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The Challenges of Using BIM in Construction Dispute Resolution Process

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Building Information Modeling (BIM) is a popular tool within the Architectural, Engineering and Construction Industry (AEC), especially in the design and construction phases of projects. BIM is recognized as a powerful visualization and communication tool, which can serve as a database for information sharing purposes. Managing the documents and communicating the technical concepts in an effective manner has always been challenging in construction dispute resolution processes for both under construction and under operation projects in the case of dispute and failures. Due to its potential capabilities, BIM can be considered a fulfilling tool for forensic engineering and dispute resolution purposes. However, the application of BIM is very limited in this area, particularly as a presentation tool in courtrooms. To identify the drawbacks of using BIM in dispute resolution and litigation, in-person interviews with construction law attorneys and forensic engineers were conducted. The identification of professionals' concerns would help researchers to have benchmarks for their empirical studies in order to investigate the effectiveness of BIM as a presentation tool compared to other conventional methods. The empirical evidence would assist judges and other legislators in the admissibility rules on using this technology in legal systems and courtrooms.

Key Words: Admissibility, Forensic Engineering, Construction, BIM, Dispute Resolution

Introduction

Many researchers consider disputes as part of construction projects' lifecycles. Legal conflicts between owners, developers, general contractors, and subcontractors are an important issue in the construction industry. Construction claims occur for different reasons, including but not limited to flaws in plans and drawings, poor management, conflicts and also for reasons out of the control of those involved, such as environmental and global barriers. As the complexity of the industry caused by the adoption of emerging technology, innovative construction techniques, new contracting and delivery methods goes up, the number of disputes increases, and the adoption of effective tools and methods in dispute resolution processes becomes more prominent (KOC et al, 2014).

Disputes can be resolved between parties by holding meetings or can end up in courtrooms where a jury might be in charge of decision making for the cases. Regardless of how far a dispute goes to be resolved, communication is a cornerstone of dispute resolution processes. This is not surprising at all when we recognize that many disputes and claims occur because of the poor communication and ineffective information exchanges between parties in verbal or written formats (IP, 2002).

In the legal system, jurors are fact finders and verdict givers who are randomly chosen and should have little or no technical background or professional experience to cases. Legal practices, especially litigation and adjudication, is a knowledgeable form of information management. Collected information is organized, and presented in the courtroom and then is analyzed by fact finders to determine a verdict or result according to the prescribed rules. That result, is then transmitted

throughout the legal system as necessary. The courtroom is therefore a place for information exchange and management (Lederer, 1999).

Information, like evidence, consists of verbal statements often supported by documents, charts, photos and physical objects. Based on the Limited Courtroom 21 Project experimental work, jurors highly preferred the electronic display of documents and want evidence to be presented visually to the greatest degree possible. In 1998 the Judicial Conference Committee on Automation and Technology released the results of their assessment of certain technologies used in federal courts. In this study each juror and the judge had their own monitors for video evidence presentation. Eighty-three percent of judges surveyed said that the technology helped them manage court proceedings better, and ninety percent of jurors surveyed said that they were able to see evidence clearly and follow attorney presentations (Lederer, 2004).

Litigation is evolving due to new technologies of visual communication, including evidence cameras, video conferencing, presentation software, computer animations and simulations, and digital video. After using photographs as evidence in the United States for the first time in 1859, the computer generated animations were the second paradigm shift in courtroom technologies. In a well-known case arising from the August 2, 1985 crash of Delta Airlines Flight 191, for instance, the government used a computer generated animation to recreate the scene just prior to the crash to demonstrate that the Federal Aviation Administration had given the pilots enough warning to avoid danger (Fadely, 1990).

