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Integrated Project Delivery: A Guide

Integrated Project Delivery (IPD) is a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction.

IPD principles can be applied to a variety of contractual arrangements and IPD teams can include members well beyond the basic triad of owner, architect, and contractor. In all cases, integrated projects are uniquely distinguished by highly effective collaboration among the owner, the prime designer, and the prime constructor, commencing at early design and continuing through to project handover.

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contents

1 Foreword ... 1

2 Introduction ... 2

3 Principles of Integrated Project Delivery ... 5
3.1 Mutual Respect and Trust. ... 5
3.2 Mutual Benefit and Reward. ... 5
3.3 Collaborative Innovation and Decision Making. ... 5
3.4 Early Involvement of Key Participants. ... 5
3.5 Early Goal Definition. ... 5
3.6 Intensified Planning. ... 6
3.7 Open Communication. ... 6
3.8 Appropriate Technology. ... 6
3.9 Organization and Leadership. ... 6

4 Setting Up an Integrated Project ... 7
4.1 IPD Team Building and Functioning ... 8
4.1.1 Project Team Formation and Team Building ... 8
4.1.2 Project Team Decision Making ... 9
4.1.3 Team Communications ... 10
4.1.4 Building Information Modeling: ... 10
4.1.5 Sharing Sensitive, Proprietary or Confidential Information ... 11
4.1.6 Compensation ... 11
4.1.7 Withdrawal/Assignment ... 12
4.1.8 Team Member Dispute Resolution ... 12
4.2 Defining Roles, Responsibilities and Scopes of Services ... 13
4.2.1 Service Scope ... 13
4.2.2 Multi-Directional Duties ... 15
4.3 Defining and Measuring Project Outcomes ... 15
4.3.1 Goals & Standards ... 15
4.3.2 Project Cost ... 16
4.3.3 Project Schedule ... 16
4.3.4 Project Quality ... 17
4.3.5 Operational Performance ... 17
4.3.6 Sustainability ... 17
4.4 Legal Considerations ... 17
4.4.1 Non-Standard Contracts ... 17
4.4.2 Professional Responsibility and Licensing ... 18
4.4.3 Insurance ... 18
4.4.4 Entity Formation ... 18
4.4.5 Joint Liability and Joint Venture ... 18

5 Delivering an Integrated Project ... 20
5.1 Building an Integrated Team ... 20
5.2 Project Execution / Redefining Project Phases ... 21
5.2.1 Conceptualization [Expanded Programming] ... 24
5.2.2 Criteria Design [Expanded Schematic Design] ... 25
5.2.3 Detailed Design [Expanded Design Development] ... 26
5.2.4 Implementation Documents [Construction Documents] ... 27
5.2.5 Agency Review ... 28
5.2.6 Buyout ... 29
5.2.7 Construction [Construction/Construction Contract Administration] ... 30
5.2.8 Closeout ... 31

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6 Multi-Party Agreements 32
6.1 Contractual Agreements 33
6.1.1 Project Alliances 33
6.1.2 Single Purpose Entities 33
6.1.3 Relational Contracts 33
6.2 Process Design 34
6.3 Decision Making 34
6.4 Sequencing and Phasing 34
6.5 Risks and Rewards 35

7 Delivery Model Commentary 44
7.1 Multi-Prime 44
7.2 Construction Manager at Risk 46
7.3 Design-Build 47
7.4 Design-Bid-Build 48

8 Conclusions and Next Steps 51

9 Glossary 53

10 Resources 56

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This Guide provides information and guidance on principles and techniques of integrated project delivery (IPD) and explains how to utilize IPD methodologies in designing and constructing projects. A collaborative effort between The American Institute of Architects (AIA) National and AIA California Council, this Guide responds to forces and trends at work in the design and construction industry today. It may set all who believe there is a better way to deliver projects on a path to transform the status quo of fragmented processes yielding outcomes below expectations to a collaborative, value-based process delivering high-outcome results to the entire building team.

Traditional Project Delivery		Integrated Project Delivery
Fragmented, assembled on "just-as-needed" or "minimum-necessary" basis, strongly hierarchical, controlled	**teams**	An integrated team entity composed key project stakeholders, assembled early in the process, open, collaborative
Linear, distinct, segregated; knowledge gathered "just-as-needed"; information hoarded; silos of knowledge and expertise	**process**	Concurrent and multi-level; early contributions of knowledge and expertise; information openly shared; stakeholder trust and respect
Individually managed, transferred to the greatest extent possible	**risk**	Collectively managed, appropriately shared
Individually pursued; minimum effort for maximum return; (usually) first-cost based	**compensation/ reward**	Team success tied to project success; value-based
Paper-based, 2 dimensional; analog	**communicatitons/ technology**	Digitally based, virtual; Building Information Modeling (3, 4 and 5 dimensional)
Encourage unilateral effort; allocate and transfer risk; no sharing	**agreements**	Encourage, foster, promote and support multi-lateral open sharing and collaboration; risk sharing

Change is Now

Technological evolution coupled with owners' on-going demand for more effective processes that result in better, faster, less costly and less adversarial construction projects are driving significant and rapid change in the construction industry. Envision a new world where …

… facilities managers, end users, contractors and suppliers are all involved at the start of the design process
… processes are outcome-driven and decisions are not made solely on a first cost basis
… all communications throughout the process are clear, concise, open, transparent, and trusting
… designers fully understand the ramifications of their decisions at the time the decisions are made
… risk and reward are value-based and appropriately balanced among all team members over the life of a project
… the industry delivers a higher quality and sustainable built environment

This is the world of Integrated Project Delivery (IPD).

IPD leverages early contributions of knowledge and expertise through utilization of new technologies, allowing all team members to better realize their highest potentials while expanding the value they provide throughout the project lifecycle.

At the core of an integrated project are collaborative, integrated and productive teams composed of key project participants. Building upon early contributions of individual expertise, these teams are guided by principles of trust, transparent processes, effective collaboration, open information sharing, team success tied to project success, shared risk and reward, value-based decision making, and utilization of full technological capabilities and support. The outcome is the opportunity to design, build, and operate as efficiently as possible.

Benefits of IPD

Recent studies document inefficiencies and waste in the construction industry. For example, an *Economist* article from 2000 identifies 30% waste in the US construction industry; a NIST study from 2004 targets lack of AEC software interoperability as costing the industry $15.8B annually; and a US Bureau of Labor Statistics study shows construction alone, out of all non-farm industries, as decreasing in productivity since 1964, while all other non-farm industries have increased productivity by over 200% during the same period. New technologies have emerged, that when utilized in conjunction with collaborative processes, are demonstrating substantial increases in productivity and decreases in requests for information, field conflicts, waste, and project schedules. Owners are increasingly demanding methodologies that deliver these outcomes.

There are reasons to acknowledge that highest and best sustainable results in meeting increasingly aggressive goals for energy and carbon reduction are best achieved through collaborative processes. The AIA's experience with the American Society of Heating, Refrigerating and Air-Conditioning Engineers' (ASHRAE's) Advanced Energy Design Guides suggest that although some reductions are prescriptively achievable (i.e., through the use of a checklist), as one exceeds a 30% reduction and moves toward even greater reductions, complex interactions of systems and context must be taken into account. Integrated processes are being acknowledged and encouraged in sustainable ratings systems such as LEED®. New energy codes, such as ASHRAE's Standard 189, include recommendations regarding integrated processes.

IPD results in greater efficiencies. The United Kingdom's Office of Government Commerce (UKOGC) estimates that savings of up to 30% in the cost of construction can be achieved where integrated teams promote continuous improvement over a series of construction projects. UKOGC further estimates that single projects employing integrated supply teams can achieve savings of 2-10% in the cost of construction. (Office of Government Commerce, Achieving Excellence in Construction Procurement Guide, Vol. 5, at p. 6 (2007) www.ogc.gov.uk)

Beyond these benefits, IPD provides positive value propositions for the three major stakeholder groups:

Owners—
Early and open sharing of project knowledge streamlines project communications and allows owners to effectively balance project options to meet their business enterprise goals. Integrated delivery strengthens the project team's understanding of the owner's desired outcomes, thus improving the team's ability to control costs and manage the budget, all of which increase the likelihood that project goals, including schedule, life cycle costs, quality and sustainability, will be achieved.

Constructors—
The integrated delivery process allows constructors to contribute their expertise in construction techniques early in the design process resulting in improved project quality and financial performance during the construction phase. The constructor's participation during the design phase provides the opportunity for strong pre-construction planning, more timely and informed understanding of the design, anticipating and resolving design-related issues, visualizing construction sequencing prior to construction start, and improving cost control and budget management, all of which increase the likelihood that project goals, including schedule, life cycle costs, quality and sustainability, will be achieved.

Designers—
The integrated delivery process allows the designer to benefit from the early contribution of constructors' expertise during the design phase, such as accurate budget estimates to inform design decisions and the pre-construction resolution of design-related issues resulting in improved project quality and financial performance. The IPD process increases the level of effort during early design phases, resulting in reduced documentation time, and improved cost control and budget management, all of which increase the likelihood that project goals, including schedule, life cycle costs, quality and sustainability, will be achieved.

AIA and IPD

Through early collaboration and the use of Building Information Modeling (BIM) technology, a more integrated, interactive, virtual approach to building design, construction and operation is emerging. To embrace, master and influence this emerging method of project delivery and to seize the new business and cultural opportunities it offers to the industry, the AIA is working with other construction industry stakeholders and through its own national, state or regional and local components, Board committees, Knowledge Communities, Task Forces, Working Groups and related activities to:

1. Collaborate with industry leaders to facilitate the dialogue, share knowledge, and accelerate the rate of change for all those seeking to improve the industry's current practices by utilizing integrated approaches to the design, construction, and operation processes;

2. Communicate the benefits of collaborative approaches to public and private sector clients, and promote changes to the design and construction procurement process to allow early information sharing;

3. Promote the benefits of developing a virtual model of a project using available technologies, built with interaction and input from an integrated and collaborative team of project stakeholders – owners, designers, consultants, constructors, subcontractors and suppliers;

4. Develop and promote the integration of collaboration techniques and technology into education curricula for architects and architectural students to enhance their design and team collaborative skills;

5. Engage the legal profession and the insurance industry in preparing contracts that support the integration of collaborative models and technology into the design and build industry and offering insurance coverages responsive to IPD; and,

6. Promote documentation of the measurable contributions resulting from implemented integrated project delivery approaches to stakeholders and promote the value and achievements of increased use of integrated project delivery methods.

The Guide

The Guide begins with introductory material about the principles of IPD and points to consider when setting up an integrated project, moves through a study of how to implement IPD, and culminates with a discussion of how to apply general IPD principles within the specific framework of new and traditional delivery models used in the marketplace today. When thoughtfully considered, absorbed, and then applied, the principles and techniques outlined in this Guide should allow readers to be able to:

- Understand principles of IPD
- Understand the value propositions of IPD from the perspective of various stakeholders
- Organize non-traditional delivery methods and alternative team relationships for improved project performance, understanding the necessary qualifications / attributes of team members
- Assess interest and adequate knowledge resources within one's team
- Discern subtle differences between possible models for IPD
- Advocate the benefit of an integrated delivery model
- Understand the issues that must be addressed in an integrated project delivery document
- With the appropriate resources, write an agreement based on integrated project delivery principles
- Implement IPD principles to proceed with confidence during this time of change.

Integrated Project Delivery is built on collaboration, which in turn is built on trust. Effectively structured, trust-based collaboration encourages parties to focus on project outcomes rather than their individual goals. Without trust-based collaboration, IPD will falter and participants will remain in the adverse and antagonistic relationships that plague the construction industry today. IPD promises better outcomes, but outcomes will not change unless the people responsible for delivering those outcomes change. Thus, achieving the benefits of IPD requires that all project participants embrace the following Principles of Integrated Project Delivery.

3.1 Mutual Respect and Trust

In an integrated project, owner, designer, consultants, constructor, subcontractors and suppliers understand the value of collaboration and are committed to working as a team in the best interests of the project.

3.2 Mutual Benefit and Reward

All participants or team members benefit from IPD. Because the integrated process requires early involvement by more parties, IPD compensation structures recognize and reward early involvement. Compensation is based on the value added by an organization and it rewards "what's best for project" behavior, such as by providing incentives tied to achieving project goals. Integrated projects use innovative business models to support collaboration and efficiency.

3.3 Collaborative Innovation and Decision Making

Innovation is stimulated when ideas are freely exchanged among all participants. In an integrated project, ideas are judged on their merits, not on the author's role or status. Key decisions are evaluated by the project team and, to the greatest practical extent, made unanimously.

3.4 Early Involvement of Key Participants

In an integrated project, the key participants are involved from the earliest practical moment. Decision making is improved by the influx of knowledge and expertise of all key participants. Their combined knowledge and expertise is most powerful during the project's early stages where informed decisions have the greatest effect.

3.5 Early Goal Definition

Project goals are developed early, agreed upon and respected by all participants. Insight from each participant is valued in a culture that promotes and drives innovation and outstanding performance, holding project outcomes at the center within a framework of individual participant objectives and values.

3.6 Intensified Planning

The IPD approach recognizes that increased effort in planning results in increased efficiency and savings during execution. Thus the thrust of the integrated approach is not to reduce design effort, but rather to greatly improve the design results, streamlining and shortening the much more expensive construction effort.

3.7 Open Communication

IPD's focus on team performance is based on open, direct, and honest communication among all participants. Responsibilities are clearly defined in a no-blame culture leading to identification and resolution of problems, not determination of liability. Disputes are recognized as they occur and promptly resolved.

3.8 Appropriate Technology

Integrated projects often rely on cutting edge technologies. Technologies are specified at project initiation to maximize functionality, generality and interoperability. Open and interoperable data exchanges based on disciplined and transparent data structures are essential to support IPD. Because open standards best enable communications among all participants, technology that is compliant with open standards is used whenever available.

3.9 Organization and Leadership

The project team is an organization in its own right and all team members are committed to the project team's goals and values. Leadership is taken by the team member most capable with regard to specific work and services. Often, design professionals and contractors lead in areas of their traditional competence with support from the entire team, however specific roles are necessarily determined on a project-by-project basis. Roles are clearly defined, without creating artificial barriers that chill open communication and risk taking.

Traditional delivery and contracting approaches contemplate separate silos of responsibility that, in practice, yield inefficiencies whenever there is a hand-off from one silo to another. Additionally, projects delivered traditionally suffer because participant success and project success are not necessarily related. Indeed, it is quite possible for one or more project participants to "succeed" notwithstanding overall project failure. IPD, however, represents a behavioral sea change in the industry by breaking down the silos of responsibility, requiring close cooperation among all major participants, and aligning participant success to project success.

IPD strategically realigns participant roles, underlying motivations, and sequences of activities on a project to utilize each participant's best talents and abilities at the most beneficial moment. Success is project-centric under an integrated delivery approach and relies on collaboration. The focus is on collectively achieving shared goals rather than meeting individual expectations. Success is measured by the degree to which common goals are achieved.

This realignment of traditional roles and project goals, however, inevitably leads to questions about what should be considered along the way toward integration. Accordingly, IPD presents a number of issues that must be considered when exploring this approach for a project. In addition to questions about how the participants' behavior must be modified, another inevitable question concerns the risks associated with greater collaboration. While it may seem counter-intuitive to speak of the risks of collaboration, as far more mischief arises when people fail to work together than when they do, no project delivery approach is risk-free.

Identified below are issues that arise when setting up a project for integrated delivery. These issues are common to all IPD projects, and are universally applicable regardless of the level of integration actually employed on a project.

