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TO EXTRACT GFC'S FROM CLASH FREE AND WELL COORDINATED REVIT MODEL

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Abstract - *Clash detections is the process of finding where the "Clash" elements of separate models occupying the same space, or with parameters that are incompatible. Finding these inconsistencies is vital, as they would severely impact the construction process, causing delays, design changes, materials costs and a cascade of headaches and budget over-runs. Clash detection was a manual process of overlaying drawings on a light table to visually see clashes a long time ago. 2D CAD operated essentially did not help in this arena . BIM tools can be used for effective and accurate clash detection for 3D digital models. Clash detection is an important and integral part of the BIM modeling process. In BIM modeling, there are several models. They are in the end integrated into a composite master model. This project is about developing Structural and Architectural 3D BIM model and using clash detection tools to detect various clashes and resolve them. These corrected models can be used to extract GFC's (Good for Construction) drawings that are used for on-site execution.*

Keywords: Clash Detection, GFCs, 3D Model Rendering

1. INTRODUCTION

In the last few years the construction industry, the complexity of modern day construction projects has increased and no significant improvement in the productivity of the construction industry has been observed. The productivity of the construction industry has traditionally been much lower than that of other industries because the main reason for this shows to be the incapability of new technologies. As other industries have improved their productivity by using new modify methods and techniques, the construction industry is also applying new technology such as building information modelling (BIM) to assist better the productivity of construction Project Management. A BIM method is consisting of the 3D models of the project which links to all the required information connected with the projects planning and construction or operation.

BIM is a 3D modelling which may involve 4th dimension as time (4D), 5th dimension of cost (5D) and information database of the project, 6D dimension is related to Facilities Management (FM) 7D dimension is related to sustainability. BIM allows a team to collaborate at a level with efficiency previously unavailable in the industry. The drawing sets are more coordinated. You can find problems in the drawing sets prior to the construction process. BIM helps to reduce time and cost of the project, etc. A lot of market researches show that the future of building design and construction will increasingly rely on BIM. It is no longer the future of construction and design industry, it is becoming the standard.

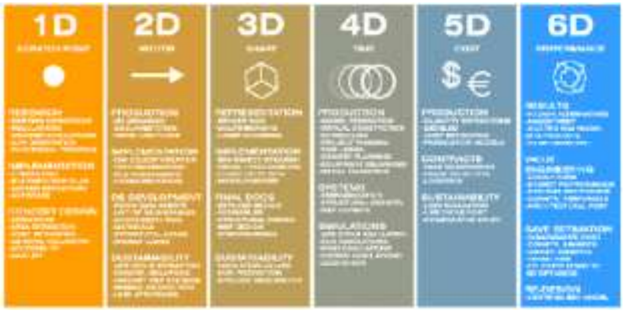


Fig-1: BIM and its dimensions.

2. LITERATURE REVIEW

Lino Maiaa, Pedro Medab and Joao G. Freitasa explained how BIM methodology introduces noteworthy changes in the way as building design, construction and maintenance are traditionally managed. This paper explores and evaluates the advantages and disadvantages of BIM methodology application on the preparation, revision and coordination of designs, as well as the analysis of the computational tools available. Using the Revit software, a building was modelled in BIM based in the design drawings carried out by using the traditional methods in CAD. BIM methodology intents the integration of all phases of the construction process, i.e. the integration and promotion of collaborative work by all the design disciplines involved in the design phase. Besides, it is supported by three-dimensional visualization applications. The great potential of BIM concept is also in standardization of information and of methods to perform the objects modelling process. Based on this, potential improvements in the preparation, coordination and revision of design documents, and management and maintenance are done. The BIM concept has assumed different definitions. Its uses in mass has generated discussions about the validity of the term and even about its applicability. Under this document, it has considered BIM as a digital representation of the physical and functional characteristics of a building. This digital presentation serves as a shared knowledge resource for information about the construction and allowing the creation of a reliable basis for decisions during its life-cycle**[1]**.

