

# Legal and Contractual Challenges of Building Information Modeling (BIM) – Contractor’s Perspective

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## Abstract

Generally, western legal systems are “individualistic” and focus on where the individual rights and responsibilities of people or parties begin and end. These types of legal systems have historically been able to handle traditional construction contracts effectively. In addition, the identifiable and quantifiable risks in such systems have enabled insurance industries to develop and offer a range of products for construction contracts. In contrast, Building Information Modeling (BIM) is “collaborative” in nature and is most effectively used when participants jointly create such models. Hence, contracts involving BIM are more challenging to put together. This challenge manifests itself in two main groups within the construction industry, which have different perspectives; Architects on one side, and the General Contractors and Subcontractors on the other. This paper investigates the current legal and contractual challenges of BIM which the construction industry faces today. A review of contemporary papers, articles, and conference publications in addition of result from survey developed and administered to the General Contractors is presented in order to understand the general perspective on this challenge. The survey results reveal that BIM is not included in the contract documents on the majority of the projects. This is perhaps because, under existing contract laws, including BIM would upset the traditional allocation of risk among the industry participants. The Design-Bid-Build contract delivery method is still used in majority of these projects, and BIM has been included in such contracts, but only as a “co-contract”, “inferential” or “accommodation” document.

## Keywords

Building Information Modeling, BIM, Model Manager, Intellectual Property Rights, Interoperability, Spearin Warranties

## 1. Introduction

There are traditionally two main construction project delivery methods used in the US construction industry: Design-Bid-Build (DBB), and Design-Build (DB). In the former, DBB, the architect is responsible for the design and the contractor is responsible for developing the means and methods to

execute upon that design within a determined cost and scheduled performance time. However, in the later, DB, one entity - the design-build team - works under a single contract with the project owner to provide design and construction services. The Owner is responsible for committing sufficient funds and taking informed and timely decisions.

There is an increasing use of BIM in both design and construction (Bynum et al, 2013). The increased use of BIM has created a concern among contractors that they may inadvertently assume responsibility for architect's design. The architects however are concerned that they may similarly assume responsibility for the contractor's means-and-methods (Larson and Golden, 2007). "The great fear on the part of architects is that general contractors will take a 'huge part' of the industry by 'owning the model'. 'Our biggest fear right now is the contractor selling the model to the client and just hiring the architect as a consultant that puts the design down.'" (O'Brien, 2008). There has been an increase in the use of design-build and other collaborative methods, such as Construction Management at Risk (CM at Risk) and Integrated Project Delivery (IPD), where each project participant plays a role in contract management, design, and construction (Bynum et al, 2013). An architect's practice to limit liability while playing an integral role in BIM has created tension related to who will be the central figure in the future use of BIM (SMACNA White Paper, 2009). It remains unclear whether the architect or the contractor (or both) will come to dominate BIM as its central figure.

BIM has definitely brought many benefits to the industry. These include single entry but multiple use, design efficiency, collaboration, flexibility, consistent design bases, three-dimensional modeling and conflict resolution, visualization of alternative solutions and options, energy analysis capability among others (Larson and Golden 2007, Ashcraft 2008). However, BIM has raised many questions in the legal and contractual aspects of its employment (Martin, 2007; Silberman, 2007; Larson and Golden, 2007; Lowe and Muncey, 2009). Many legal concerns arise from the tool itself or from the use of the tool. If BIM were to be used to produce more accurate and timely 2D documents - which are not shared - it would not create such tension. However, the use of BIM as a collaborative tool, with the promise of BIM's potential to deliver greater quality, cost and safety, is in tension with the traditional allocation of contractual risk.

The following are the major challenges of BIM use (Larson and Golden, 2007; Ashcraft, 2008; Lowe and Muncey, 2009; Simonian, 2014) in the construction industry today; a) A contractual provision for the problems of interoperability, data loss and its consequences; b) the legal status of the model; c) copyright/intellectual property rights; d) design responsibility; e) information ownership and preservation; f) risk allocation among the parties; g) the standard of care; h) rights of access; i) the effect upon existing Spearin warranties, and; j) available insurance and bonding capabilities.