4.1 IPD Team Building and Functioning

The project team is the lifeblood of IPD. In IPD, project participants come together as an integrated team, with the common overriding goal of designing and constructing a successful project. If trouble arises on a traditional project, the tendency is often to "batten down the hatches" and protect one's financial interests. Cooperation suffers and the project flounders. In contrast, IPD demands that participants work together when trouble arises. This "huddling" versus "hunkering" distinction is crucial. Because the hunkering down instinct in the face of trouble is so strong in the design and construction industry today, moving to an integrated, or huddling, approach is tantamount to cultural change. Therefore, the composition of the integrated team, the ability of team members to adapt to a new way of performing their services, and individual team members' behavior within the team are critical.

4.1.1 Project Team Formation and Team Building

In an integrated project, the project team is formed as close as possible in time to the project's inception. In some instances, the project team will establish itself based on pre-existing levels of trust, comfort and familiarity developed through past working relationships. In other instances, the owner may assemble the project team without regard to any pre-existing relationships among the team members. In any event, and to the greatest extent possible, project team members are identified and assembled at the earliest possible point in time.

Generally speaking, the project team includes two categories of team member: the primary participants, and key supporting participants. The primary participants are those participants that have substantial involvement and responsibilities throughout project, from beginning to end. For example, in a traditional project the primary participants are the owner, architect and contractor. Unlike the relationship in a traditional project, the primary participants in IPD may be defined more broadly and they are bound together by either a contractual relationship, or by virtue of their individual interests in a single purpose entity (SPE) established for the project. Refer to Section VI below for details regarding potential contractual arrangements and SPE possibilities.

The key supporting participants on an integrated project serve a vital role on the project, but perform more discrete functions than the primary participants. In a traditional project, the key supporting participants include the primary design consultants and subcontractors. In IPD, the key supporting participants enter into contracts directly with either one of the primary participants, or with any SPE the primary participants have formed. In either event, key supporting participants agree to be bound by the collaborative methods and processes governing the relationship among the primary participants.

In IPD, the difference between the primary participants and the key supporting participants is a fluid distinction that will necessarily vary from project to project. For example, on a majority of projects, a structural engineer is not normally considered a primary participant as it performs a discrete function for the project and is rarely substantially involved for the duration of the project. If, however, structural design is the overriding project concern as, for example, in bridge construction, the structural engineer would have substantial responsibilities and project involvement throughout the course of the project. Accordingly, the structural engineer would serve as a primary participant.

Great care is taken to establish an IPD team where participants can work together as a collaborative unit. Team formation considers capability, team dynamics, compatibility, communication, trust building and commitment to an integrated process. Although by no means necessary, the process of team formation and subsequent team building may include personality assessment, communication training, and other techniques to forge a strong team from disparate parts. Once the team is formed, it's important to create a team atmosphere where collaboration and open communication can flourish. Locating the team in a joint facility may facilitate open communication and cooperation, and regular meetings and video conferences may be useful when co-location is impractical. Regardless of the methods employed, it is necessary to establish a team where participants are willing and able to work together effectively and to provide the team with tools and circumstances that facilitate collaborative performance. Collectively-defined project goals and metrics to measure performance, along with compensation models that align individual success with project success, also provide incentives to work as a team.

4.1.2 Project Team Decision Making

The successful integrated project has decision making methods and processes that each team member accepts and agrees to abide by. In a fully integrated project, ultimate decision making abilities are not vested in a single team member. Rather, all decisions are made unanimously by a defined decision making body. Regardless of how the parties decide to structure the decision making body, in an integrated project one overriding principle directs the decision making body: all decisions are made in the best interest of the project.

The composition of the decision making body varies from project to project, but always consists of some combination of the primary participants and key supporting participants working collaboratively to render decisions in the best interest of the project. The actual composition of the decision making body is determined at the outset of the project and reflected in the various agreements between the parties.

In practice, team decision making is the area in which the distinction between primary participants and key supporting participants is most apparent. The primary participants, by virtue of their constant involvement on the project, are always part of the project's decision making body. Although possible, key supporting project participants are typically not part of the decision making body, but they serve as advisers to the decision making body on topics corresponding to their areas of expertise. Through the participation of all of project participants in the decision making process, whether as a member of the decision making body or in an advisory role, the project benefits because the process allows all project participants to bring their expertise to bear on the issue at hand.

In order to provide regular, timely and consistent decisions, the decision making body meets regularly according to a collaboratively set schedule. The more frequent the meetings, the greater the decision making body's ability to adapt to project circumstances. In addition to regular meetings, IPD also requires a process by which team members can call for emergency meetings to address issues that arise without notice and require immediate resolution. Without this flexibility, the project team cannot promptly respond to, and resolve, critical issues arising during the project.

4.1.3 Team Communications

Successful team operations rely on collaboration, which, in turn, necessarily relies on fluid and open communication. Accordingly, creating an atmosphere and mechanisms that facilitate the adequate sharing of information between and among team members is essential to successfully implementing IPD.

The development and use of an overarching communication protocol streamlines communications and facilitates the transfer of project data between participants and between technologies. The communication protocol and other communication tools are developed through joint workshops in which the project team discusses and decides how information will be used, managed and exchanged to ensure consistent and appropriate use of shared information. The decisions and communication protocol established at the workshops are documented and become the project's information specification.

4.1.4 Building Information Modeling

Building Information Modeling (BIM), a digital, three-dimensional model linked to a database of project information, is one of the most powerful tools supporting IPD. Because BIM can combine, among other things, the design, fabrication information, erection instructions, and project management logistics in one database, it provides a platform for collaboration throughout the project's design and construction. Additionally, because the model and database can exist for the life of a building, the owner may use BIM to manage the facility well beyond completion of construction for such purposes as space planning, furnishing, monitoring long term energy performance, maintenance, and remodeling.

BIM is an evolving technology and is not used consistently in the industry at the present time. For example, a small project or a portion of a large project may utilize a single model, but a large, complex project may depend upon many interconnected models developed by specialty participants. Major fabricator models may interact with a design model to produce fabrication information directly and to coordinate conflicts as the design and purchasing proceed simultaneously. Compared with analog practices, the constructor's work model can reduce time and material waste by interacting with the design model to provide construction staging and scheduling to pre-build the project in model form far in advance of actual construction. Models also allow for more accurate costing and estimating earlier in the project. The use of BIM allows the efficient development of extremely complex projects in ways that might otherwise not be possible given constraints of site, time or finances.

BIM is a tool, not a project delivery method, but IPD process methods work hand in hand with BIM and leverage the tool's capabilities. The IPD project team reaches an understanding regarding how the model will be developed, accessed, and used, and how information can be exchanged between models and participants. Without such a clear understanding, the model may be used incorrectly or for an unintended purpose. Software choices are made on the basis of functionality and interoperability. Open technology platforms are essential to the integration of BIM and other models into the process and they foster communication to the benefit of the project on all levels. To aid in this area, interoperable data exchange protocols are in development and are gaining acceptance in the marketplace.

Decisions are also made and documented regarding the level of detail to be modeled, the tolerances required for specific uses, and the purposes the model will serve, such as whether the model will be used to develop cost data, and will function as a contract document. If it serves as a contract document, then the relationship between the model(s) and other contract documents is determined. Protocols are also are established for conflict resolution and submittal review as well. If the model is used to develop cost data, protocols are developed for how cost information will be created and exchanged. In addition, the methods for hosting, managing and archiving the model are determined.

These decisions and protocols are vital to the effective use of BIM in IPD. Similar to the communications decisions and protocols discussed above, BIM decisions and protocols are best developed through joint workshops. Any and all decisions are documented and readily available to any participant that will utilize the model—thus ensuring consistent use of the model over the course of the project.

4.1.5 Sharing Sensitive, Proprietary or Confidential Information

Collaborative contracting arrangements contemplate the sharing of much more information under different times and circumstances than is customary under traditional models. Confidentiality agreements serve to make all IPD participants aware of the importance of the proper uses of shared confidential information. Through careful participant selection and contract drafting, IPD participants achieve a level of comfort that project information exchanged will be utilized only for project purposes.

4.1.6 Compensation

From the perspective of collaboration and integration, traditional delivery methods suffer because the individual participant's financial success is not necessarily tied to the project's success. Given human nature, project participants will work hardest to preserve their own financial success. In traditional delivery methods, that behavior sometimes results in consequences that are detrimental to the project, other participants, or both. Methods of compensation that tie the participant's success to the overall success of the project are powerful tools for unifying individual and project success. In IPD, individual financial success relies on project success. For that reason, the IPD participant's natural instinct to protect and improve its own financial interest results in behavior that benefits the project.

There are many options available to parties interested in crafting methods of compensation that align individual success with project success. The appropriateness of any method will necessarily depend on the unique characteristics of any given project and its participants. Due to their inclusion of incentive provisions, IPD contracts can be more complex than traditional construction contracts. Also, to the extent that financial consequences flow from the attainment of specific goals (e.g., completion milestones, health and safety requirements, life-cycle costs, etc.), disputes may arise afterward over whether and to what extent certain goals were achieved. Careful contract drafting, clear and unambiguous definitions of incentive milestones, and due diligence in team selection, will minimize the likelihood that such disputes will arise.

4.1.7 Withdrawal/Assignment

As discussed above, creation of a collaborative team is critical to the success of IPD. While the initial selection of team members is critical to an IPD project, continuity of values and on-going commitment among the team members is perhaps just as important to the project's eventual success. As with any project, the loss of a participant is disruptive, but in IPD the loss is exacerbated given the importance of the project team to the project's success.

The loss and replacement of a team member is disruptive to the necessary collaborative nature of the team. When a team member is lost, any potential new participant is selected to meet the same criteria as the original. Extensive transitioning takes place so that the process may continue effectively, and many of the same team building efforts occur with the new team member. However, depending on when the participant is lost, the replacement participant may face an uphill battle overcoming the feelings of being an outsider to the remaining members of the team.

Accordingly, in order to glean the greatest benefit from IPD, every effort is made to maintain the continuity of the team. Withdrawal of team members, whether through assignment or voluntary termination, is highly discouraged. At the outset of the project, the team decides the few instances, if any, where withdrawal is acceptable. Any such decisions are made part of the agreement(s) in place and the agreements may include damage provisions for withdrawal in certain circumstances.

4.1.8 Team Member Dispute Resolution

As opposed to traditional delivery approaches where adversarial relationships abound, IPD is based upon collaboration in which team continuity is of the utmost importance. As a result of this working relationship and implementation of the team's decision making process, most internal disputes among team members are avoided. It would be naïve, however, to ignore the possibility that disputes may still arise among and between the team members, even within the most cooperative and well meaning teams.

As disputes arise throughout a traditional project, often the parties' only recourse is to submit claims, which immediately thrusts the parties into adversarial positions forcing them to act in their own best interest – adopting the "hunkering down" instinct. If the parties reach that stage, the team is crippled. At that point, the benefits of IPD are lost, and it is very difficult to regain later the collaborative culture within the team. To preserve both the team and the project in IPD, these disputes are resolved internally without the necessity of filing claims and adopting adversarial positions.

Internal disputes are resolved by the project's decision-making body, which, as stated above, makes decisions unanimously in the best interest of the project. Utilizing the project's decision making body to resolve disputes provides team members a sense of ownership in the decisions that are made. To this end, the agreements controlling the project teams' relationship emphasize internal dispute resolution and provide for specific procedures to effectuate such resolution. In some cases, the participants agree to a "no suit" provision, which waives their rights to litigate or arbitrate.

In large part, the success of internal dispute resolution will depend less on the particular procedures employed and more on the degree to which the team members have adopted the team approach of IPD. When a team member

hangs on to the notion of separate silos of responsibility, the project suffers. The better the team works together, the more likely it is able to survive internal disputes. Should internal dispute resolution fail, the participants' agreements address methods for external dispute resolution, absent a "no suit" provision. In this regard, the parties may follow more traditional lines of dispute resolution, such as mediation followed by arbitration or litigation.

The internal resolution of disputes under IPD emphasizes the difference between it and traditional project delivery and the need for cultural change among the team members to effectuate IPD. Traditional contracting is about creating boundaries. A well-drafted traditional construction contract clearly defines the parties' responsibilities and the consequences of failure. Responsibilities rarely overlap as that creates ambiguity as to the correct role. The contract's focus is on the transaction – the activity that must be performed. Integrated contract approaches, on the other hand, focus on the relationships necessary for the successful completion of the project. Such relational contracts, unlike transactional contracts, are quite rare in the domestic design and construction industry. As a consequence, a scarcity of legal precedent exists. Therefore, if disputes arise, it may be more difficult to evaluate one's rights and responsibilities or predict potential outcomes

4.2 Defining Roles, Responsibilities and Scopes of Services

Traditional contracting contemplates project participants operating within their own separate silos of responsibility. IPD seeks to break down these barriers by having all major participants focus on achieving shared goals. This is not to say, however, that IPD participants do not have separate work scopes for which they are primarily responsible. On the contrary, each participant has a clearly defined work scope. For the most part, the designers remain primarily responsible for design services and the constructors remain primarily responsible for construction services.

4.2.1 Service Scope

While still determined partly by registration laws, licensing laws and agency requirements, IPD team member roles and services are viewed functionally with tasks assigned on a best person basis, even when that differs from traditional role allocations. The project team ensures that the individual participant's tasks and responsibilities, or scope of services, are clearly set out and understood at the earliest possible stage. A carefully crafted matrix of parties, roles and responsibilities provides clarity for services, tasks, leadership and supporting roles and is often used for this purpose, though other means may be implemented.

The specific manner in which the traditional scopes of services for the individual team members are realigned will differ on a project-by-project basis. However, the expected effect on traditional scopes of services can be generally characterized in accordance with elements common to all integrated projects. Accordingly, the generally expected effects of IPD on designers, constructors, and owner are set forth below.

Designers—
IPD relies heavily on an extensive and thorough design process that incorporates input and involvement of other team members, including constructors, during the design phase. Thus, the design process takes on added importance as other team members come to understand how the integrated project will work and how it will be completed. As a team member, the designer is necessarily involved in defining the design processes that will apply to the project.

Integrated projects allow for more extensive pre-construction efforts related to identifying and resolving potential design conflicts that traditionally may not be discovered until construction. As a result, designers are required to perform in an earlier stage certain services that are traditionally performed later in the project. The resulting advancement of services potentially increases the volume of services provided in the design phase.

Frequent interactions with other team members during the design phase necessitates that designers provide numerous iterations of their design documents to other team members for their evaluation and input. This interaction results in an additional responsibility to track throughout the design phase both the status of iterations provided to other team members and the nature and substance of the input received from them.

Also, the designer may not necessarily serve as the "gate-keeper" for the flow of communications between the owner and constructors, as it does in traditional project delivery. Ideally, communications are facilitated by the collective team structure and do not rely on a single gate-keeper.

Constructors—
The nature of the constructors' scope of services is primarily affected in IPD by their early involvement on the project and their participation within the integrated team. Specifically, the constructor's role increases in a significant way during early stages of design, in which constructors now provide strategic services such as schedule production, cost estimating, phasing, systems evaluation, constructability reviews, and early purchasing programs. While constructors may provide these services in traditional projects, the timing of these services is advanced.

Constructors are brought in during early project phases to provide expertise and fully participate in the design of the project. The result is a greater role in commenting on and influencing design innovation. This increased role during design requires the constructor to provide, on a continuing basis, estimating services and/or target value design services during the design phase.

Owner—
In IPD, the Owner takes on a substantially greater and more active role in evaluating and influencing design options. Additionally, the Owner is required to participate in establishing project metrics at an earlier stage than is typical in a traditional project. In light of the fluid operation IPD requires, the Owner will also be called on more often to assist in resolving issues that arise on the project. As member of the decision making body, the owner will be involved on more project-related specifics and be required to act quickly in this regard to allow the project to continue efficiently.

4.2.2 Multi-Directional Duties

Most traditional construction contracts seek to limit the parties to whom duties are owed. In direct contrast, IPD proceeds under the theory that projects run more smoothly where all parties formally recognize what exists in practice – that every construction project is a network of inter-linked, roles, commitments and mutual promises.

