Engineering Management
Field Project

Challenges, Benefits, & Risks Associated with Integrated Project Delivery and Building Information Modeling

By

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Executive Summary

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 (Wickersham 2009). 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.

Modeling technology has advanced to the point that inefficiencies in the traditional project delivery methods have been identified. Parallel modeling is the most obvious of the inefficiencies. In parallel modeling, the Contractor re-creates the Architect/Engineer's BIM model, which was developed during the design stage, for use during the construction stage. The Contractor re-creates this model because it was developed without input from the Contractor, and may not be appropriate for the "means and methods" of construction. Advanced Modeling Technology is also allowing virtual models to be developed prior to building a full-scale model at full price.

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 (Cunz 2009). There are some insurability issues

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.

Architectural and Engineering Companies must pay attention to how IPD and BIM are impacting the structure and existence of their firms, and have to become comfortable with IPD and BIM to remain competitive in the industry. Technology is allowing for the design and construction process to become more efficient and integrated, which reduces wasteful spending. Architects/Engineers must also carefully consider the risks, contractual expectations, and compensation before entering into this new type of project delivery agreement. The legal risks and financial rewards must be balanced.

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Chapter 1 – Introduction

Traditional and Common Project Delivery Methods

Traditional responsibilities and roles of the Owner, Architect/Engineer, and Contractor for a design-bid-build project have been clearly defined over the past 90 years. The Owner hires an Architect/Engineer to assemble Contract Documents (Drawings and Specifications) for the construction of a project. The Architect/Engineer assists the Owner in the selection of a Contractor to build the project by competitive bid. The successful Contractor is almost always the low bidder, without much consideration given to qualifications. The successful Contractor is then hired by the Owner to construct the project by using the Contract Documents assembled by the Architect/Engineer. During the construction phase of the project, the Owner normally hires the Architect/Engineer (usually the same Architect/Engineer that assembled the Contract Documents) to monitor the construction of the project and ensure it is constructed in conformance with the Contract Documents. The Architect/Engineer is responsible for the accuracy of the Contract Documents and the Contractor is responsible for the means and methods used to construct the project.

Design-Build and Construction Manager-at-Risk have become popular methods of delivering large projects. Selection of the Architect/Engineer, Contractor, and sometimes a Program Manager are based on qualifications and price. Owners prefer this method of project delivery due to the overall time savings in the design and construction phases. Continuous value engineering is applied throughout the design phase because of the interaction between the Architect/Engineer and the Contractor.

Paper drawings produced by the Architect/Engineer are often assembled by using AutoCAD or Micro Station and a compatible design program. Many times, three dimensional models are used as "design tools" by an Architect/Engineer to create two dimensional paper deliverables. What is meant by "design tools" is that the three dimensional models may not have been created with the intent to construct the project, so they may only be accurate enough to transfer dimensional information to paper.

Contractors, suppliers, fabricators, and others that are involved in the construction phase of the project ask the Owner for the model that was used in the development of the paper plans and specifications. Owners then request this model from the Architect/Engineer they hired to design the project. The Architect/Engineer, most of the time, will release the model that was used to develop the plans and specifications to the Owner, but will require all parties using the model to sign a list of disclosures that claims no liability for the accuracy of the information within the model, and that all parties using this model assume all responsibility for the consequences of using it.

New Project Delivery Method Using Advanced Technology

Integrated Project Delivery (IPD) is a new method of project delivery that uses a collaborative process with a team of key stakeholders early in the life of the project. This team of key stakeholders consists of the Owner, Architect/Engineer, and Contractor. The idea is to have all parties involved from the beginning to make the process more efficient, optimize results, and reduce waste (American Institute of Architects 2007).

Building Information Modeling (BIM) is much more than a three dimensional model created by using AutoCAD or Micro Station with a design program. BIM embeds the three dimensional model with detailed information, such as schedule and cost data.

The additional data embedded in the model is sometimes referred to as the fourth and fifth dimensions. BIM is likely not just one model either; it is more accurate to think of it as a set of interrelated models created by the project team that allows for the ability to exchange information (Wickersham 2009).

When IPD and BIM are combined and executed correctly, the result can be a very successful project that will reduce claims from design errors and omissions. However, IPD and BIM tend to overlap the roles and responsibilities of the Architect/Engineer and the Contractor, and this has blurred the traditional roles defined by a history of case law and legal disputes. The overlap of roles and responsibilities for this type of delivery does not come without additional risks (Ballobin 2008). The majority of Architects and Engineers are not comfortable with this new form of delivery because of the increased liability (risk) associated with turning over model files. The concern is that many other parties – Contractors, Subcontractors, Fabricators, Manufacturers, and others – who are using this model will rely on the information contained within the model to be 100 percent accurate.

Spearin Doctrine

In 1918, the Spearin doctrine set a precedent that impacted the construction industry. Today, the doctrine is being challenged due to advancements in technology which have created different methods of project delivery. The United States Supreme Court ruled in the 1918 decision that a Contractor bound to the Owner to build a project according to the Contract Documents prepared by the Owner or the Owner's Architect/Engineer, "will not be responsible for the consequences of defects in the plans and specifications." Further the Court ruled that the Owner provides an implied warranty

of the suitability of the documents for construction (*United States v. Spearin* 1918). In simple terms, if the Contractor complies with the plans and specifications, the items the Contractor constructs should be adequate, and the Contractor is not responsible for consequences due to the inadequacy of the plans and specifications. The Owner guarantees that the information contained within the plans and specifications is adequate to construct the project.

Changing Roles, Responsibilities, and Risks to Consider

Traditional paper deliverables and the process that was used to create them are becoming obsolete, but there are contractual considerations that should be considered before changing the method of project delivery. IPD used with BIM is changing the way that Owners, Architects/Engineers, and Contractors interact throughout the life of a project. Contractors are involved in the pre-design stage and are providing input that has an effect on the design. Architects/Engineers are developing a model that will be used to construct the project. This overlap of traditional roles and responsibilities affects the amount of risk placed upon Architects/Engineers and Contractors. This additional risk must be considered in the contractual agreement.

A Building Information Model (BIM) will exist for the life of the structure and the Owner will benefit from building efficiencies, initial cost savings, and operations and maintenance of the facility. Owners may expect a perfect design due to continuously modifying the model during the design stage. Architects/Engineers have to be careful that they do not end up with increased risks due to the assumption that they are solely responsible for the elements within the model, when, in reality, some of the elements

within the model may have been provided by other Consultants, Contractors, Subcontractors, Fabricators, Manufacturers, or Suppliers (AIA_Trust 2009).

The Scope of an IPD with BIM project must be carefully crafted. The definition of professional services and design should be written into the Scope. The ownership and control of the digital model(s), and the information within them, have to be understood. A process for revising the model(s) should be included in the Scope along with the organization responsible for regulating these revisions. Construction will have to conform to the completed model. Compensation should be fairly distributed based on the level of risk associated with the task being performed (AIA_Trust 2009).

Purpose of this Research

The purpose of this research is to examine some of the challenges and determine the extent of the increased liabilities and risks that may be assumed when using IPD and BIM, and how those risks can be minimized. IPD is changing the way projects are delivered with early, and often, interaction from all parties involved in the life of the project. BIM is changing the way projects are delivered by creating a model embedded with detailed information. Architectural and Engineering Companies have to become comfortable with IPD and BIM to remain competitive in the industry. Architects/Engineers must carefully consider the risks, contractual expectations, and compensation before jumping into this new type of project delivery method. The financial and legal risks and rewards must be fairly balanced.