Nam Buiab, Christoph Merschbrockb and Bjorn Erik Munkvolda explains about how, in the construction industry, Building Information Modelling (BIM) is widely seen as a boost for innovation and productivity. BIM can help in a more sustainable construction process that in turn may contribute to reduce poverty in developing countries (United Nation Millennium Goals). While BIM is increasingly being accepted in developed countries, implementations in the developing country context are less. Research show how construction firms face difficulties from several limitations having to do with the socio-economic and technological environment found in developing countries. Examples of issues include a shortage of IT personnel as well as an absence of national BIM implementation programs which prevent implementation of BIM on large scale. Based on research, this article addresses some of the issues and solutions for BIM implementations particular to low and middle income economies. Findings include that construction firms in developing countries rely on outsourcing of IT services or developing tweaks or workarounds, like using fake IT licenses, for saving cost and enabling BIM. The article also explains about the shortcomings of BIM application in developing countries, and may serve as boon for researchers interested in how BIM technology can be adopted in a developing country. In general, more studies are required to cover the gaps identified in this paper. Technological and managerial aspects should be given uttermost importance in application of BIM. BIM practice can be enhanced in developing countries as professional communities and industrial clusters are promoting for further studies . Collaboration such as open BIM will be essential to focus in further studies considering the requirements according to technical point. From the managerial view, development of an effective strategy for BIM use in developing countries should be targeted. In this pursuit, in-depth comparison between developed and developing countries is required**[2].**

Salman Azhar explains that BIM technology is an accurate virtual model of a building is digitally constructed. This model also known as a building information model (BIM) can be used for planning, design, construction, and operation of the facility. Architects, engineers, and contractors using BIM visualize how to be built in a simulated environment to identify any potential design, construction, or operational issues. BIM encourages integration of the roles of all stakeholders on a project. In this paper we get to know about the current trends, benefits, possible risks, and future challenges of BIM for the AEC industry. This study provides useful information for AEC industry practitioners for implementing BIM technology in the projects. The responsibility for the proper technological interface among various programs becomes an issue as the dimensions of cost and schedule are layered onto the building information model. The productivity and economic benefits of BIM to the AEC industry are creating great importance. BIM is readily available and rapidly maturing for further implementation of technology. BIM adoption has been much slower than anticipated due to two main reasons they are technical and managerial**[3]**.

Eissa Alreshidia, Monjur Moursheda and Yacine Rezguia's research show that with increasing complexity of construction projects, a collaborative environment becomes essential to ensure effective communication and stress free working environment during the project lifecycle. Conventional team collaboration raises issues such as the lack of trust; uncertainties regarding ownership, mistrust, revenue distribution differences and Intellectual Property Rights (IPRs), miscommunication, and cultural differences and many others. Additional issues can arise in relation to the generated data including data loss, data inconsistency, errors and liability for incomplete data. Also there are very few studies that investigate collaboration practices, data management, and governance issues from a socio-technical point of view. The development of a BIM governance framework with support of Cloud technologies is investigated in this study, Effectiveness factors that guarantee successful collaboration are identified with the aim of :-

(i) exploring barriers to BIM adoption;
(ii) exploring the role of BIM-related standards;
(iii) consulting BIM experts to develop based BIM governance solution to tackle team collaboration on BIM-based projects **[4].**

Natalia Abramova says that the purpose of this thesis was to create a model of the two-level apartment with program Revit Autodesk for company NCC. The apartment ls situated in the housing complex Skandi Klubb, which is being built in Saint-petersburg. The model was made for commercial purposes, In order to speed up the selling process of this apartment, as the most expensive one. The second purpose was to describe basics of BIM and Revit program. The thesis is divided into two main parts theoretical and practical. In the theoretical part the characteristics and main functions of Revit were considered. Also this part explains the concept of BIM. For writing these parts the books as well as internet resources were analyzed. In the practical part the main steps of creating the model were described. Also the opinion of people about this model was considered. As the result, the main characteristics of Revit program and BIM were discovered. The model of apartment was shown to the possible customers and get good reviews **[5].**

Youngsoo Jung and Mihee Joo show that recent advances in building information modelling(BIM) have disseminated the utilization of multi-dimensional (nD) CAD information in the construction industry. Nevertheless, the overall and practical effectiveness of BIM utilization is difficult to justify at this stage. The purpose of this paper is to propose a BIM framework focusing on the issues of practicability for real-world projects. Even though previous efforts in the BIM framework have properly addressed the BIM variables, comprehensive issues in terms of BIM effectiveness need to be further developed. A thorough literature review of computer-integrated construction (CIC) and BIM was performed first in order to interpret the BIM from a global perspective. A comprehensive BIM framework consisting of three dimensions and six categories was then developed to address the variables for theory and implementation. This framework can provide a basis for evaluating promising areas and identifying driving factors for practical BIM effectiveness**[6]**.