One result of this approach is a blending of traditional roles. For example, IPD requires that the constructor have greater involvement in the design process. While it is not the case that "constructors design and designers construct" under IPD models, the discrete responsibilities of the two are more intertwined than in traditional models. The blending of roles, while strengthening the creative process, can lead to the question of who is responsible for particular scopes of work. For that reason, a well-drafted IPD agreement clearly spells out individual work scopes. Collaboration is not a substitute for accountability, at least as it pertains to the primary responsibility for performing one's scope of work.

Current standards of care for designers and constructors remain intact for those activities that are traditionally performed. Nevertheless, IPD requires that, to some extent, the risk of non-performance be shared, thus promoting collaboration across traditional roles and responsibilities. IPD agreements often spread the risk of non-performance across all direct participants. In this way, the designer may directly bear some risk of constructor non-performance, and vice versa. In negotiating agreements and building project team relations, this issue is recognized and addressed up front. The participants necessarily negotiate the level of risk sharing they are jointly comfortable with, on a project-by-project basis.

4.3 Defining and Measuring Project Outcomes

In IPD, as in traditional projects, the risk of failing to meet expectations remains. Because success in IPD is measured by expressly stated shared goals, and in many cases financial consequences flow from attaining, or failing to attain, such goals, IPD agreements clearly spell out project goals and the consequences of success or failure.

The IPD project plan includes project metric values and reporting intervals to monitor progress of the project. Metrics include overall performance of the project as well as the traditional cost, schedule, and scope measurements. Meeting these metrics may also be tied to financial incentives for the parties.

4.3.1 Goals & Standards

Although the team may present alternatives and counsel the owner, goals remain the owner's province. The owner determines its program and what it wants to achieve. However, standards based upon goals and used to judge project success and compensation are jointly agreed upon. It's necessary for all parties to be comfortable with the agreed-upon anticipated outcomes, as they may affect potential bonus and compensation structures.

If the goals are simply economic, standards of project duration and cost may adequately measure attainment of these goals. Objective performance criteria, such as energy efficiency, are also easily determined. Quality of

construction and design creativity are less easily measured. These factors may require a weighted index, comparison structures, and independent evaluators. The team also agrees on when the standards will be measured. For example, the team determines if energy efficiency is measured during commissioning, or is averaged over a season or seasons. If lowered maintenance cost is a goal, the team determines when success is measured.

4.3.2 Project Cost

The overall project cost is a prime metric that is established at the project inception and tracked throughout the life of the project with agreed upon emphasis on life cycle and sustainability components. Included are the cost of the actual work, non-incentive based compensation (fees for services) and appropriate contingencies. The potential for a direct connection between the design and quantity survey during all phases creates a powerful tool to determine and manage the project cost. This is one of the prime opportunities to see the efficiency possible with IPD.

A significant benefit of IPD is the opportunity to replace value engineering with target pricing or target value design processes (a form of estimated budgeting). Under many IPD arrangements, significant consequences flow from exceeding (or beating) the target price. Early in conceptualization, the team confirms whether a project can be built for the funds available that will satisfy the owner's goals. Assuming the team validates the budget assumptions, it then pursues target value design. Unlike traditional design processes where design, budgeting, and then redesign is an iterative process, a target value design process uses immediate feedback on budget, schedule and quality to inform the development of the design. It promotes designing to a detailed estimate, rather than estimating a detailed design. For this to be accomplished, information needs to be communicated effectively to all interested parties, feedback received, and decisions made on an open and rational basis. If this is properly done, conventional "value engineering" vanishes. Moreover, by tying the decision process to the schedule, alternatives that require information can proceed on parallel paths until the appropriate "last responsible moment."

To the extent that setting the target price is a collaborative exercise, there are a number of issues to consider. In the first instance, each project participant has a direct pecuniary interest in where the target price is set. The owner's interests often favor a lower price, whereas the designers or contractors may have a financial incentive to seek a higher target price. This conflict is managed through careful participant selection, open book estimating, and proper use of independent consultants.

4.3.3 Project Schedule

One of the main potential benefits of IPD is the reduction of construction time due to the extensive planning and changes to project processes. This benefit is a common determinant in selecting IPD as a preferred process by owners. The ability to link schedule, phasing and detailed construction sequencing during design will provide efficiencies in material procurement. Early ordering of materials by key supporting participant trade contractors to coordinate with the development of the design reduces the time from the completion of design to the beginning of active work on the site of a project.

4.3.4 Project Quality

New technological tools available to IPD team members, including BIM, provide the opportunity to reduce errors within design documents as well as conflicts between trades--all well before purchasing of systems and products. Collaboration among the participants leverages these tools to create an atmosphere where quality of service, design and execution are integral to the project.

The measurement of quality is based upon metrics appropriate to the project type and is compared to previously completed projects of similar nature. As more IPD projects are undertaken by an owner or an industry, quality standards may increase.

4.3.5 Operational Performance

The establishment of performance criteria for major building systems within a project is made during early design and refined as the design proceeds. These are aligned with the project goals and set with the advice of the major trades participating in the project along with the associated design professionals.

The opportunity exists for financial performance metrics of the completed project to be established and tracked after completion. The contribution that the project team makes to the ongoing success of the performance of the finished project due to quality of design and implementation could lead to royalty or other long term financial profit sharing arrangements for those key participants.

4.3.6 Sustainability

One key area of opportunity for improvement from traditional delivery approaches is to set more aggressive goals for sustainability. Metrics can be established for lifecycle goals for all aspects of a project. Ratings criteria such as Green Globes, LEED® or SB Tool may be melded into the overall goals and incremental steps monitored throughout the design and delivery process. The opportunity also exists to set goals for carbon footprint and incorporation of alternative energies.

4.4 Legal Considerations

4.4.1 Non-Standard Contracts

Integrated approaches involve contractual relationships that are quite different from traditional contract models. Modifying a standard non-integrated contract form to call for integration can be a challenge because the approaches are very different. Negotiating and drafting agreements without the aid of prior similar contracts or standard forms can increase the cost of reaching an agreement. The AIA is currently developing standard forms to assist parties wishing to negotiate and execute an IPD agreement.

4.4.2 Professional Responsibility and Licensing

Because project participants remain responsible for individual scopes of work, an IPD approach should not alter traditional requirements with respect to professional or business licenses. Collaboration between designers and constructors does not inherently result in a blending of disciplines. Where assigned work scopes require a constructor to perform design services, it will need to handle that task consistent with registration requirements. This is no different than in the case under a non-integrated approach. If the IPD services are to be provided through a separate legal entity specifically created for the project (e.g. limited liability company), the entity may be required to obtain design and/or construction licenses, depending upon individual state laws.

4.4.3 Insurance

Using BIM and other tools to construct a building virtually in advance of actual construction substantially diminishes the risk of design errors and omissions. If the participants adopt "no suit" clauses, the risk of incurring internal first-party claims for economic loss can be eliminated through these waivers. However, where participants do not waive first party claims but assume non-traditional liability, traditional insurance products may not be available in today's insurance market. Insurance for third-party claims for personal injury and property damage may also not be available. It is now incumbent upon the insurance industry to develop and offer alternative insurance products that align with the project goals and the specific risk allocation terms established among the IPD project participants.

Furthermore, the development and underwriting of bonding and insurance require a new approach that recognizes the risk sharing framework of IPD. This may require more than the customary interaction with surety and insurance markets. Traditional legal risk management operates on a philosophy that risk follows duty and the more duties one owes to more parties, the more legal risk one incurs.

4.4.4 Entity Formation

While it is entirely possible to structure an IPD project purely through contractual arrangements between the separate participants (and it is anticipated that most will be so formed), it is also possible to carry out such projects through the creation of a single purpose entity, such as a Limited Liability Company (LLC). There can be tax and management issues to address where a separate legal entity is created to carry out the project.

4.4.5 Joint Liability and Joint Venture

IPD arrangements contemplate a high degree of collaborative effort. In many cases, project participants share, to one degree or another, in the success or failure of the overall venture. In this regard, IPD arrangements are more likely to be classified as joint ventures than the independent contractor arrangements typically encountered under traditional models. A unique risk feature of joint ventures is the joint liability of all joint venturers. Therefore, if all major IPD participants are deemed joint venturers, they may be liable to third parties for the failings of their joint venture partners. In this way, the construction team

might well bear the risk of design error and the design team could be at risk for construction errors. This risk can be managed through careful planning (e.g., appropriate insurance products and structuring the legal relationships between the parties) and contract drafting.

In practice, integrated project delivery exhibits fundamental differences from traditional models in two primary areas: team assembly and project phasing / execution. Team assembly is covered generally below; project execution topics are introduced and then explored in detail.

5.1 Building an Integrated Team

The key to successful Integrated Project Delivery is assembling a team that is committed to collaborative processes and is capable of working together effectively. In order to accomplish this, participants must:

1 Identify, at the earliest possible time, the participant roles that are most important to the project.

2 Pre-qualify members (individuals and firms) of the team

3 Consider interests and seek involvement of select additional parties, such as building official(s), local utility companies, insurers, sureties, and other stakeholders.

4 Define in a mutually understandable fashion the values, goals, interests and objectives of the participating stakeholders.

5 Identify the organizational and business structure best suited to IPD that is consistent with the participants' needs and constraints. The choice should not be rigidly bound to traditional project delivery methods, but should be flexibly adapted to the project.

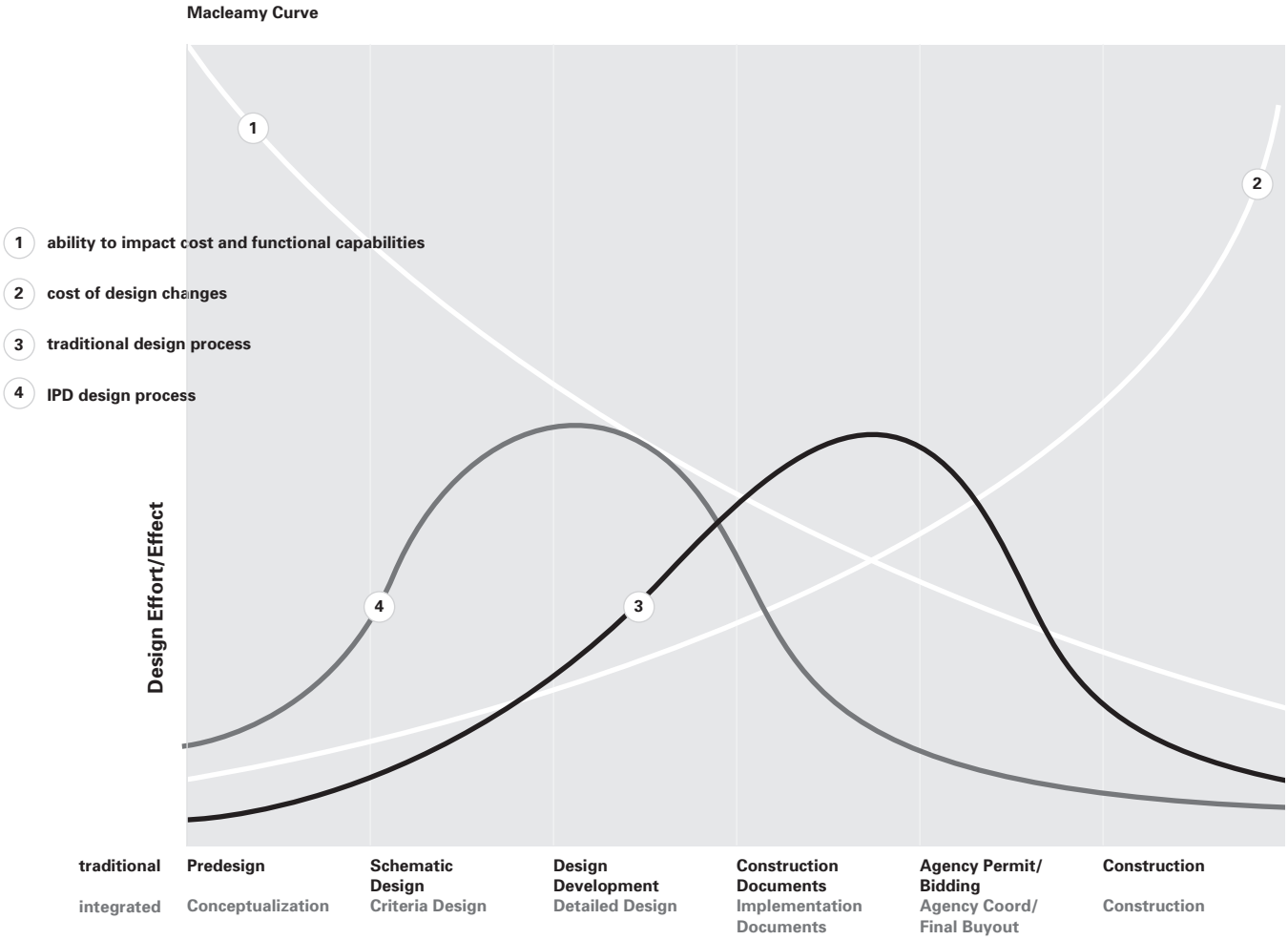
6 Develop project agreement(s) to define the roles and accountability of the participants. The project agreements should be synchronized to assure that parties' roles and responsibilities are defined identically in all agreements and are consistent with the agreed organizational and business models. Key provisions regarding compensation, obligation and risk allocation should be clearly defined and should encourage open communication and collaboration.

A Note on Building Information Modeling

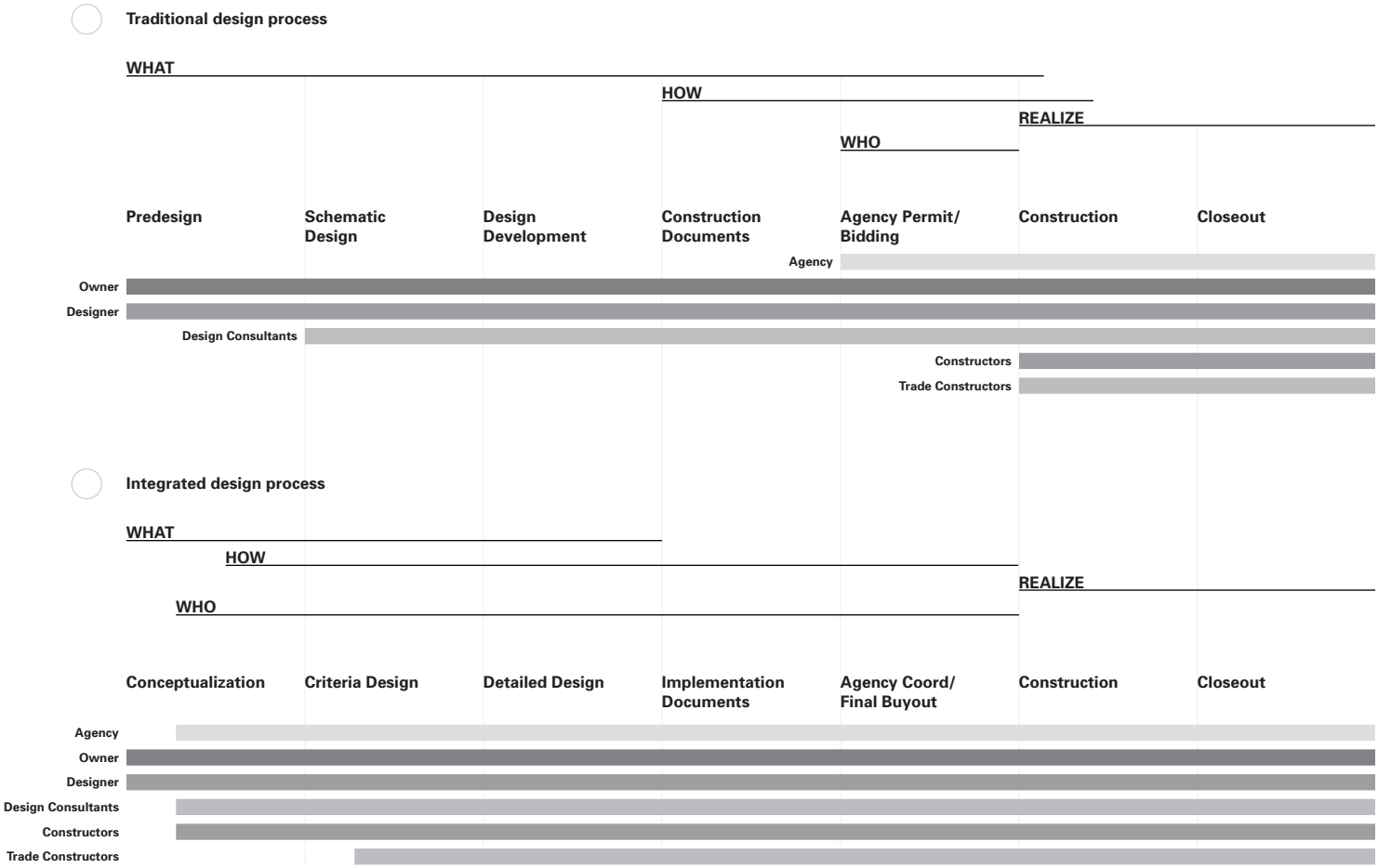
It is understood that integrated project delivery and building information modeling (BIM) are different concepts – the first is a process and the second a tool. Certainly integrated projects are done without BIM and BIM is used in non-integrated processes. However, the full potential benefits of both IPD *and BIM are achieved only when they are used together. Thus, the* IPD *phase descriptions included here assume the use of BIM.*

5.2 Project Execution / Redefining Project Phases

In an integrated project, the project flow from conceptualization through implementation and closeout differs significantly from a non-integrated project. Moving design decisions upstream as far as possible to where they are more effective and less costly suggests a re-thinking of typical project phases.



