Clash Detection for Commercial Building – Using Computing Method

Onkar Jagtap[1], Raman Pate[2], Satish Ghavane[3], Omkar Rachha[4],
S.P. Lokhande[5], Dr.N.V. Khadake[6]

[1,2,3,4]-Research Scholar, Department of Civil Engineering, JSPM'S Imperial College of Engineering and Research Wagholi,Pune – 412207
[5,] Assistant professor, Department of Civil Engineering, JSPM'S Imperial College of Engineering and Research Wagholi,Pune – 412207
[6]Professor & Head of civil department, Department of Civil Engineering, JSPM'S Imperial College of Engineering and Research Wagholi,Pune – 412207

Abstract— Clash detection is a critical process in the construction industry that aims to identify and resolve conflicts between different building systems and components. One of the popular tools used for clash detection is Building Information Modeling (BIM) software, which allows architects, engineers, and construction professionals to create a 3D model of a building project. In this abstract, I will focus on how beams are used for clash detection in BIM software. Beams are structural elements that are often used to support the weight of a building. When creating a 3D model using BIM software, beams are added to the model to represent the actual beams that will be used in the construction process.

At the conflict of Elements detection stage, the BIM software compares the location and dimensions of different building components, including beams, to identify any clashes or overlaps. If a clash is detected between two beams, the software highlights the clash and provides options for resolving it. Using beams for clash detection in BIM software helps construction professionals to identify and resolve potential conflicts early in the design process, before construction begins. This helps to guarantee that the finished building project is structurally strong and complies with all relevant safety criteria while also saving time and money..

Keywords - CLASH DETECTION, 3D MODEL, BIM, CAD, MEP, NAVISWORKS, REVIT

I. INTRODUCTION

Introduction to the Building Information System in construction industry; the necessity of BIM system in planning and design of infrastructures, BIM consists of different dimension that is 2D, 3D, 4D, 5D, 6D, 7D BIM which provide duration, timeline, scheduling, cost estimation, operations and maintenance of a building in designing phase (Sabale and Jose 2023).

Building Information Modelling is a clever model-based process that aids in the design, organization, development, and management of buildings and foundations. BIM provides information about specific building components, such as windows, dividers, or chillers, as well as framework and building-wide data and awareness (framework streams or building loads) (Sabale et al. 2023b).

The BIM procedure includes members from the whole task life cycle (modeler, engineer, temporary worker, proprietor, offices the board, and so on.) who all contribute and speak with BIM creators, who are approached to give progressively exact vitality demonstrating information. BIM is to be considered as the way toward making and utilizing computerized models for planning, development as well as activities of building ventures (Tapase et al. 2022). These models join shrewd 2D and 3D objects used to characterize a structure plan, alongside outside variables, for example, geographic area and nearby conditions, into a virtual structure database that gives a solitary, incorporated hotspot for all data related with that building's plan. The "insight" ascribed to the items incorporates characterized graphical and non-graphical data, giving the designers, Mechanical Electrical Plumbing (Sabale and Jose 2021a).

(MEP) specialists, and temporary workers the capacity to speak to geometric and utilitarian connections between building components. This data takes care of an incorporated database, which thus takes care of all structure archives and calendars for the structure venture. At the point when a change is made to the structure model, every single graphical view (plan, height, detail, and other development drawings), just as non- graphical perspectives, for example, the structure reports and calendars, consequently, mirror the change (Sabale and Jose 2022).

To find out clashes occurring using BIM system, during designing phase and execution phase and reducing cost through scheduling for a commercial building (Sabale and Jose 2021b).

II. REVIEW OF LITERATURE

We studied various papers to develop our clash detection using computing methods.

Author shows that the Building Information Model are created, the amount takes off can be produced to give cost estimations on a development venture. Better development planning is achieved through the use of BIM-based 4D booking, which facilitates understanding of the development components and calendar progress. In the end, BIM provides time and cost reserve funds and produces higher-quality development products.

The research shows how BIM technology will benefit for Architect, Engineer and Contractors for estimating and schedule and cost controls. Autodesk Revit is a BIM software for architects, structural engineers, MEP engineers, designers and contractors. Users may obtain the building information from the building models database, create a building and its components in 3D, and mark the model using 2D drawing elements (Sabale et al. 2023a).

