Airport Owners' Guide

to
Project Delivery Systems

2nd Edition
2012

Developed by a Joint Committee of the
Airports Council International-North America (ACI-NA),
Airport Consultants Council (ACC) and
the Associated General Contractors of America (AGC)

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Preface

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Airport managers want projects done timely, economically and with high quality. As airport markets have matured, the redevelopment of facilities has become more complex and costly, with projects more likely to generate high impact on operations and the need to work around passengers, aircraft or ground vehicles.

We started the *Airport Owners' Guide to Project Delivery Systems* to introduce aviation management and development professionals to techniques for procuring and conducting design and construction projects that other industries had found to be useful. It arose from a level of frustration by all of the stakeholders in airport development, the airport owners and operators, the design professionals and the construction companies, all of whom were tending to focus more time and attention in protecting their interests in the event of project failure and less time and attention positioning the project for success.

The Guide is designed for use by the airport executive who must make the decision on the appropriate delivery method, and convince the governing authority that it is indeed appropriate; for the development professional who must make the recommendation to the executive and carry out the owner's role in the project's delivery; and for the procurement practitioner who must undertake the proper contracting processes and documentation for selection of the contracting parties and administration of the project contracts in accordance with the laws, regulations and obligations of the owner, and, often, state and federal governments.

The Guide contains sufficient detail for each of these role players to understand the characteristics and potential suitability of various project delivery systems and contracting approaches. The airport executive may want to particularly focus attention on the sections describing considerations for selecting a project delivery method, specifically Section III A-D, Selecting the Appropriate Project Delivery System, Appendix C, Alternative PDS Selection: An Owner's Example, and Appendix F, FAA Grant Program/Airport Improvement Program (AIP) which outlines the constraints and prospects for alternative delivery of FAA grant eligible projects.

Among other things, the Guide identifies for the airport executive the kind of management support that is necessary under various project delivery approaches since the level of staff expertise and time demands on staff vary with the different methods. As well, the airport executive must consider any local political implications of different methods.

The Guide is a reflection of industry trends and opportunities not a promoter of any particular project delivery approach or contracting method. It will always be a work in progress as those trends evolve and additional opportunities for delivering airport projects are explored. We hope it will be used as intended: to open airport owners and operators to the range of possibilities to deliver timely, high quality, cost-efficient facilities to their customers, employees and community.

I. Introduction

Those involved in airport design and construction are aware of the challenges of providing safe, quality projects that meet tight budgets with short timeframes. Most airport owners are aware of the growing popularity of having multiple project delivery options available to them.

This paper presents an analysis of the most often adopted project delivery systems and offers guidance to owners on selecting the most advantageous project delivery system (PDS) for a given project. The scope of this discussion includes an analysis of what conditions influence project success and the project conditions for which each PDS is most applicable and offers the greatest potential to deliver a successful project. The concepts and principles shared in this paper are applicable to any capital project, though the size and complexity of the project must be carefully considered during the process of selecting the most appropriate and beneficial delivery system.

A Joint Committee of the Airports Council International-North America (ACI-NA), Airport Consultants Council (ACC) and Associated General Contractors of America (AGC) offer this paper, "Airport Owners' Guide to Project Delivery Systems – 2nd Edition" for general industry use. This Airport Project Delivery Systems Joint Committee recognizes and appreciates that any guidance document should be the result of a broad collaborative effort so that the guidance offered considers and reflects the thoughts and practices of the maximum number of parties who may be affected by the guidance.

Readers are encouraged to provide feedback and reactions, both positive and negative, by contacting any of the sponsoring organizations included in the **Acknowledgements** section at the end of the document.

The following points provide highlights of the key changes reflected in this Second Edition:

- Definitions have been updated to reflect the latest industry consensus
- Integrated Project Delivery (IPD) has been added as a recognized project delivery system
- Private Public Partnerships (P3) are introduced with references to additional material
- Guidance on selecting the most appropriate project delivery system has been expanded
- Examples of owner selection processes and roles/responsibilities have been added
- FAA project funding criteria for project delivery systems has been added
- A compendium of the information and lessons learned from the performance of a series of Alternative Project Delivery Systems Workshops has been added

II. Project Delivery Systems and Procurement Methods

A. Project Delivery Systems Definitions

This paper provides a comparative overview of project delivery system approaches by describing those most widely used together with their primary attributes and strengths. To provide clear and unambiguous comparisons, we establish definitions for various project delivery systems and then describe the areas of commonality or difference among those systems.

