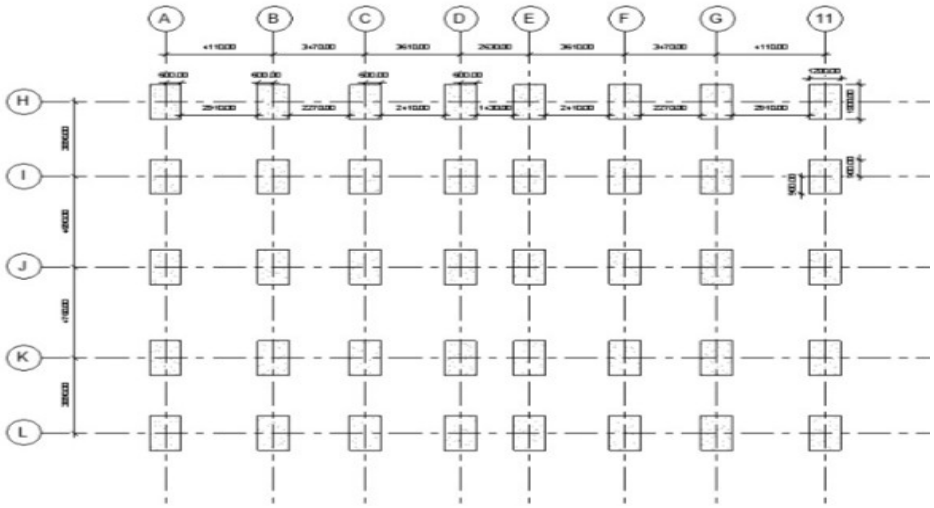


Fig:(19) centerline plan Revit2020

Clash Detection

Now after completion of modeling the next step is to detect clash between the element structural as well as architectural elements. Clash detection is important process in BIM process completion without clash detection BIM process couldn't be a complete complex of structure or building itself. Clash detection is done by Navisworks. In this paper Navisworks 2018 Is used for clash detection. Navisworks works on principal of induvual element ID clash with the other element ID. By that clash can be identify between different elements. For that need to prepare for test so that Navisworks can able to identify where to detect clash on particular area of identification. The test are as follows

Column Vs column
Beam Vs beam
Slab Vs slab
Column Vs beam
Column Vs slab
AR Wall Vs AR wall
AR Wall Vs column
AR wall Vs slab

Table :(1) test combination

After preparation of all test on Navisworks are clarified for next process which is selection tree. Selection tree is process for selection of different type of structural element and architectural element separately. Structural element consists of column, beam, slab and foundation also ramp. And architectural element is architectural wall, window, door, etc.by selection different type of elements as requires for various type of test mention above. By then process is become simple for test between the elements. Select both side item in selection box than after run test button gives a number of clashes detect between each test. the last work is to wright a report on test which can also done by Navisworks by clicking button wright report, report show with element id of both clashing element with each other also their type of clash which differ in soft and hard clash.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

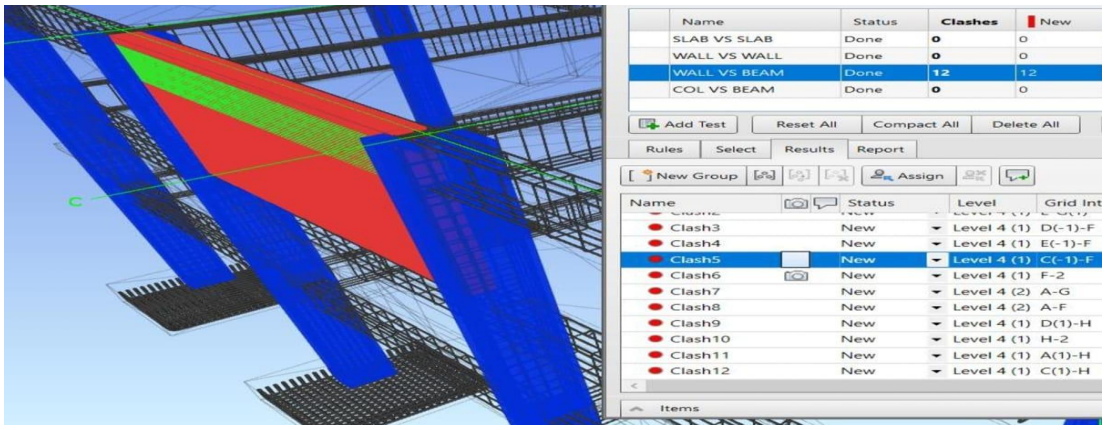


Fig:(22) clash test by NAVISWORKS2018

Clash report shown by Navisworks as shown in fig which refer that only architectural wall clash with beam so that there are 12 clashes shown by Navisworks with different ID of selection. All other clashes are shown as zero that means other elements are not a clash with each other neither architectural with architectural nor structural with structural element or with each other structural and architectural element.