Chapter 2 – Literature Review

Introduction

Several published articles, reports, and white papers discuss the differences between traditional project delivery and IPD. The literature describes the collaborative relationship required of the Owner, the Architect/Engineer, and the Contractor involved in IPD from the conceptual phase through completion of construction. IPD is compared with the traditional project delivery method of design-bid-build (See Figure A-1 in Appendix), and then some of the challenges, contractual issues, and risk exposures are outlined. BIM is mentioned in almost all of the articles that discuss IPD. BIM used with IPD involves the sharing of data-rich 3D models among Owners, Designers, Contractors, and Suppliers. Consequently, a common fear that arises is an unintended assumption of responsibility for the design by the Contractor, and an unintended assumption of responsibility for the means and methods used during construction by the designer (Larson and Golden 2008). Some of the challenges, contractual issues, and risks identified by experts in the Architectural, Engineering, and Contracting industry are discussed in this chapter. The result of the one and only BIM dispute, to date, is also discussed.

There are also published articles and guidelines suggesting using IPD and BIM actually minimizes the risks Owners, Architects/Engineers, and Contractors face in the development of a project. In fact, some organizations have rebuilt their organizations around IPD in an effort to mitigate risk. Key principles that must be understood by all participants using IPD are early and collaborative involvement of all parties, mutual trust

and respect, shared risks and rewards, and a commitment to work as a team in the best interests of the project (Cunz 2009). These articles and guidelines also place an importance on educating the participants of their roles and responsibilities and an expectation to be project focused instead of profession (or company) focused.

Architect/Engineer and Contractor Relationship

The structure of the traditional design-bid-build contract that Owners, Architects/Engineers, and Contractors in the United States are familiar with is based on shifting risk, which leads to an adversarial relationship between the parties involved in the project. In the traditional design-bid-build project delivery method, the roles and responsibilities of the participants are separated. Information, expertise and knowledge are not shared, but hoarded. When issues arise on a project, there is little cooperation between the Architect/Engineer and Contractor and there is a strong tendency to protect one's financial interests. It is possible for a project participant to succeed and have the overall project fail (American Institute of Architects 2007).

IPD involves collaboration between the Owner, Architect/Engineer, and Contractor throughout all stages of the project. Everyone works together in the early stages of the project to set goals. When these goals are achieved, there are rewards, in the form of profit, associated with these goals. The idea is to have the entire project team communicating and on the same page throughout the project. When BIM is used with IPD, a single model is created for the project by the Architect/Engineer and the Contractor, thus eliminating the redundancy of the Contractor producing another model. The Owner does not pay for the same effort twice by two different entities and the overall

project schedule is reduced. With the entire team aligned toward a common goal and working together, waste is reduced and efficiency is optimized.

Convincing Architects/Engineers and Contractors, whose previous experience has been the traditional design-bid-build project delivery method, to communicate, share information, and be project focused, instead of profession focused, presents an enormous challenge. The risk shifting, traditional delivery method has been the primary method used by the industry and there are unknowns that surface when communication between the Architect/Engineer and Contractor takes place throughout all stages of the project. Most Architects/Engineers that are experienced in the traditional design-bid-build project delivery method are not comfortable with IPD and BIM due to the increased risks that may be assumed.

The One and Only Known BIM Dispute

There is one known BIM dispute settlement which validates the fear of assuming additional responsibility that many experienced Architects/Engineers share. The one and only major lawsuit related to the use of BIM was settled out of court, so many of the facts will remain unknown. What is known is that the delivery method of the project was design-bid-build, the building was a life-sciences building at a major university, and BIM was used in designing the mechanical, electrical, and plumbing (MEP) system. The MEP system was fitted into the ceiling plenum using a certain installation sequence and this sequence was not made available to the Contractor in the design documents. When the Contractor was 70 percent complete with the MEP system, it ran out of space in the plenum. The Contractor sued the Owner, the Owner sued the Architect, and the insurance carrier sued the MEP Engineer. The settlement was significant, totaling

millions of dollars, which was shared by the Architect, MEP Engineer, and the Contractor (Post 2011).

BIM was used in the design of the MEP system, on a design-bid-build project, and a certain installation sequence was used in the design process to fit all of the elements of the MEP system into the plenum. The traditional project delivery method of design-bid-build, using paper drawings and specifications, discourages specifying a certain sequence of items to be installed because that would involve the Architect/Engineer in the means and methods of construction. The Contractor has the responsibility to ensure the construction of the project meets the drawings and specifications, including the ability to choose the means and methods of construction. Although this dispute was settled out of the courtroom and many of the facts remain unknown, the message that it sends to the Architectural and Engineering community is to proceed with caution when using BIM in the design process because the historical roles and responsibilities change, and the protection of the Spearin doctrine may not apply.

Insurance and Contract Structure

Determining the appropriate types of insurance for the participants in an IPD and BIM project is difficult. IPD and BIM is a different way of delivering a project than the traditional design-bid-build method. There is an overlap of the traditional responsibilities of the Architect/Engineer and the Contractor in IPD and BIM that could present problems determining who is at fault in the event of a dispute. A clear separation of liability does not exist in IPD and BIM; instead, Design firms, Contractors, Owners, and Insurers only have an understanding of the roles and responsibilities. Insurers may be hesitant to provide a policy for projects when the lines of responsibility seem uncertain (AIA_Trust

2009). The American Institute of Architects (AIA) and ConsensusDocs have published contractual documents for use with IPD and BIM that suggest the types of insurance coverage required for the project participants.

A clear separation of responsibility and liability has been established for the traditional delivery method and the industry standard agreements through historical legal decisions. Typical insurance policies required of the Architect/Engineer in the traditional design agreement between the Owner and the Architect/Engineer are Professional (Errors and Omissions) Liability, Commercial General Liability, Automobile Liability, and Worker's Compensation and Employer's Liability. Typical insurance policies required of the Contractor in the traditional construction agreement between the Owner and the Contractor are Commercial General Liability, Automobile Liability, and Worker's Compensation and Employer's Liability.

It is not possible to discuss insurance policies required of each IPD participant without discussing the type of agreement being used. AIA Document A295 – 2008 General Conditions of the Contract for Integrated Project Delivery and ConsensusDocs 300 Standard Form of Tri-Party Agreement for Collaborative Project Delivery are the closest to the traditional project delivery methods from an insurance perspective, which makes them more manageable for insurance companies to provide insurance policies. Each company is responsible to provide the typical traditional insurance policies required for design and construction. However, in any IPD Agreement, the Contractor may want to consider design liability insurance due to the increased participation during the design phase. The Architect/Engineer may want to consider a Builder's Risk policy for the increased participation during the construction phase (Ballobin 2008).

AIA has also published AIA Document C195 – 2008 Standard Form Single Purpose Entity Agreement for Integrated Project Delivery and AIA Document C191 – 2009 Standard Form Multi-Party Agreement for Integrated Project Delivery. These two agreements are complex and would likely only be used on very large projects. These agreements require all parties of the agreement to retain an insurance consultant to identify and obtain the insurance required for the project. The insurance consultant and parties of the contract are required to establish an insurance program. The parties of the contract have to retain the customary insurance coverages set forth in the General Conditions until an insurance program is agreed upon.

IPD and BIM require collaboration between all participants during all phases of the project. Contractors provide advice to the Architects/Engineers during the design on the constructability and costs of the project, and this type of involvement could be perceived as playing a role in the design of the project. Contractors should purchase the same design liability insurance as the Architect/Engineer to protect themselves from any issues that may arise due to this involvement. The level of involvement of the Architect/Engineer during the construction phase of the project may require the Architect/Engineer to consider additional insurance policies to cover tasks that may be perceived as being involved in the means and methods of construction.

Dispute Resolution

The method of resolving a dispute, as outlined in AIA Document A295 – 2008 General Conditions of the Contract for Integrated Project Delivery and AIA Document A195 – 2008 Standard Form of Agreement between Owner and Contractor for Integrated

Project Delivery, is shown in Figure 1 below and described herein. A Claim by the Owner or Contractor is initiated by written notice to the Initial Decision Maker, who is the Architect/Engineer unless otherwise stated in the Agreement. The Initial Decision Maker reviews the Claim and requests additional information, rejects the Claim, approves the Claim, suggests a compromise, or advises the Owner and Contractor that he or she is unable to resolve the Claim. The Owner or Contractor can file for mediation of an initial decision. If mediation does not resolve the Claim, it is subject to arbitration. The award rendered by arbitration is final.

