A Review Paper on Structural BIM Process for Building Design

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***Abstract* - The subject of building information modelling (BIM) has become a central topic of the improvement of the AECOO (Architecture, Engineering, Construction, Owner, and Operator) industry around the world. The building can be designed by using Autodesk Revit Software. Autodesk Revit is Building Information Modelling (BIM) software for landscape architects, landscape architects, structural engineers, MEP engineers and contractors. The software allows users to design a building and its components in 3D annotate the model with 2D drafting elements and access building information from the building model's database. The Residential building has two flats. Our structure has ground floor and five floors. Staircase can be placed in between two flats. By using of Analysis and Design we can get similar functionality with analysis professional, which lets you test the effects of structural loads and verify code compliance using advanced BIM tools. The software which integrates with BIM workflows, is available only in architecture, engineering & construction collection.**

***Index Terms* - AECOO, Revit software, BIM tools.**

I.INTRODUCTION

Building Information Modelling (BIM) is an intelligent model-based process that provides insight for creating and managing building projects faster, more economically, and with less environmental impact. Purpose for Building information modelling (BIM) Autodisk, Revit, Architecture building design software works the way architects and designers think enabling you to design freely and deliver efficiently. A multi storied residential building which possess multiple floor above the ground level, which aim to increase the floor area of the building in shortest built up area. Structural analysis is a subject which involves designing, planning to build up a perfect building. Basically each project is different Data to measure the soil specific such as moisture content, bearing capacity of soil, types of soil etc.

1.1 Building Information Modeling

The building information modelling process covers geometry, space, light, geographic information, quantities, and properties of building components. BIM can be used to demonstrate the entire building life cycle, including the processes of construction and facility operation.

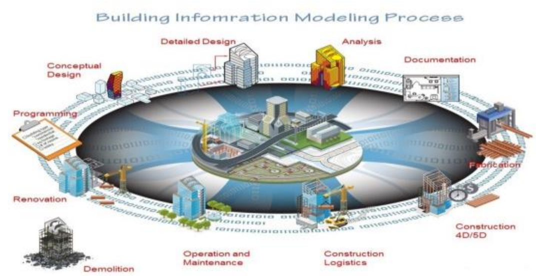

Fig. 1. BIM Process

1.2 Some elements can have sub-elements

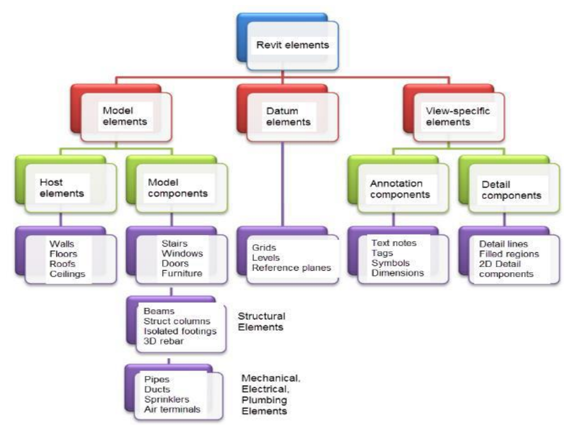

Fig.2. Revit structure (About Element Behavior in Revit,)

1.2 Using Revit Software Starting a Project
1. Double Click and open Revit software.
2. Initially 1st we need to select Revit architecture template from template panel.
3. Then we will entering into the Revit GUI.
4. We can see left side properties box and right side project browser.
5. In view menu manages units and set the units as per need.
6. Now set the grids.
7. Go to application menu bar save the file with require name in specified folder.

II. LITERATURE REVIEW

A.H.Oti et al.(2016) studied The provision of Application Programming Interface (API) in BIM-enable tools can contribute to facilitating BIM-related research. APIs are useful links for running plug-ins and external programmes but they are yet to be fully exploited in expanding the BIM scope. The modelling of n-Dimensional (nD) building performance measures can potentially benefit from BIM extension through API implementations. Sustainability is one such measure associated with buildings. For the structural engineer, recent design criteria have put great emphasis on the sustainability credentials as part of the traditional criteria of structural integrity, constructability and cost. This paper examines the utilization of API in BIM extension and presents a demonstration of an API application to embed sustainability issues into the appraisal process of structural conceptual design options in BIM. It concludes that API implementations are useful in expanding the BIM scope. Also, the approach including process modelling, algorithms and object-based instantiations demonstrated in the API implementation can be applicable to other nD building performance measures as may be relevant to the various professional platforms in the construction domain.