All clash can be solved by visual expression or referring initial AutoCAD plan. In this case lintel level base point was shifted by 136mm in vertical direction and 80mm in horizontal direction so the clash between architectural wall and structural member that is beam accorded. It is resolve by shifting lintel level AutoCAD level by given mistaken spacing initially also by adjusting architectural wall height.

Note- for Navisworks clash detection Revit file must be exported to Navisworks and save with “nwd” format

Clash Resolution

Above point shows the clash in model so has to resolve the clash before end point conclusion and final submission of the model. The Navisworks 2018 report shows the 12 wall and beam clash which can be resolved by again revit2021. While resolving clash the point was observed that lintel level floor plan was shifted from its initial position with refer to project base point level base point was shifted.

The below fig shows the 12 hard clashes between wall and beam also it show the each element ID as highlighted in yellow color.

```
WALL VS BEAM Clash
Tolerance:      0.001m
Total:  12
New:    12
Active: 0
Reviewed:       0
Approved:       0
Resolved:       0
Type:   Hard
Status: OK

------------------


Name:   Clash1
Distance:       -0.070m
Image Location: WALL VS BEAM_files\cd040001.jpg
HardStatus:     New
Clash Point:    18.270m, 1.449m, 4.250m
Grid Location:  E-F : Level 4

Item 1
Element ID:     397955
Layer:  GROUND LEVEL
Path:   File ->PROJECT ME DRAFT 2.2.nwd ->GROUND LEVEL ->Walls ->Basic Wall ->Generic - 230mm Masonry ->Basic Wall ->
Item Name:      Masonry - Concrete Blocks
Item Type:      Solid

Item 2
Element ID:     399407
Layer:  ROOF LEVEL
Path:   File ->PROJECT ME DRAFT 2.2.nwd ->ROOF LEVEL ->Structural Framing ->Concrete-Rectangular Beam ->300 x 750 mm
Item Name:      Concrete, Cast-in-Place gray
Item Type:      Solid
```

Fig:(23) clash report by Navisworks 2018

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

Clash Free Model

After getting report on clashes, all hard clash shown by Navisworks clash to be resolved easily as Navisworks gives each element ID. By given ID of element find each element and remove clash between the element. While removing the clash one should refer the architectural and structural plan so that will not go out of the line while modeling the structural element.

As removal of all clashes again need to export to Navisworks, for the clarification on clash free model. Navisworks shows zero clash till the time process will counting for clash free model. Removal of hard clash are necessary and important but not the soft clashes, soft clash can be ignored. Hard clash may cause major quantity change and defect in structural model aesthetically.