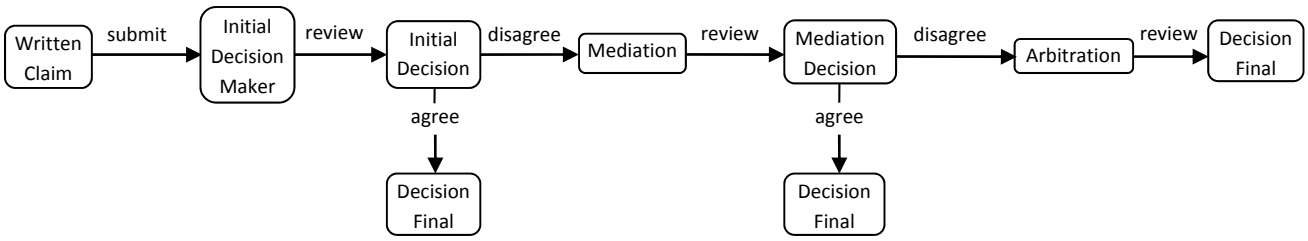

Figure 1. AIA Document A295-2008 and AIA Document A195-2008 Owner/Contractor Dispute Resolution Flowchart.

When using AIA Document A295 – 2008 General Conditions of the Contract for Integrated Project Delivery and AIA Document B195 – 2008 Standard Form of Agreement between Owner and Architect for Integrated Project Delivery, a dispute is settled in the following way. A dispute between the Owner and Architect/Engineer is first subject to mediation. If the dispute is not resolved by mediation, it is subject to arbitration where the decision rendered is final. See Figure 2.

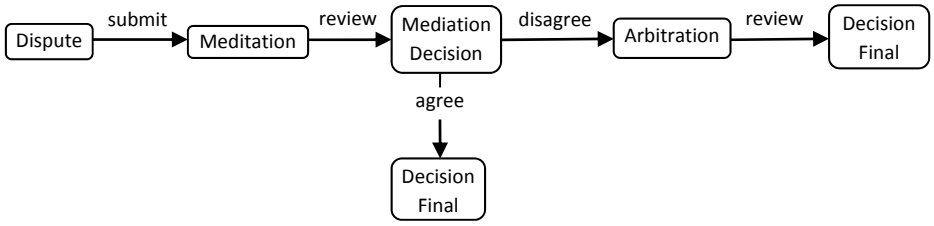

Figure 2. AIA Document A295-2008 and AIA Document B195-2008 Owner/Architect-Engineer Dispute Resolution Flowchart.

Dispute resolution when using ConsensusDocs 300 Standard Form of Tri-Party Agreement for Collaborative Project Delivery is described in this paragraph, and shown in Figure 3. The first step in resolving a dispute is direct discussion among the Parties' representatives to reach a resolution. If the Parties' representatives are unable to reach a resolution, the matter is presented to the Management Group. The Management Group will review the dispute and take one of the following actions: request additional data, request an analysis of the dispute, or attempt to negotiate a resolution of the dispute. If the Management Group cannot resolve the dispute, the issue is presented to a Project Neutral, Dispute Review Board, or is attempted to be resolved using mediation. If the Project Neutral, Dispute Review Board, or Mediation is unsuccessful, the matter is submitted to arbitration or litigation in the state or federal court having jurisdiction where the decision is binding.

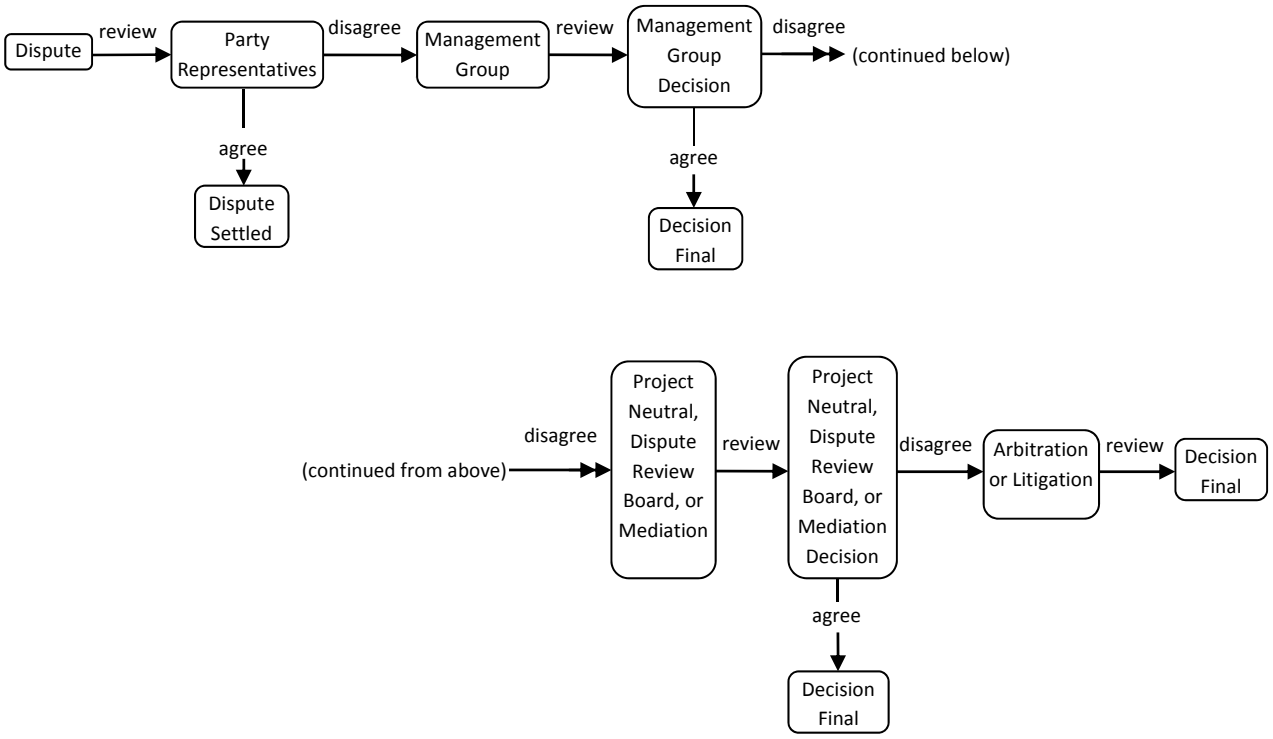

Figure 3. Consensus 300 Dispute Resolution Flowchart.

When using AIA Document C195 – 2008 Standard Form Single Purpose Entity Agreement for Integrated Project Delivery, disputes are resolved in the following way. Any Member with a dispute must notify all affected Team Members of the dispute and schedule a meeting to resolve their differences within 15 days of the dispute notification. If a resolution cannot be made among the affected Members, the dispute is presented to the Governance Board. The Governance Board must render a decision within 30 days of notice of the dispute. If the dispute is still unresolved after the decision of the Governance Board, it is referred to arbitration through a Dispute Resolution Committee for final resolution. The Dispute Resolution Committee consists of a chief executive of each Member and a Neutral. The Neutral is the chair of the Dispute Resolution

Committee and the Neutral endeavors to facilitate a mutual resolution of the dispute within 60 days of notice of the dispute. In the event a mutual resolution cannot be reached, the Neutral shall decide the matter by requesting information from the Members and rendering a decision within 60 days of receipt of all information requested. See Figure 4.