For this paper, we distinguish between project delivery systems and contract types. Contract types, which are further described later in the document, are defined as the contractual arrangements by which the parties are compensated.

A project delivery system is defined as 'the arrangement of relationships among the various parties involved in the design and construction of a project that established the scope and distribution of responsibility and risk'. A project delivery system establishes responsibility for how the project is delivered to the owner.

The project delivery system defines who is responsible for each of the various phases of the project (the conceptual design, the detailed design and the construction) and establishes the nature, timing and responsibility for work scope boundaries related to the various transitions and "handoffs" for each of these phases of the project. For example, in the Design-Bid-Build project delivery system, the design and construction are generally performed by different entities and each phase is distinct in both scopes of work and schedule for hiring by the owner.

The project delivery system is the approach by which the project is delivered to the owner, but is separate and distinct from the contractual arrangements for financial compensation. While a potentially infinite number of variations exist, most of the PDS alternatives fall into one of the following basic options shown in bold, with the most common mechanisms for owners to select its designers and constructors is shown below each delivery system.

- **Design-Bid-Build (DBB)**
- **Construction Management at-Risk (CM@R or CMAR)**
  [also known as Construction Manager/General Contractor (CM/GC)]
- **Design-Build (DB)**
- **Integrated Project Delivery (IPD)**

Defining terms to ensure that all stakeholders are speaking and understanding the same language is a focal point of this paper. In addition, this paper includes key information required

for selection of the most appropriate PDS for each project, in order to get an airport owner started in its planning and development.

Every project must be considered on a case-by-case basis to determine the most appropriate PDS *for that project*. There is no consensus on which PDS offers airport owners the highest probability for success on an individual project, or even on what is meant by the term "project delivery."

"Defining" Characteristics

Because industry-wide accepted definitions of project delivery systems do not exist, it is of little surprise that many groups have chosen different characteristics to define their lists of project delivery systems. There is no right or wrong set of definitions, but there is a need for consistency to facilitate communication. The following definitions of project delivery systems are as broad as possible, using terms that are generally accepted in the industry. This allows the definitions to work with as many specific situations as possible. The definitions are based on what we shall refer to as "defining" characteristics.

Defining characteristics uniquely distinguish one PDS from the others. The *defining* characteristics of project delivery systems used in this paper include:

- Are the design and the construction under separate contracts directly with the owner, combined under one contract, or are the design and construction entities separate but contractually bound by a single multi-party contract with the owner?
- Is total construction cost the criterion for selection of the constructor?

Using these two simple *defining* characteristics creates the following uniquely defined project delivery systems:

- **Design-Bid-Build (DBB)**
  - Design and construction are separate contracts (versus Design-Build, where the contracts are combined)
  - Total construction cost is the primary factor in selection of the constructor
- **Construction Management at-Risk (CM@R, CMAR, or CM/GC)**
  - Design services and construction services are contracted separately (versus Design-Build, where the contracts are combined)
  - Criteria for final selection does not include total construction cost (versus Design-Bid-Build where total construction cost is a factor in final selection)

  Note: The eventual establishment of a Guaranteed Maximum Price (GMP) is typical with CM@R, especially in the public sector.
- **Design-Build (DB)**
  - Design and construction responsibilities are combined in one contract
- **Integrated Project Delivery (IPD)**
  - The designer, the builder and the owner (and possibly other key members of the project team) all sign one multi-party contract

The first three project delivery systems are referenced in the Federal Aviation Administration's (FAA) Advisory Circulars, and are most common to the industry. This paper also addresses a "fourth" project delivery system, Integrated Project Delivery (IPD). This new and still rapidly evolving project delivery system is based on the key team members, including the owner, all signing one "multi-party" contract.

Detailed Project Delivery Systems Definitions

The paper offers the following detailed definitions that airport owners can use as a starting point. The definitions can be a baseline that they can use to establish their own definitions at their own airports. It is expected that airports will choose terminology that is consistent with terms used in their locale or by their legislative bodies. It is recommended that each airport organization take the time to confirm its own set of PDS options and the definitions for each option as further described later in this paper.