Miyoung Ohm et al.(2017) studied The emergence of building information modeling (BIM) has generated several BIM jobs. However, despite opinions by BIM experts, questions regarding BIM jobs and their competencies still have no clear solution. This paper addresses this question by the collection and analysis of 242 online job postings, written in English, from the US, the UK, and China. These 242 job postings comprised a total of 32,495 words, from which 35 types of job titles and 5,998 terms related to job competency were extracted. Sequentially, the 35 job types were classified into eight BIM job types by analyzing the relations between the job titles using the role and position analysis of social network analysis. The eight BIM job types were BIM project manager, director, BIM manager, BIM coordinator, BIM designer, senior architect, BIM mechanical, electrical, and plumbing (MEP) coordinator, and BIM technician. The 5,998 competency-related terms were categorized into 43 competency elements using the O*NET classification as a framework for analysis. The 43 competencies were then subcategorized into essential, common, and job- specific competencies for the eight BIM job types. The findings of this paper could contribute to the research, industry, and academia by a) providing researchers with a scientific foundation for conducting studies related to BIM jobs and competence in the future; b) setting up guidelines for recruiting and training BIM experts in the industry; and c) allowing universities to develop BIM-related courses depending on their educational goals.

Yang Zou et al.(2016) studied Risk management in the AEC (Architecture, Engineering and Construction) industry is a global issue. Failure to adequately manage risks may not only lead to difficulties in meeting project objectives but also influence land-use planning and urban spatial design in the future growth of cities. Due to the rapid development and adoption of BIM (Building Information Modelling) and BIM-related digital technologies, the use of these technologies for risk management has become a growing research trend leading to a demand for a thorough review of the state-of-the-art of these developments. This paper presents a summary of traditional risk management, and a comprehensive and extensive review of published literature concerning the latest efforts of managing risk using technologies, such as BIM, automatic rule checking, knowledge based systems, reactive and proactive IT (information technology)-based safety systems. The findings show that BIM could not only be utilized to support the project development process as a systematic risk management tool, but it could also serve as a core data generator and platform to allow other BIM-based tools to perform further risk analysis. Most of the current efforts have concentrated on investigating technical developments, and the management of construction personnel safety has been the main interest so far.

Yujie Lu et al.(2017) studied the applications of BIM for the development of green buildings, the activity of making buildings in a way that protects the natural environment. As the usefulness of BIM has been widely recognized in the building and construction industry, there is an urgent need to establish an up-to-date synthesis on the nexus between BIM and green buildings. After an in-depth review of hundreds of journal articles published from 1999 to 2016 and 12 widely used types of BIM software, this study provides a holistic understanding and critical reflection on the nexus between BIM and green buildings, which is systematically illustrated by a "Green BIM Triangle" taxonomy. The proposed taxonomy indicates that the nexus between BIM and green buildings needs to be understood based on three dimensions, namely project phases, green attributes and BIM attributes. Following the proposed taxonomy, this paper systematically illustrated 1) The applications of BIM in supporting the design, construction, operation, and retrofitting processes of green buildings 2) The various functions of BIM for green building analyses such as energy, emissions, and ventilation analysis 3) The applications of BIM in supporting green building assessments (GBA) 4) Research gaps and future research directions in this area. Through critical review and synthesis of BIM and green buildings based on evidence from both academic research and industrial practices, this paper provides important guidance for building researchers and practitioners to better align BIM development with green building development in the future.

Hasan Burak Cavka et al.(2016) studied that Building information modeling (BIM) is emerging as a potential solution for facility owners to address the challenges of poor information fidelity, interoperability, and usability in project delivery to support the lifecycle of their assets' information. Despite the many benefits offered by BIM, its use for facility operations remains significantly limited. The reality is that implementing BIM in large owner organizations is a complex challenge. In particular, a significant barrier to BIM adoption for owners is the challenge of identifying and formalizing the information requirements needed to support model-based project delivery and asset management. This paper presents the results of a longitudinal research project that investigated two large owner organizations in Canada to better understand the process of developing and formulating BIM requirements to support the lifecycle of their assets. Specifically, the objectives were to formalize an iterative approach to the identification and characterization of owner requirements and to develop a conceptual framework that would relate digital and physical products to owner requirements and organizational constructs, to underpin the formalization process. As part of this research an array of requirements documentation were analysed, interviews were performed with numerous facility management personnel, and BIMs from four projects were analysed. A methodology is introduced to support a rigorous and detailed analysis of BIM requirements. The investigation of the owner requirements helped to develop an understanding of the required information content, and its alignment with BIM. Finally the relationships between organizational constructs, owner requirements, and BIM were mapped. As the construction industry shifts towards model-based project delivery, this research will inform owners about how to think about handover of digital facility models, and what to require in models based on their specific needs.