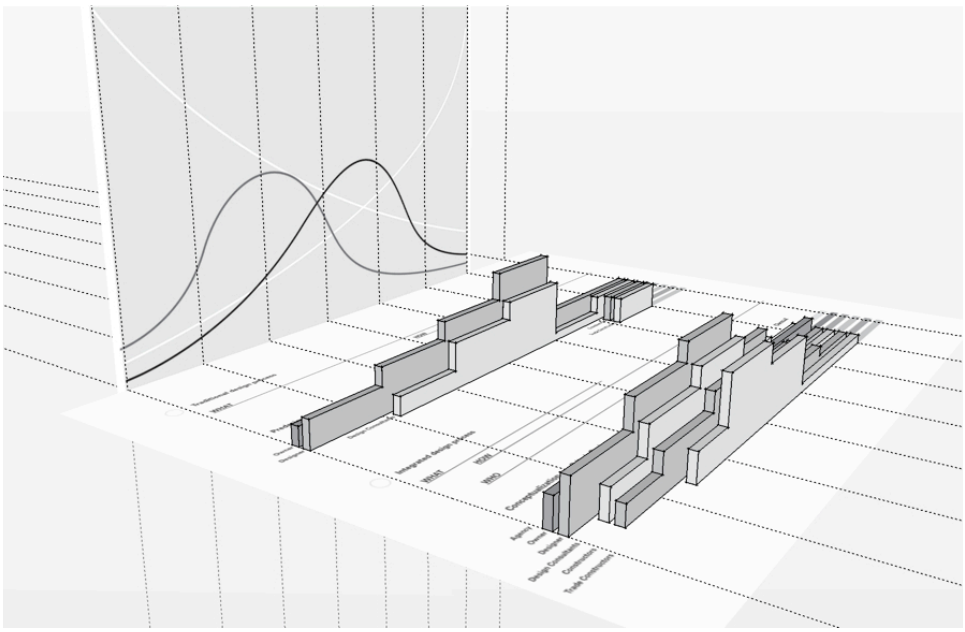
Introduced in the Construction Users Roundtable's "Collaboration, Integrated Information, and the Project Lifecycle in Building Design and Construction and Operation" (WP-1202, August, 2004)", the "MacLeamy Curve" illustrates the concept of making design decisions earlier in the project when opportunity to influence positive outcomes is maximized and the cost of changes minimized, especially as regards the designer and design consultant roles.



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.

In addition to shifting design decision making forward, redefinition of phases is driven by two key concepts: the integration of early input from constructors, installers, fabricators and suppliers as well as from designers; and the ability to model and simulate the project accurately using BIM tools. These two concepts enable the design to be brought to a much higher level of completion before the documentation phase is started. Thus the first three phases of the integrated project: Conceptualization, Criteria Design, and Detailed Design (described in detail on the following pages) involve more effort than their counterparts in the traditional flow.

This higher level of completion in earlier project stages means that the next phase, Implementation Documents, requires less effort than the traditional Construction Documents phase, and the early participation of regulatory agencies, trade contractors, and fabricators allows shortening of the fifth and sixth phases, Agency Review and Buyout, as well. The result is that the project is defined and coordinated to a much higher level prior to construction start than is typical with traditional delivery methods, enabling a more efficient Construction phase and a potentially shorter construction period. The IPD phases conclude at project Closeout.



The z-axis suggests levels of "design effort" of project participants during the different phases of the project. The "MacLeamy Curve" backdrop is offered for general comparison to the "shifting forward" concept in the area of design effort. Note in particular the increase in "design effort" of constructors and trade contractors over the traditional model.

The project phase descriptions that follow below in outline format are presented from two perspectives: Outcomes and Primary Responsibilities.

Outcomes—
The breadth of knowledge and depth of collaboration that is the essence of IPD require that phase outcomes – milestones and deliverables – be defined succinctly. These outcome definitions enable all team members to understand the level of detail at which they should be working, and what decisions have (and have not) been finalized so they can proceed with confidence.

Primary Responsibilities—
In an integrated project, all team members provide whatever input they can to all aspects of the project. Here "responsibility" means only that the indicated team member is charged with coordinating, integrating and ensuring the completeness of the task or information needed—it does not suggest that professionally licensed responsibilities are in any way modified or diminished. On many projects, where governing laws don't dictate otherwise, certain building systems may be provided under design-build arrangements. In such instances, the specialty trade contractor may take on the design consultant's responsibilities for those systems.

Team leadership under IPD will vary from project to project depending on a number of considerations, such as contractual relationships and the skills of individual team members. The Integrated Project Coordinator (IPC) is primarily a facilitator, and may be a retained third party or one of the team members. In many cases the responsibilities will migrate. For example, the prime designer may be the IPC during the design phases while the prime constructor takes on that role as the project moves into construction.

The following phase descriptions are offered as a point of departure – responsibilities and timing of deliverables will vary according to the needs and priorities of the specific project. References to traditional project phases are included in brackets [] for comparison purposes.

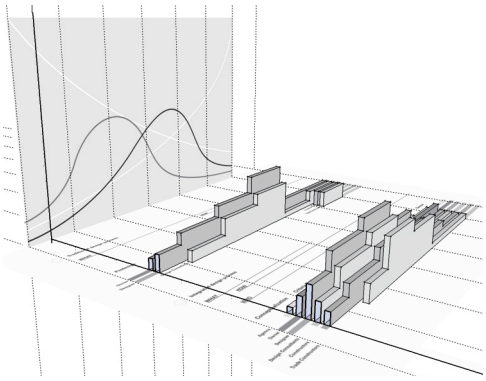


Diagram 1
Conceptualization

5.2.1 Conceptualization [Expanded Programming]

Conceptualization begins to determine WHAT is to be built, WHO will build it, and HOW it will be built.

Outcomes

- Performance goals are developed by the team:
  - Size
  - Sustainable or green criteria or goals
  - Economic performance based on the complete building life span including operation
  - Successful outcome metrics (e.g. cost, schedule, quality, etc.)
- Cost structure is developed earlier and in greater detail than a conventional project.
  - Costs may be linked to Building Information Model to enable rapid assessment of design decisions
  - Costs are detailed by system, providing an understanding of the cost range and importance of each system
  - Key parties assess areas where greatest improvements are possible
  - Initial benchmarking comparison is performed to assess project costs against market rates
- Preliminary schedule is developed and linked to developing model
- Communication methodologies and technologies are identified and key parameters agreed upon
  - Building Information Modeling platform(s)
  - Administration and maintenance of BIM(s)
  - Source of truth for all data
  - Interoperability criteria
  - Data transfer protocols
  - Level of detail development by phase
  - Development of tolerances

Primary Responsibilities

- Owner
  - Establish goals regarding the function and performance of the building, schedule, and budget based on organization's business case
  - Provide project funding establish critical financial milestones
  - Determine method of project procurement
  - Lead selection of integrated project team
  - Provide site data such as topography, utility locations, soils condition, environmental impact studies and reports, Phase I mitigation reports
  - Provide parameters of owner construction policies and programs regarding insurance, safety and risk mitigation
  - Establish internal processes and organization for user input, reviews, approvals and decision making
  - Provide team with information about legislative or jurisdictional requirements affecting project
- Integrated Project Coordinator
  - Overall facilitation, coordination, organization and direction of the integrated team
  - Team's compliance with owner's requirements
  - Overall project schedule
  - Completeness of necessary project information
- Prime Designer
  - Validation of opportunities and options of the business proposition to the physical outcome of the project
  - Confirm space program meets code requirements and applicable standards and is aligned with overall project goals
  - Visualize massing of building and adjacency concerns on its site
  - Identify sustainable design outcomes that have a cost impact to the project
  - Design schedule
- Design Consultants
  - Feedback on building systems relative to achieving project performance goals
  - Identify unique project and system requirements that will effect project outcomes
- Prime Constructor
  - Cost information: comprehensiveness and integration into model.
  - Constructability
  - Initial procurement and construction schedule, including integration into model
- Trade Contractors
  - Initial cost data for their scope of work
  - Cost options for applicable scope of work
  - Constructability for applicable scope of work
  - Initial schedule data for applicable scope of work
- Suppliers
  - Specific cost data
  - Identification of long lead items
  - Product data sheets
  - Life cycle and energy efficiency data
- Agencies
  - Input regarding project constraints, code requirements, and testing and inspection requirements
  - Validation of application/review schedule

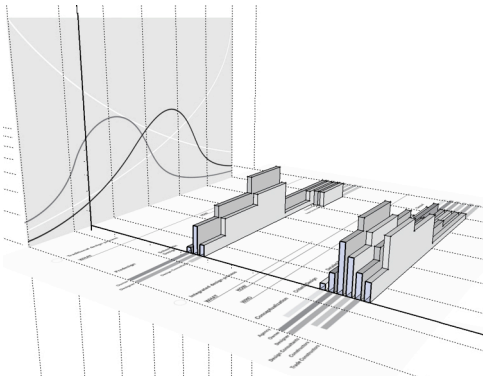


Diagram 2
Criteria Design

5.2.2 Criteria Design [Expanded Schematic Design]

During Criteria Design, the project begins to take shape. Major options are evaluated, tested and selected.

Outcomes

- The following aspects of the project are finalized, allowing the team to proceed with confidence to the next level of detail:
  - Scope
  - Form, adjacencies and spatial relationships
  - Selection and initial design of major building systems (structure, skin, HVAC, etc.)
  - Cost estimate (at appropriate precision)
  - Schedule (at appropriate precision)
- Agreement is reached on tolerances between trades to enable prefabrication.

Primary Responsibilities

- Owner
  - Final arbiter, after consultation, regarding project goals and standards
  - Establish decision criteria to evaluate proposals with respect to current and future operations
  - Decisions based on available options
  - Facilitate site specific/user input and coordinate it with the team
  - Facilitate user group reviews and feedback to team regarding revisions
  - Reviews and approval of criteria documents
- Integrated Project Coordinator
  - Overall facilitation, coordination, organization and direction of the integrated team
  - Lead selection of integrated team members
  - Coordinate assignment of responsibilities, actions and completion requirements
  - Coordinate and track integrated team's performance
  - Coordination of overall project schedule
- Prime Designer
  - Integration of design input from all team members
  - Confirm user experience of building as it relates to project goals
  - Form, adjacencies and spatial relationships of the project
  - Coordinate selection of major building systems and performance requirements
  - Regulatory requirements for the building (i.e.: fire/life safety plan)
  - Sustainability targets and proposed systems
  - Outline or Performance Specification
  - Refinement of design schedule
- Design Consultants
  - Selecting major building systems and setting performance requirements
  - Locate major pieces of equipment and routing in the project
  - Identify unique conditions that need to be addressed in the next phase as the systems are being detailed
- Prime Constructor
  - Continuous cost feedback using information extracted from the model. At this phase many items may be conceptual, i.e., based on floor area or unit counts
  - Validation of target cost
  - Refinement of construction schedule
  - Constructability issues
  - Initial discussion of tolerances and prefabrication opportunities
- Trade Contractors
  - Validate target cost for applicable scope of work
  - Validate schedule for applicable scope of work
  - Provide input for tolerances, prefabrication opportunities
  - Assess compatibility with the design and work of other trades
- Suppliers
  - Validate target cost for specific items
  - Validate lead times for long-lead items
  - Provide input for tolerances, prefabrication opportunities
- Agencies
  - Permit application requirements and schedule
  - Validation of fire/life safety plan
  - Performance-based code analysis can begin using the BIM

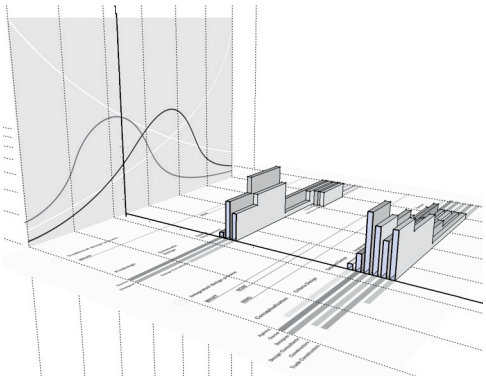


Diagram 3
Detailed Design

5.2.3 Detailed Design [Expanded Design Development]

The Detailed Design phase concludes the WHAT phase of the project. During this phase, all key design decisions are finalized. Detailed Design under IPD comprises much of what is left to the Construction Documents phase under traditional practice, thus the Detailed Design phase involves significantly more effort than the traditional Design Development phase.

Outcomes

- Building is fully and unambiguously defined, coordinated and validated
  - All major building systems are defined, including any furnishings, fixtures and equipment within the scope of the project
  - All building elements are fully engineered and coordinated. The team will have collaborated to resolve any inconsistencies, conflicts or constructability issues
  - Agreement is reached on tolerances between trades to ensure constructability and to enable as much prefabrication as possible.
  - Quality levels are established
- Prescriptive Specifications are completed based on prescribed and agreed systems
- Cost is established to a high level of precision
- Construction schedule is established to a high level of precision

Primary Responsibilities

- Owner
  - Provide decisions and guidance to all alternative options
  - Approve the design prior to implementation documentation phase, allowing the team to proceed with confidence
  - Be the arbiter of changes to the design and overall acceptability as it relates to performance
- Integrated Project Coordinator
  - Overall facilitation, coordination, organization and direction of the integrated team
  - Coordinate alternative options for presentation to Owner
  - Coordinate and track integrated team's performance
  - Ensure compliance with project requirements
  - Lead performance checking of building systems from the Integrated
  - Team's stakeholders
- Prime Designer
  - Coordinate and integrate input from project stakeholders and ensure compliance with project requirements
  - Detail concept ideas into constructible form
  - Code compliance
- Design Consultants
  - Complete design of building systems
  - Verify system performance
- Prime Constructor
  - Provide continuous cost feedback using information extracted from the model; all item quantities are based on quantity survey or lump sums provided by Trade Contractors and suppliers
  - Verify that cost is all-inclusive and accurate
  - Verify prefabrication decisions
  - Verify construction schedule
  - Finalize coordination of building systems, including MEPS
  - Verify tolerances
- Trade Contractors
  - Provide input for coordination and conflict resolution.
  - Provide detail-level models for applicable scope of work, adjust models to coordinate with other systems
  - Verify cost for their scope of work
  - Verify schedule for their scope of work
- Suppliers
  - Provide input for coordination and conflict resolution
  - Provide models of specific items
  - Verify cost for specific items
  - Verify schedule for long lead items
  - Verify tolerances for specific items
- Agencies
  - If performance-based code analysis using the BIM is underway, it is expanded here

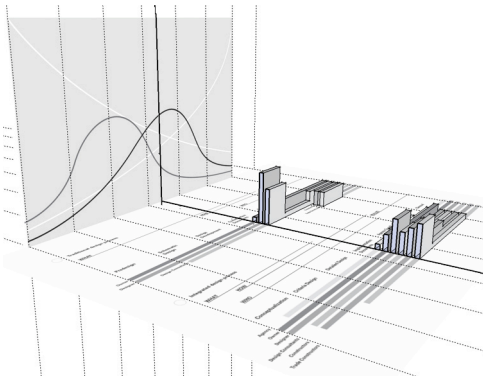


Diagram 4
Implementation Documents

5.2.4 Implementation Documents [Construction Documents]

During this phase, effort shifts from WHAT is being created to documenting HOW it will be implemented. The goal of ID phase is to complete the determination and documentation of how the design intent will be implemented, not to change or develop it.

