Application of Building Information Modeling in Construction Management with Clash Detection

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Abstract: The development of an engineering design requires the participation of several parties involved in different disciplines, where each discipline conducts its own project in a somewhat disconnected manner from the remaining, therefore requiring project compatibility. In this context, an efficient conflict analysis between disciplines is essential to guarantee a well-developed design. The Building Information Modelling (BIM) methodology and tools associated with it present themselves as an excellent asset to support the process of conflict analysis, as they make it possible to merge all disciplines in an integrated virtual environment. The high level of detail and visualization provided by a BIM model leads to better collaboration between those involved throughout the design, hence resulting in a significant reduction of potential errors during the construction phase. The aim of the present study was to evaluate the practical capabilities of the BIM concept in the conflict analysis between building services, namely, HVAC, Firefighting design, and the structural design. In this work, commercial software such as Revit 2016, and Navisworks Manage were used for generation of 3D model and performing Clash Detection.

Index Terms - **Clash Detection, BIM, Conflict analysis**

I. INTRODUCTION

Building Information Model is virtual construction of building which contains all the data about building like, components, geometry, construction activities, materials used etc. The model can be used to demonstrate the entire building life cycle. (Bazjanac 2006)

A range of disciplines come together to work on different aspects of construction projects. Using the architect design as a reference, structural consultant, MEP consultant, façade consultant (and many others) will each produce their own design. Each design will involve variety of, documents and structured data files having non-geometric data about what is being constructed. It is tough to manually coordinate all the design of construction project and find faults in design. Clashes in design results into cost overrun, delay of project timeline and unsafe working environment. Use of 3D clash detective tool during design phase will reduce conflicts to greater extent and ensures efficient design for project. Building Information Modelling (BIM) is emerging as an innovative way to manage projects. A survey on 32 major projects by Stanford University CIFE showed following result by using BIM in project.

- Reduction in unbudgeted changes was 40%
- Cost estimation accuracy within 3%
- Elimination of 80% time in preparing cost estimation.
- 10% cost saving with conflict analysis.
- 7% time saving in project.
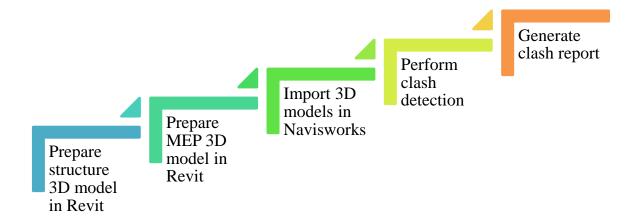
II. RESEARCH OBJECTIVE

- To study various problems in design and coordination in construction industry.
- To improve design and coordination problems with the help of Clash Detection.

III. NEED FOR STUDY

In any multidisciplinary project composite design needs to be inspected before execution starts. Most clashes in design recognize during execution which leads to cost and time overrun. To avoid conflicts between various design use of clash detection with 3D modelling in design phase results in more efficient design.

IV. RESEARCH METHODOLOGY

Steps to perform clash detection

4.1 Data Collection

Data has been collected from residential project situated at Ahmedabad. Data collection includes project information and various drawings. The 2D drawings of the project are adopted for model drawings. These drawings include 2D plans for Lower ground level, upper ground level, structural and MEP drawings for upper ground floor level.

Table 4.1 Data Collection

Location	Ahmedabad
Type of Building	Residential
Type of structure	Frame Structure, B+G+13
Start Date	07/05/2016
End Date	31/12/2019
Flat Area	11,500 sqft
No of Flat	18
No of Blocks	2
Civil work cost	22cr
Total Project Cost	52cr

4.2 3D modelling

3D modelling is critical part of AEC industry because it is related to visualization, planning, cost estimation and design management. Autodesk Revit is widely used BIM tool that satisfy all above requirement. In this research work, 3D model of structure and MEP is prepared using Revit 2016. Levels are created according to section drawings and the plans are imported according to levels. 3D modelling of building starts with R.C.C frame of building which includes column, beam, slab, etc. Properties of column, beam, slab like thickness, length, width, level are created according to design .3D MEP model is prepared with reference of structural model. Figure below shows the 3D structure and MEP models.
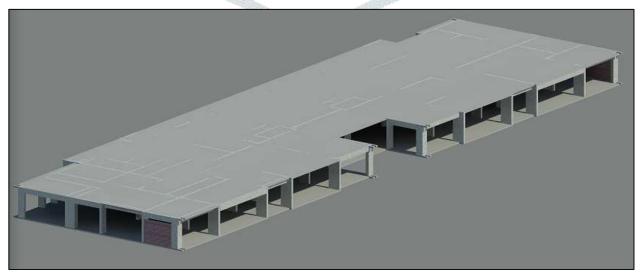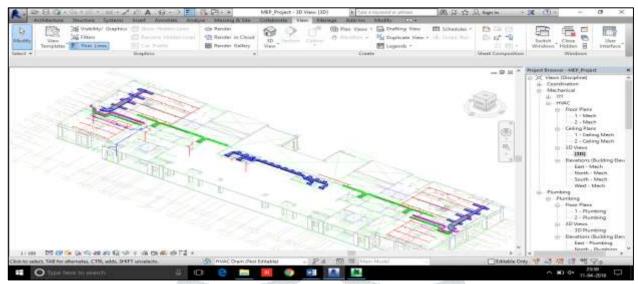

Figure 1: Architectural Model

Figure 2: MEP Model

4.3 Clash Detection

Clash detection is primary BIM tool for any multidisciplinary project where during design phase it is necessary to identify and eliminate clashes in design to ensure smooth flow of construction during construction stage of project. In clash detection test it detects the conflicts between different elements within 3D Building Information Model before actual construction starts, and therefore it optimize time in the construction schedule, reduce costs and change orders. By using clash detection application in AEC industry increase the productivity of design and construction project. In this research Navisworks 2016 is used to perform clash detection test. Two tests were performed 1) structure vs MEP 2) MEP vs MEP.