Again, the subject is the tension between collaboration required in BIM, and the individualistic nature of US contract and tort law as it relates to construction (Larson and Golden, 2007; Ashcraft, 2008; Woolford, 2010; Andre, 2011; McDaniel and Thomas, 2013). The law currently does not allow the traditional Owner, Architect and Contractor entities to "share" responsibilities for their activities. Many external organizations are also participants are involved in this discussion. These include the American Bar Association's Forum on the Construction Industry ("ABA"), the American Institute of Architects ("AIA"), and the Associated General Contractors of America ("AGC"), among others. Each of these participant's representative organizations are pursuing their own version of a "consensus" document related to BIM. The AGC's BIM Forum, a collection of construction industry participant and lawyers, has organized a group known as "ConsensDocs", which has produced a document called "ConsensusDoc 301", which promotes the contractor's view of BIM and attempts to preserve the traditional allocation of risk (Lowe and Muncey, 2009).

The AIA has published a similar document E202-2008 "Building Information Modeling Protocol Exhibit", and a more recent document E203-2013 "Building Information Modeling Protocol Exhibit"

(AIA, 2014). The document E202-2013 is not a stand-alone document, but must be attached as an exhibit to an existing agreement, such as the AIA Document B101–2007, Standard Form of Agreement between Owner and Architect, or A101–2007, Agreement between Owner and Contractor.

Finally, this study investigates the perceptions of legal and contractual challenges, mentioned in “a” through “j” above, which general contractors (GC) face from the increased use of BIM. The objective of this research is to; 1) understand the legal and contractual challenges that the introduction of BIM has created in the construction industry; 2) understand the GC’s perspective of these legal and contractual challenges, and; 3) educate the industry participants regarding the challenges to better prepare them for future work.

## **2. Research Methodology**

A survey questionnaire was developed and administered to certain participants in the construction industry. The survey questionnaire was addressed to project managers/project executives. There were 25 total questions in the survey, which focused primarily on the legal and contractual challenges raised by the use of BIM. The primary target audiences for this research were General Contractors (GC) who are or were using BIM on their projects. Thus, the link to a web-based survey hosted on SurveyMonkey (<http://www.surveymonkey.com>) was emailed to 200 construction companies in the U.S. The list of companies was compiled from a list of the top 400 contractors found in the publication Engineering News Record, ENR 2014. A number of local GC’s known to the authors through personal contacts were also contacted. A total of 27 positive responses were received, with a return rate of 14%. The survey indicated that these 27 general contractors had at least 280 projects, which employed BIM. The survey data, analyzed and represented below, thus represents information based on more than 280 BIM-related projects.

## **3. Discussion of Survey Results**

### **3.1 Project Characteristics**

#### **3.1.1 Contract Delivery approach**

When asked about the contract delivery approach, on their current or most recent contracts, 52% responded “Design-Bid-Build”, 11% “Design-Build”, 26% “Construction Management”, and the remaining 11% responded “other”. A few construction firms mentioned Integrated Project Delivery (IPD) in the “other” category. This reveals that the Design-Bid-Build approach is still the one used most commonly, even though Design-bid and IPD are considered the project delivery methods most suitable for use with BIM (Bynum et al, 2013). This may be the reason for construction industry’s slow adoption of BIM.

#### **3.1.2 Number of BIM projects**

When asked about the number of current or recent projects which used BIM, 38% responded “1 to 5” BIM projects, 7% responded “6 to 10” projects, 11% responded “11 to 15”, and 44% responded “more than 15” projects. The survey also showed that there were at least 280 projects, which currently or recently used BIM, which suggests that the number of projects using BIM is increasing.

#### **3.1.3 Information Manager (IM) or Model Manager (MM)**

The survey showed that the Architect operated as the Model Manager on 26% of the projects, the general contractor on 37%, the Construction Manager on 26%, and “Other” on 11%. These results suggest that general contractors are taking the lead on managing the model and acting as a “gatekeeper” to govern access, security, tracking, and coordination of the model (Andre, 2011).