The traditional shop drawing process is merged into this phase as constructors, trade contractors and suppliers document how systems and structure will be created. In addition, this phase generates the documents that third parties will use for permitting, financing and regulatory purposes.

Because the Detailed Design phase concludes with the design and all building systems "fully and unambiguously defined, coordinated and validated," the Implementation Documents phase comprises less effort than the traditional Construction Documents phase.

Outcomes

- Construction means and methods are finalized and documented
- Construction schedule is finalized and agreed upon
- Cost is finalized and agreed upon
- Costs are tied to the model
- The specifications are finalized, supplementing the model with narrative documentation of the design intent wherever necessary
- Implementation Documents define and visualize the project for participants who aren't involved in the development of the model, providing:
  - A "finance-able" project (a completed model that gives "the bank" sufficient detail to finance the project)
  - Bid documents for parties outside the integrated process
- The "shop drawing" phase that in traditional phases occurs after Construction Documents will be largely completed during the Implementation Documents phase
- Prefabrication of some systems can commence because the model is sufficiently fixed (object sizes and positions are frozen) to allow early purchasing and prefabrication to begin

Primary Responsibilities

- Owner
  - Verify project performance targets and business case
  - Final approval of project scope and metrics
  - Coordinate financial requirements necessary to begin construction
  - Facilitate final user reviews and approvals
  - Initiate transition planning to utilize completed project
  - Establish user appeals process
  - Finalize specifications for major equipment
  - Define owners requirements for construction safety programs and controls regarding Interim Life Safety, noise, vibration, infection control
- Integrated Project Coordinator
  - Overall facilitation, coordination, organization and direction of the integrated team
  - Coordinate complete information for legal requirements of project as it relates to the owner's procurement method
  - Coordinate team input and facilitating team buy-in for overall project schedule and budget
- Prime Designer
  - Finalize model for architecturally related design intent for construction
  - Provide descriptive information for fabrication and construction of architecturally related scope
  - Finalize specifications
- Design Consultants
  - Finalize model for consultant's related design intent for construction
  - Provide descriptive information for fabrication and construction of consultant's related scope
  - Finalize specifications
- Prime Constructor
  - Control of the BIM may transfer from the Prime Designer to the
  - Prime Constructor at the conclusion of Detailed Design
  - Finalize construction schedule through 4D modeling
  - Finalize construction cost through 5D modeling
  - Complete information for:
    - Procurement
    - Assembly
    - Layout
    - Detailed schedule
    - Procedural information (testing, commissioning)
  - Ensure that all necessary work is accounted for.
- Trade Contractors
  - Finalize cost and schedule for applicable scope of work.
  - Ensure BIM and specifications include sufficient and unambiguous information for completion of applicable scope of work.
  - Technically sophisticated Trade Contractors will augment the design model in lieu of preparing separate shop drawings, or will create a synchronized model for fabrication or installation purposes
  - Develop implementation information for applicable scope to shop drawing level
- Suppliers
  - Finalize cost and schedule for their specific items
  - Technically sophisticated suppliers will augment the design model in lieu of preparing separate shop drawings, or will create a synchronized model for fabrication or installation purposes
  - Develop implementation information for their scope to shop drawing level
- Agencies
  - Verify completeness of permit submittals

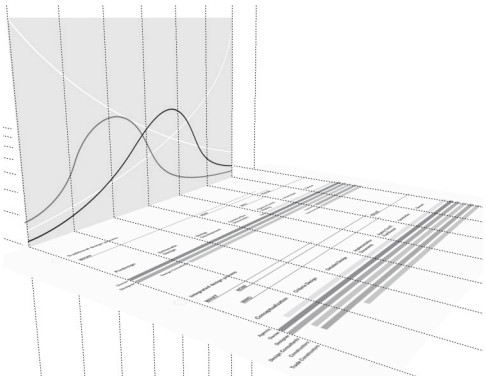


Diagram 5
Agency Review
no design effort in this phase

5.2.5 Agency Review

Use of BIM and early involvement and validation by agencies shortens the final permitting process.

Agency Review commences in Criteria Design and increases in intensity during the final review period. This early involvement minimizes agency comments and required changes to the design as submitted for permit.

Building Information Models have the ability to provide information either directly or through linked databases that can enhance and streamline a reviewing agency's ability to check the design for building code or regulatory criteria. In addition, analysis software can use the model information to generate performance or criteria analyses that validate the design.

Outcomes

- All necessary permits and approvals

Primary Responsibilities

- Owner
  - Final arbiter and lead strategy regarding negotiations with jurisdiction providing permits
  - Facilitate project teams response to modifications required by jurisdiction
  - Obtain permits and approvals
- Integrated Project Coordinator
  - Overall facilitation, coordination, organization and direction of the integrated team
  - Overall coordination and management of the Agency Review process
- Prime Designer
  - Interface with agency representative to ensure code compliance of design is understood
  - Coordinate the BIM to ensure code compliance is demonstrated in a mutually agreed interoperable format
- Design Consultants
  - Interface with agency representative to ensure code compliance of their scope of the design is understood
  - Provide scope-specific input to the BIM to ensure code compliance is demonstrated in a mutually agreed interoperable format
- Prime Constructor
  - Coordinate applications for construction-related permits (cranes, street closure, etc.)
- Trade Contractors
- Suppliers
- Agencies
  - Schedule for application submittals and review completion.
  - Review and approval of design and construction plan
  - If performance-based code analysis using the BIM is underway, it is finalized here

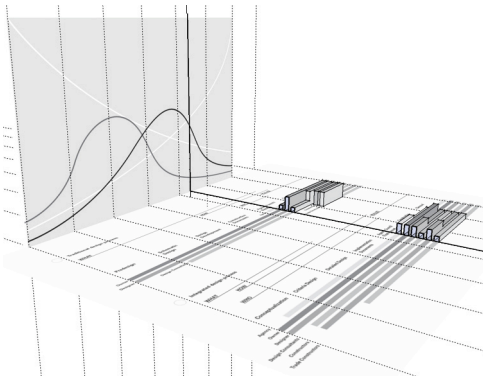


Diagram 6
Buyout

5.2.6 Buyout

IPD assumes early involvement of key trade contractors and vendors, so buyout of work packages they provide occurs through development of prices throughout the design phases, culminating at the conclusion of Implementation Documents. Accelerated project definition during Criteria and Detailed Design allows early commitment for procurement of long lead, custom, or prefabricated items. The IPD Buyout phase is much shorter than under traditional delivery methods, since most work is already contracted for.

Outcomes

- **Commitments are in place for all work, materials and equipment needed to complete the project**

Primary Responsibilities

- **Owner**
  - **Final arbiter of requirements for pre qualification requirements Define organizations requirements for outreach**
  - **Participate in pre bid conferences and provide organizations**
  - **requirements affecting bidders**
- **Integrated Project Coordinator**
  - **Overall facilitation, coordination, organization and direction of the integrated team**
- **Prime Designer**
  - **Respond to questions from remaining trades bidding on the project**
  - **Respond to pre-fabrication studies to ensure integrity of the design intent.**
- **Design Consultants**
  - **Respond to questions from remaining trades bidding on the project Respond to pre-fabrication studies to ensure integrity of the design intent.**

  Prime Constructor
  - **Ensures that commitments are in place for all work needed to complete the project.**
  - **A variety of negotiating strategies may be used, based on the level of participation of the provider in the integrated model**
  - **Work packages can be bid based on quantities extracted from the model**
  - **Overall coordination and management of the buyout process**
- **Trade Contractors**
- **Suppliers**
- **Agencies**

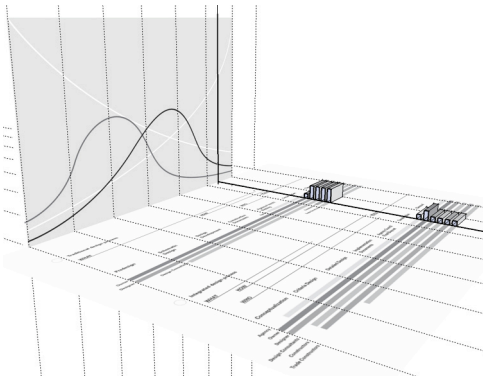


Diagram 7
Construction

5.2.7 Construction [Construction/Construction Contract Administration]

In the Construction phase, the benefits of the integrated process are realized. For architects under traditional delivery models, construction contract administration is considered the final stage of design—the last chance to address issues and achieve solutions. But in Integrated Project Delivery, the design and its implementation are finalized during the Detailed Design and Implementation Documents phases. Thus, construction contract administration is primarily a quality control and cost monitoring function. Because of the greater effort put into the design phases, construction under IPD will be much more efficient.

Outcomes

- Substantial Completion of the project, characterized by:
  - Virtually no RFIs from major trades because prime constructor, key trade contractors and key vendors have been involved in developing the design intent and implementation
  - Less construction administration effort required because submittals for key scopes of work have already been integrated into the model and conflicts have been resolved virtually
  - Better understanding of design intent by all participants because the BIM provides effective visualization
  - More pre-fabrication resulting in:
    - Less waste because more assemblies are factory generated.
    - Fewer injuries because more work is being performed in a more controlled environment
  - A schedule tied to the model to allow visualization of crew coordination and deviations from planned sequences and durations
  - Some elements of current construction administration will remain similar to current practice
    - Quality control, inspection and testing will be relatively unchanged
    - Changes within the agreed project scope will be virtually eliminated, but owner-directed changes will need to be formally negotiated
    - Scheduling and progress will be periodically reviewed

Primary Responsibilities

- Owner
  - Monitor organization need for change based on revisions to business case
  - Manage Owner's contractual obligations
  - Manage Owner's internal review and decision process
  - Manage Owner's transition process to occupy and startup of completed project
  - Organize equipment procurement and staging
- Integrated Project Coordinator
  - Overall facilitation, coordination, organization and direction of the integrated team
- Prime Designer
  - Overall responsibility for Construction Contract Administration from a design perspective
  - Respond to RFI's and processing of submittals as required to support trades not part of the initial design activities
  - Coordinate RFI and submittal responses from all design consultants
  - Provide updates to BIM as required responding to field conditions and Design Consultant needs
  - Coordinate any changes due to field conditions not foreseen in the BIM.
  - Issue design change documents as required to respond to latent conditions and or owner-directed changes
  - Review change requests to confirm entitlement
  - Work with prime constructor to ensure the construction is proceeding in conformance with design intent
  - Issue substantial and final completions documents
- Design Consultants
  - Respond to RFI's and processing of submittals as required to support trades not part of the initial design activities
  - Provide updates to BIM as required responding to field conditions
  - Coordinate any changes due to field conditions not foreseen in the BIM
  - Issue design change documents as required to respond to latent conditions and or owner directed changes
  - Review change requests to confirm entitlement
  - Work with prime constructor to ensure the construction is proceeding in conformance with design intent
  - Issue substantial and final completions documents
- Prime Constructor
  - Coordinate trade contractors, suppliers, and self-performed work to ensure completion of the project according to budget, schedule and quality goals defined by the project team
  - Ensure safety of all personnel on the project site
  - Maintain good relations with neighbors
  - Coordinate with regulatory agencies for required inspections
- Coordinate required testing
- Trade Contractors
  - Coordinate their activities with the overall project to ensure efficient flow of work.
- Suppliers
  - Coordinate fabrication and delivery of materials/assemblies/equipment to ensure efficient flow of work.
- Agencies

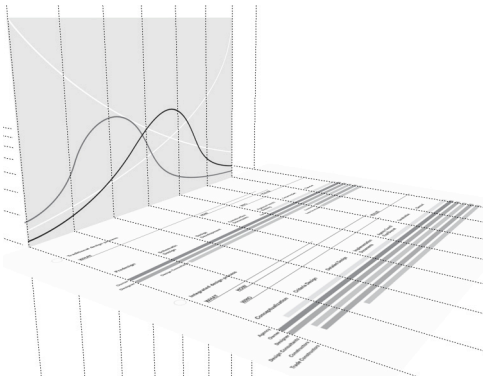


Diagram 8
Closeout

5.2.8 Closeout

An intelligent 3D model can be delivered to the owner.

Closeout of an integrated project greatly depends upon the business terms agreed by the parties. For example, if the business structure contains compensation incentives or penalties, the closeout includes calculation of appropriate credits or deducts. Some issues, however, such as warranty obligations, occupancy, and completion notification, remain unchanged due to statutory and legal requirements. Other issues, such as punch list correction, are not significantly affected by integrated project delivery.

Outcomes

- **A complete building information model reflecting "as-built" conditions will be provided to the owner for long term use for building management, maintenance and operation. This model can also be used for:**
  - **Integration of building monitoring, control and security systems**
  - **Comparing actual performance of building and systems to planned performance**
  - **Referencing of warranty, operation and maintenance information**
- **Traditional warranties will remain for installation quality and defective products.**

Primary Responsibilities

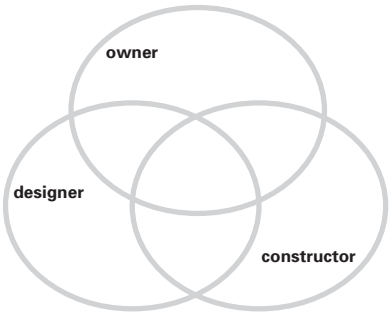
- **Owner**
  - **Training of operation and maintenance personnel**
  - **Complete jurisdictional requirements for occupancy and project completion**
  - **Initiate continual monitoring of project with respect to project goals and metrics related to performance**
- **Integrated Project Coordinator**
  - **Overall facilitation, coordination, organization and direction of the integrated team**
- **Prime Designer**
  - **Work with owner on user needs to use the BIM for life cycle benefit.**
  - **Document and or analyze any Post Occupancy Evaluation feedback**
- **Design Consultants**
  - **Work with owner on user needs to use the BIM for life cycle benefit.**
  - **Document and or analyze any Post-Occupancy Evaluation feedback**
- **Prime Constructor**
  - **Finalize the BIM to correspond with built conditions.**
- **Trade Contractors**
  - **Provide Operation &Maintenance (O&M) information for applicable scope of work**
- **Suppliers**
- **Provide O&M information for applicable scope of work**
- **Agencies**

In a multi-party agreement (MPA), the primary project participants execute a single contract specifying their respective roles, rights, obligations, and liabilities. In effect, the multi-party agreement creates a temporary virtual, and in some instances formal, organ-ization to realize a specific project. Because a single agreement is used, each party understands its role in relationship to the other participants. Compensation structures are often open-book, so each party's interests and contributions are similarly transparent. Multi-party agreements require trust, as compensation is tied to overall project success and individual success depends on the contributions of all team members. For a MPA to be successful, the participants must be committed to working as a team to achieve team goals.