***Design-Bid-Build (DBB)**:* Often considered as the traditional approach, in the DBB project delivery system the project owner or developer hires a team of design professionals to design the project. Upon completion of the design, the design professional prepares single or multiple packages of construction documents with which the owner will solicit competitive bids for construction. The design professional's involvement on behalf of the owner may continue during the construction phase in the form of administering the construction contract, managing changes and ensuring general conformance with the contract documents. Attributes commonly associated with a DBB project delivery system are as follows:

- The owner holds contracts separately with a designer and a builder
- The design and construction are sequential, i.e. the design is generally completed prior to construction bidding (A DBB project can be fast-tracked so that construction may begin before the design is 100% complete)
- Design changes are accommodated prior to start of construction
- Little or no builder input in design, planning or value engineering (VE) is realized
- No early builder influence on constructability, phasing and sequencing
- Procurement begins with construction
- Specifications are prescriptive
- Significant owner involvement and decisions are required
- Responsibility for project delivery is shared between the designer and the builder
- The owner is responsible to the builder for design errors (via the Spearin Doctrine which states that the owner warrants the adequacy of the plans to the builder)
- The owner controls design and monitors construction quality compliance
- Low bid cost and numerous qualified bidders encourage a high level of competition

Construction Management at-Risk (CM@R, CMAR or CM/GC): As an alternative to DBB, many projects use a CM@R approach where the construction manager is engaged by the owner to be directly and completely responsible for the construction of the project. The timing of the CM@R's engagement, which occurs ideally relatively early in the design process, has a large impact on his influence in the project. Some owners have found that there is benefit to selecting the CM@R at the same time as the designer, and even further, some have found benefits to hiring the CM@R prior to the design team.

Under this arrangement, the CM@R contractor, not the owner, holds the contracts for the construction subcontractors (or self-performs the construction) and so the CM@R contractor is not only responsible for management of the construction, but also is at risk for the construction cost. The additional attributes commonly associated with a CM@R delivery system as compared to a traditional DBB approach include:

- Transfer of responsibility and risk from the owner to the CM@R contractor for the entire construction effort; "performance risk", including subcontract administration and coordination, cost and schedule
- The CM@R contractor is responsible to each construction subcontractor for coordination, delay or impact on the overall construction effort
- The owner remains responsible to the builder for design errors (Spearin Doctrine)
- The owner retains control of design quality and direction
- The ability to gain the builder's input to design, phasing, logistics and value management decisions is increased
- Daily involvement, resources and control over the construction effort are reduced for owners

Design-Build (DB): The DB project delivery system differs from the DBB and CM@R approaches, as the project owner or developer hires a single entity to design and build the project instead of a separate designer and builder. A design professional is no longer directly engaged by the owner as the "designer of record" but rather functions typically as a sub-consultant to the DB entity.

In general, the DB concept is not new, having its roots in the ancient "Master Builder" concept. In many instances, the owner engages a design professional to assist in the development of a conceptual design and to prepare a clear specification of the functionality and performance requirements that the finished project must provide. This practice of a having a conceptual design professional on DB projects is sometimes referred to as preparation of "bridging documents". Design-Builders may be selected using a variety of methods, such as low bid, best value bid or qualifications based selection, as later described.

Among the issues to consider with DB is the size and complexity of the overall project and the potential for reducing the number of qualified bidders. Also, because the DB entity is responsible for design, the project owner should refrain from imposing design changes and preferences. All design requirements should be included in the performance specifications at the time of contract award. Finally, because the DB contracting entity is often a builder, special insurance may be required to ensure the intended transfer of risk, such as for design professional liability or errors and omissions.

Attributes common to the DB project delivery system are as follows:

- The owner holds a single contract with the DB entity for the delivery of the entire project
- The design and construction overlap, allowing construction to begin before the design is 100% complete
- Procurement, such as bulk material ordering, may begin prior to design completion
- Specifications are performance-based rather than prescriptive
- A comprehensive and carefully prepared performance specification is required
- Minimal daily owner involvement, resources and decisions are required as compared to DBB and CM@R
- Dependent on contract conditions and form, construction costs are generally known once the DB contract is awarded, and usually, though not always, are fixed no later than the midpoint of design completion. With the introduction of progressive GMPs, however, the price could be set as a GMP at the completion of design development.
- Transfer of responsibility and most risk from the owner to the DB entity for the entire design and construction effort
- The ability of the builder to influence design, planning, phasing and value management is maximized
- Number of qualified bidders and high bid cost (due to project size) may limit competition

Variations of the DB project delivery system include the terms Engineer-Procure-Construct (EPC) and Turnkey (TK), although in reality, these variations are little more than differences in terminology among various industries.