Robert Anton Kivits explains Building Information Modeling (BIM) is the use of virtual building information models to develop building design solutions and design documentation and to analyze construction processes. Recent advances in IT have enabled advanced knowledge management, which in turn facilitates sustainability and improves asset management in the civil construction industry. There are several important qualifiers and some disadvantages of the current suite of technologies. This paper outlines the benefits, enablers, and barriers associated with BIM and makes suggestions about how these issues may be addressed. The paper highlights the advantages of BIM, particularly the increased utility and speed, enhanced fault finding in all construction phases, and enhanced collaborations and visualization of data. The paper additionally identifies a range of issues concerning the implementation of BIM as follows: IP, liability, risks, and contracts and the authenticity of users. Implementing BIM requires investment in new technology, skills training, and development of new ways of collaboration and Trade Practices concerns. However, when these challenges are overcome, BIM as a new information technology promises a new level of collaborative engineering knowledge management, designed to facilitate sustainability and asset management issues in design, construction, asset management practices, and eventually decommissioning for the civil engineering industry**[7]**.

Aleksander Nikal and Wojciech Wodynski explain how BIM has been widely adopted by the construction sector, though Facility Management (FM) is still based on a variety of disparate FM systems. The operational phase requires comprehensive set of well-structured information regarding the building asset. Therefore, a BIM model filled with the multifarious information from the pre-use phase ought to be exploited through its integration with existing FM systems. This paper aims to appreciate the contribution of BIM in optimizing the processes conducted conventionally within the FM practice. The importance of sustained information flow for the efficient operational stage is a pre-requisite of the further discussion. The exploration of FM application areas for BIM-enabled processes is aimed to depict the potential of the BIM for FM concept. By elaborating on the existing challenges concerning the shift from traditional FM processes to new BIM-based approach the outstanding problems are realized. On these grounds advice is provided. The study focuses mainly on new investments, where information management must be sustained from the project inception until the current operational stage. The paper proves the potential of BIM for the optimization of FM practices, presenting a wide range of application areas followed by tangible benefits for the building performance across its life-cycle. Identified barriers are assumed to be mitigated by diligent implementation of provided recommendations. It is concluded that BIM-based FM processes have the potential to shed a new light not only on the FM sector itself but on the perception of the whole industry being based on the collaborative approach towards delivery of the intelligent facilities. Nevertheless, such results demand profound cultural changes within the construction sector, with the FM appreciation as a starting point**[8]**.

Felipe Munoz La Rivera, Juan Carlos Vielma, Rodrigo Herrera and Jorge Carvallo say Structural engineering companies (SECs) currently have a series of deficiencies that hinder their processes and interactions, decreasing their productivity, lacking collaborative and interconnected processes, not including current work methodologies such as building information modeling (BIM). The BIM methodology seeks to integrate processes and professionals involved in engineering tasks by working on platforms with coordinated and intelligent 3D virtual models. BIM has great potential for structural engineering companies (SEC) and solves their most salient problems. This paper defines a methodology to implement BIM in the SEC, focused on solving the complexities of the design phase, those that make the implementation of BIM in these offices a nontrivial task. Characterized by the optimization of resources, flexibility, and adaptability, the methodology proposed for BIM implementation within SEC clearly and objectively identifies the resources and expectations of the organizations, sets out the requirements necessary to develop the BIM methodology, and provides practical and technical recommendations for planning and monitoring the implementation**[9]**.

Jian Li, Ying Wang and Xiangyu Wang explain that Building Information Modelling (BIM) is a process involving the creation and management of objective data with property, unique identity and relationship. In the Architecture, Engineering and Construction (AEC) industry, BIM is adopted a lot in the lifecycle of buildings because of the high integration of information that it enables. Four-dimensional (4D) computer-aided design (CAD) has been adopted for many years to improve the construction planning process. BIM is adopted throughout buildings' lifecycles, in design, construction and operation. This paper presents five large-scale public and financial projects that adopt BIM in the design, construction and operational phases. Different uses of BIM are compared and contrasted in the context of the separate backgrounds. It is concluded that productivity is improved where BIM is used to enable easy sharing and integration of information and convenient collaboration**[10]**.