The tight integration of MPAs combined with project-based decision making and compensation promotes excellent team performance. Although important on all projects, the supportive qualities of multi-party agreements are well suited to projects that are complex or uncertain, because tightly integrated teams are flexible and creative.

Multi-party agreements require thorough planning, careful negotiation, and intensive team building efforts. This process can be costly and must occur during the earliest stages of project conception. This is especially true if the participants have little prior experience with multi-party agreements or with each other. Although this overhead cost is easily absorbed on large projects, on smaller projects the overhead can be reduced by using team members with prior collaborative experience.

Diagram 1
Multi-Party



Multi-party agreements vary in form, responding to the specific needs of a project and its participants. However, these variations share several key attributes:

- The parties are bound together by a single agreement or an umbrella agreement;
- The agreement creates a temporary, virtual or formal, organization complete with management and decision making processes;
- Processes are tailored to support the team environment;
- Decisions are arrived through consensus and seek "best for project" outcomes;
- Some portion of compensation is tied to project, not individual, success; and
- Roles are assigned to the person or entity best capable of performing.

6.1 Contractual Agreements

Despite the custom nature of multi-party agreements, three general forms have emerged: Project Alliances; Relational Contracts; and Single Purpose Entities. Each will be discussed in greater detail below.

6.1.1 Project Alliances

Project Alliances were developed to support oil exploration in the North Sea. To meet these challenges, the parties created a project structure where the owner guaranteed the direct costs of non-owner parties, but payment of profit, overhead and bonus depended on project outcome. This compensation scheme bound the parties to succeed or fail together. To reinforce Alliance teamwork, all significant decisions were made by facilitated consensus and the parties waived any claim between them, except for willful default. Since their development by the North Sea oil industry, Project Alliances have been extensively used in Australia for large civil works and vertical construction, have seen continued use in the United Kingdom, and are beginning to be adopted in the United States. An excellent description of the Australian experience that contains detailed implementation recommendations, is found in the Project Alliancing Practitioners' Guide (2006) published by the Government of Victoria.

6.1.2 Single Purpose Entities

A Single Purpose Entity (SPE) is a temporary, but formal, legal structure created to realize a specific project. The SPE can be a corporation, limited liability company, limited liability partnership, or other legal form. In an integrated SPE, key participants have an equity interest in the SPE based on their individual skill, creativity, experience, services, access to capital or financial contribution. Typically, equity owners are paid for any services they provide to the SPE. However, an additional element of compensation is tied to overall project success.

The creation of a new, independent legal entity raises additional issues regarding taxation, corporate formalities, and management. Because the SPE is a separate entity, it must also be adequately insured.

6.1.3 Relational Contracts

Relational Contracts are similar to Project Alliances in that a virtual organization is created from individual entities. However, it differs in its approach to compensation, risk sharing and decision making. In a relational contract, the parties may agree to limit their liability to each other, but it is not completely waived. If errors are made, conventional insurance is expected to respond. Thus, there is a measure of traditional accountability. Compensation structures have project-based incentives, but there may or may not be any collective responsibility for project overruns. Decisions are developed on a team basis, but unlike the Project Alliance, the owner usually retains final decision rights in the absence of team consensus.

Because the balance of accountability, risk and control in Relational Contracts more closely follows traditional project structures, they may be better suited to the needs and risk profiles of certain projects and participants. In addition, Relational Contracts may offer a transitional structure to a more completely integrated approach.

Relational contracts are more common in other areas of commercial activity. Strategic alliances among commercial firms grounded on trust arrangements often proceed on a relational contracting basis. These combinations are governed more by personal relationships than by the terms of any formal contract. See Stewart Macaulay, Non-Contractual Relations in Business: A Preliminary Study, 28 Am. Soc. Rev. 55 (1963); Stewart Macaulay, An Empirical View of Contract, 1985 Wis. L. Rev. 465; David Campbell, Ian MacNeil, Relational Theory of Contract (2004).

6.2 Process Design

Process design is critical in Multi-Party Agreements. Incentives, accountability, communications, decision structures and many other factors are balanced and blended on a project-by-project basis. Paragraphs 3-5 below set forth the factors to consider in evaluating MPAs. Where these factors differ among Project Alliances, Relational Contracts or SPEs, those variations are separately discussed.

6.3 Decision Making

Ultimate decision making varies between multi-party project models. In Project Alliances, upper level decisions are made by facilitated consensus. There are no “tie-breakers” or dispute resolution. This structure forces the parties to negotiate. In a SPE, ultimate authority vests in a board of directors or board of control. The membership of this board and its authority are determined on a project-by-project basis. In Relational Contracts, decisions are discussed and resolved by consensus at the team level, but the owner retains ultimate authority.

However, decisions need to be made on a micro, as well as a macro, level. For that reason, the project protocols determine areas of responsibility for decision making. For example, structural integrity remains the structural engineer’s province and while other parties may recommend, the structural engineer decides whether a proposed modification is acceptable. Collaboration needs flexibility, but it also needs structure.

6.4 Sequencing and Phasing

With two exceptions, the tasks performed by each party during the project are very similar to the tasks performed by the parties under the Construction Manager as Constructor (CMc) project delivery approach. A detailed discussion of those tasks is contained below in Paragraph VII. b.

The two exceptions occur during Conceptualization and Closeout. At the beginning of Conceptualization, the team is formed and engages in an intense process design effort that creates the structure and team work for all that follows. Closeout is the mirror of process design. It is the stage where the project’s success is evaluated and the fruits of collaboration distributed. These two efforts form the core of MPAs and are described in detail in Paragraph VI. 5. iv.

6.5 Risks and Rewards

6.5.1 Compensation

6.5.1.1 Project Alliance

Compensation in the Project Alliance model is used to allocate the risk of poor project outcomes while creating incentives to achieve project success and thereby control risk. The owner bears primary responsibility for major cost overruns. Responsibility for minor overruns is borne by the non-owner participants who also share in potential gains. These goals are accomplished through a three-limb compensation system.

The first limb is the direct cost of designing and executing the project, including direct costs and field overhead. The second limb, the pain share, is the normal overhead and profit each non-owner participant usually receives based on auditing historical projects. The third limb, the gain share, is a bonus the non-owner participants obtain if the project is more successful than initially planned. Whether a non-owner participant will receive compensation under the second or third limbs depends on whether the project meets or exceeds its goals. For example, if a project's direct costs exceed the anticipated Target Outturn Costs (the jointly agreed anticipated project cost), the non-owner participants receive their actual costs, without any corporate overhead or profit. If the project achieves its goals, the non-owner participants receive their normal overhead and profit in addition to their costs. If the project exceeds its goals, the non-owner participants receive a gain share bonus. Because the non-owner participants never place their direct costs at risk, the owner is the primary risk bearer for catastrophic overruns. Compensation is directly tied to project success and thus the participants must cooperate to maximize their individual returns.

The Project Alliance approach has three principal hurdles. First, the anticipated outcomes must be accurately described and quantified. Next, the parties must determine when and how the outcomes are measured. Finally, formulas must be crafted to appropriately reward participants for their contribution to the project.

Quantifying outcomes is critical to Project Alliance success. If the success criteria are quantitative, such as cost-to-budget or duration-to-schedule, formulas can be created to determine the level of project success. But even in these simple cases, care must be taken to correctly set the level for each project criteria. For example, if the principal criterion is cost, the target must not be too low, thus making it very difficult for the participants to achieve the goal, nor too high, which makes achieving the gain share too easy. Moreover, it is important to clearly delineate what project costs will be used when comparing to the project goal. Because this negotiation is sensitive and critical, the assistance of an independent cost estimator may be useful. Although it is convenient to analyze the Project Alliance delivery method using cost as the only success variable, Alliances

have also used indexes based on quality or other performance goals. Qualitative goals are more complex, but an index or scoring system can be used to turn qualitative into quantitative results. To increase objectivity, a third party can use the scorecards to "grade" the qualitative goals.

Contingencies are related to project outcome levels and must be directly addressed. In theory, the Project Alliance approach does not have explicit contingency funds, but setting the target cost higher than absolutely necessary effectively creates a design and construction contingency. Contingency can also be built into the labor rates used for the direct cost calculations, so these need to be audited for their relationship to actual cost. If there are contingencies, they should be explicit, not implicit, and should be managed on a project, not an individual, basis.

Once targets are established, the parties must determine when and how they are measured. If cost is the only criteria, it can generally be determined at project closeout. But if the criteria include energy efficiency or operational costs, time will be required to determine success. In this event, an appropriate duration and testing regime must be developed during process design. It may also be possible to reserve part of compensation for determination at this later date. Timing of final measurement may also be affected by warranty periods.

Measurement of the direct costs is theoretically simple, but practically complex. Manufacturers, fabricators, contractors and design professionals all use differing accounting approaches. Because direct costs can be manipulated to include aspects of overhead, profit or contingency, it is important that all calculations be based on completely open books. In addition, the parties may want to retain an independent accountant to determine how direct costs should be measured for each party. Accurate measurement of direct costs relates directly to creating appropriate gain and pain sharing formulas. If overhead, profit or contingency creep into a party's direct costs, the compensation and risk allocation are effectively changed.

The formulas for gain and pain sharing should consider the parties' respective contributions, and not simply be based on a percentage of costs. However, the traditional profitability of different professions and trades may inform, although not control, the discussions. It may also be possible to balance contributions differently depending upon the criterion. For example, the MEP engineers and contractors may share more liberally in energy savings, whereas the constructor and designer would have a larger percentage of overall cost savings.

6.5.1.2 Single Purpose Entity

In a SPE, participant compensation is divided into two tiers. The first tier reflects payments by the SPE to the individual participant, either under a standard contract for services or terms set forth as an exhibit to the entity's governance documents. Although infinite variations are possible, commonly these agreements are cost-plus or negotiated lump sum-plus fee.

The second compensation tier is tied to the success of the project itself. In instances where the SPE independently owns the project, this second compensation tier is reflected in the value of the participant's equity interest. This value is captured by the participant when the project is sold, or from operational revenues, if the project is held by the SPE after completion.

In instances where the SPE does not own the project, and the entity is instead formed solely to facilitate the design and construction of the project in a fully integrated manner, this second compensation tier will take the form of an incentive program from which the equity owners providing services may receive additional compensation based on a successful project. The methods of compensation in this instance would be similar to the performance-based bonuses discussed below in the Relational Contracts section.

The ratio between the value of this second compensation tier to the amount of direct compensation creates a "spectrum of integration." If the second compensation tier predominates, total compensation is greatly dependent on project success. At this edge of the spectrum, the SPE compensation plan is somewhat similar to a Project Alliance. If direct payments predominate, then project success is a less critical factor and the SPE compensation plan more closely resembles traditional project delivery methods.

As with Project Alliances, the benefit allocations should be based on relative risk and the parties' respective contributions.

6.5.1.3 Relational Contracts

Compensation in a relational contract varies with the parties' needs and creativity. However, the basic approach uses direct cost, a fixed, negotiated sum for overhead and profit for each participating entity, and a variable performance-based bonus. The bonus should be tied to project success, rather than individual goals and can include criteria such as schedule, quality and performance. The compensation method may or may not involve a guaranteed maximum price for the project or any particular scope of work. When guaranteed maximum prices are provided by each trade, parties may try to reduce their risk by including contingencies in their individual contract amounts. However, this artificially raises the estimated project cost because each individual contingency, when summed, exceeds the contingency required for the entire team. Thus, one approach requires the parties to show, through audit if required, that their individual contract amounts have no additional contingency buried in labor productivity or overhead rates. The individual contingencies are replaced with a general project contingency that is available for design or construction errors.

Setting accurate and fair target outcomes is subject to the same issues discussed under Project Alliances. In addition, where aggressive targets are used, i.e., targets that are distinctly better than traditional outcomes, it may be appropriate to include a compensation band that is available as an incentive for innovative solutions to achieve the aggressive targets.

6.5.2 Dispute Resolution

Dispute resolution under the Project Alliance model is very simple. The parties agree to waive any claim against each other except for willful default. As a result, no dispute resolution mechanism is required among the Project Alliance participants.

SPE and relational contract projects require that dispute resolution be addressed. In general, the dispute resolution procedures should form a progression from direct negotiation, to facilitated negotiations (such as mediation) and finally binding resolution (such as arbitration or litigation). Regardless of the specific procedure chosen, every emphasis should be placed on developing a system that encourages and facilitates internal resolution of disputes. The internal resolution of disputes will allow the integrated and collaborative process to continue. As the parties are forced to resort to external dispute resolution procedures, they are taking steps away from integration, toward the adversarial relationship that exists within the traditional delivery process. A critical ingredient of IPD is continuity of purpose among the team members. If the team members must resort to external means of dispute resolution, that continuity of purpose is destroyed.

Regardless of the MPA type chosen, there will be some project participants, such as sub-tier constructors, consultants and vendors, that are not party to the MPA. Contracts with these non-participants should include dispute resolution provisions and the MPA should determine whether claims of specific non-participants are the responsibility of the MPA or its individual members. In addition, all projects have the potential for third-party claims due to structural or operational failures, personal injuries, economic losses or otherwise. In general, these third-party risks should be addressed by appropriate insurance.

6.5.3 Risk Allocation

Risk is a function of the likelihood of a loss weighted by its severity. In contrast, exposure to risk is the number of possible avenues by which loss can occur. For example, the increased interdependence of collaborative projects increases the number of parties relying on another party's contributions and who could potentially initiate a lawsuit. But the same interdependent web can reduce the likelihood and severity of loss. Exposure may increase, although true risk decreases.

Discussions of risk often focus on the liability issues resolved in courts and arbitration proceedings. However, the business risks faced by design and construction entities, such as cost overruns, failure to meet project goals, and market uncertainties, occur far more often and are far more serious than the liability risks. When evaluating project delivery alternatives, parties should determine how the different alternatives mitigate the business risks faced by the project and its participants, as well as how they respond to liability concerns.

6.5.3.1 Project Alliance

6.5.3.1.1 Project Outcomes

The risk of poor project outcomes is shared among Project Alliance participants, but in differing degrees. The non-owner participants are guaranteed their direct costs and thus only risk their overhead, profit and potential bonus. In contrast, the owner's risk is unlimited, tempered only by the cost reduction in payments to the non-owner participants.

In larger projects, owners may be able to offset their risks with insurance related to delay in completion, operational hazards or other economic risks. The owner's risk may also be mitigated by pre-leasing, price guarantees, or other methods of controlling market risks.

6.5.3.1.2 Liability

The Project Alliance participants agree to waive liability among each other except for willful default. Willful default does not occur unless a party abandons the project. For all practical purposes, there are no liability concerns within the Project Alliance. However, the Project Alliance, and its participants, are still liable for damage inflicted on third parties. Job site safety, structural collapse, or other liability concerns must still be addressed. Standard liability insurance will generally be sufficient to address third-party incidents, and the unified structure of a Project Alliance is well suited to Owner Controlled Insurance Plans (OCIP) or similar wrap-up policies. The insurances should, in all instances, be reviewed to identify potential coverage limitations, such as joint-venture exclusions, professional services exclusions, or limitations on coverage for construction level services (i.e. means and methods exclusions in professional liability policies.)

6.5.3.1.3 Dispute Resolution

Because liability is released within the Project Alliance, there are no dispute resolution mechanisms. Decisions made by and for the Project Alliance are by facilitated consensus. The parties have agreed to abide those decisions; as such there can be no further disputes to resolve.

6.5.3.2 Single Purpose Entity

6.5.3.2.1 Project Outcomes

The SPE bears unlimited responsibility for project outcomes. However, SPEs are usually limited liability entities and the risk of catastrophic loss is contained within the SPE and does not flow through to individual SPE participants. SPEs often use project financing where the project value, rather than the participants' credit, secures the lender's investment. If a major loss occurs, the equity participants risk their equity contributions, but nothing more. Depending upon prior history, risk and other concerns, lenders may require individual guarantees, especially on smaller projects.