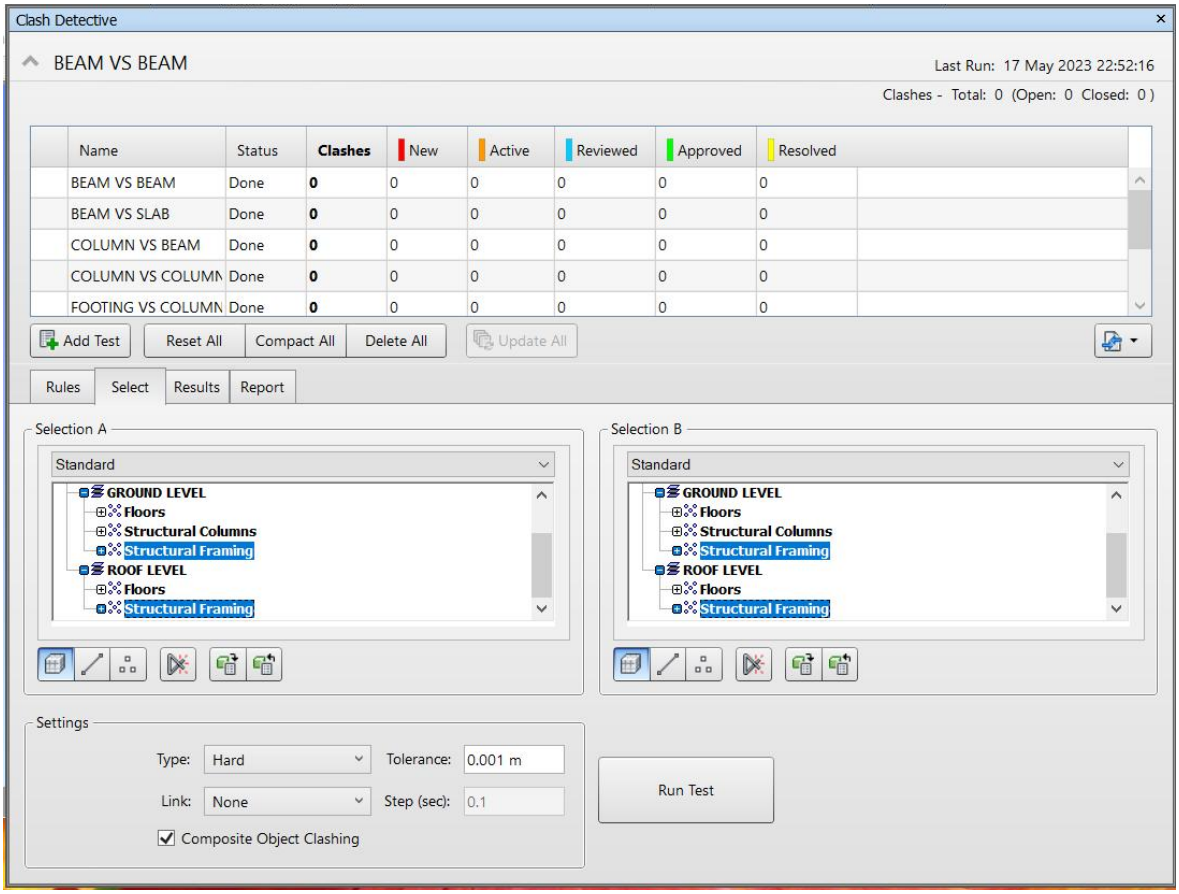


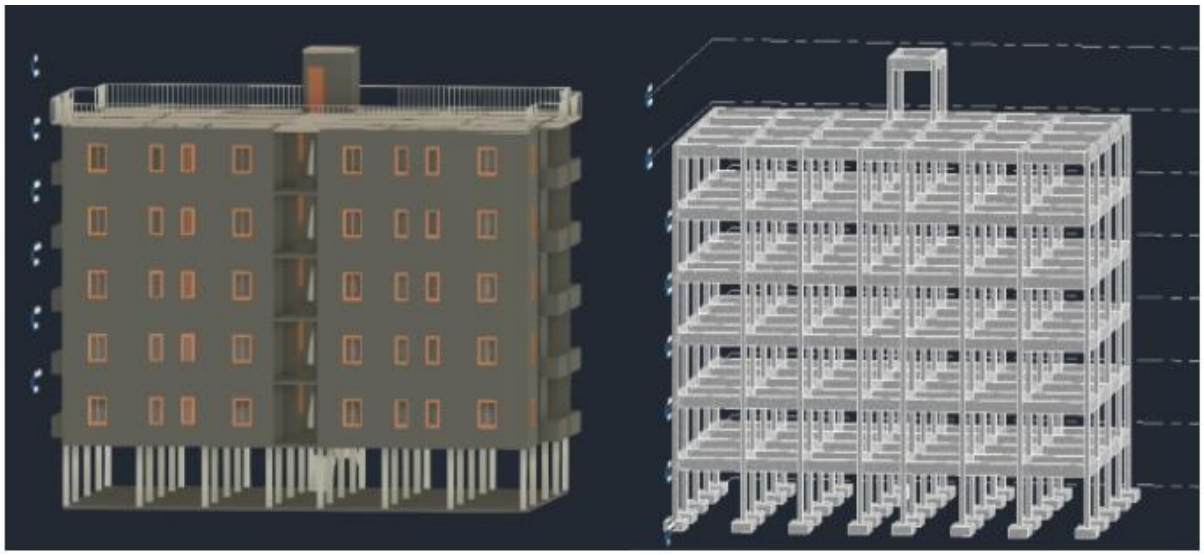
Fig:(24) zero clash report by Navisworks 2018

Revised Model (R2)

After resolving all clashes given by Navisworks. For zero clash detection model has been finalized for final submission call as clash free model. And the model revision is taking place so model called to be (R2) that is revision second. These all records are published on BIM 360 platform or else it is with BIM coordinator. Above model is (R2) which is consist of all level which are foundation level, ground level, lintel level and roof top level. The levels heights are as per AutoCAD drawing details. In the model both structural and architectural elements are presented. This is 3D visualization overall plan of error free model this model preparation and sheet are directly used for construction which is GFC drawings that is Good For Construction.

