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Reviewing And Resolving Clashes in Revit Wall and Structure Family in Commercial Building Project

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ABSTRACT

Building information modelling is the Most innovative thing that has happened to the AEC industry in recent times. It has led to a transition from 2d drawings to Smart 3d models full of Information. Much has been discussed about the benefits of BIM and its influence in the Life's of Architects, engineers, Builders and all the stake holders of a Building construction project. One of the major benefits of BIM has been influential In Reducing the errors at construction site by detecting clashes in Design and allowing the Designers to modify or rectify the design before it being constructed. This paper studies this Aspect of Clash detection of BIM in detail. Many software's are used in BIM to get the desired outputs in 3d model, this paper discusses and analyses the Clash detection tool in BIM with a Live project case study in Pre construction stage in Revit 2022 and concludes with the Results and findings of the study.

Key Words: *BIM, Revit, Clash Detection*

INTRODUCTION:

Building Information Modelling (BIM) is defined by Wikipedia as the process of generation of and management of building data during its life cycle using three-dimensional, real-time, dynamic building modelling software leading to decrease in wasted time and resources in the Design and Building of construction. Building information modelling is an intelligent and smart model that has data which is collected in it since creating the model from its inception to final completion. The Difference between traditional CAD drawings and BIM is the amount of Intelligence provided to each component in the building like wall, column, Door or an air conditioner.

The BIM Process involves all the stakeholders involved in a construction project like an architect, civil engineer, site manager, Surveyor, Interior designer, mechanical engineer, Plumbing engineer etc. All these stakeholders provide different and calculated data to the BIM model in real time and the information gets stored in the Model. These blocks have information stored in them that are useful throughout the life cycle of the project. related to the Design. BIM is not software it is a process of production of intelligent Models for Design, Construction, monitoring and Facilities management. It is useful in Pre construction, Post Design, During the site construction and after the construction is completed.

The "intelligence" attributed to the objects includes parametrically-defined graphical and non-graphical information, giving the architects, MEP engineers, and contractors the ability to represent geometric and functional relationships between building elements**.** If a small change like changing the size of a door is done to a single door in any place in a model, the entire Elevations, sections, schedule, quantities is automatically updated without any error. That is the power of BIM in architecture. Because of this aspect of BIM, it has wide range of benefits.

BIM is used extensively by architects for designing Buildings, developing detail drawings, making photo realistic 3d visualisations, calculating Building schedules. BIM is used by civil engineers for tracking progress at site, construction sequencing, Project management and site management. BIM is sued by Quantity surveyors for taking off exact and accurate building estimate. BIM is used by MEP engineers for exact designing of cooling systems, calculating Design

loads of equipment's and designing efficient system for services. Contractors and Subcontractors use BIM to make accurate 3d shop drawings for construction.

LITERATURE REVIEW

It is important to evaluate the cost effectiveness of BIM for an overall construction project and its benefit to Finances in construction process. Brittany K. Giel *et.al* Confirmed that the ROI of BIM ranged from 16 to 1,654%. The RFI'S reduced to 34% for a small-scale project and reduced to 64% on a three storied Residential Building, 43 %in a commercial complex., the number of change orders were decreased by 40, 48, and 37%. Racha Chahrour *et.al* confirmed that the savings Due to implementing class detection in BIM saved 20% of project contract value on a multimillion-dollar project, Confirming the benefit of clash detection in Pre construction stage.

Barbara Pedo *et.al* concluded that Early collaboration between all stake holders in a construction site is important for the final design to be clash, automating processes for clash coordination using BIM software reduced the number of clashes. Botagoz Akhmetzhanova *et.al* concluded that the number of clashes in BIM model increase if different stake holders work in different files. It also concludes that in the time of Covid pandemic mostly all the BIM experts worked from home in different files, lead to increased number of clashes in BIM models.

