Integrated Project Delivery (IPD)

IDI Project Delivery Tool

This document is a collection of quoted material from the document *Integrated Project Delivery: A Guide*, published by the American Institute of Architects (National and California). 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. In IPD, project participants come together as an integrated team, with the common overriding goal of designing and constructing a successful project.

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. Existing standard form contracts for Design-Build can be easily modified to reflect an integrated delivery approach. These contracts must clearly outline an incentive strategy that encourages the project team to collectively achieve shared goals rather than meeting individual expectations. Success is measured by the degree to which common goals are achieved. Compensation is directly tied to project success and thus the participants must cooperate to maximize their individual returns.

The following table summaries some of the differences between traditional project delivery and integrated project delivery.

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

Comparison of traditional and IPD process

Table of Contents

1 Introduction 3

2 Principles of Integrated Project Delivery 4

3 Project Team 6
- 3.1 Building an Integrated Team 6
- 3.2 Team Communication 6

4 Contracts and Incentive Structure 7
- 4.1 Relational Contracts 7
- 4.2 Incentive Strategy 8
- 4.3 Incentive Strategy and Project Closeout 9

5 Design-Build 10
- 5.1 Challenges to Design Build 10
- 5.2 Guaranteed Maximum Price 11

6 Project Stages 13

Appendix A: Conceptualization 15

Appendix B: Criteria Design (Extended Schematic Design) 18

Appendix C: Detailed Design (Expanded Design Development) 20

Appendix D: Implementation Documents (Construction Documents) 22

Appendix E: Agency Review 25

Appendix F: Buyout 27

Appendix G: Construction (Contract Administration) 28

Appendix H: Closeout 30

Appendix I: Sample Design-Build Contract 32

1 Introduction

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. 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.

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 life-cycle. 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 the following principles:

- ***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.

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.

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.

2 Principles of Integrated Project Delivery

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

3 Project Team

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.

3.1 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.

3.2 Team Communication

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 Contracts and Incentive Structure

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, organization 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.

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.

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
- Roles are assigned to the person or entity best capable of performing

Despite the custom nature of multi-party agreements, three general forms have emerged: Project Alliances; Relational Contracts; and Single Purpose Entities. Project Alliances and Rational Contracts are very similar but Rational Contracts has been chosen as the approach of choice.

4.1 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.

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.

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. Existing standard form contracts for Design-Build, however, can be easily modified to reflect an integrated delivery approach. This will be discussed in the Design-Build section of the report.

4.2 Incentive Strategy

Compensation methods should 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-tiered compensation system:

3	Gain share: a bonus the non-owner participants obtain if the project is more successful than initially planned
2	Pain share: the normal overhead and profit each non-owner participant usually receives based on auditing historical projects.
1	Direct cost of designing and executing the project, including direct costs and field overhead.

Whether a non-owner participant will receive compensation under the second or third tier depends on whether the project meets or exceeds its goals. For example, if a project's direct costs exceed 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.

This approach has four principal hurdles:

1. The anticipated outcomes must be accurately described and quantified
2. The parties must determine when and how the outcomes are measured
3. Formulas must be crafted to appropriately reward participants for their contribution to the project
4. Contingencies must be managed on a project basis, not an individual basis

Quantifying outcomes is critical to success under this system. 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 using cost as the only success variable, there are examples of teams that 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.

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. 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. Contingencies are related to project outcome levels and must be directly addressed. In theory there are no 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.

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 engineers and contractors may share more liberally in energy savings, whereas the constructor and designer would have a larger percentage of overall cost savings.

4.3 Incentive Strategy and Project Closeout

Closeout determines 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.

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 previously been accomplished using weighted scoring sheets completed by independent advisors.

5 Design-Build

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, constructibility 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.

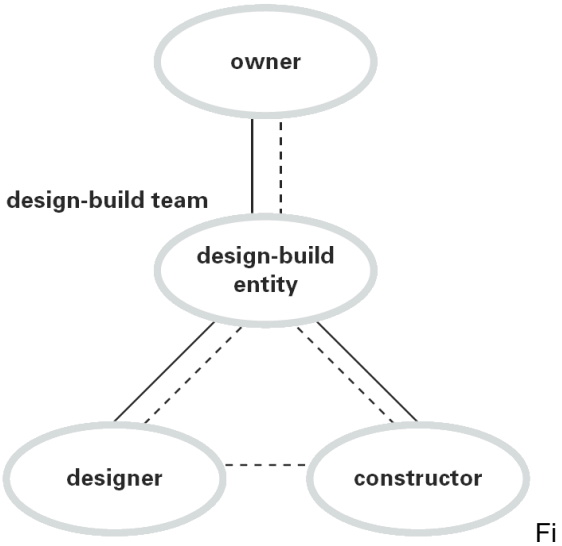

Figure 1: AIA diagram of design-build team

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, quantitative or performance requirements in the owner's design criteria.

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.

5.1 Challenges to Design Build

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.

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. 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 maintaining the project budget.

5.2 Guaranteed Maximum Price

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 comparative savings may become less useful as a project metric for determining shared savings.

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.

The IDP 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.

6 Project Stages

Within the IPD syste, there are 8 stages:

1. Conceptualization (Expanded Programming)
2. Criteria Design (Extended Schematic Design)
3. Detailed Design (Expanded Design Development)
4. Implementation Documents (Construction Documents)
5. Agency Review
6. Buyout
7. Construction (Contract Administration)
8. Closeout

This section outlines the 8 stages of the project. Following this section there are 8 Appendices which outline the outcomes and responsibilities for each stage of the project.

1: Conceptualization

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

2: Criteria Design (Extended Schematic Design)

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

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.

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.

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 inten-sity 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 gen-erate performance or criteria analyses that validate the design.

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.

7: 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.

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.

Appendix A: Conceptualization

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

Objectives

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

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

Appendix B: Criteria Design (Extended 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.

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

Appendix C: 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

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

Appendix D: 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

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

Appendix E: 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

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 inter operable 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 inter operable 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

Appendix F: 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

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

Appendix G: 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

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

Appendix H: Closeout

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.

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

Appendix I: Sample Design-Build Contract

Sample contract.