

# **3D BIM Model as a Legal Construction Document**

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## **Abstract**

This study will identify the barriers of using a 3D BIM model as a legal construction document. 3D BIM models help any individual visualize a project even when they have no training in the Architectural field. Not only is visual information found in a 3D BIM model, additional information such as Specifications, A/E drawings, Schedules, Cash Flow and Submittals can all be contained within the files.

Each file has a Digital Professional Signature that identifies who created the file, the creation date, and type of file. Also contained within this signature is an IP address record which tracks each time the file has been shared on line. By using the Digital Professional Stamp and Signature the information in the file cannot be edited or extracted thus giving a higher level of protection to the professional's work. This is the best way to protect and enforce copyright standards while still allowing universal access users.

3D BIM models are not new as a legal document – it has been used for years in different industries in particular for the manufacturing of computer mother boards. This type of use is analogous to building design as it is complicated to produce and built in a similar manner to a construction project with the process being team oriented with many stakeholders. Similarly, it is imperative that construction documents live in a three dimensional culture in order to facilitate coordination and exchange of information. By unifying all documents into a single format; the design and construction process of a project can be integrated into a 3D BIM model.

## **Keywords**

BIM Implementation, Claims, 3D file, Copyright, Construction Documents.

## **1. Introduction**

Building Information Modeling (BIM) is defined as the process of generating, storing, managing, exchanging, and sharing building information in an interoperable and reusable way (Vanlande et al., 2008). It requires the development and use of a computer generated model to simulate the planning, design, construction and operational phases of a project (Robert et al., 2013); this study identifies and analyses the barriers of the 3D BIM model as a legal construction document and discusses methods that could be implemented to minimize or limit liability of construction documents. Research has been performed which includes a survey and study of existing journals in the topic of BIM technology to collect and analysis data.

## **2. Hypothesis**

3D BIM model will be available to Architects use as a legal document; to minimize or limit liability on construction documents.

### **3. Relevance**

Architects who want to standardize 3D BIM model implementation in the process of construction documents.

### **4. Contribution**

Other studies has been done to analyze BIM implementation; these study focus only in identify barriers of using 3D BIM model as a legal Construction Document for Architects.

### **5. What Constitutes a Legal Construction Document (Nepomechie and Poynton, 2013)**

Long before they come to occupy physical space, buildings are “built” many times over. The act of producing CDs is itself an act of construction. The unique combination of words and drawings that are construction documents is the last iteration of the virtual building—and the first that most nearly approximates its final shape. The heart of any project resides in its construction drawings and specifications. Construction documents typically include the following types of information:

#### **5.1 Legal and contractual information.**

- Contractor bidding requirements (invitation to bid or advertisement; information and instructions to bidders; bid forms; and bid bonds).
- Contract forms (form of agreement between owner and contractor; forms for payment bonds and certificates).
- Contract modifications (e.g., additions or changes after the contract is signed, such as orders for minor changes in the work, construction change directives, and change orders).
- Information available to bidders (e.g., surveys, borings, drawings of existing conditions).

#### **5.2 Procedural & Administrative info:**

- Contract conditions (general conditions of the contract for construction, which outline the rights, responsibilities, and duties of owner, architect, and contractor, as well as others involved in the construction process, and supplementary conditions particular to the project).
- Architectural and construction information.
- Drawings (includes architectural, structural/ mechanical/electrical/civil engineering, landscape design, interior design, graphics, and other specialty and shop drawings).
- Specifications (outlines the levels of quality and the standards to be met in construction of the project).
- Addenda (additions or changes to any of these documents issued by the architect during the bidding or negotiation processes)

### **6. Methodology**

This research was developed through a review of literature and journals that have been collected for this study all on the topic of BIM technology. This review provided us a list of BIM barriers and outcomes in the architectural field which we use to develop 6 basic question for the survey and help us collect data which was analyzed. We did this survey in April, 2016 with 10 different professionals who were working at that time for Architectural and Engineer firms in the Atlanta area. All questions

were asked in person or by phone so that we had a direct contact with those being interviewed. This gave us the opportunity to explain the objective of the exercise and better understanding of how the collected data was going to be used. This is the list of questions asked in the survey:

- a) Do you consider 3D BIM model as good interdisciplinary coordination tool?
- b) Do you think the 3D BIM model is a profitable practice for Architects?
- c) Is the 3D BIM model is a reliable Construction document?
- d) What level of experience do you have in BIM software?
- e) Can an old dog learn a new trick?
- f) Which file format you think is best to use with 3D BIM model?