Integrated Project Delivery (IPD): IPD is an alternative project delivery system that embodies a high degree of collaboration using a single contract, which the designer, builder and owner all sign. There are also projects that employ many of the principles of the IPD contracting method, but use a more conventional PDS – which is often referred to as "IPD Lite," "IPD-ish," or Integrated Practice (IP). These hybrids attempt to capture the spirit of IPD while embracing practical realities of owner established procurement practices.

According to the American Institute of Architects' (AIA) website and "Integrated Project Delivery: a Guide"[1]*:*

> *"Integrated Practice / Integrated Project Delivery (IP/IPD) leverages early contribution of knowledge and expertise through the 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…IPD projects are uniquely distinguished by highly effective collaboration…Commencing at early design and continuing through to project handover."*

IPD as a project delivery system is relatively new and not yet tested in the aviation marketplace, but presents several interesting opportunities for designers, builders and owners to collaborate at the highest level.

The basic concept of IPD is centered on a single, multi-party agreement among the owner, designer and builder in which there is a shared project objective with shared risks and rewards. The focus of the IPD process is to deliver a successful project outcome, not a series of individual services. The agreement defines the working relationship of the three parties with the role of each party maintained. The parties agree to work towards a common outcome and agree to avoid change orders and lawsuits.

The owner benefits in an IPD agreement by having a target cost, schedule and program agreed early in the process with more certainty of outcome. The designer and builder mutually gain or lose profit based upon the project team's performance, regardless of the performance of the individual firms. Both the designer and builder put their profits (fees) at risk. If the team meets the agreed target cost, schedule and program, they are paid their "normal" profits. If they beat the agreed targets their profits are increased accordingly. If the targets are not met, their profits are reduced or potentially eliminated. The goal of IPD is to achieve shared "pain" or "gain".

Exploratory discussions have taken place with FAA headquarters to initiate a dialogue on IPD and to identify and resolve issues affecting its usage. Many of the concerns and issues raised by the FAA are similar to those that affect other alternative delivery systems such as Design-Build and CM@R.

In all likelihood, initial usage of IPD on aviation projects may not be the pure form but might be considered "IPD Lite" or "IPD-ish" as described above. These projects would employ many of the principles of the IPD method but would be delivered under a more conventional project delivery system. There also exists the possibility to use IPD on individual projects within a larger program, such that FAA funding is not involved or until the FAA has developed guidelines on its implementation. IPD may also be utilized by private entities, including airlines, in delivering projects on airport property.

Appendix A – Industry Studies Comparing Project Delivery Systems presents the results of a survey performed to identify available industry performance data comparing project delivery systems. A number of references were identified that present the results of existing studies, reports, assessments and similar evaluations by industry groups, universities, and business and industry professional comparing the performance of various project delivery systems.

B. Procurement Methods Definitions

Qualifications versus Price

Historically, design professionals and others providing design or "consulting services" to public bodies have been hired on the basis of **Qualifications** (as required by FAA and/or state law); where the basis of selection was solely on professional qualifications and experience, whereas the selection method for the builder had been based solely on **Price**. Definitions for common procurement methods include:

1. Low Bid – total construction cost is the sole criterion for final selection (Total Construction Cost = 100 percent of final selection criteria)

2A. Best Value: Total Cost – both total construction cost and other factors are criteria in the final selection (Total Construction Cost = between 0 and 100 percent of the final selection criteria)

2B. Best Value: Fees – both fees and qualifications are factors in the final selection (Total Construction Cost = 0 percent of the final selection criteria; Fees are a criterion in the final selection)

3. Qualifications Based Selection (QBS) – cost is not a criterion for the final selection; qualifications is the sole factor used in the final selection (Total Construction Cost = 0 percent of final selection criteria)

Project Delivery System	1. Low Bid	2A. Best Value: Total Cost	2B. Best Value: Fees	3. Qualifications Based Selection (QBS)
DBB	X	X *	N/A	N/A
CM@R	Not typical**	Not typical **	X	X
DB	X	X	X	X
IPD	Not typical	Not typical	X	X

Table II-1: Procurement Methods by Project Delivery System

* There is no specific definition of Best Value: Total Cost when used with separate contracts for design and construction. The previous edition of this paper referred to this as a type of CM@R, but in this edition, the definition of Design-Bid-Build has been broadened to include this selection type.