## **3.2 Technological Issues**

### **3.2.1 Interoperability**

Seven percent of the projects experienced interoperability problems “often”, and a majority of companies or projects - 66% - responded that they encountered problem “sometimes”, 21% “rarely”, and 7% “never”. This indicates that BIM is still not fully interoperable between the various software products. A software publisher’s expressed warranty is incorporated into the purchase contract with the purchaser, and that contract’s limitation of damages to the purchase price has been held to be not unconscionable (M. A. Mortenson Co., Inc. v. Timberline Software Corp., 2000). Thus, if errors in a BIM-related software package result in economic loss to the user, the injured purchaser’s recovery is limited to what it paid the manufacturer for the software. However, the user of that software’s liability to other parties is not similarly limited, and such a user is exposed to a “liability gap” if those software errors result in defective model or other deliverable items.

### **3.2.2 Experiencing Data Loss and Dealing with the Data Loss**

On their current or most recent projects, 52% responded that they experienced data loss “sometimes”, 41% responded “rarely” and 7% responded that they “never” experienced data loss. This suggests that the problem of data loss is still significant. When analyzing the data on the provisions for dealing with lost data, only 34% reported projects which had provisions for dealing with data loss, 38% reported projects which did not have provisions for dealing with data loss and another 28% were not sure about whether or not their projects had any provisions for dealing with data loss. This suggests that a significant number of projects did not consider a provision for dealing with data loss in their contracts.

The best case study for the legal system’s efforts to deal with electronic data management comes from an employment discrimination action in a New York District Court case (Zubulake v. UBS, 2004). There, some employee e-mails were deleted from the active system despite the existence of a duty “to preserve” on part of the employer. The employee claimed this amounted to a spoliation of evidence, and sought several sanctions against the defendant employer. So, the legal precedent which has emerged from the Zubulake decision is that electronic information must be protected from loss and actively preserved by the all parties and their counsel whenever litigation is “anticipated”.

What this means for the traditional participants is clear. Since litigation is not uncommon to construction projects, the traditional participants and their counsel must anticipate litigation from the start of their projects, have clear electronic records management policies in place and identify “key” players in the participant organizations - usually those who supervise the creation and use of data.

### **3.2.3 Data misuse**

Models should only be used for the purpose for which they are intended. When a model made for one purpose is used for another, currency, adequacy and tolerances become a concern (Ashcraft 2008). From the survey data, only 7% of the project models were “always used” for the intended purpose, and 34% “frequently used”. However, 45% of models were used “only sometimes” and 14% of the models were “never used” for their intended purpose.

## **3.3 Legal and Contractual challenges**

### **3.3.1 Legal Status of the Model**

There were four questions related to the legal status of the model. The first question was whether or not the BIM was included in the contract. Of all respondents, 69% of the contracts did not include the model in the current or most recent contract, 24% did include the model, and 7% of the respondents were not sure

about the status of the model. The second question was whether or not the model was included in any other parts of the contract. Of all respondents, 67% of the current or most recent contracts did not include the model in any other parts of the contract, only 24% included the model, and 9% respondents were not sure about the status of model. The third question was if the model was not included, then what the legal status of the model was. Of all respondents, 7% used the model as co-contract document (which governs affairs between the parties), 17% used the model as an inferential document (which provides visualization of the design intent inferable from the contract documents), and 31% used the model as an accommodation document (which can be used by others, but not relied upon). The fourth question was related to the confusion of the component parts, which constituted a record on the contract, 22% responded that there was “no” confusion, and the remaining 78% responded that there was “slight” to “moderate” confusion.

The responses show that BIM is still not fully integrated into the contract, which means BIM is used only to produce more accurate and timely 2D documents that are NOT shared. This is known as “CAD on Steroids” (Ashcraft, 2008), and an effective sharing of the model is still far away. Whether the model was or was not included in the contract documents answered many of the doubts regarding collaboration, clarity, and risk allocation, and these survey results are presented below.

### **3.3.2 Copyright/Intellectual Property Rights**

On the subject of ownership of the Building Information Model, the project owner retained ownership of the model in 41% of the current or most recent contracts. The architect retained ownership in 26% of these contracts, the contractor retained ownership in 7% of these contracts, and joint ownership was reported on 26% of contracts. In response to the clarity of ownership of the model, 45% responded that the model ownership was “not clear” to “somewhat clear”, 33% responded model ownership was “moderately clear”, and only 22% responded that the model ownership was “highly clear”.