## **6.1 Literature Review Barriers and Outcomes**

### **6.1.1 Barriers in implementing BIM in Architectural practice (Arayici et al., 2011):**

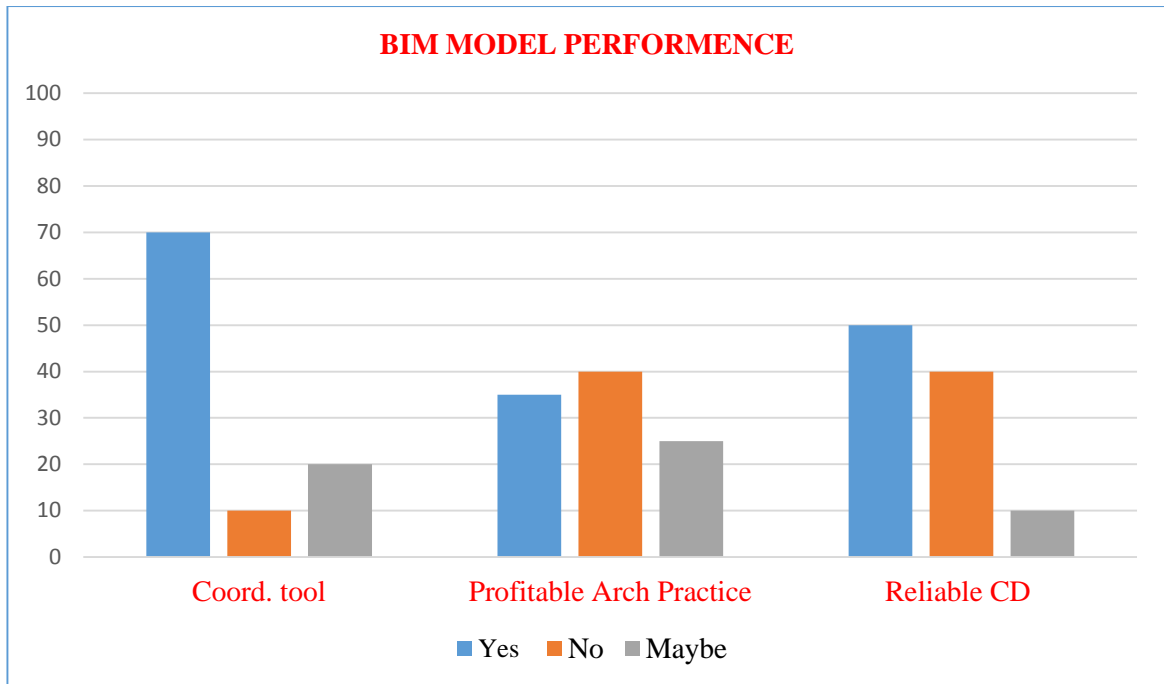
- Overcoming the resistance to change, and getting people to understand the potential and the value of BIM over 2D drafting,
- Adapting existing workflows to lean oriented processes,
- Training people in BIM, or finding employees who understand BIM,
- The understanding of the required high-end hardware resources and networking facilities to run BIM applications and tools efficiently,
- The required collaboration, integration and interoperability between the structural and the MEP designers/ engineers,
- Clear understanding of the responsibilities of different stakeholders in the new process including construction lawyers and insurers.

### **6.1.2 Outcomes in implementing BIM in Architectural practice (Arayici et al., 2011):**

- Greater integration and collaboration with other disciplines in the production process.
- Adopting technology change to provide a more effective business process.
- Effective intelligent real time response.
- All information of the project is stored in detail.
- Consistently a better quality design outputs.
- Reduction in RFI and site management issues.
- Reduce Quality Administration/Quality Control time;
- Ability of staff to use the BIM system and capacity improvement;
- 2D representations, schedule and cost can be easily obtained.
- Reduces cost, travel, printing and document shipping.

## **6.2 Atlanta Architectural Firms Survey Result on BIM Implementation**

- a) Do you consider 3D BIM model as good interdisciplinary coordination tool?  
Yes 70%      No 10%      May be 20%
- b) Do you think 3D BIM model is a profitable practice for Architects?  
Yes 35%      No 40%      May be 25%
- c) 3D BIM model is a reliable Construction document?  
Yes 50%      No 40%      May be 10%