** If the CM@R procurement is with the "low bid" (total construction cost being the sole criterion) or Best Value: Total Cost; it is by definition: Design-Bid-Build Low Bid or Design-Bid-Build Best Value.

As seen in Figure II-1 below, by definition, procurement of the Design-Bid-Build project delivery system is only by Low Bid or Best Value: Total Cost. Procurement of CM@R, however, can be accomplished by either Qualifications Based Selection or Best-Value: Fees selection (if CM@R is done with Low Bid, it is Design-Bid-Build). On the other hand, Design-Build can be procured with any of the four selection methods: Low Bid, Qualifications Based Selection, Best Value: Total Cost or Best Value: Fees. Because the procurement method is a critical element in defining a project delivery system procurement process, it is important to refer to them together.

Options Matrix: Typical Delivery System / Selection Options

DELIVERY SYSTEM Common Terms	Low Bid	Best Value: Total Cost	Best Value: Fees	Qualifications Based Selection (QBS)
Design-Bid-Build Competitive Sealed Bid; Low Bid; Inv. to Bid (IFB)	☐	☐	n/a	n/a
Const. Mgt. at Risk CM@R, CMAR or CM/GC	Not Typical	Not Typical	☐	☐
Design-Build One Step; Two Step	☐	☐	☐	☐
IPD Multi-party; Lean Project Delivery; Alliancing	Not Typical	Not Typical	☐	☐

Figure II-1: Options Matrix - Typical Delivery System / Selection Options

It is generally believed that a low bid process often provides the most competitive initial construction cost as compared to a Qualifications Based Selection. It is also generally recognized, however, that this primarily holds true for situations where the design and scope of work is well defined at the time of the construction contract and where a high degree of change is not contemplated during the construction period. In such cases, the builder is willing to assume the cost risk to construct the work as designed, and if all goes well, the owner receives a project delivered for the agreed price.

As stated earlier, the QBS system is mandated by FAA for the selection of design professionals where Airport Improvement Program (AIP) funds are involved, as well as, under many other Federal and State procurement regulations. Guidance can be found in FAA Advisory Circular

AC150/5100-14D, "Architectural Engineering and Planning Consultant Services for Airport Grant Projects," dated September 30, 2005[2] and other governing documents.

Since Design-Build can be implemented with any of the four selection types, it should be noted that the selection of the design professional may be part of a selection process that could include some element of price competition. For projects utilizing federal funding, FAA Advisory Circular 150/5100-14D[2] states that contracting for Design-Build services can be done by two methods: QBS or Competitive Proposal Selection (CPS). CPS is a two-step process whereby the Design-Build teams respond to a Request for Qualifications (RFQ) solicitation and are short-listed using a QBS process. Then a Request for Proposal (RFP) including design criteria is issued to the short-listed teams, who respond with separate technical and price proposals. The technical proposals are evaluated first on a numerical "points earned" system, and then price proposals are opened and factored into the "points earned" system to determine final selection.

Definition of "Price"

PDS discussions require both an understanding of the term "price" as well as an understanding of how total construction costs are categorized.

The three categories of total construction costs are:

- Construction Cost of the Work
- Builder's and Designer's Fee (including profit)
- Builder's General Conditions (although definable by contract, usually includes permits and connection fees, bonds and insurance, staff costs, job trailer and equipment, and temporary facilities)

Depending on the project delivery system chosen, one or more of these may be part of the "price" portion of the competition. Exercise caution anytime the word "price" is used during a discussion on project delivery. Clarify which element(s) of the Total Project Cost is being referred to when the word "price" is mentioned.

C. The Delivery Systems/Selection Approaches Options Matrix

When the definitions for the project delivery systems as described previously in this section are combined with the definitions used for the procurement types, the result is the Delivery Systems/Selection Approaches Options Matrix, shown in Figure II-2 below with commonly used industry terms.

Because the industry has gone for so long without standard definitions, many readers may not entirely agree with these definitions. This is not unusual and highlights one of the purposes of this paper: to provide a framework for these discussions. Because the Delivery Systems / Selection Approaches Options Matrix works with nearly every known system of delivering

design and construction, we encourage readers to insert into the "Project Delivery Options—Worksheet" matrix the names they use to describe the ten scenarios described in the matrix.

