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IMPORTANCE OF BIM IN CONSTRUCTION INDUSTRY -A Review

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Abstract – BIM is the digital representation of Building which is Divided in the three parts Architecture, Structure & MEP. Information Modeling (BIM) can be a beneficial platform for Structural Engineers. Also beneficial in construction Industry. The current state of BIM is analyzed, giving a general overview on how architectural, Structural Engineering and construction firms are applying it on their projects. Over the past decade the fields of civil engineering, structural engineering, have increasingly used the building information modelling (BIM) approach in both professional practice and as the focus of research. Structural engineering companies & Construction Company's 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).BIM methodology seeks to integrate processes and professionals involved in engineering tasks by working on platforms with coordinated and intelligent 3D virtual models. Over the past decade the fields of civil engineering, structural engineering, have increasingly used the building information modelling (BIM) approach in both professional practice and as the focus of research. However, the field of structural engineering, which can be seen as a sub-discipline of civil engineering, misses, as far as the authors are aware, a real state-of-the-art on the use of BIM in this regard to start bridging that gap. in structural engineering, enabling them to perform a detailed content analysis of publications.

The main aim of BIM is to enhance project performance and produce better outcomes. BIM helps the construction manager to gather data and information from the relevant disciplines and communicate them more effectively.

Key Words: *BIM, Revit, MEP.*

1. Introduction:

The use of new methods and software is one of the most important tools that structural engineers are using nowadays to stay competitive. Engineers are constantly looking for new ways to improve and keep the pace on today's economy, reaching to new heights in the aspects like productivity, coordination and problem solving. Building Information Modelling (BIM) can potentially help with these important aspects. The core feature that BIM offers is the ability to integrate intelligent objects in the model. These intelligent objects contain all the data regarding a specific component, from geometric characteristics to the way they interact with other components, making the entire model full of information.

Structural engineers can take advantage of BIM in different ways, as the model can be constantly updated with any changes in the design or general specifications, keeping all the data as accurate as possible. BIM

transforms the way we handle and visualize components. It has grave impact on designing activities like, conceptual design and structural analysis. BIM ensures reduction in design and drafting errors and hence provides with lower designing cost and improved productivity. It also allows for better analysis of situations through simulation. The fact that the use of BIM lets one visualize the whole picture lets one identify potential design issues, and come up with new and creative ways to solve problems.

By Using the BIM IN Construction Industry, the Architect, Engineer, Construction Companies, & Structural Engineer are work Together i.e. Work in cloud means that on the one Project the Architect, Engineer, MEP Consultant are work together that's why the quality of work will Improve and losses are minimized and the improper communication will be avoid and the work will be fast.

Nowadays most of the structural engineers are using new methods and software to stay competitive. Engineers always look for new methods to increase and maintain the productivity, coordination and problem-solving abilities to pace on today's economy. BIM can possibly help these goals with significant altitude. BIM is referred as a platform that supports structural engineers, detailers, and fabricators to enhance robust structural design, reduces faults, and creates collaboration between stakeholders and organizations. It also explains how designer and fabricator software supports to achieve new trades and establish projects. In various ways BIM can take place in improvement of structural engineering by maintaining all the information as correct as possible via updating models regularly. The fields of creation, arrangement and flexibility of information are also analyzed with the interest that BIM shows for structural design. The following sections intend to assess the advantages of BIM in structural design. First of all, literature review on structural design and BIM is presented to explain and define the importance of BIM in structural design. In methodology part data sources are listed and the classification of research subjects are tabulated. In the next section the advantages of BIM are shown and finally, in the findings section, the importance of BIM and the advantages of BIM are discussed for structural design.

2. Brief Literature Review

Cesar Augusto Hunt [1] presented the benefits BIM can offer in structural engineering. Also, the importance of inter disciplinary coordination and the benefits arising out of it were discussed in detail.

M. Obergriesser1, A. Borrmann [2] studied the impact of BIM on the construction industry. Multidisciplinary facet of BIM and its impact in Information Delivery Model was studied was evaluated by them.

Gary Wyaat [3] examined the role of the structural engineer in the BIM process and explains how the integrity of BIM model is maintained during the structural engineering process. Also, the benefits and advantages of BIM in structural engineering and the difference between the CAD centric and BIM centric drafting is discussed.

William F. Ikerd [4] evaluated the changing trends in the design industry. The time required by majority of structural engineers to completely transit to BIM was analysed by him. Also, a logical justification about why BIM is the next phase of evolution in the design industry is explained by the author.

Barlish and Sullivan 2012 [5] Building Information Modeling (BIM) has become the essential methodology including the digitalization of the built environment supply chain. BIM is a digital representation of the physical and functional characteristics of a building and serves as a knowledge sharing vehicle for building information.

Juan et al., 2017 [6] Incentives and use related to BIM have been increasing over the past few years and received considerable recognition for its ability to reduce costs and time as well as improve quality.