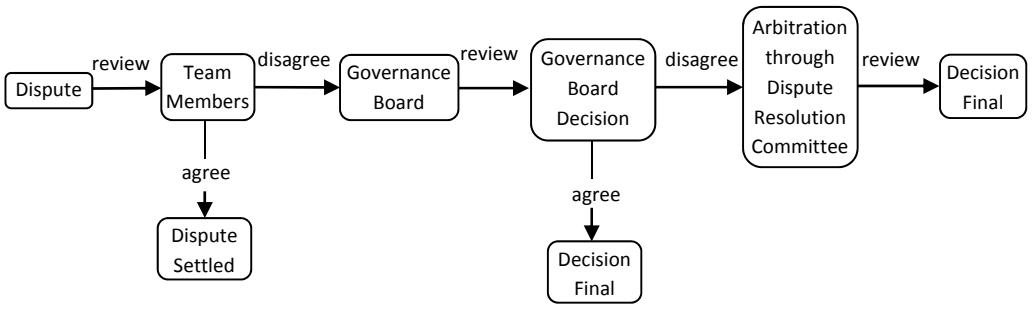

Figure 4. AIA Document C195-2008 Dispute Resolution Flowchart.

When using AIA Document C191 – 2009 Standard Form Multi-Party Agreement for Integrated Project Delivery, disputes are resolved by the following method. If an issue cannot be resolved among the Members of the Project Team, it is brought before the Project Management Team. If the Project Management Team cannot resolve the dispute, the dispute is submitted to the Project Executive Team. In the event the Project Executive Team cannot reach a decision, the dispute is referred to the Dispute Resolution Committee. The Dispute Resolution Committee consists of senior management representatives and a Project Neutral. The Project Neutral endeavors to mediate a resolution. If mediation does not resolve the dispute, arbitration or litigation in a court

(pre-selected in the development of the agreement) renders a binding resolution to the dispute. See Figure 5.

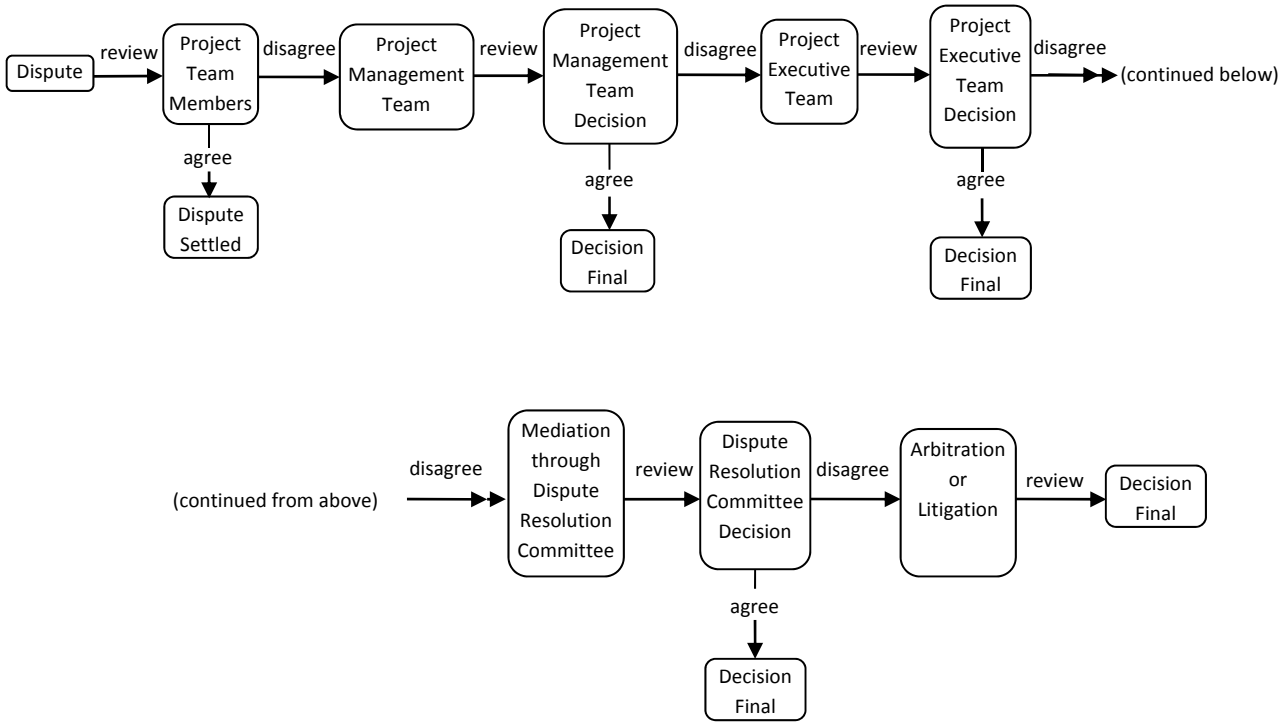

Figure 5. AIA Document C191-2009 Dispute Resolution Flowchart.

Waivers, Indemnification, Limitations on Liability

Waivers for consequential damages, subrogation, and other claims are important clauses to consider in any type of agreement, and these topics are included in the standard AIA and ConsensusDOCS agreements mentioned in this paper. The participants should attempt to place limits on their liabilities that do not exceed their respective fees, incentive compensation, insurance proceeds, or some other type of predetermined amount.

BIM and Its Uses Today

Building Information Modeling (BIM) is being used today mainly in a relatively non-integrated environment in the development of a project due to the structure of the contract being used and the form of deliverables specified within the contract. Architects/Engineers are using BIM to assist in the design, and then they deliver the two dimensional paper plans and specifications that are specified in the contract. The Architect/Engineer usually will furnish a copy of the model used in the design for the Contractor's use in building another set of models for the physical construction phase of the project. Furnishing the model to the Contractor for this type of use is usually an afterthought, and therefore the models are shared with disclaimers that claim no liability for the accuracy of the information within the model, and that all parties using this model assume all responsibility for the consequences of using it (Larson and Golden 2008).

This type of BIM use is criticized as being wasteful because of the redundancy of the project members re-creating the same model. The Owner pays for the multiple creations of the same model, and the time spent in the creation of these models adds length to the overall project schedule.

BIM, which is a design tool, is an advancement in technology that allows for a complete virtual design model to be developed before actual construction, thus reducing costly claims and disputes during construction. Combining BIM with the collaborative nature of IPD makes sense because all parties are involved from the inception of the project and have provided input in the development of the model. There is an understanding among the project team of what the information contained within the

model should, or should not, be used for. This type of interaction also helps Architects/Engineers who may not be familiar with construction practices avoid designing an element of the project that may be difficult and more costly to construct.

IPD Principles

Although a great deal of this paper discusses the contractual issues and challenges of IPD, this method is more than just another type of contractual agreement. IPD is a mindset, a spirit, and a philosophy. Participants have to want to share information, ideas, and resources for a greater, and perhaps later, return. Full commitment is required from everyone involved for IPD to be successful (Cunz 2009).

Achieving the benefit that IPD offers requires the participants of the project to follow some key principles. Some of the key principles are mutual trust and respect, mutual benefit and reward, collaborative innovation and decision making, early involvement of key participants, early goal definition, intensified planning, open communication, appropriate technology, organization, and leadership (American Institute of Architects 2007). Owners, Architects/Engineers, and Contractors must define their roles, responsibilities and goals at the first meeting. Leaders of the project should be selected for each phase of the project. The project scope, standards, budgets, goals, exchange of electronic information, management of the electronic models, and other important aspects of the project must also be discussed at the first meeting (Cunz 2009).

Education

The misuse of BIM can have serious legal consequences, so proper education on how to use BIM is important. BIM requires adequate and effective communication

between all parties involved in the project. The communication should be focused not only on the design of the project, but on scheduling, sequencing, costs, and all the other information that is input into the BIM model. BIM is being used as a design tool and a construction site management tool, so the users have to become aware of its capabilities and limitations. This cannot be accomplished without the proper training, and this training can be a significant expense. The BIM dispute discussed in this chapter is the one, and only, known dispute at this time, but the decision seems to have suggested the designer should have communicated the sequencing of the plenum installation to the Contractor, thus involving the designer in the means and methods of construction. This decision should be noted by all designers, because the use of BIM may increase the liability that lands on the designer (Goldberg 2011).

Summary

The historical design-bid-build contractual structure is based on shifting risk and the roles and responsibilities of the Architect/Engineer and the Contractor are separated. This contractual structure is very comfortable for the experienced Architects/Engineers and Contractors.