If there are any of the ten that they do not use, just put "N/A" to indicate that they either do not have that option available to them or they do not consider that option one of their available options.

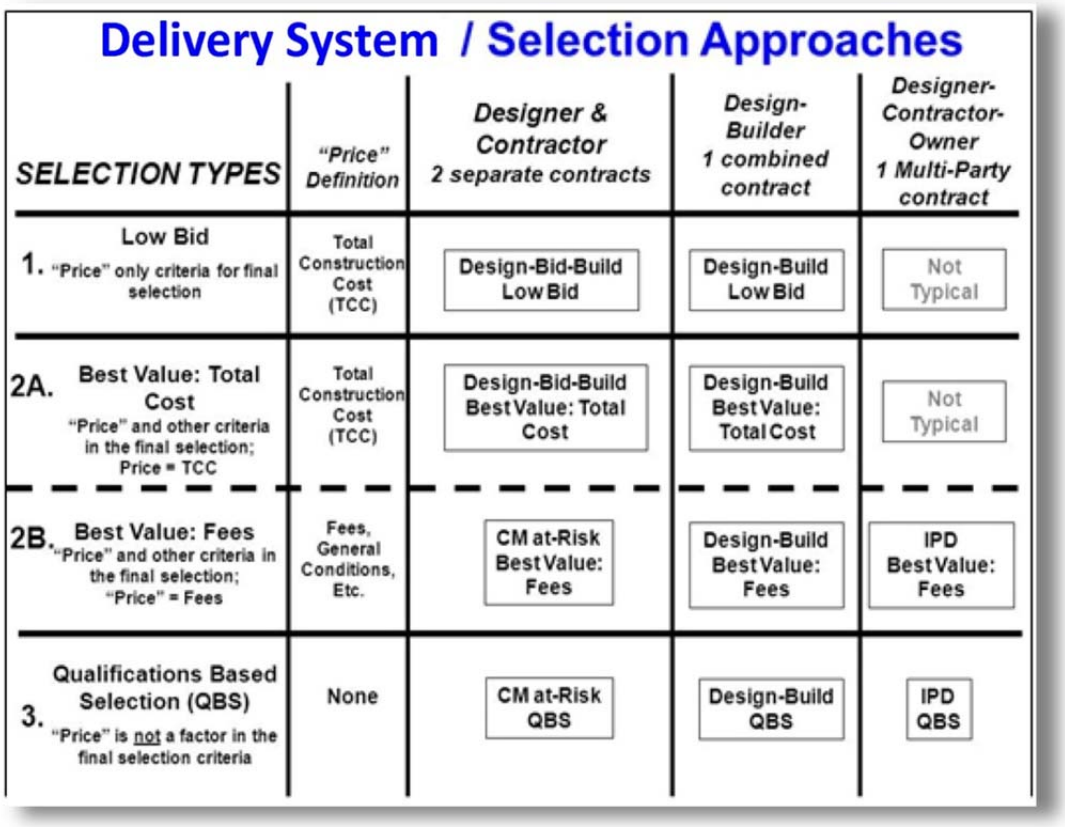


Figure II-2: Delivery System / Selection Approaches

There are no names that are "right" or "wrong." Use whatever names you would like, but try to avoid adding to the list of ten (try rather to ensure that all options are just a hybrid of one of the ten). Even if you do not normally use all ten options, or don't agree with the use of all ten, be aware that all ten options exist and that one or more options may not be included on your list of "available" options.

III. Selecting the Appropriate Project Delivery System

A. Ability to Use Alternative Project Delivery Systems

As a fundamental issue when choosing the appropriate PDS, an airport owner or facilities professional responsible for the delivery of capital projects must determine if it is possible to use new or alternative project delivery systems. Many airports are either looking for, or already proceeding with, the use of Alternative Project Delivery Systems for a variety of reasons that are addressed in this paper.

Over the past decade, publicly-owned airports have increasingly been able to choose a project delivery system other than Design-Bid-Build for capital improvement projects. Legislation prompted by pressure from industry groups, a desire for change, project overruns and delays, and other factors has been drafted at the local, state and federal level for the use of alternative project delivery systems.

Revisions to FAA Advisory Circular AC150/5100-14D[2] identify principal changes to the professional services procurement process and added alternative project delivery systems to the FAA's formalized acceptance of a variety of project delivery systems. Major changes in state procurement laws and codes in the past few years have also provided options for the use of alternative PDS.