Shabtai Issac et al.(2017) studied that the fact that a large portion of the work in construction projects is usually carried out by different subcontractors, makes an effective work packaging process crucial for the subsequent execution planning. However, the definition of optimal work packages is currently challenging and time consuming. A method was developed to allow the work packaging process to be carried out in a more accurate and efficient way, using data from Building Information Models (BIM). This method is based on a bottom-up approach that can take into account relations between specific components, and the consequent interruptions that will occur in the construction processes. The method incorporates BIM data in Design Structure Matrices and Domain Mapping Matrices to automatically generate a list of proposed work packages with minimal interfaces. An application of the method in a case study demonstrated that it can accelerate the work packaging process, and allow alternative solutions to be explored at an early stage in the project.

Daniele Parrone et al.(2017) studied that the seismic performance of non-structural elements is nowadays recognized to be a key issue in performance based earthquake engineering. The knowledge of construction details within a building is of paramount importance in order to reduce uncertainties and improve the quality of the analysis and design, particularly in regards to non-structural elements. The use of Building Information Modelling (BIM) could represent a new frontier in the seismic design of non-structural elements by increasing the reliability of the seismic design and/or assessment. This study discusses the effectiveness of using Building Information Models in seismic design of non-structural building elements. A simple tool has been developed to perform automatically the seismic design of sway braces for pressurized fire suppressant sprinkler piping systems based on information extracted from a Building Information Models. The effectiveness of the proposed procedure was validated via a case study.

Dolli Mansuri et al.(2017) studied that the formwork systems are accountable for a significant share of the cost of reinforced concrete structures. The application of constructability principles to the design, selection and management of formwork systems in the preconstruction phase can significantly reduce the cost of reinforced concrete construction projects. Although many studies have developed tools and methodologies to automate the design and selection of formwork systems, few studies have explored the benefits of improving the process of managing formwork. The focus of this paper is on the use of BIM along with a cascading tool to maximize the return on formwork investment and improve the management of formwork.. The paper discusses the use of BIM to extract data required for the cascading tool, working of the cascading algorithm and the development of the tool. The paper ends by presenting a case study where the developed tool was applied on a construction project in Cincinnati, Ohio and 13% savings in formwork material cost was reported.

Weisheng Lu et al.(2015) studied that There is a lively debate on the application of Building Information Modelling (BIM) to construction waste management (CWM). BIM can be utilized as a less expensive, virtual, and computational environment to enable designers to ponder different design options, or contractors to evaluate different construction schemes, both with a view to minimizing construction waste generation. However, existing debate on this topic too frequently treats BIM as a cure-all silver bullet; without some major hurdles being adequately addressed, the applications of BIM will remain rhetorical. This paper aims to demystify BIM's computational application to CWM. Based on a critical literature review, a prototypical framework of a computational BIM for CWM is delineated, within which the two key prerequisites of ‘information readiness’ and ‘computational algorithms’ are highlighted. Then, the paper details the required information and how it can be organized in a standalone database or encapsulated in existing BIM for CWM. Learning from the historical development of data infrastructure in the field of BIM based cost management; the process to develop the required information is likely to be tortuous but is unavoidable. The paper further explores computational BIM algorithms that can manipulate the information to facilitate decision-making for CWM. Finally, the operation of computational BIM is elaborated by relating it to various prevailing procurement models within which BIM applications are contextualized. Although the framework reported here has been substantially developed for experimental application, , it is not to be taken as an immediately applicable solution but rather as an illustration of the kind of platform on which future development of computational BIM for CWM can proceed in a more efficient and effective fashion.

Pawel Nowak et al.(2015) studied that the possibilities of Building Information Modeling (BIM) techniques and relevant software for decision making optimization in construction. Some relevant description of BIM elements needed for optimization in construction investment process. Authors presents chosen tools for decision making - point of reference method. Paper consist also practical example of suggested methodology use - choice of the best location of the office building.