In IPD, all participants are working together in the early stages of the project where goals are set, information is shared, efficiency is optimized, and team members are project focused instead of profession focused – all in an effort to reduce risk. However, the unintended assumption of responsibility for the design by the Contractor, and the unintended assumption of responsibility for the means and methods used during construction by the designer are risks that must be considered when using IPD and BIM.

The result of the one and only BIM dispute to date was a shared responsibility between the Architect, MEP Engineer, and the Contractor. This result suggests the Architect/Engineer's responsibility does not end with providing suitable documents for construction.

Due to the result of the BIM dispute and the perception of the role/responsibility overlap, the Architect/Engineer should consider protecting themselves by purchasing additional insurance policies to cover tasks involved in the "means and methods" of construction. Similarly, Contractors should consider purchasing the same liability insurance the Architect/Engineer has to protect themselves for their interaction during design.

BIM is widely being used today by Architect/Engineer's in a non-integrated environment to transfer dimensional information onto paper deliverables (drawings and specifications). The capabilities of BIM go far beyond transferring dimensional information to paper. BIM can be used to create a virtual model before constructing the full scale model. However, the users of BIM have to become aware of its capabilities and limitations through proper training. Misuse of BIM can result in serious consequences.

Disputes will arise when a number of participants are involved throughout the project. The standard agreements provide a road map for resolution of a dispute. In the IPD agreements, there is a great effort to resolve disputes at the project level, keeping them out of the court room. The standard IPD agreements also provide clauses for waivers of consequential damages, subrogation, and other claims.

IPD is a different method of delivering a project with collaboration between the Owner, Architect/Engineer, and Contractor from the very beginning. The key principals of IPD are mutual trust and respect, mutual benefit and reward, collaborative innovation and decision making, early involvement of key participants, early goal definition, intensified planning, open communication, appropriate technology, organization, and leadership (American Institute of Architects 2007). Interaction between Architects/Engineers and Contractors in IPD can reduce errors and omissions during design, simplify construction, and reduce the cost of construction.

Conclusion

Professionals, who include Architects and Engineers, should be in charge of the information and the overall project process. The protection of public health, safety, and welfare is critical, so when using IPD and BIM having a licensed professional "in charge" makes sense. These "professionals" must become true team leaders and possess the capability of monitoring the design and construction elements so that conformance with the intent of the contract documents is maintained. This type of involvement may increase the liability that the Architect/Engineer accepts and could require higher fees (AIA_Trust 2009).

IPD and BIM will affect the liability of each participant differently compared to the traditional design-bid-build delivery method and some participants will have to modify their business practices and insurance coverage (Ballobin 2008).

Chapter 3 – Research Procedure

The purpose of this research is to examine some of the challenges and risks of Integrated Project Delivery (IPD) and Building Information Modeling (BIM) by reviewing articles written by individuals involved in the architecture, engineering, and construction fields. It is very important to understand that IPD and BIM are two separate subjects: IPD is a new method of project delivery and BIM is the latest advancement in model-based technology. IPD can be performed without using BIM, and BIM can be used in projects that do not use the IPD method. However, the greatest benefits are realized when the IPD method is used for project delivery with BIM being used as a design and construction tool.

The articles referenced highlight the good and the bad of IPD with BIM by comparing them to the well-known design-bid-build, design-build, and construction project manager at-risk project delivery methods. There are challenges and risks that surface when comparing these methods, and some of them were discussed in the literature review. It may not be fair to compare IPD with BIM to the methods used in the past, because they are just different methods of project delivery. With that being said, IPD with BIM will be compared to the historical methods of delivery because there is nothing else to compare them to. The traditional delivery methods have set precedents by a history of legal decisions that make some participants involved in IPD with BIM feel uncomfortable because of the early collaboration and overlap of roles involved in IPD. The outcome of the only known BIM dispute does nothing to help comfort the participants who are “on the fence” to favor IPD over the traditional methods. The IPD

process and an information management method for BIM are highlighted in the next chapter.

Chapter 4 – Results

Findings

This chapter begins with a brief description of some of the IPD and BIM Standard Forms of Agreement, and then explains the IPD methods. A process to manage the exchange of information when using BIM is also discussed.

IPD and BIM Contract Documents

The American Institute of Architects (AIA) and the Associated General Contractors of America (AGC) have developed standard forms of agreement in an effort to encourage the use of IPD and BIM.

The AIA Standard Contract Forms addressing IPD's financial and business terms are as follows: AIA Document B195 – 2008 Standard Form of Agreement between Owner and Architect for Integrated Project Delivery and AIA Document A195 – 2008 Standard Form of Agreement between Owner and Contractor for Integrated Project Delivery. AIA's Standard Form addressing IPD's detailed delineation and phasing of the scope of services is AIA Document A295 – 2008 General Conditions of the Contract for Integrated Project Delivery. The A295 – 2008 Document is intended to be attached to both the A195 - 2008 and B195 - 2008 agreements. AIA issued AIA Document E202 – 2008 Building Information Modeling Protocol Exhibit (Form E202) to address the BIM model, which can be attached to a wide range of AIA Owner-Architect and Owner-Contractor agreements. AIA Document E201 – 2007 Digital Data Protocol Exhibit (Form E201) covers data transfer between the Owner and Architect. The Digital Data

Licensing Agreement (Form C106) is a free-standing agreement that was developed for parties who do not have contractual privity (Wickersham 2009).

The ConsensusDocs 300 Standard Form of Tri-Party Agreement for Collaborative Project Delivery is a contract signed by the Owner, Architect/Engineer, and Contractor. This form of agreement details a collaborative (IPD) approach to design and construction. Phasing, scope, insurance, copyright, dispute resolution, budget setting, and value engineering are also addressed in the ConsensusDocs 300 Tri-Party Agreement. The ConsensusDocs 301 Building Information Modeling (BIM) Addendum was released to address the BIM model. The ConsensusDocs 200.2 Electronic Communications Protocol Addendum covers digital communications, such as email, payments, and transfer of drawings (Wickersham 2009).

An alternative agreement, issued by AIA, is the AIA Document C195 – 2008 Standard Form Single Purpose Entity Agreement for Integrated Project Delivery. The Owner, Architect/Engineer, and Construction Manager form a new limited liability company (LLC) which becomes a project-specific design/build firm. The LLC enters into a contract with the Architect/Engineer for design, the Construction Manager to manage the construction, and into a series of contracts with trade contractors to carry out the actual construction of the project (Wickersham 2009).

Another alternative agreement, issued by AIA, is the AIA Document C191 – 2009 Standard Form Multi-Party Agreement for Integrated Project Delivery. Communication, information sharing, decision making processes, project goals, compensation criteria, allocation of risk, and the use of BIM or another technology are discussed among all

participants at the beginning of the project. The Owner, Architect/Engineer, Contractor, and perhaps other key participants are all under one form of agreement that aligns the success of the individual participants with the success of the project.

The standard forms mentioned above may require project specific modifications, but are a good starting point in creating an agreement(s) when using IPD and BIM.

Transitional IPD Process

AIA Documents A295-2008, A195-2008, and B195-2008 are sometimes referred to as the Transitional IPD Documents because the Architect/Engineer and Contractor agreements with the Owner are separate, but they require the Architect/Engineer and Contractor to work together throughout the entire project. The Transitional IPD Documents integrate the duties and services of the Owner, Architect/Engineer, and Contractor over six phases – Conceptualization, Criteria Design, Detailed Design, Implementation Documents, Construction, and Closeout. The Contractor provides constructability, material availability, estimating and other advice to the Architect/Engineer throughout design. The Contractor and Owner negotiate a Guaranteed Maximum Price (GMP) and identify the GMP Documents at the end of the Detailed Design Phase. The Contractor is compensated by the Owner for the efforts provided prior to the establishment of the GMP.