3. METHODOLOGY

3.1. Modelling in Autodesk REVIT

Autodesk Revit is a software under the BIM methodology where architectural, structural, MEP drawings are used to create a 3D model of the project to be undertaken for construction. They use it as it allows them to design a building and structure and its components in 3D. Also with 2D drafting elements the model is annotated. To plan and track various stages in the building's construction lifecycle from concept to construction, Revit 4D BIM has capable tools and later if needed demolition too. Revit was intended to allow architects and other building professionals to design and document a building or any considered project by creating a parametric 3D model that included both the geometry and non - geometric design and construction information, what later becomes known as Building Information Modelling or BIM. Several other software packages such as Arch CAD and Reflex allows working with a 3D virtual building model, and allowed individual components to be controlled by parameters. Revit uses a graphical "family editor" tool rather than a conventional programming language. For example, changing the position of a wall would update the neighbouring walls, floors and roofs, to correct the placement and values of dimension and notes, adjust the floor area reported in schedule, redraw section views, etc., so that the model will remain connected and all documentation would be coordinated accordingly. In Revit, the concept of bidirectional associativity between components, views and annotations has a distinguishing feature. Contraction of Revise-It is the ease of making changes which inspired the name of Revit. Revit which relies on a new technology, context driven parametric, that was more measurable than the vibrational and history driven parametric used in mechanical CAD software is solely dependent on parametric change propagation engine. To change the parameters that drove the whole building model and associated documentation, parametric building model tool is used.

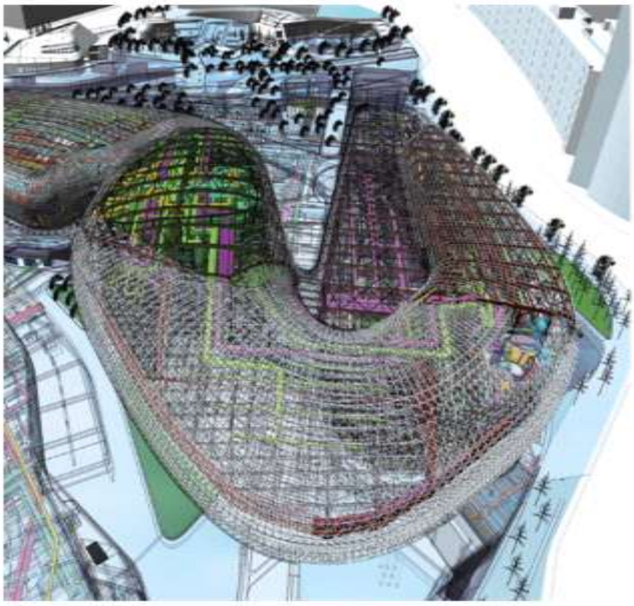


Fig-2: Rendered 3D model on Revit.

3.2. Clash Detection

For any complex project, the primary requirement is clash detection wherein composite design needs to be inspected for the identification of clashes. When elements of different models occupy the same space, a clash occurs. In clash detection method, inspecting and identifying the various interferences which occurs frequently in coordination process of 3D models are created in different modern software.

3.3 Need of Clash Detection

In traditional method organizations, contracts are within the contractors, buying materials, ensuring a good coordination and assembly order of the different systems of a project. The most clashes are recognized when the contractor receives the design drawings and everyone is on-site and working. It compares 2D designs with 3D model to find conflict clashes between the specialty designs. Because the specialty contributors i.e. structural engineers, MEP engineers etc. develop their designs separately, so when comparing these designs on different drawings is a process where clashes are easily overlooked.