The author considered that there is a strong need for tools that may include the wellness in design concept. The ongoing rise of the BIM and the assessment of the virtual structure and development in the engineering, building and development industry are on a very basic level changing the procedure by which structures are planned and built. BIM is fast becoming recognized as the preferred method for communicating the goal of the plan experts to the owner and other partners. This information models can be utilized by different individuals from the plan group to organize the creation of the structure contrast frameworks. Offsite development space provides a number of benefits, including speed, economics, maintainability, and security. (1)

Edger Preto According to Berdej, the creation of engineering design necessitates the involvement of numerous parties engaged in various disciplines, each of which executes its own project in a way that is somewhat disjointed from the others, necessitating project compatibility. The article includes research to assess the usefulness of the BIM concept in the comparison of building services. (Mechanical, electrical and plumbing (MEP)). His work contributes to demonstrating the advantages of BIM in the conciliation and coordination between different agencies, as well as the benefits of its application in clash analysis in an engineering design. (2)

III. Materials & Method

In the writing audit area, a short presentation of BIM-based multi-dimensional demonstrating has been given. The subsequent stage is to research how BIM can affect the customary work process of an AEC venture which includes multiple disciplines and different partners. A logical research procedure dependent on the grounded hypothesis is produced for information assortment and result examination.

The goal of the investigation is to determine problems which emerge while using the BIM framework for business planning, structuring, and execution. working in Pune and Delhi district; right now, models made in various present-day programming resemble Revit Architectural, Revit Structural and Revit MEP. In BIM, 3D models for various sorts such like Structural, Civil, and Architectural and MEP (Mechanical, Electrical and Plumbing). At the point when mix of all these various kinds of models to make a total BIM model there will be odds of Clash between these components.

❖ Determination of the site

- The assortment of the information with the end goal of the task is completed for making a 3D model.
- The locales to be chosen are business working in Pune and Delhi district.
- To accomplish the destinations of the undertaking; the
- information from the locales is gathered which have the accessibility the accompanying plans:
    - Architectural Plan
    - Structural Plan
- Mechanical, Electrical and Plumbing Plans
- The site is chosen based on mechanical arrangements that is Ducting, electrical and plumbing. Each part of the MEP necessity ought to be present.

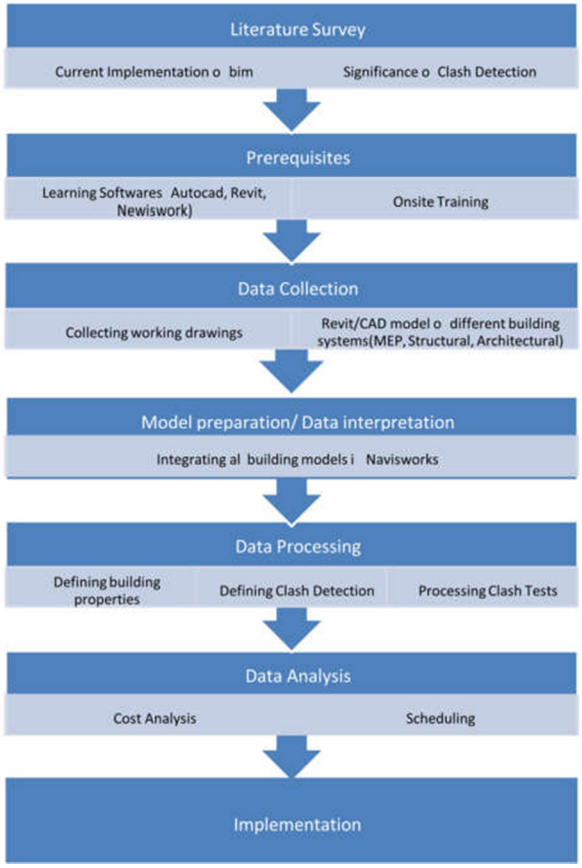

Fig.1 Workflow of Model

IV. CLASH DETECTION

Clash Detection is the technique for reviewing and distinguishing the different interfaces which much of the time happen in planning procedures of 3D models made in various virtual products like Revit Architecture, Revit Structure, and Revit MEP. In BIM 3D models of various sorts such like basic, common, compositional and MEP (Mechanical, Electrical and Plumbing). At the point when mix of all these various kinds of models to make a total BIM on a light table to recognize any Clashes.

There are 3 fundamental kinds of Clash.

- HARD CLASH:

This form of clash occurs when two objects are housed in the same space. such as lower ceiling lights and funnels that pass through partitions. This type of information is loaded into the BIM for showing objects, and hard Clash provides the placement based on geometrical calculations as well as calculations based on semantic and rules..

- DELICATE CLASH/CLEARANCE CLASH

Delicate Clash identifies Clash, which occur when the article requires increasingly positive spatial or geometric resistances, spaces, and cushions within their support zone for greater openness, protection, upkeep, and security. For example, a cooling part would need specific clearances to consider maintenance, access, or security, which a steel bar would void.