During the Conceptualization Phase, the Owner furnishes the requirements of the project, including the budget, for the Architect/Engineer, Contractor, and Owner to review and arrive at a mutual understanding. The Architect/Engineer discusses the design alternatives with the Owner and Contractor and presents a schedule for inclusion

into the Project Schedule to perform design services that includes allowance for the Owner's review, Owner's consultants review, approvals of authorities having jurisdiction, etc. The Owner, Architect/Engineer, and Contractor review the entire Project Schedule, revise as appropriate, and agree not to exceed the timeline established, except for reasonable cause. The Architect/Engineer and Contractor also evaluate the Owner's program and budget for the Work and provide recommendations.

During the Criteria Design Phase, the Architect/Engineer, with the advice provided by the Contractor, prepares preliminary design documents for the Owner's review and approval. The preliminary design documents consist of a site plan drawing, building plans, sections and elevations, and sketches. Major building systems and construction materials are included on the drawings or described in writing in this phase. The Contractor obtains information from Subcontractors and Suppliers for inclusion in the Project Schedule and Cost Estimate. The Owner, Architect/Engineer, and Contractor meet to review the Criteria Design Documents, Project Schedule, and Cost Estimate. If revisions are required in order to meet the Owner's Budget, the Architect/Engineer, Contractor, and Owner decide what modifications have to be made to the documents. These modifications are incorporated in the Detailed Design Phase.

During the Detailed Design Phase, the Architect/Engineer further develops the approved Criteria Design Documents by providing more details on the drawings, specifications, and/or model. The Contractor supplies a list of Subcontractors and material suppliers, collects information from material suppliers and fabricators, and updates the Project Estimate and Schedule. The Owner reviews the Project Estimate against the Budget at this point to determine if any modifications are needed in order to

bring the Project back to within the Budget, or if an increase in the Budget is needed. The Architect/Engineer revises the drawings, specifications, and model as needed and submits the Detailed Design Documents, consistent with the Owner's Budget, for review. After the Owner accepts the Detailed Design Documents, the Contractor prepares a Guaranteed Maximum Price (GMP) for construction of the project. This GMP includes any further development of drawings, specifications, and the model. Once the GMP is accepted by the Owner, the GMP itself, the Detailed Design Documents on which the GMP was based upon, and a written statement of the basis of the GMP, become the GMP Documents.

In the Implementation Documents Phase, the Detailed Design Documents are further developed as needed for construction of the Project. During this phase, the Architect/Engineer considers the Contractor's recommendations for substitutions, incorporates product and cost data, incorporates requirements of governmental authorities having jurisdiction, and provides information that impacts the Project Schedule to the Contractor. The Contractor revises the Project Schedule and Cost Estimate and agrees in writing with the Owner on a commencement date. The Contractor submits Shop Drawings to the Architect/Engineer for review and approval during this phase as well. At the conclusion of this phase, the Implementation Documents replace the Detailed Design Documents and become part of the GMP Documents.

During the Construction Phase, the Contractor performs the Work in accordance with the GMP Documents. The Architect/Engineer advises and consults with the Owner during the Construction Phase and provides administration of the Contract. The Architect/Engineer visits the site during construction at appropriate intervals, becomes

familiar with and observes the Work, reviews submittals, and determines if the Work is being performed in accordance with the GMP Documents. If the Work is not in conformance with the GMP Documents, the Architect/Engineer has the authority to reject that portion of the Work.

The Closeout Phase begins with the Contractor requesting the Architect/Engineer to provide a final inspection of the Work. The Architect/Engineer and Owner inspect the Work to check conformance with the GMP Documents. Items of Work requiring the Contractor's attention are noted in a list. The list is provided to the Contractor for completion or correction. After the Contractor addresses the items in the list, the Architect inspects the Work to confirm the items have been corrected or completed. Once all of the items are addressed to the satisfaction of the Architect/Engineer and Owner, a Certificate of Substantial Completion is issued to the Contractor.

Single Purpose Entity IPD Process

The Single Purpose Entity for IPD (AIA Document C195 – 2008) is a complex arrangement that would only be used on large and complicated projects. The Single Purpose Entity IPD Agreement establishes a Limited Liability Company (LLC) for the purposes of designing and constructing the project between the Owner, Architect/Engineer, Construction Manager, and other key project participants. The LLC enters into separate agreements with the Architect/Engineer, Construction Manager, and other non-members for design and construction and with the Owner to obtain Project funding.

The duties and services of the Owner, Architect/Engineer, and Construction Manager involved in the six phases – Conceptualization, Criteria Design, Detailed Design, Implementation Documents, Construction, and Closeout are the same as described in the Transitional IPD Process. Two additional phases are inserted between the Implementation Documents and Construction Phases. These phases are called the Agency Review Phase and the Buyout Phase. The Agency Review Phase ensures the creation of documents for governmental review to obtain the necessary construction permits. The Buyout Phase involves the management of construction contracts and subcontracts necessary to construct the project within the Target Cost and Project Schedule.

A Target Cost proposal is developed by the Construction Manager at the conclusion of the Criteria Design Phase and has sufficient detail to allow the Owner to review and make a proper evaluation of the project. Once the Owner accepts the Target Cost Proposal, it becomes the Target Cost, and the Primary Project Goal is to maintain the Target Cost. Actual Costs are compared to the Target Costs monthly, and all variations are projected to Project completion. If the projected costs exceed the Target Cost at Project completion, the Company develops a recovery plan for approval by all Members.

The Members set Project Goals with Goal Achievement Compensation tied to the Project Goals. Project Goals consist of comparing the Actual Costs to the Target Costs at key milestone dates, completion of a task (or group of tasks) ahead of schedule, and other pre-determined goals. This is how the Architect/Engineer, Construction Manager, and other participants make profits during the project. Services provided between the Project

Goals are reimbursed on the basis of direct and indirect costs only. If the Actual Costs are less than the Target Costs at project completion, a portion of the savings is paid to the participants as Incentive Compensation. If the Actual Costs are equal to or greater than the Target Costs, the Architect/Engineer, Construction Manager, and other participants are not entitled to compensation for services beyond their direct and indirect costs up to the amount of the Target Cost or the amount of any Goal Achievement Compensation earned for the achievement of Project Goals.

The Members also develop a Risk Matrix and assign responsibility for managing each type of risk based on the person's ability to control the risk. The Construction Manager is responsible for periodically updating the Risk Matrix. This Risk Matrix is only used as a project management tool and is not incorporated into any agreements.

Multi-Party or Tri-Party IPD Process

The Multi-Party Agreement for IPD (AIA Document C191 – 2009) is an arrangement to promote collaboration that integrates Owner, Architect/Engineer, and Contractor under one agreement from the outset of the Project. All participants are required to communicate, share information, make decisions in a collective manner, and establish project goals and compensation criteria based on the success of the project, collectively manage and allocate risk, and use BIM and other technologies to manage the project. This type of arrangement aligns the success of the individual participants with the success of the project, while maintaining the familiar roles and responsibilities of each party.

The duties and services of the Owner, Architect/Engineer, and Contractor are the same as described in the Single Purpose Entity IPD and Transitional IPD Processes. Project Goals, Goal Achievement Compensation, Actual vs. Target Cost Incentive Compensation, Compensation for services provided between Project Goals, and allocation of Risk are also the same as described in the Single Purpose Entity IPD Process. The differences are the following: the Project Executive Team establishes the Project Goals and Goal Achievement Compensation; the Project Management Team is responsible for day to day management of the project and executing the decisions made by the Project Executive Team; and the Target Costs are developed by the Team.

The Tri-Party Agreement for Collaborative Project Delivery (ConsensusDocs 300) is very similar to the Multi-Party Agreement for IPD (AIA Document C191 – 2009). The terminology used within the Tri-Party Agreement differs from the Multi-Party Agreement as follows: Designer is used in place of Architect/Engineer, Constructor is used in place of Contractor, Management Group is used in place of Project Executive Team, Collaborative Project Delivery Team is used in place of Project Management Team, and Project Target Cost Estimate is used in place of Target Cost. The Compensation structure is not locked down to payment for Direct Compensation between Goal achievements, Goal Achievement Compensation and Incentive Compensation. Choices of a few different compensation structures are outlined in the agreement and the freedom to choose between them is allowed. Project Goals are set by the Management Group. The Project Target Cost Estimate is created by the Collaborative Project Delivery Team and is reviewed by the Management Group.