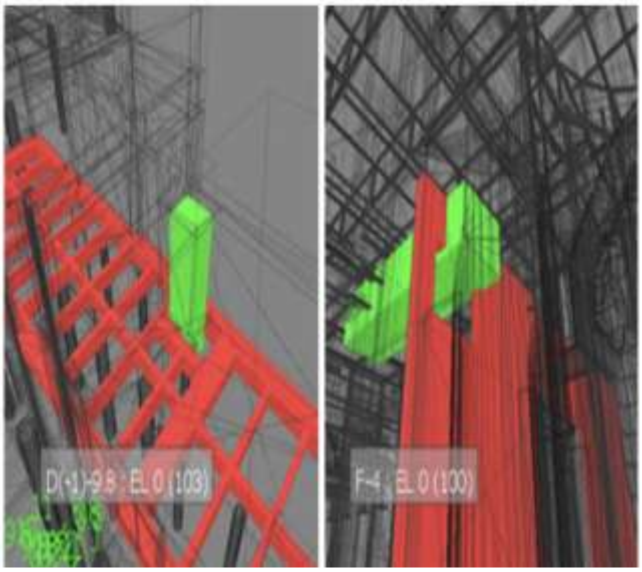


Fig-3: Clash Detection as seen in Navisworks

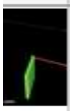
Image	Clash Name	Status	Grid Loca on	Descrip on	Clash Point	Item ID	Layer	Item Name	Item Type	Item ID	Layer	Item Name	Item Type
	Clash10	New	3-4 : 8th floor	Hard	x:-1295.661, y:-748.749, z:25.330	*Element* ID: 2273157	<No level>	Top Rail(Internal)	Solid	*Element* ID: 1998813	24.15m 8th Refuge flr	160mm NSW	Solid

Fig-4: Clash Detection result table.

One example of how Clash Detection works is given. At first a 3D model is created using families and its groups which consist of various structural features like columns, beams, footings, foundations, slabs, walls, tie beams etc. This 3D model is created using Autodesk Revit software which looks as in fig 5.

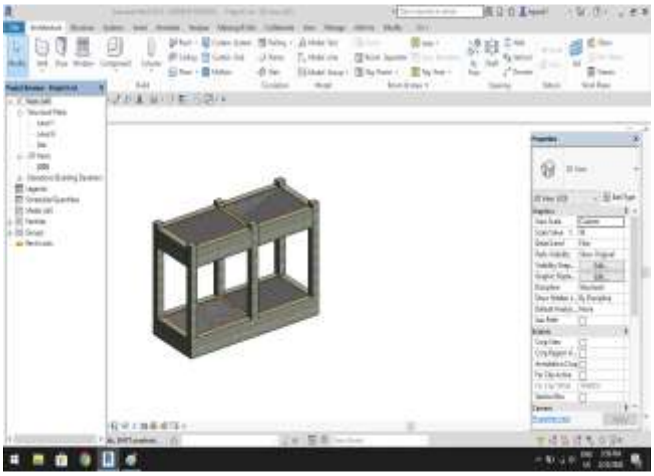


Fig-5: 3D view of example in Revit.

After the model is created this file is linked to Navisworks Manage. Once the file is opened in Navisworks tests can be run for Clash Detection in this software which help to find out structural faults.
refer fig 6.

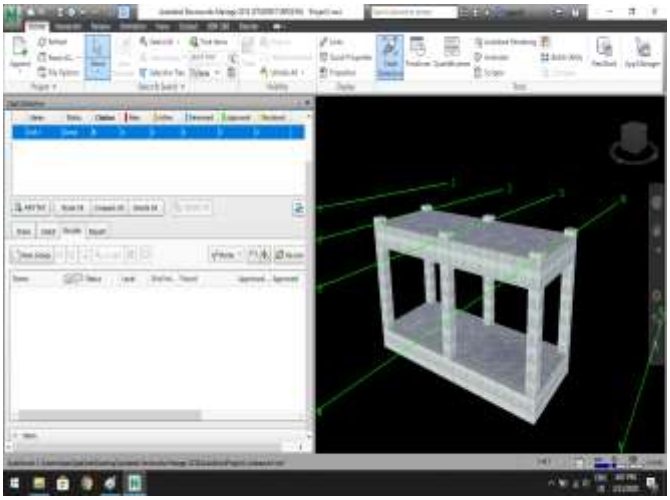


Fig-6: Clash Detection of example in Navisworks.

3.4. Use of Navisworks

It is an Autodesk software that enables the analysis, simulation and communication of design and constructability. It allows shared and combined viewing and review of models of different types (Revit, Inventor, Rhinoceros, Solidworks, Sketchup, Allplan, Robot, CYPE, ...).

Main Uses

1] Clash Detection: To reduce costs and minimize changes and delays, Interferences detection and management allows us to anticipate, prevent and resolve problems in the virtual model before construction begins.
2] Planning: One can manage the changes that occur during the construction progress by using Navisworks Manage which combines spatial coordination with construction planning, allowing the simulation and analysis of it,

4. CONCLUSIONS

BIM Improves visualization of construction projects. Improves productivity due to easy retrieval of information and increases co-ordination of construction documents. Storing and linking of important information such as vendors for specific materials, location of details and quantities required for estimation and tendering eased due to BIM. Increased speed of delivery.

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