While the use of computer generated representation is becoming popular and the newer technologies such as Virtual Immersive Environment (VIE) and holograms are introduced to litigation, empirical research in this crucial area is barely sufficient. Due to the collateral effects of presentation tools, the need for some systematic examination of the effects of courtroom technology is clear. Without useful empirical research, judges who must rule on the admissibility of demonstrative evidence using the new technologies are not able to make an informed decisions, and lawyers always doubt the effectiveness of their presentation strategies, for example they would never know with certainty whether a particular technology is persuasive or causing bias or if it speeds up the judgement making process or increases the preparation costs and if both which one outweighs the other. This issue also applies to forensic engineers who help lawyers in finding the causes of failure in engineering related claims and might serve as an expert witness in order to communicate their findings with judges and jurors during the trials, if disputes are not resolved through negotiation, mediation, and arbitration (Feigenson, 2003). To fill this gap in knowledge and in order to facilitate the adoption of emerging technologies through performing the empirical studies, first, we need to figure out why a particular technology is not utilized in courtrooms and what the main concerns are regarding that technology.

Within the construction industry, the effectiveness of the BIM as a powerful communication tool has been proven. Through using BIM, the flow of information can be visualized, and visualization can play a very important role in escalating the level of perception of the decision makers. Based on the survey research conducted by Sattineni et al (2011), uses for BIM in US construction include 1) visualization, 2) architectural design/ modeling, 3) collision detection, 4) estimating, 5) MEP design/ modeling, 6) structural design/modeling, 7) marketing and scheduling. This result emphasizes that BIM is recognized and appreciated as a visualization tool and accordingly as a powerful cognitive tool within the construction industry (Sattineni et al, 2011).

In spite of the all-encompassing use of BIM in the architectural, engineering and construction industry (AEC) over the projects' lifecycles, especially during the design and construction phases, it is not effectively used for claim management and dispute resolutions. In fact, there are less than a dozen examples of using BIM in dispute resolution processes in the literature in this area. The first practice of using BIM in forensic investigations goes back to the collapse of the I35W Bridge in Minnesota in 2007. In this project, Revit was used as a 3-D visual database and to codify the relationship between the data and the physical structure in an interactive three-dimensional environment. This model was named the "Forensic Information Model (FIM)". During the investigation, the team collected and reviewed more than 50,000 documents, including design and shop drawings, inspection and maintenance reports, photos and videos before and after the collapse, analysis documents, witness testimonials and material evidence from the collapse site. This model enabled the parties to catalog and access available information on every component of the truss bridge and facilitated the communication among the investigation team and the clients (Brando et al, 2013).

Another examples of using BIM for forensic investigation purposes includes, the facade investigation of the Manhattan and Metrodome Roof Deflation in Minnesota by Thornton Tomasetti as an extension of the FIM created in the I35W Bridge incident. The challenge inherent in collecting and organizing the huge amount of new and historical data in these projects was a good motivation for the application of BIM in facade investigations (Karanci et al, 2013).
In addition to the FIM approach to the application of BIM in forensic projects, there are a few examples of using BIM in delay claims. The complexity of causal relationships between events and activities in delay claims makes these kinds of disputes very challenging for experts to analyze, explain, and resolve. The literature review of claims and disputes in the construction industry indicates inquisitiveness in using 3D and 4D visualization tools in the forensic investigations of delay claims.

Gibbs et al (2014) compared the effectiveness of 2D and 4D visualization for a delay claim using the case study approach. The delay claim they simulated included the design and construction of a reinforced concrete frame, internal staircases, and provisions for tower cranes (including the tower cranes' bases). They used Excel for their 2D and Synchro software for their 4D simulation. In the 2D simulation using excel, they failed to link a construction program with logic and could not present the site layout or space available between areas. In the 4D simulation, some of the main limitations included not being able to represent planned vs actual progress side by side and restriction of the software in incorporating the photographs, annotations, and links in the model.

Another evidence of using BIM in construction disputes were published by Koc et al (2014). A BIM model of the case which was a residential and commercial building project was created to investigate the benefits of BIM on overcoming the challenges during the dispute resolution process. The documents reviewed for making the model included: work schedules, site reports, payment certificates, project NOC's (No Objection Certificates) and authority permits, correspondences between client and contractor, correspondences between consultant and contractor, 2D drawings and contract documents. The research outcomes indicated that the claims were prepared faster and more accurate in a visualized environment provided by BIM and the quality of presenting the disputes for the resolution purpose were greatly improved.