Anthony Okakpu *et.al* Found that the Main reason of high number of clashes between Architecture, Mechanical, Plumbing and electrical systems was the isolated working of individuals in different software's, it emphasised on lack of single platform for all Pre construction Modelling and clash analysis. also, it concluded that low training on BIM lead to increased clashes between models of stakeholder. Anderson O. Akponeware *et.al* Observed that BIM is most innovative and efficient approach in construction Industry in this century. It helps in coordination clash detection and better construction economics. Concludes that the making of a 3D BIM model can be beneficial to even small-scale Residential development in saving cost. Harshil S. Thakkar *et.al* Concluded that BIM use even for commercial redevelopment project led to decrease in errors, reduced cost, increase in quality of project and reduce conflicts at site.

SCOPE OF WORK

The study involves Study of interference of Two main disciplines -Architecture and Structure in the design development stage. In this Project the 3d Architecture Model was created in Autodesk Revit Architecture. The Structural Model with Structural components were created in Autodesk Revit Structure. The Interference analysis and check was done in Autodesk Revit 2022 and Clashes were detected using this BIM tool. The clashes were resolved and a final Clash free model was prepared for further Use.

METHODOLOGY

This Research aims at using Revit 2022 to reduce the problem of using multiple software's for clash detection and resolving in a medium size commercial project and make the BIM model clash free. Autodesk Revit 2022 was used for Designing the floor plan, creating 3d model, running Interference test of all elements. The research focuses on using one single software to create a clash free result.

First the architecture 3d model was created as per the design intent and architect's concept in Revit architecture**.** The architecture Model was shared with the structural consultant for The Positioning of Columns, Slabs, Footings and Beams. The structural engineer created the structural elements as per the structural design for the building in 3d.

The level of Detail was maintained at LOD 300. The created model was reviewed by the architect and checked for clashes. The clashes were then resolved using Interference checking in Revit 2022.

- Preparing the architecture model as per design in Autodesk Revit architecture
- Preparing the structural model in Autodesk Revit Structure as per architecture design
- Collaboration and Interference check of the elements in Revit architecture
- Finding the clashes in the model
- Viewing the clashes in the collaboration view
- Resolving the Clashes
- Conclusion

DATA COLLECTION

The architecture Building 3d for study was created as per the architecture plan in Revit 2022. The total area of the building is 20,302 sq.m. The building is G+20 storied structure with four towers connected with a common floorplate. The building 3d consisted of architecture 3d elements like curtain walls, doors, Windows, façade panels, generic models, lighting fixtures, furniture system, plumbing fixtures. The structural consultant added the structural Floors, structural beams, structural slabs, structural columns as per the Design and structural analysis. Clash detection was done by the Architect who is also BIM coordinator for the project.

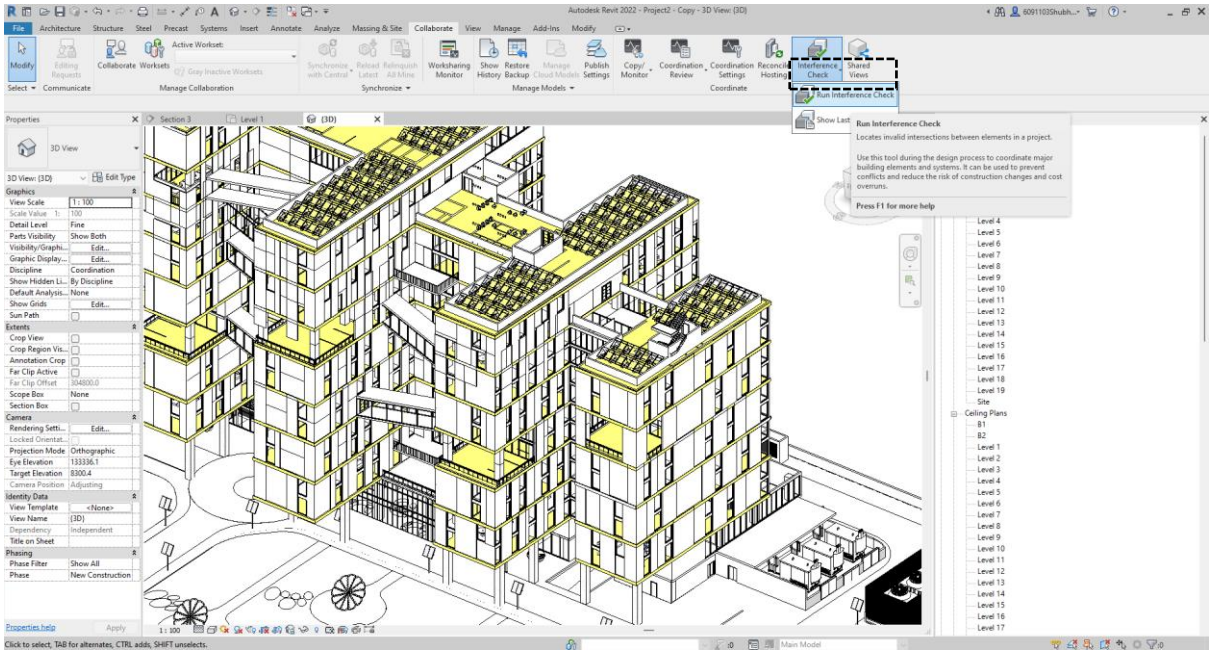
Software used: There are many software's in the BIM industry like Synchro 3d, Autodesk Navisworks. Autodesk Revit was used as it is used by all domains of building engineering and is a globally used software for BIM coordination. Autodesk Revit 2022 was used for creating the architecture model and the structural model.