DOI: 10.48175/568

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67



1) Architectural plan 2) Structural plan

Fig:(25) final model with ST-AR by revit2021

Discussions

BIM improves workflow efficiency as it follows all process in sequence. Architect and structural designer are iterative throughout the process that have traditionally been intensive. Architects, structural engineers and builders all able to view information and use different design templates at the same time of modelling. Different aspect of models could be made to show variations. If any changes are made, needs to care be taken that all documentation is updated as per revision made so that all revisions changes are in digital form.

The collective utilization of information so that edits made in one and other format are automatically throughout the system. Approaching any revise design through database storage is easy to manually design documents such as schedules, colour filled diagrams, drawings and 3D models.

• The amount of time it takes to redo work on a plan is reduced.

• Workflows will never produce errors

BIM provides a stable platform for computer system and engineer. A BIM process collaboration and also it provides a store the architectural and design data which can be used for 3D modelling can be uploaded on BIM 360 platform. This process includes design and structural approach, with aesthetic visualization for the creative changes to new type of materials and design concepts.

• paint to walls.

• interior features.

• Testing the aesthetic visuality

The ability of process is architects can see and test their plans before construction and project designs by that improved plan efficiency can be possible. projects can be tested for long-term. Iteration between designer and architect can be undertaken so possibility to achieve best practice designs. Also schedule of quantity can be approachable for cheaper construction models and efficient use of materials. BIM helps clients to engage with projects throughout the process. The 3D models you can use for design purposes and also it is easier to share ideas. 3D views of models make it easy for everyone irrespective of specialized in architectural training to view floor plans and visualise the final model after completion. Having a 3D model of project has now become part of construction process. It is impossible to view in 3D modelling without BIM data. simple

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

But BIM creates 3D views that represents the part of the design process. It is simply one of the ways in which project can be presented to client in simple the 3D model created on BIM360 platform allows to accessibility, enabling anyone to everyone who has been working for project, they can explore other discipline like structure architecture and MEPF. Only if they have the correct permission. This helps design teams, modelers and architects become more proactive in their workflow for GFC.

Bonus Fact About BIM:

The special characteristic of BIM is that its revision storage methodology. Creating model for design which allows for collaboration, modelling and workflows. However, it also makes the process easy to overlay many more information, a process also consists of other dimensions that 3D by means the terms like 4D, 5D and 6D.

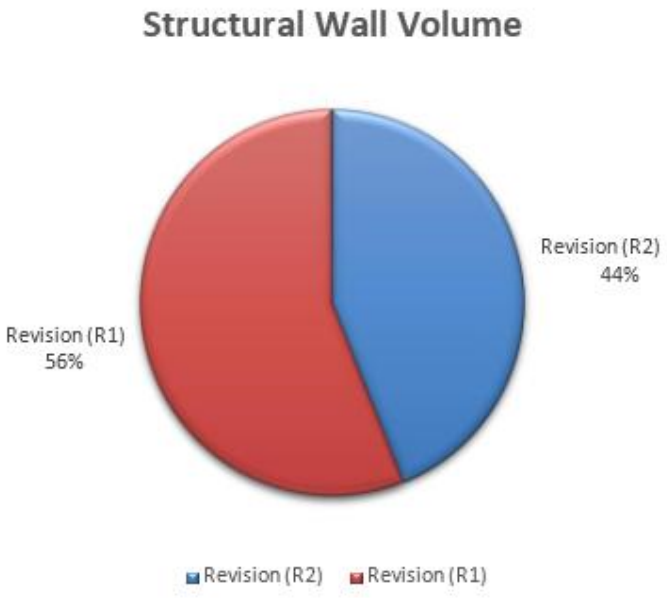
• 4D: construction sequencing. To provide detailed information about build order within the model.

• 5D: cost. BIM allows for the overlay of construction product and installation costs, by that reduction in construction cost project.

• 6D: lifecycle information. Cost projections can be extended up to estimate maintenance and operational cost of an asset. This can also contain information about maintenance and replacement cycles of a structure.

Result:

In this report there were two numbers of revisions are made, which are revision (R1) and revision (R2). Revision (R1) basically a model with initial stage without any clash detection. And revision (R2) is clash free model, all clash detections are done by Navisworks 2018 as mentioned in early topics The schedules of structural elements are made before and after clash resolution. Total Quantities of structural framing, structural column, wall and slabs are compared with revision one and revision two that is (R1) and (R2). Chart for comparisons between these two revisions are given below with help of graph format.