Disputes and Claims

The IPD AIA and ConsensusDocs have Dispute Resolution provisions that attempt to resolve a dispute at the project team level by reaching a mutual and unanimous agreement. Refer to the Literature Review chapter for descriptions of the Dispute Resolution processes within the AIA and ConsensusDocs Standard Agreements. If a unanimous agreement is not reached, the dispute is elevated up to a management team consisting of Project Managers or Officers of the Companies for resolution. If a unanimous agreement is still not reached, the issue is presented to a Project Neutral for mediation. If mediation is unsuccessful, arbitration or litigation is the final step where the decision is binding. The point here is there is a great deal of effort to resolve disputes at the project level, thus keeping them out of the court room. A great deal of time and expense is saved when issues are resolved at the project level.

Claims during the Construction Phase made by the Contractor for additional cost or time are initiated by written notice to the Owner and the Initial Decision Maker, with a copy sent to the Architect. The Architect may be identified as the Initial Decision Maker in the Contract, and if this is the case, a copy would not be sent to the Architect. Consequential Damages arising out of the Work related to the Contract are waived between the Owner and the Contractor.

BIM Model Management Procedures

A Building Information Model (BIM) is used to the greatest extent practicable during these highly collaborative processes. The Owner, Architect/Engineer, and

Contractor are required to meet and delineate the types of software to be used, standards and tolerances, and the permitted uses of all digital information.

BIM is a set of inter-related models created by different members of the project team that offers the ability to exchange information (Wickersham 2009). Because there are a number of models with information from different members of the project team, there must be a defined information management process with named model or information managers for the phases of the project. Standard documents have been created that can be attached to the contract when BIM is used in the project. AIA's Document E202 – 2008 Building Information Modeling Protocol Exhibit (Form E202) and ConsensusDocs 301 Building Information Modeling (BIM) Addendum can be attached to Owner-Architect and Owner-Contractor agreements to address the management of information.

The BIM document establishes information management procedures and authorized uses of BIM on the project, and assigns responsibility for the level of development at each project phase. Coordination and conflicts, model ownership, model standards, file formats, file naming, file structure, coordinate systems, units, model management, responsibilities, utilization of a project BIM website, archiving procedures and authorized uses are defined. An information manager is selected to control all of the data, and users of the data, for the project. The information manager keeps a log of all the model elements at each stage of the project and controls access to this data. The information manager also is responsible for backing up and restoring the data, maintaining security of the information, and providing users with access instructions and system requirements.

Each participant is responsible for the contribution it makes to the overall project model and consequential damages relating to the use of the model are waived among the project participants. Each participant warrants to the other participants that it is the owner of all copyrights of its contribution and each participant agrees to indemnify and hold harmless the other parties for third party claims related to its contribution to the model.

Summary

Traditional delivery methods clearly define the roles and responsibilities of the Owner, Architect/Engineer, and the Construction Manager or Contractor. The history of legal decisions and availability of insurance policies make these methods very comfortable for the individuals involved in the delivery of a project. Modeling technology has advanced to the point that inefficiencies in traditional delivery methods have been identified. Parallel modeling is the most obvious of the inefficiencies. Parallel modeling is the re-creation of the Architect/Engineer's BIM model, developed during the design stage, by the Contractor for use during construction. The Contractor re-creates this model because it may be easier and faster than manipulating the Architect/Engineer's BIM model, and because this model was developed without input from the Contractor and may not be appropriate for the "means and methods" of construction.

The construction industry is one of the few industries, if not the only one, that builds a full-scale model at full price (Cunz 2009). Advancements in Modeling Technology allows for virtual models to be developed prior to building the project in the

field. Collaboration and interaction between the Owner, Architect/Engineer, and Contractor during IPD is critical in creating the virtual model. Bringing all participants together at the project's inception to ultimately reduce waste and optimize efficiency is the goal of IPD (Ballobin 2008). If the Contractor, or Construction Manager, is a member of the team during the design stage, advice on constructability, equipment and systems selection, and pricing can be offered. These items can be implemented into the model, eliminating the need for the Contractor to re-create the entire model.

There are also challenges in 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 (Cunz 2009). Some insurability issues and legal concerns exist due to the overlapping roles and responsibilities of the Architect/Engineer and Contractor that have to be considered when using IPD. These concerns and issues can be neutralized within the IPD Agreement(s). The true benefit of IPD and BIM is realized by the project Owner by saving time and money when all parties can rely on the accuracy of the model by eliminating the effort of re-creation, and must be driven by the Owner (AIA_Trust 2009).

Owner Driven Change

Owners are responsible for about two-thirds of all claims against design firms, and early collaboration by using BIM and IPD benefits the Owner by reducing claims during construction (Ballobin 2008). Contractors are able to provide advice during design in the phasing of construction, selection of materials, identification of long lead time items, cost estimates, and overall feasibility of the project. BIM allows

Architects/Engineers to focus more on design and less on drafting, and the results are reduced risks, improved productivity, streamlined production, and facilitation of quality control. BIM will benefit the Owner in operations and maintenance for the life of the facility and initial cost savings (AIA_Trust 2009). Owners are in a position to drive the use of BIM and IPD by demanding both be used in the development of the project.

Ownership and Control of the BIM Model

It is critical to understand that BIM is a set of inter-related models created by different members of the project team that allows for the exchange of information (Wickersham 2009). The individual party that creates the model owns it. The right to use an individual model is the more appropriate question. The legal right to reproduce, use, make derivative works, distribute, and display has to be incorporated into the project agreements. This includes downloading of the models from a shared site to create the overall BIM model (Larson and Golden 2008).

What member of the team is most appropriate to manage the individual models and the BIM model? It makes the most sense for a professional service company to be in control of and manage the sources of information that go into the model. This is adding an additional risk to the scope of the design firm, and the fee for design services should reflect this additional exposure (AIA_Trust 2009).

BIM and Lack of Use

One of the top reasons for not using BIM is lack of demand by Owners. This lack of demand may be due to the fact that Owners do not understand the capabilities of BIM. Architects/Engineers should use BIM's visualization capabilities to demonstrate the

solution-finding process to their clients and stress the importance BIM has on reducing errors and discrepancies that are common in two dimensional paper deliverables (McGraw Hill Construction 2012).

Value of BIM

BIM has proven to be successful when used on vertical building construction projects because of the complexity of these large projects. The value of BIM is beginning to be realized on horizontal infrastructure projects. Organizations that have experience using BIM on the vertical projects are using their BIM expertise as a competitive advantage to win new infrastructure projects of all sizes (McGraw Hill Construction 2012). Other benefits of using BIM reported by Architects/Engineers and Contractors are that it reduces errors in construction documents, improves learning for younger staff through collaborating with experienced people, reduces claims/litigation, and increases profit. BIM also helps integrated project teams work more effectively (McGraw Hill Construction 2011).

Conclusions

BIM presents an opportunity for design firms to concentrate more on design, manage the model, and become leaders of the IPD and BIM process; however, it does expose them to potential Contractor claims and vicarious liability due to their assumed "responsible charge" of the design elements within the model that were provided by other consultants, subcontractors, and manufacturers. The IPD process also requires a higher level of effort early in the project by the designer. The design firm accepting this responsibility should reflect the elevated risk with higher front-end fees (AIA_Trust

2009). The contract should state that participation in the IPD process does not make the Architect/Engineer responsible for the means and methods used during construction and that the Contractor is not responsible for the project design to ensure that the parties of the contract do not take on responsibilities outside the original scope, fee, and insurable risk (Wickersham 2009).