6.5.3.2.2 Participant Cost Overrun

The participants bear the risk of cost overruns within their individual scopes of work. The cost overrun risk is a function of the terms governing the services each party is providing to the SPE. This risk can be limited, as in a cost-plus contract, or can be severe, if services are contracted for a fixed fee or cost. However, the cost overrun risk should be distinguished from cost increases caused by changes in scope or differing site conditions, which would normally be SPE risks, not participant risks.

6.5.3.2.3 Liability

Participant liability to the SPE and to other participants is theoretically unlimited, but in practice is often adjusted by contract. Typical risk management tools are limitations of liability, consequential damage waivers, waivers of liability, and waivers of subrogation. Liability to third parties is as allowed by law, both on behalf of the SPE and its participants. This is identical to the third-party liability existing on a conventional project.

Risk management in SPEs can be enhanced by broadened insurance coverages. Often, the broadened insurance is obtained through an Owner Controlled Insurance Program that may have expanded builder's risk, professional liability and even delay in start-up or operational risk coverages.

In addition to the risk management benefits, the broader insurance may make financing easer to achieve. However, these expanded coverages are available in negotiated policies, not off-the-shelf coverages, and their availability is subject to market conditions and the bargaining power of the project participants.

6.5.3.2.4 Dispute Resolution

Because SPEs are capable of bringing actions against the participants, and the participants can bring actions against each other (perhaps limited by the contractual devices mentioned above), in the absence of a "no suit" provision, dispute resolution tools need to be integrated into the agreements between the SPE and the participants and should be coordinated between agreements.
Decisions of the SPE are normally made by a Board of Control with a structure appropriate to the type of legal entity used by the SPE. Control may be in proportion to equity interest, but that is a decision the parties will make on a project by project basis. When disputes arise between participants or between the SPE and participants, they should be resolved through an escalating program of direct negotiation, facilitated negotiation and then binding resolution by arbitration or litigation. Another approach is to use a standing arbitration panel, project neutral, or a dispute review board, to either resolve, or recommend resolution, of disputes as they arise.

6.5.3.3 Relational Contracts

6.5.3.3.1 Project Outcomes

Under relational contracts, the owner bears the ultimate risk that the project does not meet financial or performance goals. This risk may be mitigated, to the extent that a guaranteed maximum price has been established, a profit participation agreement is reached, or possible recoveries against participants for negligence or breach of their contracts is pursued. The participants also risk the variable portion of their compensation, such as a bonus opportunity or innovation fund.

6.5.3.3.2 Participant Cost Overrun

Participants may or may not bear the risk that their costs will exceed compensation due under their contracts. The more of this risk that is borne by the participants, the more likely that they will seek to protect against this risk by including contingencies in their pricing. If each participant bears the risk of cost overruns, it becomes more akin to conventional project delivery approaches. However, even in these scenarios, the potential for shared gain reduces the likelihood of occurrence.

6.5.3.3.3 Liability

Within the project, parties are responsible for their own errors and omissions. This is a distinctive difference between Project Alliances, where intramural liability is waived, and relational contracts that retain individual accountability. As with SPEs, the extent of liability can be adjusted through indemnity, limitation of liability, waiver of consequential damages, waivers of liability to the extent of insurance coverage, and waivers of subrogation. In addition, if a project contingency is used, some portion of error and omissions risk can be absorbed by the project contingency fund. Liability to third parties is essentially unchanged by the relational contract project delivery approach.

Conventional insurance products are used by the participants in relational contract projects. Each participant purchases its own insurance, which protects it against its own liability. But the policies should be carefully reviewed against the services each party will provide. If a contractor is providing incidental design or design-build services, Contractor's Professional Liability coverage should be obtained. If designers will be assisting with sequencing or other construction level services, the policies should be reviewed for exclusions that might limit coverage for means and methods or construction-related activities.

6.5.3.3.4 Dispute Resolution

Relational contracts use team-based decision processes. However, the team ultimately works for the owner and the owner retains final decision rights. Disputes within the project are resolved through an escalating negotiation process of structured negotiation, facilitated negotiation, and the binding resolution through arbitration or litigation.

6.5.4 Closeout

Closeout of a MPA mirrors the complexity seen in process formation. Timing, substance and process issues must be addressed when crafting the closeout process.

Closeout will be used to determine whether the project has met its initial goals. If time and price are the only criteria, it should be possible to close out these financial aspects shortly after substantial completion. However, if the criteria also include longer term goals, such as energy efficiency, maintenance costs, or productivity, then final assessments must be deferred until the project has been commissioned and operated through a full season or other operational cycle. Qualitative goals, such as quality, aesthetics, or creativity may require additional time to determine as well.

Warranty periods should be correlated with Closeout procedures. If there are adequate guarantees of warranty compliance, Closeout may proceed before warranties expire. However, if complying with warranties is a concern, Closeout may need to be deferred until after the warranty period expires.

Where quantitative criteria are used, the Closeout procedures should be determined during process design. Specific commissioning protocols and calculations should be developed during project design. Criteria such as money and time, should be agreed to by the parties, or if agreement cannot be reached, verified by independent audit.

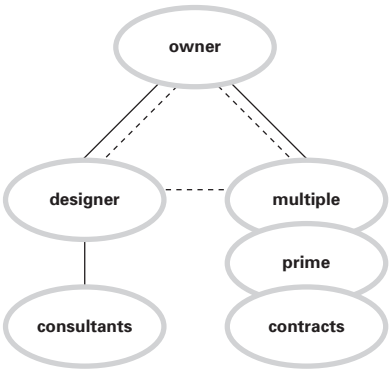
Qualitative criteria must be reduced to quantities before they can be used in compensation formulas. This has been accomplished using weighted scoring sheets completed by independent advisors.

The Principles of Integrated Project Delivery set forth in Paragraph III, the issues identified in Paragraph IV, Setting Up an Integrated Project, and the implementation techniques set forth in Paragraph V, Delivering an Integrated Project, can be applied to any delivery model on any project. The topics above are common to any project seeking to become more integrated. However, certain characteristics of a particular project or delivery model may affect the level of integration that can be achieved. In some instances, participants may be required to use a delivery model that does not allow a constructor to be involved early in conceptualization (i.e. Design-Bid-Build). Other models, however, rely on earlier constructor involvement and would be more amenable to utilizing IPD methods (i.e. Construction Manager at Risk and Design-Build). In any event, each of the traditional delivery methods presents unique challenges to integration.

The following section addresses some of the more popular traditional delivery models, their inherent challenges to integration, particular issues for consideration, and potential ways to address these challenges and issues.

7.1 Multi-Prime

Diagram 1
Multi-Prime



contracts
communications

Multi-Prime is commonly utilized within a Design-Bid-Build process. In Multi-Prime project delivery, the owner contracts directly with multiple contractors or trades to complete construction. Thus, the owner acts as the general contractor/construction manager on its own project. The method optimizes the owner's control over the trades and reduces construction cost by eliminating the general contractor/construction manager's fee and general conditions costs. In essence, the owner is thought to get the project "wholesale."

Multi-Prime project delivery requires that the owner provide substantial management services of the various participants' efforts. Accordingly, the owner must have extensive experience and internal resources to write individual trade contracts, facilitate buy out, verify and process progress payments, respond to RFI's, address and execute change orders, prepare lien releases, insurance claims, safety programs disputes and claims typically managed by a general contractor or construction manager.

7.1.1 Opportunities for IPD

The traditional Multi-Prime model may be modified to achieve many of the benefits of Integrated Project Delivery. Though typically used for Design-Bid-Build project delivery, Multi-Prime can be adapted into Design-Build, Negotiated Select Team, and other models depending on when it is advantageous to select the trade contractors, the degree of risk to be transferred

to each trade contractor, the jurisdictions overseeing the project and the degree to which the owner wants to adopt an integrated process. In all organization models, however, the owner maintains the central role in the design and construction process.

Opportunities for integration are increased in delivery methods where the constructor can be brought early into the project, such as Design-Build. Within this model, the owner and designer can develop a bridging document, competitively bid completion of the design and construction to individual trades, and hold separate contracts for each Design-Build trade contractor. The same opportunity exists for both public and private projects. In addition, however, private projects can also utilize aspects of Select Negotiated Teams. In this scenario, owners can negotiate with individual trades to provide pre-construction services on a fee basis and construction services on a fixed cost or cost-plus basis.

7.1.2 Challenges to IPD

Integration relies heavily on a collaborative team in which the team members have a certain level of equality in decision making. In this regard the primary benefit of Multi-Prime, the optimization of owner control, can serve as its biggest challenge to integration. In Multi-Prime, the owner stands in a naturally authoritative position and garners an extensive amount of responsibility by virtue of its experience and familiarity with the construction process. The owner's authoritative position, coupled with its ability to go forward with limited input from those it has contracted with, has the potential to stifle the collaborative process.

If the parties wish to implement an integrated form of Multi-Prime, the owner must pay special attention to team building and avoid creating a barrier to collaboration between the design side and construction side (which is directly related to the owner in multi-prime). To achieve integration in Multi-Prime, given the owner's position with the virtual organization, the owner must have or acquire expertise in team formation and building for creating a collaborative enterprise.

An additional challenge Multi-Prime presents to implementing IPD, which is not unique to this delivery model, is the separation of contracts. The owner is required to negotiate separate contracts with the designer and the various prime contractors it has decided to utilize. Not only does this present a potentially disjointed team, it necessitates additional care on the owner's part to ensure identical processes and procedures are part of the various contracts. When faced with a potentially large and disjointed project team, contract terms establishing common processes and performance requirements aids in aligning behavior among the team members. In order to address this need for commonality among the various agreements, the owner must either negotiate coherency of all agreements or a set of general conditions all the parties agree to be governed by apart from their individual contracts. The owner may also, as opposed to adoption of general conditions, choose to negotiate a teaming agreement among the parties to control their interrelated activities.

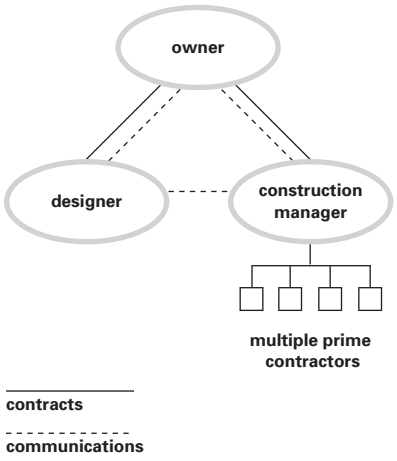
Finally, when Multi-Prime is used for Design-Bid-Build, which is the typical scenario, it offers few opportunities for IPD, as detailed in Paragraph VII. d.

7.2 Construction Manager at Risk

"Construction Management" is a generic phrase applied to a variety of project delivery scenarios in which specific Construction Management services are called for in addition to the general services a constructor traditionally provides. The construction manager is hired early in the design process to deliver an early cost commitment and to manage issues of schedule, cost, construction, and building technology. CMc (Construction Manager - Constructor) differs from CMa (Construction Manager - Adviser) by virtue of the construction responsibilities assumed. When the construction manager and constructor are one and the same, the construction manager assumes all the liability and responsibility of a general contractor, which is why this particular delivery system is known not only as CMc but also as Construction Manager at Risk.

7.2.1 Observations/commentary on characteristics of model

Diagram 2
Construction Manager at Risk



CMc offers the same direct owner-architect and owner-contractor contractual relationship as Design-Bid-Build: the advisory benefits of CMa, and the early cost commitment characteristic of Design-Build. It differs from Design-Build in that design remains the responsibility of an architect, who has contracted independently with the owner. The CMc delivery model introduces the constructor prior to construction to oversee scheduling, cost control, constructability, and to bring additional expertise to project management, building technology, and bidding or negotiation of construction contracts. In the CMc model, the constructor is typically selected through a qualifications-based selection early in the design phase and paid a fee for services performed in the design phase (although owners sometimes competitively bid CMc contracts, the AIA doesn't encourage that practice). The principles of integration suggest that the construction manager should be involved in the project as soon as feasibly possible. Indeed, in one variation of CMc, Negotiated Select Team (NST), the owner contracts with the CMc at the beginning of design, if not even earlier.

7.2.2 Opportunities for IPD

The CMc delivery model is particularly well-suited to IPD. The constructor already serves as construction manager during the preconstruction portion of the project, thereby achieving a primary goal of IPD, bringing all relevant parties into the delivery process early, when decisions have the greatest impact on performance.

The difference between the traditional and integrated CMc delivery models is not a difference in the structural models themselves, so much as it is an enhancement of the collaborative opportunities between the parties. Whereas the traditional CMc delivery model, in which the CMc is brought onto the project prior to construction but otherwise follows traditional service scopes for both architect and constructor, might be considered at least partially integrated, a fully integrated CMc project might see the architect and the constructor working with the owner to establish project goals, utilize BIM, and adopt other principles of integration and implementation techniques.

Construction manage-ment is appropriate to public and private projects of almost any scale, on which budget or schedule must be closely monitored; or extensive coordination of design consultants or trade contractors is required. Because work performed by trade contractors is typically bid, CMc

satisfies the bidding requirements of most public procurement codes. As a result, in instances where a bid delivery method is required, CMc offers the best potential for approximating fully integrated delivery.

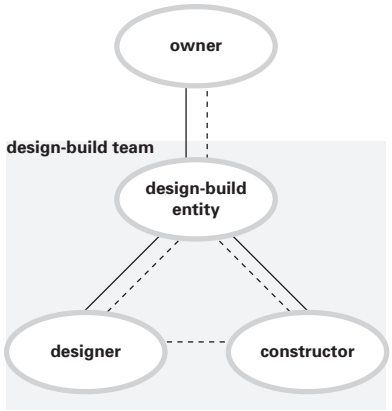
7.2.3 Challenges to IPD

The principal criticisms of Construction Manager/Advisor (CMa), in which the Construction Manager is a fourth party to the project, have historically been the ambiguous assumption of responsibilities conven-tionally held by architect and constructor, and the insertion of a fourth party to serve as a filter between the owner and the architect or contractor; but when the construction manager is also the constructor, these concerns are minimized.

Similarly to Multi-Prime, separation of contracts poses a challenge to implementing IPD in the CMc delivery model. The owner must negotiate separate contracts with its designer and constructor. As with Multi-Prime, in order to achieve commonality of purpose and processes to achieve that purpose, the owner will either negotiate coherency among the agreements or require adoption of a set of general conditions or teaming agreement controlling the parties' behavior.

7.3 Design-Build

Diagram 3
Design-Build



contracts

communications

Design-Build is characterized by a single point of responsibility for both design and construction activities. The owner often chooses Design-Build to transfer risk and coordination effort to one contractual entity and to assure a higher level of coordination. The owner's role in Design-Build has typically required heavy involvement early in defining the project criteria, followed by less management later on as the design-builder executes the project in conformance with the established criteria.

Many owners choose Design-Build in order to reduce project-based risk. By combining design and construction under a single entity, coordination, constructability and cost-of-change is presumed to be improved. Most of the risk is borne by the design-builder, often in exchange for retaining some or all of any savings identified.

The design-builder accepts the owner's design criteria and exerts greater control over the project from thereon. Project success is often measured by improved project delivery time or cost savings found by the design-builder as compared to the agreed-upon Guaranteed Maximum Price. The burden is on the owner to be clear on the acceptable level of quality expectations through descriptive, quantitiative or performance requirements in the owner's design criteria.

Design-Build procurement may take many forms including, but not limited to: 1) qualifications only selection, 2) best value selection with criteria documents provided by the owner, or 3) price driven selection with detailed bridging documents provided by the owner, This broad spectrum sets the stage for various levels of integration that may be possible under design-build.