In the project Revit 2022 version was used which is the latest version right now. After the models are created the Interference check is finally done in Revit architecture.

The architecture model 3d render is shown in **fig(a)** the structural model 3d is shown in **fig(b)**

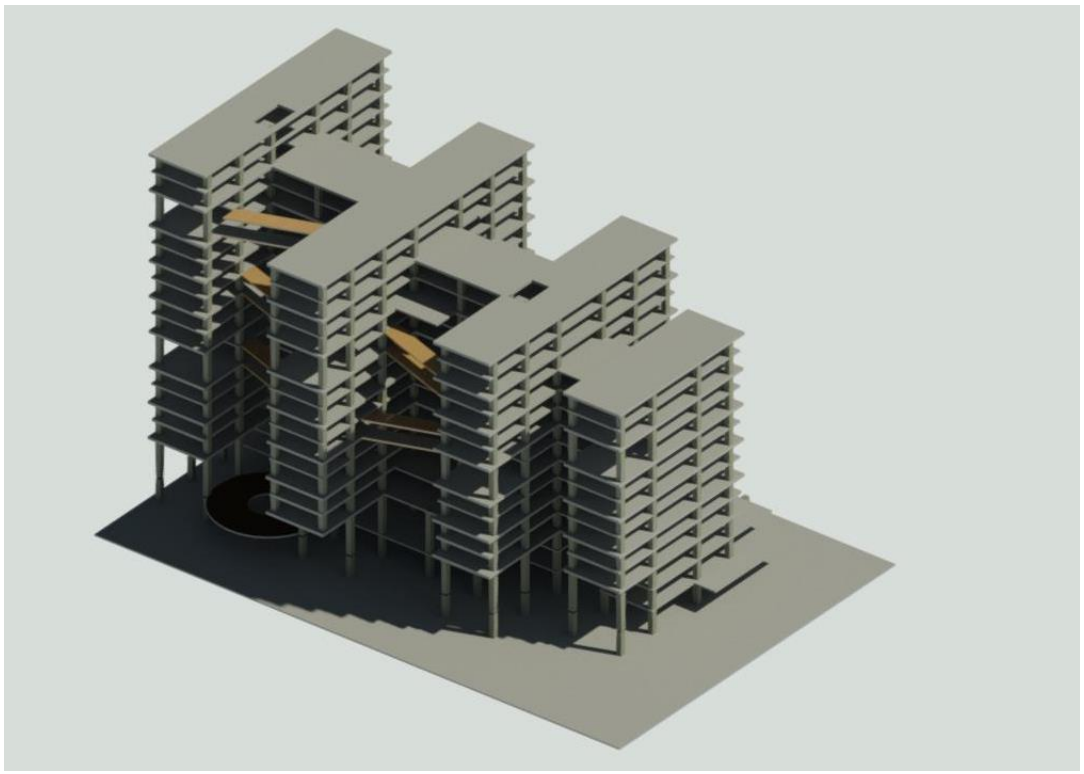
Clash detection process:

To start the Clash detection process. First one need to click the collaborate tab, then click the Run interference Check,



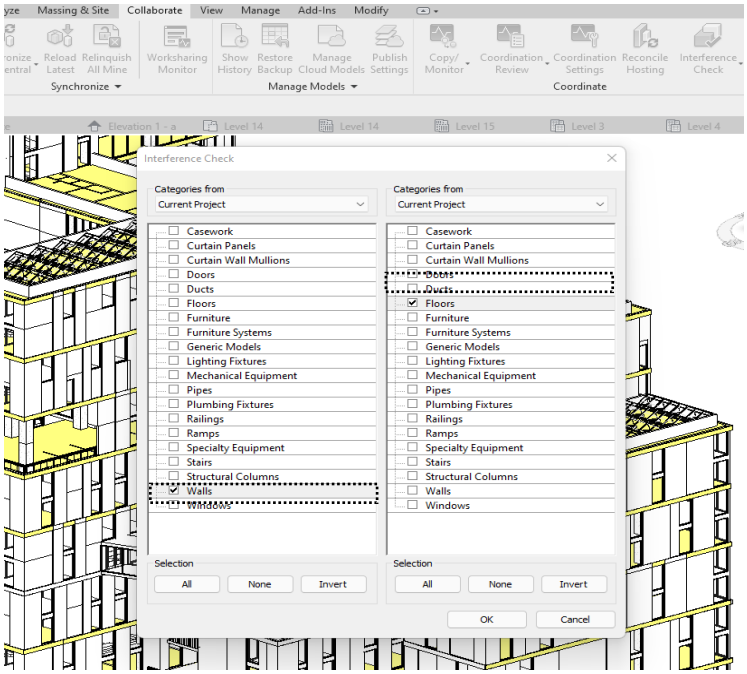
Fig(a) showing the Combined model (Architecture + Structure)

Fig(b) showing the Rendered Architecture model



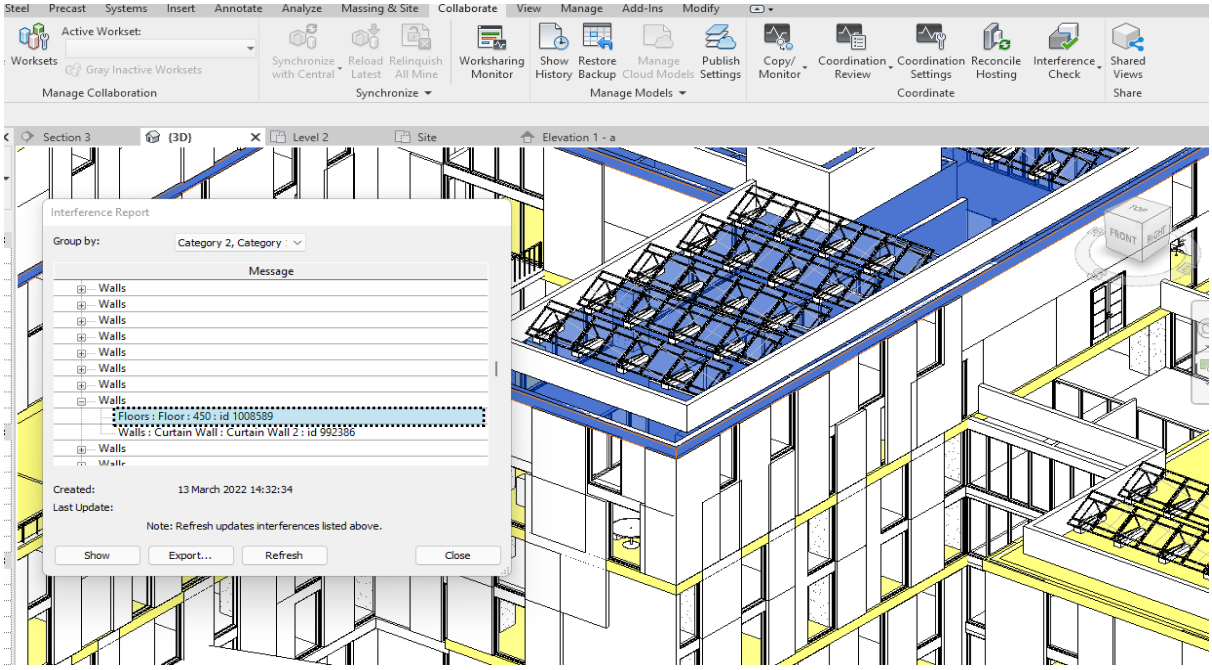
Fig(c)showing the Rendered Structural model