The easiest transition from traditional project delivery to IPD would be to use the "Transitional" IPD documents (Ballobin 2008). The Transitional IPD documents are identified at the beginning of Chapter Four. Using the Transitional IPD documents allows the critical collaboration and interaction to take place early on in the project, but may not appropriately distribute the risks and rewards. The Single Entity, Tri-Party, and Multi-Party IPD methods use incentives to maximize the effectiveness of collaboration, distributing the risks and rewards more appropriately.

A great deal of information is shared with the use of IPD and BIM and the users of these models have to be able to rely on the accuracy of this information. The use of IPD and BIM requires more construction knowledge during design, and possibly a digital education for the older and more experienced Architects/Engineers (Goldberg 2008).

Mutual trust and respect among participants, a belief in shared risks and rewards, and a commitment to work in the best interests of the project are key principles of IPD (Cunz 2009). Adhering to these principles may require team building in order to open up the lines of communication and align all the team members toward the same goals. Team building activities will also reveal the strengths and weaknesses of the participants and allows past experiences and expertise to benefit the project.

The methods used to deliver projects for the past 90 years are not the methods that should be used to deliver projects moving forward. Architects/Engineers must pay attention to how IPD and BIM are impacting the structure and existence of their firms (AIA_Trust 2009). Construction companies are hiring Architects and Engineers to lead their in house BIM teams. Technology is allowing for the design and construction process to be more efficient and integrated and this must be embraced by the architecture, engineering and construction communities in order to reduce wasteful spending. Reducing wasteful spending sounds responsible; however, it must be mentioned that the proper legislation must be in place to allow the IPD process to be used in an effective manner.

Most infrastructure projects are public projects with federal or state funds being used to design and construct the project. The design is completed with no input from the builder, and the successful Bidder to construct the project is usually the Bidder that submits the lowest cost proposal to complete the Work. In order for Integrated Project Delivery to be performed in the most effective manner, the Contractor, or the Construction Manager, has to be selected prior to design commencing. If the law does not allow a Contractor to be selected based on qualifications, the advantages of the early collaboration between the Owner, Architect/Engineer, and Contractor will never be realized.

Architecture, Engineering, and Construction is expensive. Technology is allowing the Architecture, Engineering, and Construction Industries to make a difference and reduce wasteful spending by using the Integrated Project Delivery process and Building Information Modeling. This cannot happen if the proper legislation is not in

place to allow Integrated Project Delivery, so the Architecture, Engineering, and Construction communities must educate government officials on a new, more efficient, method of project delivery.

Chapter 5 – Recommendations and Suggestions for Additional Work

This research paper (1) examined some of the challenges, liabilities, and risks expected when using Integrated Project Delivery (IPD) and Building Information Modeling (BIM), (2) introduced the Integrated Project Delivery (IPD) and Building Information Modeling (BIM) processes, (3) identified and discussed some of the IPD and BIM standard agreements that have already been created by the AIA and the ConsensusDocs, and (4) highlighted the effect advanced technology is having on the Architecture, Engineering, and Construction Industries.

The legal decisions on IPD and BIM claims will set precedents that Architecture, Engineering and Construction Companies must be monitoring. These decisions can and will impact the structure of future contractual agreements.

Professional (Errors and Omissions) Liability, Commercial General Liability, Automobile Liability, and Worker's Compensation and Employer's Liability insurance policies may not be enough to protect participants in all phases of an IPD and BIM project. This is an area that needs to be explored, because if insurance is not available, then higher fees may be justified.

Another area to explore is continuing education for BIM participants. BIM is a technology that is still in its infancy and will forever be advancing. How does a company go about establishing continuing education expectations for its employees? Does the company allow its employees to learn on the clock and pay for the staff to keep up with

the advancements in technology? Or are the employees expected to attend classes on their own time and at their own expense?

Another area to explore is educating government officials on the advantages of using IPD and BIM.

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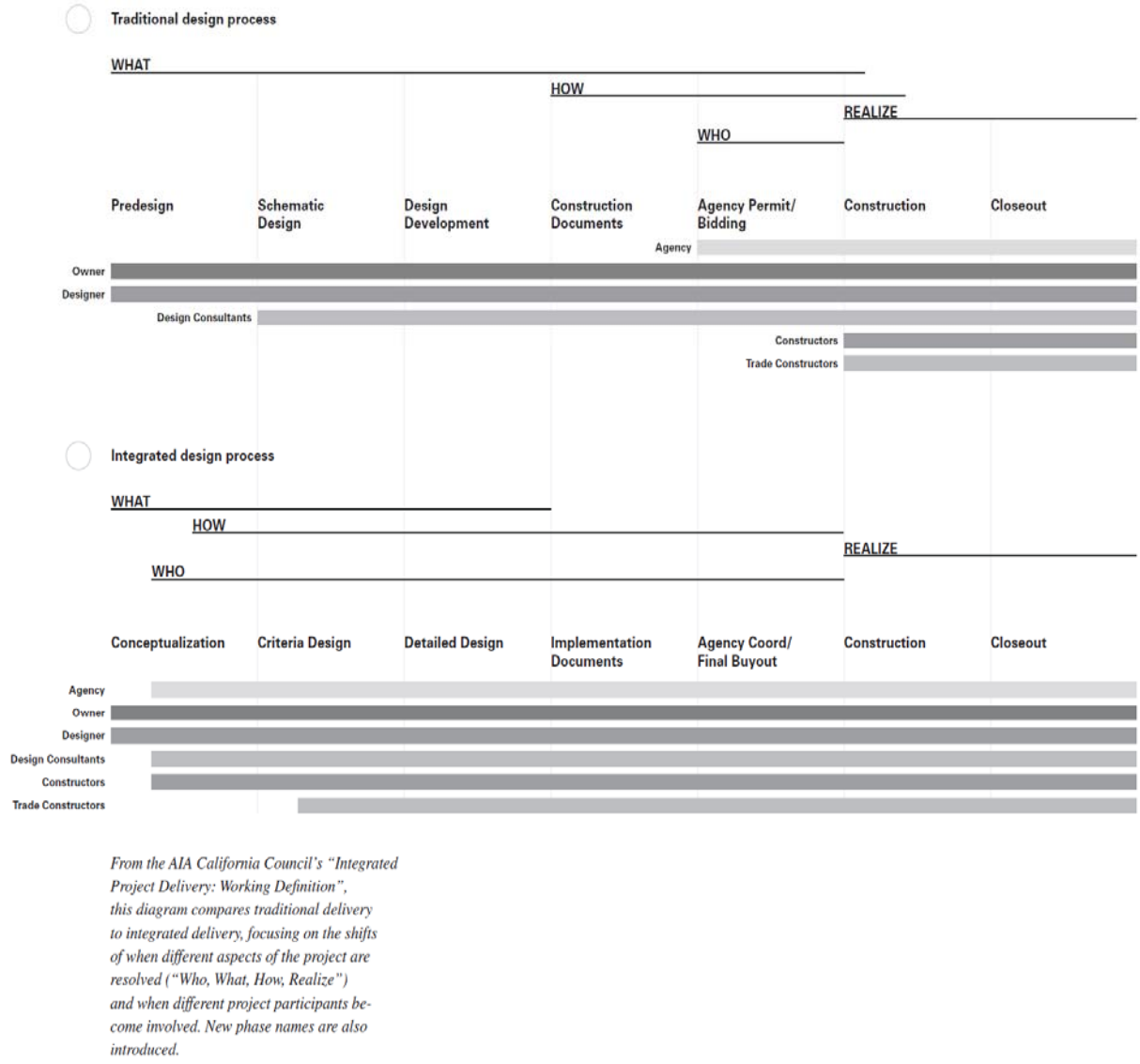
Appendix



From the AIA California Council's "Integrated Project Delivery: Working Definition", this diagram compares traditional delivery to integrated delivery, focusing on the shifts of when different aspects of the project are resolved ("Who, What, How, Realize") and when different project participants become involved. New phase names are also introduced.

Figure A-1. [American Institute of Architects 2007, 22, fig.]