Traditionally, and according to the AIA document B141, the architect owns the plans and the design, but the survey revealed that the architect owned the model only in 26% of the current or most recent contracts. The collaborative, multi-party authorship of the model raises intellectual property questions not present in the traditional preparation of plans and specifications (Larson and Golden, 2007; Ashcraft, 2008; Woolford, 2010; Andre, 2011; McDaniel and Thomas, 2013). The ConsensusDOCS 301 BIM Addendum, to which the AIA is not a party, does not assign ownership, but recognizes that it is to be negotiated among the traditional participants early in the project. Therefore, each project’s contract must address the issues of copyright of both the data submitted by each party and the model itself.

### **3.3.3 Access Rights**

Regarding clarity of access to the information contained in the Building Information Model, 19% of the respondents reported that the contracts were “not clear at all”, 15% reported “slightly clear”, 33% reported “somewhat clear”, 22% reported “moderately clear” and only 11% reported “highly clear”. The contracts documents’ specification of the rights of each project participant to obtain copies of BIM at the completion of the project may also prevent disputes over those rights. This is particularly true when issues arise over contract claims or construction defects (Silberman, 2007). It can be inferred that the current or most recent contracts were not clear in majority of cases on who would have access to information contained in the BIM at each stage of the project, and after project completion. Access to information after completion, which heightens security problems, becomes especially important for projects.

### **3.3.4 Design Responsibility**

In responding to the question of how proper was the design responsibility distributed on the most recent contract, 52% responded that the contracts were “somewhat proper” or “slightly proper”, 33% reported the contracts were “moderately proper”, and 15% reported the contracts were “highly proper”. The survey results show that majority of the contracts were not clear about the design responsibility.

Conversely, in response to the question about who is in “responsible charge” of the design, “the architect”

was the responsible party in a majority of the contracts (82%), with “the engineer” (7%), “the contractor” (4%), and “other” at (7%). The survey results show that the architects were responsible charge in overwhelming majority of the contracts.

An architect may delegate certain parts of the design to engineers with the expertise in the Mechanical, Electrical, Plumbing and Structural systems, or to other contracting firms which have both the expertise to do such engineering and the capability to perform such work. However, to do so raises difficulties. The architect must still obey rules related to his licensure and be in “responsible control” of the work. BIM designs may contain “embedded” information from subcontractors and their vendors, and BIM software can react to that information and changes in the model without the architect knowing or checking on this. Such systems – created by non-architects – offer “automated” design, and produce work which an architect or engineer has not and cannot supervise to the degree necessary to satisfy this “responsible control” requirement, or be in “responsible charge” of the work (Ashcraft, 2008). Therefore, the prime contract should contain language, which clearly defines the responsibilities of all of the construction participants (Silberman, 2007; Hurtado and O’Connor, 2009).

### **3.3.5 Information Ownership and Preservation**

Regarding the question on ownership and preservation of information, 52% responded that the current or most recent contracts were “somewhat appropriate”, 3% reported “slightly appropriate”, 31% reported “moderately appropriate”, and only 14% reported “highly appropriate”. The survey results show that the ownership and preservation is in majority of case at least somewhat appropriate. The dynamic model is a valuable assembly of data, which is fragile, as well as susceptible viral infection and physical loss. An Architect’s “Valuable Papers” insurance policy may cover catastrophic loss, but this coverage does not extend to others in the collaborative process. Architect’s professional liability policy does not provide coverage for this either. Although, a “technology rider” product is currently being evaluated for commercial general liability policies (Ashcraft, 2008). As stated earlier, preservation of data is required any time litigation is “anticipated”.

### **3.3.6 Risk allocation**

Regarding the question on the result of the clarity of risk allocation on the current or most recent contracts, 7% responded that the contracts were “not clear at all”, 28% reported they were “slightly clear”, another 28% reported they were “somewhat clear” and 34% reported they were “moderately clear”. Only 3% responded that these contracts were “highly clear”. BIM substantially alters the relationship among the parties traditionally involved in construction projects by blending their roles (Ashcraft, 2008). The survey results show that the risk allocation among the parties was not necessarily always clear.