As the literature indicates, BIM still is not very popular among professionals who are working on claims and forensic engineering cases. The low rate of BIM application in forensic investigations is highly questionable when we know that the majority of forensic engineers working on construction

claims are familiar with BIM applications or are using them for design, construction or facility management purposes.

The main question that this paper seeks to answer is: "Why BIM, including its recognized potential in visualization and enhancing the communication, is not utilized during the dispute resolution process particularly inside the courtrooms?"

Methodology

In order to answer the research question, the qualitative approach by conducting face-to-face interviews with construction law attorneys and forensic engineers was employed. The questions were unstructured, and interpretative and focused on experts' knowledge, opinions, and experience also to ensure that the questions are leading to appropriate results and are aligned with the research objectives, the pilot study was performed. Following the data collection, the content analysis method was used to analyze the data.

For the purpose of this study, the type of expertise and experts' willingness in participating in the research were the most important factor rather than random selection of the participants. Forensic engineers were invited from companies specialized in forensic investigation projects. Since the number of these companies is very limited, forensic engineers experienced in different forensic projects were selected to increase the reliability of results.

In this study, 12 participants including four attorneys and eight forensic engineers were interviewed. Based on the content analysis of a Ph.D. database undertaken on the accepted dissertations by universities in Great Britain, there is no standard number of interviews for research with qualitative data and social scientists have different opinions about the required number of interviews in social science research (Baker, 2012). In this research, the lowest level of experience among participants was ten years and they included female and male professionals.

Results

Based on the conducted interviews, the challenges of using BIM in the resolution of disputes in construction projects from the experts' perspectives are as follows:

- Resource requirement: Creating a 3D Model is very costly and time- consuming. Clients mostly do not accept to pay for BIM, unless a lot of money are involved in the case or/and the case is very complicated.
- Novelty of BIM for forensic purposes: Building Information Modeling was mainly introduced for design and engineering of new projects and is not there for forensic investigations. BIM is not worth spending money and time when you can accomplish the work using conventional tools and also is beneficial for few cases that are very complicated.
- Complexity issue: BIM is very hard to understand not only for experts who need to use it in a court setting when they serve as an expert witness but also for jurors who are not construction experts, especially if they have not been exposed to this technology and 3D modeling before.
- Reliability issue: Using BIM might be very risky. For jurors, 3D models might look beautiful but not necessarily true.

- Lack of experimental supports: The complexity of BIM might negatively affect the jury's verdict against a party who used it. Since this effect is not tested experts are reluctant to use BIM models in courtrooms.
- The dominance of experience in litigation systems: Many people who do expert witness at present are not familiar with BIM and are reserved about using technology. Typically forensic engineers who are picked by attorneys and are known for attorneys and judges have many years of experience. Supposedly, this generation does not know how to used BIM properly.
- Lack of information for creating a model for existing buildings: Creating a BIM model for existing buildings is very challenging. Many of these buildings do not have the design or as-built drawings. So it is not possible to make an accurate and reliable model and pull information out of the model with the accuracy level that people are expected to provide in litigations.
- Manipulating the model: If are not used properly, BIM models have potential to prejudice the outcome of the cases and twist the real story behind an incident.

Conclusion

This paper is the part of an ongoing research and discusses the application of BIM in dispute resolution processes in the construction industry. Based on the finding from the literature, BIM was used as an information management and visualization tool for a limited number of forensic cases but there is no evidence of using BIM as a presentation tool in courtrooms for communicating the technical concepts with final fact finders. In this qualitative research professional participants including forensic engineers and construction law attorneys were interviewed and eight barriers to using BIM in the dispute resolution process as presented in the result were identified.

The outcome of the research emphasizes on the necessity of empirical studies in order to investigate the effectiveness of BIM vs the conventional tools that lawyers and forensic engineers are currently using for the construction dispute resolution. Identification of the existing concerns over using BIM would help researchers, who are working on evidence visualization tools to find out what features and characteristics of this technology should be tested. Since this research is qualitative the outcomes do not help in having statistical inferences.

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