B. Considerations in PDS Selection

In determining the appropriate PDS, asking some fundamental questions will serve to establish the basic parameters for the selection process. The questions are loosely grouped under typical evaluation criteria as follows:

Human Resources: Are owner staff resources sufficient in both number and qualifications, or should additional management services be procured?

- What kind of management support is needed for monitoring scope, costs, subcontractors, etc.?
- Who is qualified to establish contract expectations? Do documents reflect fund-source demands for reporting?
- Who understands and can best articulate and document project expectations?
- Is there sufficient and qualified staff available for prompt design review?
- Is there sufficient staff to ensure prompt payment processing?

Level of Design Detail: What is the organization's desired level of control for the design?

- How much design input is typical for the organization, regardless of project delivery system?
- How important is the architectural design compared to functionality? To price?
- To what level of detail should bridging documents be developed? (Bridging documents are drawings and specifications that represent owner expectations and are developed prior to solicitation of DB team.)
- Who decides what a change is?
- Who assigns value to the change?
- How are other decision-makers engaged if the project delivery system changes?

Risk Assessment and Management

- Who indemnifies whom for what? Is that reasonable?
- Is a wrap-up policy sufficient and most cost effective?
- Are consequential damages really a risk? If schedule is a risk, can damages be limited to milestone completion?
- Who is overseeing compliance with quality control, safety and design intent?
- Could construction activities adversely impact airport operations thereby encouraging early participation of construction input?
- Is there cost uncertainty where design and estimating processes should be developed in parallel?

Size and Complexity of Project

- Is it a simple building type, 'cookie cutter' facility or one with limited aesthetic impact?
- Can it be broken into multiple packages to allow for various delivery optimizing cost efficiencies?
- Is the project cost primarily paid to a vendor (people mover, passenger boarding bridges or baggage systems), thereby offering greater benefit by bringing the vendor into the design discussion earlier?
- Is the final design solution critical to the image and functionality of the project?

Expanding on the summary list of questions, below is a more detailed analysis of basic project parameters, (key parameters are identified below), and their impact on determining the best delivery, management and selection process options.

1. <u>Stand-Alone Project or Part of a Capital Development Program Affect Management Requirements</u>

    a. Stand-alone project implies:

i. One-time buildup of resources for a short period – the owner may not engage the services of a program manager due to the short duration of a single project.
ii. No economies of scale. With a stand-alone project, the owner may not benefit from procurement gains due to a lack of economy of scale, which could affect the PDS chosen and the use of owner supplied equipment and materials.

b. Project as part of a larger Capital Development Program implies:
i. Buildup of resources - (usually external) that are spread over a number of projects and over a longer period. It is a cost-effective method of management and may affect the type of PDS chosen; more management resources on staff could result in 'leaner' management requirements for the designer and builder.
ii. Benefit from economies of scale. Being part of a larger and more comprehensive capital development program, the owner may elect to modify certain procurement methods to achieve further gains (such as a dedicated concrete batch plant on site with fixed pricing, owner supplied equipment [passenger loading bridges over a number of terminal projects, etc.); use of expert advisors could benefit the project.

2. Impacts to Airport Operations or Commercial Business Enterprise

a. Effect of the project on airport operations may dictate level of delivery control. Projects that affect airfield or terminal operations may require greater planning, approvals and notifications by the owner or its consultant. When that consultant comes on board, its required qualifications can be best controlled by the appropriate delivery system and selection process.
b. Impacts to airport commercial business revenue may dictate schedule constraints or speed of implementation. The need to minimize impact on commercial and retail revenue may dictate an alternative project delivery system.

3. Owner's Control of Design and Phasing

a. The type of project may dictate the owner's desire to control design and scope (high vs. low). The type of project and the ability to deviate from a design could impact the PDS choice. As described earlier, Design Build is a delivery that typically releases the DB consultant to make design decisions once the owner has established design expectations. Therefore, a high desire to control design throughout the course of project development might least lend itself to a DB delivery.
b. The scope of the project may dictate the owner's need to define and control project phasing in relation to impacts on airport operations or commercial business enterprise – as a result of the project scope which may affect airport operations and/or commercial enterprise (some of which may not be completely known at the time of tender), the owner may choose a more controlled delivery process to ensure that the phasing and impacts to operations or commercial/retail are minimized, and that there is a flexible method of altering the sequence of the work to respond to changing operational conditions.