After clicking the Interference check I decided to do a clash detection between Walls (Curtain wall) and the floor. Total 98 clashes were found.

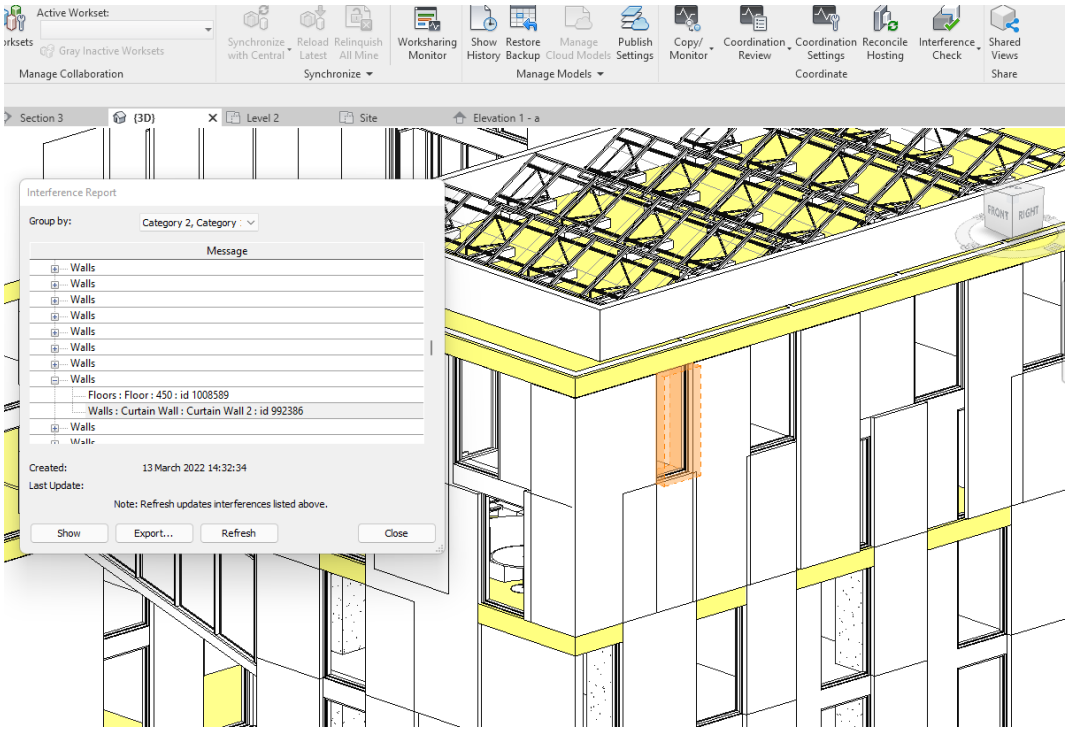


Fig(d)showing the Interference check Tab

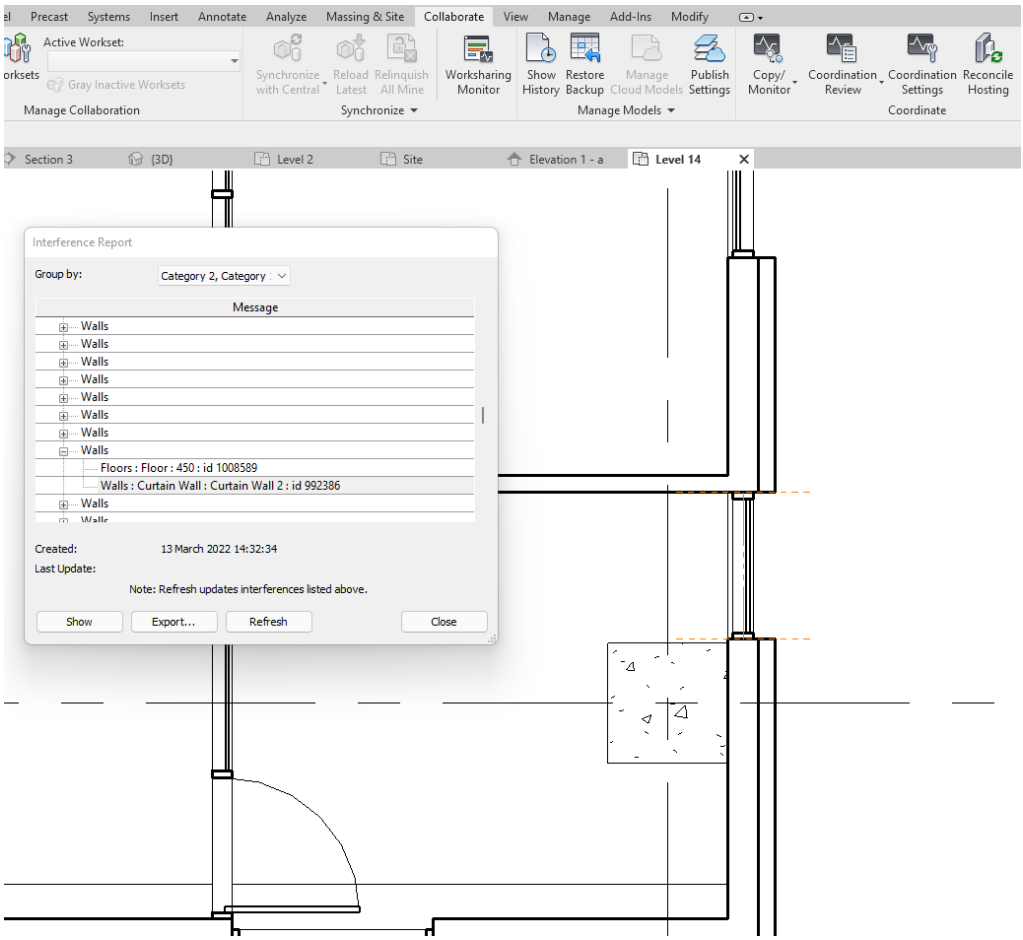
An Inference report is generated showing all the clashes and where the clash is detected. We can select the ID of wall or floor to see the element in the 3D and other views



Fig(e) showing the Floor that is clashing in 3d



Fig(f) showing the Curtain wall that is clashing with the Floor above in 3d



Fig(g) showing the same curtain wall as seen in Plan views.

- The clashes were all identified in the model and resolved.
- After identifying the clash using Interference check tool. It is possible to check clashes between all elements of each discipline. In the above example I demonstrated clash detection of A wall and structural Floor inside the model.

Conclusions

The following conclusions can be derived from the study above

- BIM is the Present-day solution to detecting and avoiding clashes in the construction of Buildings and avoiding mistakes beforehand before these take place at construction site.
- The main reason why so many clashes occur in the construction project happens when BIM is not used in the preconstruction process while designing and design documentation
- Use of BIM for preparing 3d models ensures that the clashes are detected in advance and the clash detected are resolved Virtually in computer before the problem being faced at site.
- Making 3d BIM models ensures that there is clash free construction compared to traditional 2d drawings.
- BIM enabled automated Clash detection is beneficial in saving time than manual clash detection.

- The Use of Multiple software's for clash detection can be avoided for small projects and doing clash detection in a single software is possible.
- The Clash detection in Revit 2022 creates an accurate report of Clashes which can be resolved internally in the same software.
- Using single software for clash detection and modelling enabled easy monitoring of the project for clashes and clash resolving.

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