Azhar et al. 2015 [7] demonstrates; "BIM has gone from being a buzzword to the centerpiece of AEC3 technology". Although BIM is applied to many large design and construction projects it is still not common practice throughout the industry. Now, design and construction projects are more efficient in terms of cost reduction, quality improvement, time schedule and a better work flow between project participants.

Sanchez and Joske, 2016 [8] In addition, project owners have started realizing other benefits deriving

from BIM as a work method, such: as reduce claims, enabling easier calculations and visualizations for promotional purposes and ease of cross-disciplinary collaboration to name a few Cost reduction.

Barry Jones (2014) [9] The paper discusses a proposal for an integrating partnership for decision-making at preconstruction stages of major construction projects. IPD and BIM form essential tools and strategies in this decision environment. IPD linked to the "Big Room" concept will be discussed. The paper will focus on some of the challenges that are presented and ways that might assist in creating a safer, greener, more sustainable environment. The environment proposed is one that fully utilizes the strengths of intelligent collaborative computer agents that interact with the multi-discipline pre-construction team to interrogate and refine the design solution before construction commences. All contributors are collaboratively drawn into the design and pre-construction process. Time is saved because a concurrent problem-solving approach is adopted rather than a sequential problem-solving approach that has typified pre-construction activities in the past. In particular, the system proposed will assist the design process to deliver safely-built sustainable buildings.

Ireneusz Czmoch & Adam PĆkala 2014 [10] Next, the idea of Building Information Modelling (BIM) and its practical benefits are described. Main part of the paper is devoted to discussion about what kind of difficulties we may encounter during the implementation of the BIM technology and how they are related to the potential benefits. It is very important to conclude that BIM based design can be effectively implemented in the design practice by experienced designers. BIM allows for simplification of many tasks and considerable savings both in terms of money and time. However, the successful implementation of this technology requires skillful design team who acts exactly in accordance with BIM system procedures. Nowadays, given the high cost of implementation, application of BIM is profitable mostly for large projects. As the software and hardware become cheaper, the accessibility of BIM would spread over smaller projects. Doubtlessly, BIM is the most complete designing tool, which can change radically the designing process in the following years.

Joseph A Wright 2014 [11] Building Information Modeling (BIM) has been making significant inroads in the construction industry in the early part of this century to the point that now 4- and 5-dimensional models are common practice. Software is also getting better at communicating between packages without loss of data. The use of BIM has significantly enhanced the ability to deliver satisfaction to construction Owners by enabling the use of Integrated Project Delivery (IPD) as the preferred method of project delivery. However, there still is significant room for improvement in the area of integrating the knowledge or informational aspects of the constructed project. This paper explores the need for the integration of information, or emphasizing the "I" in BIM and IPD through the use of case studies.

Saravanan S (2016) [12] In construction projects, the life cycle is implemented in a cradle to grave approach. It is split into planning, design, construction, operation & maintenance and facility management phases until the useful life of the facility. Traditional project approaches that are used in the industry still face a lot of challenges due to cost & schedule overruns poor collaboration among the project participants and inefficient ways of handling the constructed facility during the implementation of the life cycle. In order to create an interdisciplinary work environment among the project participants, Integrated Project Delivery (IPD) process, a substitute for traditional approaches focusing on defining the roles of project participants and creating successful project outcomes is introduced last decade. To execute the IPD process, Building Information Modeling (BIM) which is a digital representation of physical and functional characteristics of a facility in which the entire project information that are used during each phase of the project life cycle can be stored in a single database subsequently providing a virtual model can be used as a tool.

Ryan T. Manning 2012 [13] Integrated Project Delivery (IPD) is a new method of project delivery that uses collaboration and a team of key stakeholders (Owner, Architect/Engineer, and Contractor) early in the life of a project to make the process more efficient, optimize results, and reduce waste (American Institute of Architects 2007). Building Information Modeling (BIM) is a set of interrelated models created by the project team that offers

the ability to exchange information. BIM embeds the three-dimensional model with detailed information, such as schedule and cost data. When IPD and BIM are combined, the result can be a very successful project that reduces claims from design errors and omissions. Challenges also present themselves when using IPD for the delivery of a project, such as overcoming decades of mistrust, lack of communication, and opposition between the Architect/Engineer and Contractor. There are some insurability issues iii and legal concerns due to the overlapping of the historical roles and responsibilities of the Architect/Engineer and Contractor that must be considered when using IPD and BIM. The historical roles and responsibilities have been defined by a history of case law and legal disputes between the Architect/Engineer and Contractor. These concerns and issues can be neutralized within the IPD and BIM Agreement(s). This paper examines some of the challenges, benefits, and risks presented when using IPD and BIM. IPD and BIM are changing the way projects are delivered with early, and often, interaction from all parties involved in the project, and by creating a model embedded with detailed information that will ultimately be used to construct the project.