7.3.1 Opportunities for IPD

Design-Build is contractually very well-suited for increasing collaboration among the design and construction team members. The designer and constructor are both retained at the same time so can implement IPD principles from the start. Also, members of the Design-Build team often have self-selected

to work together and have established a rapport and methodology for working together. The owner is also a part of the Design-Build team and may require any level of involvement desired.

7.3.2 Challenges to IPD

Like many of the other traditional models, one of the more common characteristics of Design-Build serves as one of its largest challenges to IPD. Under traditional Design-Build, the owner usually participates through completion of the design and then seeks to minimize input and involvement to protect the clear silos of responsibility and risk. As a result, opportunities for project improvement and innovation are, unfortunately, also minimized. Accordingly, in order to achieve integration, the owner must adjust its traditional involvement in Design-Build. The increased owner involvement necessary for IPD is a significant shift from traditional Design-Build delivery and should be reflected in the owner/design-builder agreement.

Beyond mere increased involvment on the project, the owner may consider other changes that will increase the level of integration on the project. In addition to initiating, funding and establishing design criteria for the project, the owner may want to alter the compensation model to create incentives for the Design-Build team to seek project improvements rather than reduced first cost. Linking compensation to project goals such as building performance, sustainability, and accelerated delivery can be used to promote greater collaboration and better outcomes. Establishing a target cost, deferring or eliminating a GMP, and using open book accounting for project costs fosters owner collaboration throughout the project cycle.

Integrated Design-Build becomes a shared, multi-point responsibility. The input, responsibility and decision making is distributed among the team as appropriate and coordinated by the design-builder. The architect does not hold the same contractual relationship to the owner under Design-Build, unless the architect serves as the design-builder. However, there is still a duty to deliver the owner's defined project, assist the design-builder in achieving project success, and safeguard the public. The open, collaborative nature of integrated Design-Build makes the task easier.

Existing standard form contracts for Design-Build can be easily modified to reflect an integrated delivery approach. Single point responsibility of the Design-Builder allows collaboration among parties under the design-builder's control with little modification. The Design-Build delivery method has been established long enough to be a well-understood baseline. Achieving an integrated approach is mostly a matter of adding clarity of roles and scope of service rather than altering the fundamental structure of the Design-Build agreement. Inclusion of additional early participants and their roles and responsibilities should be clearly stated. Requirements for design consultants to collaborate, transfer model data and incorporate input from related trade contractors and vendors should be added.

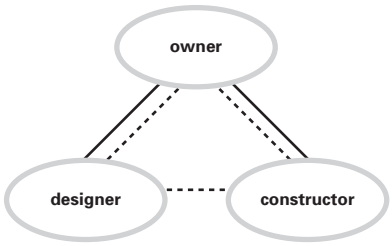
Costing under the traditional Design-Build agreement is usually fixed early in the form of a Guaranteed Maximum Price (GMP) or lump sum, with most of the risks borne by the design-builder. Deferring the GMP until later in the process allows the benefits of the early trade involvement, model-based decision making, and collaborative efforts to be achieved before costs are finalized. The agreement should reflect flexibility in the agreed-upon process and timing for establishing and maintaning the project budget.

Compensation for the design-builder is often determined on a percentage of construction cost either fixed or subject to a GMP. A formula for sharing any achieved savings below the GMP cost may be determined. The efficiencies of an integrated approach may identify savings over a traditional baseline approach. That savings may form part of the design-builder's compensation. As integrated projects become prevalent or even the norm, such comparitive savings may become less useful as a project metric for determining shared savings.

A portion of compensation attributed to achieving (or missing) project goals is another possible incentive compensaation method. The design-builder may put portions of anticipated profit at-risk against the goals or additional compensation may be made available for going beyond a baseline measure. Portions of the design-builder's services such as criteria development, evaluating alternatives, and other work prior to establishing the GMP or lump sum may be compensated on a time and material basis.

7.4 Design-Bid-Build

Diagram 4
Design-Bid-Build



contracts

communications

Design Bid Build (DBB) is unquestionably the most prevalent delivery model for a construction project in the United States' construction industry. One reason is that the delivery model offers the owner the market advantage of open competition through a regimented design phase followed by separate bid and construction phases. Additionally, many governments dictate that "open bidding" be used in state construction projects, thus substantive early involvement of the eventual constructor is prohibited.

In a DBB project the owner initially enters into a contract with the designer for design services. The designer works with the owner to develop the owner's project requirements, from which point the designer develops a design. That design is then put out for bid, allowing the owner to select a constructor for the project. Upon the owner's selection of a contractor based on the bids received, the project proceeds to construction. The project is designed with little, if any, input from the parties actually constructing the project. As a result a significant amount of constructability and/or coordination issues are not discovered and resolved until construction.

7.4.1 Opportunities for IPD

DBB offers very few opportunities for true integration. Based on its structure, the DBB delivery model does not permit early involvement of the constructor in the design process.

7.4.2 Challenges to IPD

As noted above, due to DBB's rigid phase system, DBB does not naturally lend itself to integration. Indeed, of all the current delivery models, DBB offers the least possibility for integration. The hallmark of IPD is early involvement of all the primary project participants. Under a traditional DBB process, the constructor is not involved until after the design is completed. While DBB cannot be integrated, it can be improved through the utilization of some of the principles and tools of integration discussed above.

IPD requires the earliest possible involvement of the constructor. While a DBB structure will not allow the constructor to be involved from the beginning of the project, there are options. For example, the owner and the

architect can consider bidding the project at the earliest stage possible. As part of the request for bids, the owner and architect would express their intent and desire to proceed in an integrated fashion upon acceptance of bids. At that point, the parties would proceed, to the greatest extent possible, as set forth in the implementation phase described above.

Owners that choose to proceed under this adaptation of traditional DBB must be aware that the project will be bid on less complete construction or bidding documents than is the case in traditional DBB projects. This early bid process, however, allows the owner to reap the greatest benefit from integration by allowing the constructor to bring its expertise on constructability, etc to bear on the project at a much earlier stage in design.

The consequence of early bids is a loss in their accuracy and the receipt of bids containing large contingencies. The bottom line impact of this fact can be alleviated by adjusting the manner in which hard budgets are established, allowing then to be reset following the constructors contribution to developing more complete implementation documents. The owner will also have to expect that there will be added amounts of redesign that the designer will have to perform as a result of this process, which will require an adjustment to the traditional ways designers are compensated for such redesign services.

It should also be noted that a standard DBB project, or any project for that matter, would benefit from developing a strong team following bid acceptance. Byproducts of a strong team are a greater commitment to the project, improved communications and a willingness to work through disputes rather than resorting to an adversarial mentality. Although a traditional DBB project cannot be integrated, it can still benefit from the principles of integration.

"People seek change, but do not want to be changed"
—Peter Senge, "The Fifth Discipline"

While change is never easy, it is achievable.

The industry is changing. Technologies are allowing great advances in efficiency and accuracy, but changes in processes are even more significant in new delivery methods. To be successful, an integrated project requires that the designer, constructor, owner and other participants in the enterprise take on new roles and competencies. This is a significant change in culture for all team members.

However, the change may not as daunting as one might think. Generational skill sets (i.e. communication skills of baby boomers vs technology skills of the X or Y generations) yield surprising depth in necessary talent within existing firms in all areas of industry. The leveraging of those talents with the addition of effective collaboration with key project participants earlier than is traditional yields a formula for success.

What is next?

Clearly defined new business models that provide a collaborative framework for the integrated project team, clearly defining new roles and responsibilities of each participant, minimizing risk, maximizing shared respect, reward and recognition, and providing incentives for taking on new processes.

What is the AIA doing?

The AIA is collaborating with a number of organizations to enhance technology and interoperability platforms and develop industry wide processes, standards and metrics. Listed below are a just a few such examples:

- *National BIM standards*—The AIA is working with the National Institute of Building Science (NIBS) on the important topics of National BIM standards and interoperability through buildingSMARTalliance. These are efforts open to all; the input of practitioners is essential to their success.

- *Construction Users Roundtable relationships*—Through the 3xPT Strategy Group and Productivity Committee, the AIA is working on delivering guidelines and metrics for integrated delivery.

- *McGraw Hill SmartMarket Report on Interoperability*—Sponsored in part by the AIA, released in October 2007, this report builds the business case for interoperability in a transformed industry.

- IPD *Presentations*—The members of the AIA's Integrated Practice Discussion Group and AIA California Council give many informational presentations each year, at component events across the country.

- IPD *Pre-Convention Events*—The AIA holds an event focused on IPD-related topics each year on the day(s) before the National Convention, offering a number of sessions valuable to all project participants.

What can you do?

Break down traditional barriers or silos of effort. Develop a confidence in information sharing. Actively participate in discussion groups that push toward an effective, collaborative approach to information sharing.

Require the project team to utilize integrated Building Information Modeling technology. Consider a full-team work area with multiple screens for display of project images for real-time collaborative issue resolution. Propose new approaches to team compensation based on value and long term outcomes. Seek resources.

Talk. Share. Collaborate. Experiment.

Change is happening. Change is now.

4D Building Information Model
A model that incorporates the dimension of time used to visualize a construction schedule.

5D Building Information Model
A model that incorporates cost data, used to automate quantity takeoffs for cost estimating. Coupled with 4D, it can be used to predict cash flow.

Best-for-Project
Describes a decision making standard where decisions are measured against shared goals / objectives about what's best for the project vs individual stakeholder outcomes.

Building Information Model
A Building Information Model, (BIM) is a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its lifecycle from inception onward. A basic premise of BIM is a collaboration by different stakeholders at different phases of the life cycle of a facility to insert, extract, update or modify information in the BIM to support and reflect the roles of that stakeholder. The BIM is a shared digital representation founded on open standards for interoperability.

Source: National Building Information Model Standard (NBIMS) committee. For a more complete definition, see http://www.facilityinformationcouncil.org/bim/faq.php#faq1.

Buyout
Buyout is the process of obtaining price commitments for all work packages in a project. There are several methods by which this can be accomplished, ranging from sealed bids to direct negotiations. In the IPD approach most of the price commitments are developed through a continuous effort, with many of the trade contractors and suppliers participating in the design and refining their prices as the project progresses.

Buyout Phase
The Buyout phase in IPD is limited to obtaining price commitments from subs and suppliers who weren't involved during the design phases.

Constructor
The party on the project responsible for performing and overseeing construction by its own and/or hired forces.

Cost Model
A breakdown of the construction and project budget into detailed "cost targets." The construction budget is developed in both a detailed component(s) based format and a CSI based format based on the project's goals, detailed program and performance requirements. The cost targets are developed collaboratively by the integrated team prior to commencing the conceptualization phase of the project process. The structure provides the benchmark for the team to support continuous cost management as the project progresses to ensure that it will be completed within the targeted budget.

Designer
The design professional on the project responsible for performing and overseeing overall project design.

Design Consultant
The professional consultant(s) on the project responsible for performing and overseeing design in specific areas of the work (i.e., structural, mechanical, landscape, electrical, civil, etc.)

Integrated Project Coordinator
An individual responsible for overall facilitation, coordination and direction of the integrated team. This role may or may not shift among members of the team depending on delivery model and project phase. Leadership and consensus building skills are critical to this role. In some instances, this role may be filled by an outside party.

Key Supporting Participant
A person or organization whose contribution is critically necessary to achieve project goals but is not a primary participant.

Integration
The coming together of primary participants (which could include owner, designer, constructor, design consultants, and trade contractors, key systems suppliers, etc,) at the beginning of a project, for the purpose of designing and constructing the project together as a team.

Open Book
Common usage term for the contractual rights owners have to review and audit the financial records of contractors performing cost-plus contracts.

Open Interoperability Standards
Non-proprietary protocols and data structures that support the exchange or joint use of digital information by differing software tools.

Owner Controlled Insurance Program (OCIP)
A comprehensive, project specific insurance program obtained by the owner and intended to cover all key project participants. An OCIP can include coverages for builder's risk, workmen's compensation, comprehensive general liability and professional liability. The specific details of coverage, and the allocation of premium cost, are unique to a specific project. In some instances, similar coverage can be obtained by the contractor on behalf the project as a Contractor Controlled Insurance Program (CCIP). OCIP and CCIP are sometimes generically referred to as "wrap insurance."

Primary Participant
Core group of team members involved in and responsible for the project from inception through completion.

Process Design
The crafting of the process and protocols which the IPD will follow throughout the course of the project. Process design is facilitated by the IPC.

Project Alliance Agreement
In a Project Alliance, the key participants collectively assume responsibility for agreed project performance. The profit (or loss) to each participant is determined by the team's success in meeting project goals, not individual performance. The shared opportunities and responsibilities align the parties' interests and provide an incentive for collaboration and blame-free performance. To further enhance the collaborative process, all decisions

must be unanimous, disputes must be resolved without litigation and within the Alliance, and compensation is determined on an open-book basis.

Relational Contracts
Construction contracts that focus on communications and relationships between the parties as well as their specific rights, obligations and deliverables.

Single Purpose Entity (SPE)
An independent legal entity created to accomplish a specific project. Often a limited liability company or a limited liability partnership, the single purpose entity is generally dissolved once the project is completed and its financial goals achieved.

Target Value Design Process
The process of establishing early financial targets for the project, and then designing to an associated detailed estimate rather than estimating a detailed design. Iterative in nature.

Virtual Organization
Refers to the assembled project team in an IPD. While not a business entity, it is project specific, organized around project goals not participants and may use co-location to increase efficiencies in communication.

National Institute of Building Sciences, National BIM Standards (NBIMS) Committee
many related articles on Integrated Project Delivery, Building Information Modeling
http://www.facilityinformationcouncil.org/bim/publications.php

U.S. General Services Administration
the Nation's largest facility owner and manager's program to use innovative 3D, 4D, and BIM technologies to complement, leverage, and improve existing technologies to achieve major quality and productivity improvements.
http://www.gsa.gov/bim

The American Institute of Architects
Integrated Practice information
www.aia.org/ip_default

The American Institute of Architects, California Council
resources related to IPD including Frequently Asked Questions
www.ipd-ca.net

Associated General Contractors of America
BIM Guide for Contractors
http://agc.org/

McGraw-Hill Construction
source for design and construction industry information regarding IPD
http://www.construction.com/NewsCenter/TechnologyCenter/Headlines/archive/2006/ENR_1009.asp

Construction Users Roundtable (CURT)
owners' views on the need for Integrated Project Delivery
http://www.curt.org/

Open Standards Consortium for Real Estate
standards related to information sharing/BIM
http://oscre.org/

Open Geospatial Consortium
an international, voluntary consensus standards organization that is leading the development of standards for geospatial and location based services
http://www.opengeospatial.org/

FIATECH
a consortium of leading capital project industry owners, engineering construction contractors and technology suppliers that provides global leadership in development and deployment of fully integrated and automated technologies
http://fiatech.org/

LEAN Construction Institute
a non-profit corporation dedicated to conducting research to develop knowledge regarding project based production management in the design, engineering, and construction of capital facilities.
http://www.leanconstruction.org/

National Institute of Standards and Technology (NIST)
Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry
http://www.bfrl.nist.gov/oae/publications/gcrs/04867.pdf

National Institute of Standards and Technology (NIST)
UNIFORMAT II Elemental Classification for Building Specifications, Cost Estimating, and Cost Analysis
http://www.bfrl.nist.gov/oae/publications/nistirs/6389.pdf

OmniClass
a classification structure for electronic databases
http://www.omniclass.org/

Construction Specifications Institute
MasterFormat
http://www.csinet.org/s_csi/docs/9400/9361.pdf

Design Build Institute of America (DBIA)
library of information and case studies related to design build
http://www.dbia.org

Center for Integrated Facility Engineering (CIFE)
research center for Virtual Design and Construction AEC industry projects
http://www.cife.stanford.edu

International Alliance for Interoperability (IAI) / buildingSMART Alliance
an international organization working to facilitate software interoperability and information exchange in the AEC/FM industry
http://www.iai-na.org/