Lieyun Ding et al.(2014) studied that the utilization of Building Information Modeling (BIM) has been growing significantly and translating into the support of various tasks within the construction industry. In relation to such a growth, many approaches that leverage dimensions of information stored in BIM model are being developed. Through this, it is possible to allow all stakeholders to retrieve and generate information from the same model, enabling them to work cohesively. To identify gaps of existing work and evaluate new studies in this area, a BIM application framework is developed and discussed in this paper. Such a framework gives an overview of BIM applications in the construction industry. A literature review, within this framework, has been conducted and the result reveals a research gap for BIM applications in the project domains of quality, safety and environmental management. A computablemulti- dimensional (nD) model is difficult to establish in these areas because with continuously changing conditions, the decision making rules for evaluating whether an individual component is considered good quality, or whether a construction site is safe, also vary as the construction progresses. A process of expanding from 3D to computable nD models, specifically, a possible way to integrate safety, quality and carbon emission variables into BIM during the construction phase of a project is explained in this paper. As examples, the processes of utilizing nD models on real construction sites are described. It is believed to benefit the industry by providing a computable BIM and enabling all project participants to extract any information required for decision making. Finally, the framework is used to identify areas to extend BIM research.

III. PROJECT IN REVIT

After a huge success of AUTOCAD in architecting, Revit was designed as a tool which could do the work AUTOCAD did but instead using programming language, achieve a direct modification of properties of objects. This goal was scored using parametric model of references, system of “families” and elements. There were 2 different Revit versions each had unique functions:

- Revit Architecture was specifically designed to help architectures.
- Revit Structure performed tests and analysis to ensure structure’s stability and planned reinforcements if needed.

A. Creating a Project:

1. Before going to design the model in revit get the plan from architect.
2. As per need set the units.
3. Using grid line draw the plan view.
4. Using draw panel draw the grid lines.
5. In draw panel we have line. circle rectangle, arc etc options.
6. Using these draw panel select the tools and complete the grid line diagram.
7. In properties box some modifying tools will be there to modify the grid lines.
8. Using copy, move, rotate, array options we can complete the grid diagram in less time.

IV. METHODOLOGY

Revit software were used in order create an intelligent 3D model with detailed design, analysis and planning. Revit Architecture not only maximizes productivity but also helps to streamline your design and documentation workflows; speeding projects from design to completion while automating updates across your model with a single design change. Autodesk Revit Architecture offers many other tools and features that can enhance productivity such as
Physical Materials for Building Performance Analysis, Autodesk 360 Integration, Work sharing, Construction Modelling, Bidirectional Associatively, Parametric Components, and much more.
The two-stage literature review method was adopted to identify journal articles that describe and investigate the use of cloud-BIM technologies in the construction field, published in refereed journals, conference proceedings and other scholarly publications. First, a comprehensive literature search based on the ‘title/abstract/keyword’ search method was conducted using the Scopus, SCI and Google Scholar.

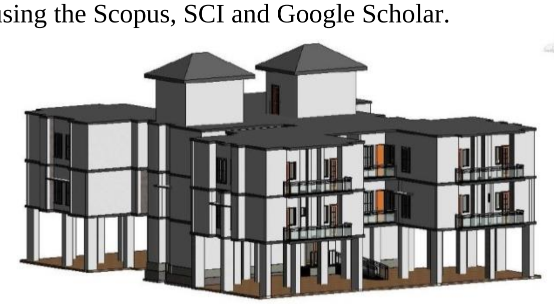

Fig. 3. 3D view of building

Fig.4. Floor plan of 1st floor

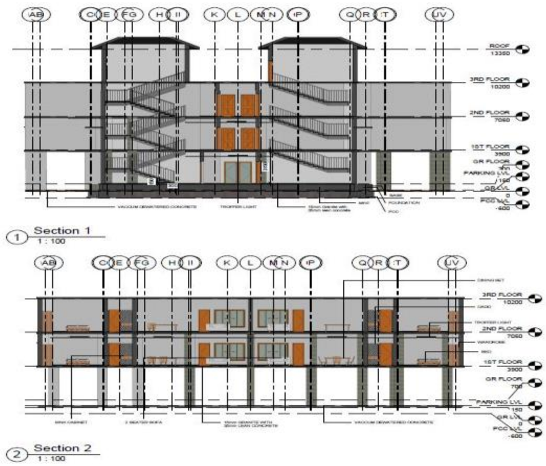

Fig.5. Section Plan

V. CONCLUSION

This project gives the realistic modelling of building and accurate families ranging from furniture to lighting fixtures, as well as import existing models from other softwares like Auto CAD etc. We can get the approximate estimations of building also using Revit Architecture. In this Project we have done planning, modelling, scheduling of Doors and we have created families also for this commercial building.

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