To perform test, Revit Models are imported in Navisworks. Then click on clash detective tool which will open clash detective window. Then next step is to click on "add test" button, which will allow us to select 3D models for analysis. After performing test, test report is generated from report tab.
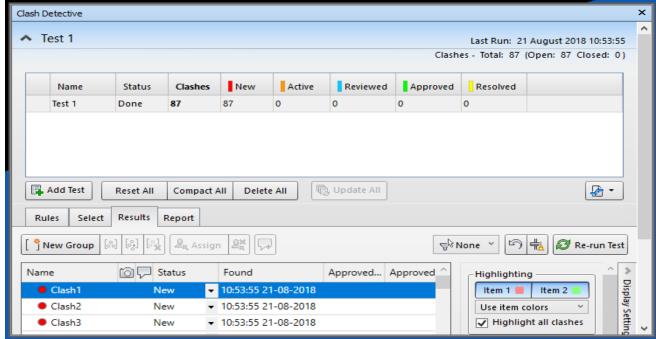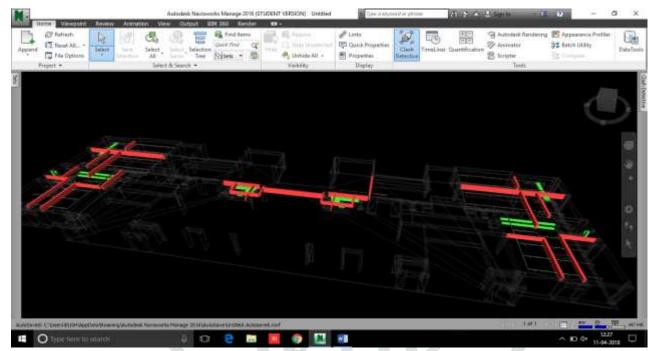

Figure 3: Result of Clash Detection Test
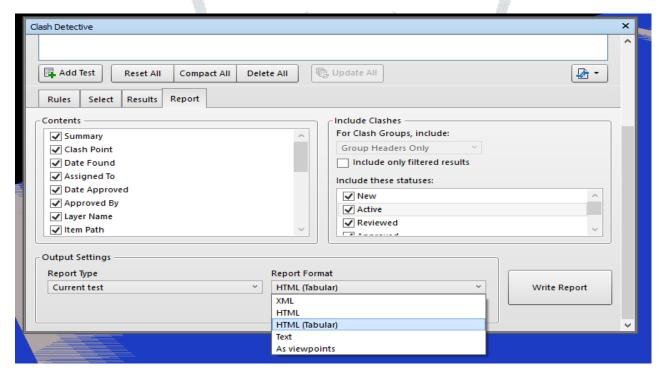
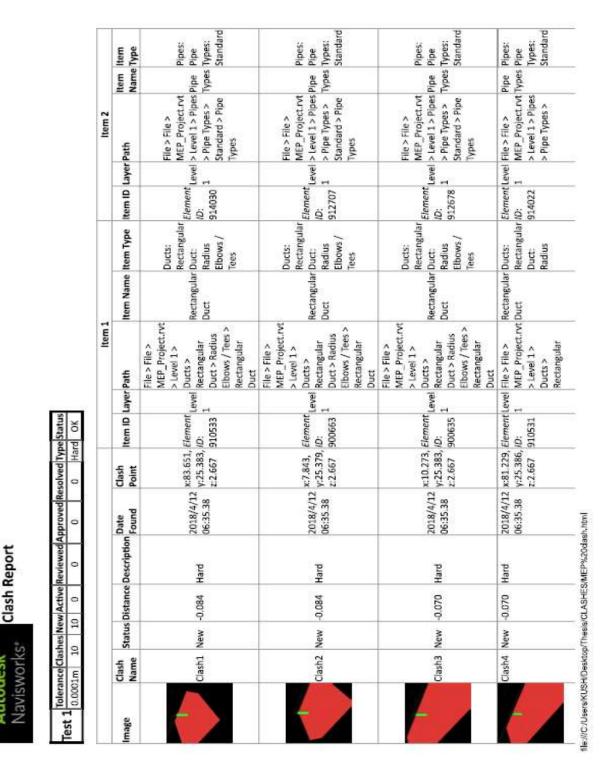*Figure 4: Clashes in Navisworks*

Figure 5: Generating Clash Report

Figure 6: Clash Report in Tabular Format

V. CONCLUSION

Building Information Modelling (BIM) is fast growing within the AEC industry and its application shows countless effects on construction projects in terms of performance improvement and time & cost saving. In India, construction industry is not applying true potential of BIM due to lake of, awareness, knowledge and technical skills. One of the major benefits of performing clash detection is to identify conflicts in design in early stage of project where it is much easier, cheaper and less time consuming to rectify design.

Detecting potential clashes before they occur allows designers to avoid unforeseen costly mistakes and helps in preparing efficient design. In this research, analysis report from Naviswork shows total 93 clashes in design. 87 clashes were identified between structure and MEP services and 06 clashes were between MEP services. These clashes can be eliminated by applying BIM in design stage which leads to smooth flow of construction and saving in time and cost of project.

VI.ACKNOWLEDGEMENT

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