### **3.3.7 Standard of Care**

The survey result on modification of standard of care revealed that 30% reported that the standard of care was “somewhat modified”, 41% reported it was “not modified at all”, 15% reported it was “moderately modified”, 11% reported it was “slightly modified”, and 4% reported it was “highly modified”. Liability for design is traditionally based on the “Standard of Care” for each discipline. “Standard of Care” is a Tort law concept which Contract law borrows to define the reciprocal responsibilities of each contracting party. California Business and Professional Code demands that the architect be “in responsible control of” his professional services. It defines “responsible control” to mean “that amount of control over the content of technical submissions during their preparation that is ordinarily exercised by architects applying the required professional standard of care” (California Law, 2014). The survey results show that the modification of the “Standard of Care” among the parties was not necessarily always clear. How much collaboration can an architect have on a BIM-related project and still meet this standard? To what extent can he rely on his collaborator’s contributions and still meet this standard? These questions are the future research topics.

### **3.3.8 Spearin Warranties**

When asked “how significantly is the Spearin warranty affected by BIM collaboration on the current or most recent contract?”, 59% reported that Spearin warranty are “moderately and somewhat affected”, 15% reported this warranty was “slightly affected” and the remaining 26% reported that they were “not affected at all”. Under Spearin, the owner implicitly warrants the information, plans and specifications which an owner provides – through his hiring of the Architect - to the general contractor. This general contractor would not be liable to the owner for any loss or damage which results solely from insufficiencies or defects in such information, plans and specifications (United States v. Spearin, 1918). Being a contributor to the model on a project using BIM may break down this protection. If the contributor is seen as performing design-related activities, the contributor may take on the errors and omission liabilities of a designer. Therefore, the contractors try to avoid such implications.

### **3.3.9 Insurance**

In response to the subject of indemnification, insurance or bonding provisions in the current or most recent contracts, 63% reported that these contracts did “not have any” insurance and bonding provisions on the contract, 22% reported they were “not sure” about such provisions and only 15% reported that these contracts did have provisions to cover the liability for modeling errors. It can be inferred that the majority of the contracts did not have clearly visible provision for indemnification, insurance or bonding. The main idea is that an architect maintains professional liability insurance for his activities. When the architect delegates his design obligations, he is at risk unless the contractors to whom he delegates have professional liability insurance in place when they perform changes. Otherwise, any defective design claims could seek restitution from the architect’s professional liability insurance policy.

## **3.4 Internal Consistency (Reliability) of the scale: Cronbach’s Alpha**

There were nine survey questions directly related to the legal and contractual challenges of the BIM model, and whether or not and how clearly the contracts address or measure the contractor’s perspective on the issues created in the 5 points Likert scale. The internal consistency of these items was analyzed by using SPSS. The internal consistency, as determined by a Cronbach’s alpha of 0.79 and Standardize Cronbach’s alpha of 0.793 were obtained respectively. The value 0.79 shows that there was a good internal consistency of the scale.

## **4. Conclusions and Recommendations:**

Here is a summary of the major findings and the conclusion of this research:

1. The survey results show that a majority (52%) of construction contracts still follow the design-bid-build approach to project delivery.
2. A larger proportion of the construction companies (44%) have more than 15 projects in their current or most recent contracts, which employ BIM.
3. It is still too early to say who will be the dominant owner of the model, since the survey shows the ownership spread unevenly among the project participants.
4. A majority of respondents (63%) think that the risk allocation among the parties is “not proper at all”, or “slightly proper”, or only “somewhat proper”.
5. A majority of the contracts (69%) do not include the model in their contracts and a majority of the contracts (67%) did not even consider the model in other parts of the contracts. Only 24 % of the contracts considered the model in their contract as a “co-contract” document, an “inferential document”, or an “accommodation” document. This indicates that the participants do little sharing of the model.

The authors recommend expansion of this study to determine the perspective of the architects or designers to determine commonalities and differences in their perceptions of the challenges posed by BIM. The authors also intend to expand the number of survey respondents through a second round of inquiry from

GC's. They would use more clarification in the design of the questions to address some of the comments received in the first round of survey.

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