**Figure 1: Question a), b) and c) Analysis**

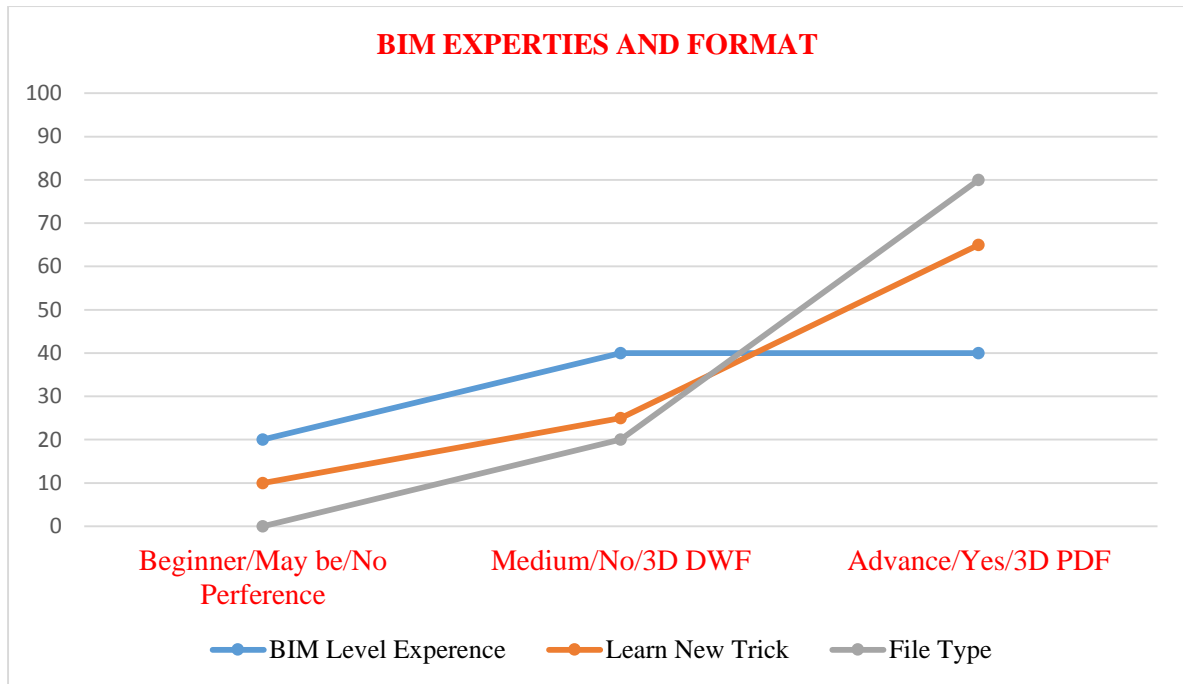
**Analysis result**

80% is the average of Architects who consider 3D BIM model as good interdisciplinary coordination tool.

47.75% is the average of Architects who consider 3D BIM model as a profitable practice for Architects.

55% is the average of Architects who consider 3D BIM model as a reliable Construction document tool.

- d) What level of experience do you have in BIM softwares?
  - a. Advance 40%    Medium 40%    Beginner 20%
- e) Can an old dog learn a new trick?
  - a. Yes 65%    No 25%    May be 10%
- f) Which file format you think is best to use with 3D BIM model?
  - a. 3D PDF 80%    3D DWF 20%



**Figure 2: Question d), e) and f) Analysis**

**Analysis result**

50/50 is the level of BIM software experience for this group.

70% Architects think that an old dog can learn a new trick.

3D PDF considered the best file format.

Most Architect surveyed have been involve in the profession for less than 10 years are more open to learn BIM on the other hand Architects with more experience are not open to learning new technologies. 3D BIM model as reliable Construction document still a debate in the architectural industry; but 80% think is a good coordination tool. Medium and basic level 3D BIM users are the majority in the population of BIM technology; 80% consider 3D PDF as better 3D BIM format than 20% who prefer 3D DWF. 3D BIM technology still not yet a profitable in Architectural practice.

**7. Conclusion**

By finding all the barriers we see that implementation of multiple different formats in Architectural Design is a reality, including but not limited to word documents, spread sheets, specifications, 2D & 3D however, it is clear that only one format can combine all this information in one place and that format is the 3D BIM model.

The study shows that most Architects that been involved in the profession for less than 10 years are the majority of BIM users and more open to improve or learn new BIM technologies. Implementation of 3D BIM models is increasing day by day should becoming a more common practice and a good coordination tool. 3D PDF is been chosen as the most universal format. Conversely, the 3D BIM model as a legal construction document still a debate; because the Architectural industry has not yet gotten to the point of using 3D BIM models as a profitable practice in the majority of the design Projects.

Thus, the Architectural practice should use 3D BIM model on virtually all projects and continue forward by unifying into a single format all the design and construction process of a project. Even with the different barriers to overcome, BIM is a quickly improving technology and an accurate and useful tool that facilitates coordination and the exchange of information.

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