Simon Beveridge 2012 [14] The research was undertaken to determine the frequency and best practices of using BIM in commercial construction. Leading commercial contracting firms were contacted and employees were selected to complete a telephone survey that was designed to determine how they are using BIM. It was found that BIM is being used with more frequency on projects, with plans to continue to implement it even further on all projects that allow for its use. Most companies are incorporating trade contractors in their coordination meetings but are taking the lead to ensure a high standard is maintained. Trade contractors are given responsibility to resolve smaller clashes while bringing the larger problems to the clash detection meetings. The model quality being received is increasing as well the frequency of models being received from the design team; however, there is a lack of consensus as to the level of development requirement to ensure the model can be used for facilities management. Commercial contractors are adopting building information modeling for a variety of reasons. These include client requirements, innovative technology strategies, and fear of being left behind. Overall, its use improves processes within their companies. The general agreement is that BIM is having a positive impact on profitability, schedules and sales. BIM further improves the efficiency, effectiveness and competitiveness. The best practices undertaken by commercial contractors include using BIM as a sales and marketing tool, utilizing subcontractors' knowledge and allowing them to resolve minor clashes, having combination of BIM teams and BIM experts and investing in training employees and further development of BIM uses.

Aryani Ahmad Latiffi , Suzila Mohd , Narimah Kasim & Mohamad Syazli Fathi 2013 [14] The aim of this paper is to explore BIM implementation in Malaysian construction industry. Building Information Modeling (BIM) is a set of digital tools that can manage construction projects effectiveness. BIM has been used by the Architecture, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 10 | Oct 2018 www.irjet.net p-ISSN: 2395-0072 © 2018, IRJET | Impact Factor value: 7.211 | ISO 9001:2008 Certified Journal | Page 14 Engineering and Construction (AEC) industries in Malaysia. The idea to implement BIM in Malaysia was introduced by the Director of Public Works Department (PWD) in 2007. A literature review was done to explore previous BIM studies on definitions and history of BIM, construction issues, application of BIM and BIM tools in construction projects as well as benefits of BIM. Malaysian government encourages construction players to apply BIM to construction projects because it can overcome construction project problems such as delay, clash of design by different professionals and construction cost overrun. Autodesk tools have been suggested by the government as a BIM tool platform. Other tools include Revit Architecture, Revit Structural, Revit MEP. It is crucial for construction players to be aware of the importance of BIM application in construction projects. This is because BIM can be one of the conditions required of a company to qualify for government and private projects, similar to what is practiced in some other countries. Moreover, BIM helps to increase construction project efficiency and effectiveness. It can also be implemented to improve communication and collaboration between construction players

3. Conclusion:

The survey highlighted that the awareness level of BIM has increased, but the full potential of BIM has not been explored yet. In India, people are treating BIM as a drafting tool and not utilizing it for managing projects and data management, proper training should be delivered to make BIM mandatory in projects to realize benefits. It is kind of important to understand BIM implementation in the construction process than just learning BIM-based software. Different set of software has different functionalities and BIM has the potential to combine and share that data, applicability through common data environment. In line with this, the data generated on construction sites are huge involving different kinds of data such as cost, quality, workmen, safety, and to name a few. These data need to be managed properly and BIM is a single repository where the data can be shared, managed, and stored in the digital platform. As the industry is moving towards more complex and mega projects, the need for proper safety management onsite is equally important.

The benefits of using building information modeling are evident, especially when analyzing the way that this methodology enhances the structural design workflow. Engineers are realizing the power of BIM for more efficient and intelligent design, and most firms using BIM are reporting strong favor for this technology. The increase in productivity is a significant benefit that BIM provides in structural engineering. Construction documents are generated completely automatic when using a building information model, significantly reducing the time required for detailing. It also reduces the need to make extensive checks, helping prevent errors in the documentation that can affect the construction. Using the building information model not only enables the production of construction documents, but it also serves as a base to present the results from the structural analysis and design in an easy sharable way, keeping all the information regarding the analysis, design and documentation of a structural project in one place. A single building information model is used for both the analysis and the documentation phases, contributing to better coordination between the structural analysis results and the overall design, increasing consistency throughout the entire project. The improved coordination can also be seen in better interoperability between team members' software's, allowing architects, structural and MEP engineers to manage a project more effectively.

The ability to create simulations and check different structural scenarios greatly help with analyzing a structure and taking decisions. This provides great project insight, enhancing its understanding and facilitating the process of solving problems and coming up with ideas. These visualizations can be used to present ideas in a clearer way, simplifying the process of explaining complex situations and helping teams communicate more adequately.

The ability to retrieve all the information related to a structure is particularly helpful at the time of disasters and natural calamities. Also, this holistic approach is well suited to help perform retrofitting and making some changes post construction safely.

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