- 4D/WORKFLOW CLASH

This type of conflict could involve the hiring of contractual workers, the conveyance of gear for example cranes, bulldozers and materials, and general course of events clashes. For instance, work groups showing up when there is no gear nearby. Since these items are every now and again planned as brief, wrecked, or another timetable so connect them for Clash location to ensure they don't influence to extend.

V. OBJECTIVES

Analysis and Interpretation of all the data collected in BIM system and removal of the clashes encountered.

Cost reduction through scheduling of project.

To offer broad principles for avoiding disputes between various parties when a commercial project is being built.

VI. SCOPE OF THE PROJECT WORK

To provide 5D representation of the building for better understanding.

To decrease in rework by bringing out proper coordination which results in reduction of cost and time

To provide simplified and standardize solution for clash detection process.

VII. RESEARCH METHODOLOGY

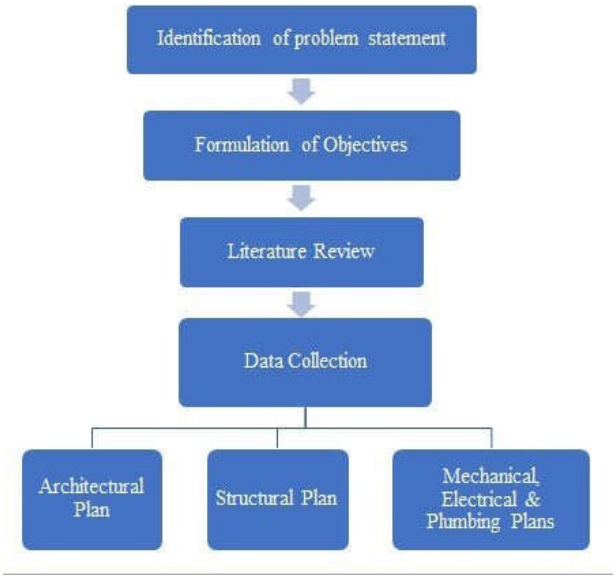

Fig.2 Methodology Adopted

IX. DESIGN & DATA ANALYSIS FLOWCHART

Flowchart of the workflow of software's used for creating the BIM Model to bring out the clash detection in the office building

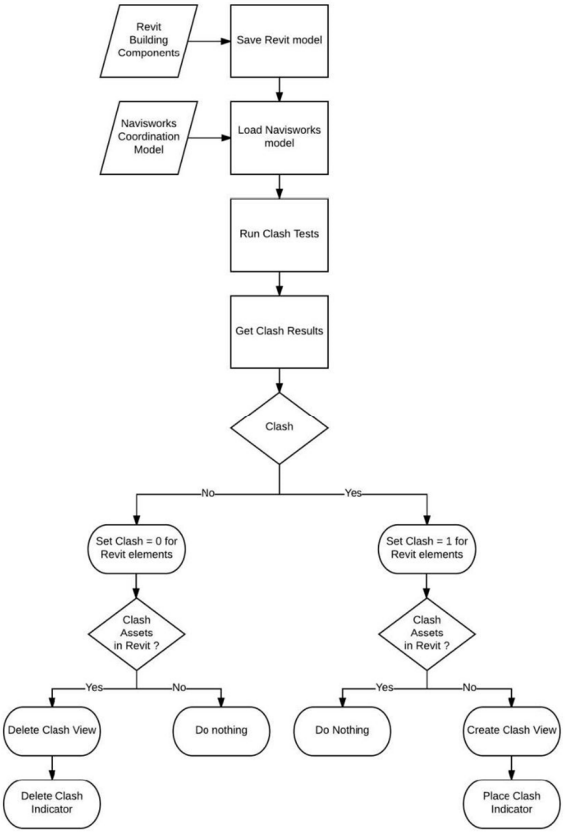

Fig .3 Design Flowchart

This case study consists of following Building Services system of the workspace:

A. Mechanical Ventilation System

B. Public Health Engineering Systems:

1. Domestic System
2. Drainage System
3. Sanitary Fixtures

C. Fire protection System

X. CONCLUSION

Building Information modelling shows great results on projects in terms of performance, time, and cost. Implementing clash detection tools is useful to decrease coordination errors, human errors so that result in high level of accuracy of models. So, this will avoid reconstruction.

Users of Navisworks should first properly set up the components or objects they wish to compare during collision detection under the Batch tab before proceeding with executing a clash test.

Users of Navisworks may accomplish this by going to the clash detective tool, where they can access the Batch tab. One of the most crucial jobs for Navisworks users is to accurately identify conflicts and then classify them in accordance with their similarities. When clashes are grouped together according to their potential to create obstacles for AEC professionals in construction, it becomes easy for them to understand the nature of the clashes.

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