As pie chart diagram shows that revision (R1) volume is 6% greater than that of revision (R2)

Similarly, all the structural members are compared with each other for every revision the results are given below. The comparisons between revision of structural elements are as follows

1. Structural column
2. Structural framing
3. Slab

The pie chart diagram for all this schedule are comparisons between revision (R1) and revision (R2).

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

Observation:

All the quantities given by Revit schedules are compared with each other so that can able to understand the how much it will affect the model without been clash resolution.

These chart shows that there is 2% of increases in quantities in 1st revision so it has to important to remove clash before construction.

All of those clashes between structural elements were solid clash which eventually affect the quantity there by construction cost of project.

It observed that clash between the element were happened because of lintel level drawing was shifted by 80mm horizontally and 136mm vertically. This could happen on construction site but with process the BIM modeler and coordinator can initiated the defect in structural drawing and remediations could easily handover to structural discipline. For a practical reason it can be very costly for client side, it will be because of waste of material, waste of time, Labour cost etc. also re-woke. So, it is helpful for client and all the discipline to follow BIM process and maintained recorded for the same.

CONCLUSION

• This research enhances the speed of construction by resolving all clashes before the construction started.

• It gives smooth coordination between structure and architecture by considering all factors. It also enhances design flow at construction site.

• It gives all detailing which are required for construction which are column details, foundation details, beam details etc.

• It also helpful to produce error free documentation.

• It can create "N" no of revision easily with proper tracking of workflow.

• It also gives schedules for each member used in construction considering architecture and structural member.

• It provides drawing and detailing sheet for onsite construction directly.

• To take records of all changes made during construction phase during revision.

• To schedule the quantity in early stage so that there will be no changes of exceeding budget.

• It allows MEPF, structural engineer and architecture to manage project more effectively as it records and co-ordinate between all these disciplines.

• Anyone can understand the project phase and aesthetic of Project after completion by viewing the 3D view from all aspects.

• Anyone who has been working on project can view other discipline so that they could understand the project in all other aspect and make changes accordingly in their respective area of discipline. (Only for small changes which would not be affect structure in any condition)

• In comparison of Revision (R1) total quantity and Revision (R2) total quantity, Revision (R1) quantities are exceeded by 12% than that of Revision (R2) total quantity. As considering all aspect of construction of RCC members total cost for 1 square per meter is approximately 780 Rs. / sq.m. So as from results (R1) is not economical as it could take approximately 1 lakh 50 thousand more than (R2). Without considering any rework, labour and machinery cost etc. for the project. (R1) is time consuming because every problem couldn't get identify until the project is in its construction phase.

REFERENCES

[1] Ford, S., Aouad, G., Kirkham, J., Brandon, P., Brown, F., Child, T., Cooper, G., Oxman, R., Young, B., An information engineering approach to modelling building design, Automation in Construction 4(1), pp. 5-15. (2019)

[2] Sacks, R., Eastman, C.M., Lee, G., Parametric 3D modeling in building construction with examples from precast concrete, Automation in Construction 13(3), pp. 291-312. (2017)

[3] Migilinskas, D., Ustinovichius, L., Computer-aided modelling, evaluation and management of construction project according PLM concept, Lecture Notes in Computer Science 4101, pp. 242-250. (2016).

[4] Eastman, C., Teicholz, P., Sacks, R., Listo, K. BIM handbook: A guide to building information modeling for owners, managers, designers, engineers, and contractors. Hoboken (New Jersey): pp. 1-490. (2018).

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

[5] Smith, D. K., Tardif, M., 2009. Building Information Modeling: A Strategic Implementation Guide For Architects, Engineers, Constructors. Real Estate Asset Managers. pp. 19-216. (2020)
[6] Popov, V., Juocevicius, V., Migilinskas, D., Ustinovichius, L., Mikalauskas, S. The use of A Virtual Building design and Construction model for developing an effective Project concept in 5D environment. Automation in construction 19(3), pp. 357-367. (2021)
[7] Froese, T. Future directions for IFC-based interoperability, ITcon 15(8), Special Issue IFC - Product Models for the AEC Arena 15(8), pp. 131-246. (2018)
[8] Fischer, M., 2008. Framework & Case Studies Comparing Implementations & Impacts of 3D/4D Modeling Across Projects. CIFE Technical Report pp. 1-250 (2018)
[9] Thomassen, M., 2011. BIM & Collaboration in the AEC Industry. Construction Management, Master's (MSc) Thesis, pp.1-160. (2021)
[10] Amor, Tomas, Challenging traditional design with BIM. StructureMagazine, pp. 36-37 (2017).