4. Project Size and Complexity

   a. The size and complexity of the project may dictate the amount of supplemental expertise and administrative support the owner may require. The project could include multiple areas of development requiring unique and varying expertise, as well as, an ebb and flow of support. Choosing multiple delivery systems that align with specific project requirements may optimize use of each delivery.

Airport owners should perform a comprehensive self-assessment of internal resources (both quantity and skill set), legislative restrictions, cost and schedule requirements, operational complexity as well as comfort with change to define the type of project delivery system (and management support) best suited for the owner/project. In addition, the airport owner should consider the major factors influencing the project and then consider the requirements of the project. These major factors are shown in Table III-1.

1. Schedule/ Necessity to Overlap Phases	2. Ability to Define the Project Scope/Potential for Changes	3. Owner's Internal Resources	4. Desire for a Single Contract or Separate Contracts	5. Regulatory/ Legal or Funding Constraints
Tight project milestones or deadlines Amount of overlap of design and construction phases that are feasible	Scope definition – clearly defined or ability to progress definition through project development Potential for changes during construction Need/desire for the builder input during design Flexibility to make design changes after construction cost commitment	Ability or desire to define and verify program and design content /quality Experience with the particular PDS and forms of contracts Ability to participate in multiple trade builder/supplier evaluation Desired contractual relationship and ability to recoup savings	Ability or desire to take responsibility for managing the design Ability or desire to eliminate responsibility for disputes between designer and builder/single point responsibility Local or small business participation	Regulatory and statutory requirements Budget and funding cycle Multiple funding sources

Table III-1: Additional Considerations When Selecting an Appropriate PDS

Addressing these key considerations early in the project cycle provides airport owners with additional means for analyzing options for the selection of the most appropriate project delivery system.

The Joint Committee has prepared an owner's survey questionnaire for this purpose to collect their experiences in utilizing different PDS and has included the questionnaire in **Appendix B - PDS Lessons Learned Questionnaire** of this paper. The Joint Committee respectfully requests readers of this paper to contribute to this effort by sharing their own experiences, both good and bad. Airport owners are asked to answer the survey questions and forward their responses to any of the sponsoring organizations included in the **Acknowledgements** section at the end of the document.

To meet this challenge, owners are encouraged to consider and use the understanding gained from this paper, as well other PDS process examples and tools, referenced in **Appendix C – Alternative PDS Selection: An Owner's Example** and **Appendix D – PDS Selection Tools,** respectively, as an aid in evaluating and selecting the PDS most appropriate for their project.

C. PDS and Risk Exposure

In addition to consideration of the major factors and the ability to use alternative project delivery systems, a thorough review of the potential project risks, their appropriate allocation and the mitigation measures to be implemented should also be performed.

The airport owner's appetite for risk and the owner's capability and experience in managing the types of risk inherent in a given project will have a direct effect on the project delivery system chosen. The timing and the allocation of the risk vary depending on the project delivery system. Therefore, each delivery option provides a different approach to allocating the risks and typically will result in timing differences in transferring or mitigating the various risks.

Each project delivery system has a different impact on the team dynamic and risk allocation. Although a detailed discussion of all project risks is beyond the scope of this paper, in the context of defining risk associated with each project delivery system, the following is offered for consideration.

Design-Bid-Build (DBB): DB carries the limitations of a low bid selection of the builder in which an owner might "get what it paid for" in terms of the builder's final performance. In the DBB delivery the owner is saddled with a considerable degree of risk — risk that cannot be fully assessed and quantified until the end of the project. Best value selection is one tool the owner could consider utilizing to mitigate against a selection made solely on the lowest price. A best value selection provides the owner an opportunity to prequalify its builder and a greater ability to subsequently "choose its partner" on criteria other than merely relying on lowest price at the time of bidding.

Construction Management at Risk (CM@R, CMAR or CM/GC): This PDS evolved from two primary perceptions:

- The owner's concern that consultant construction managers (CM Agents) are hired to manage the work as an extension of the owner's staff, but without contractual obligations to meet design, schedule or budget obligations; and
- Any innovations for cost or schedule savings developed by the DBB builder when bidding the work, was realized solely by the builder, without benefit to the owner.

To remedy both of these perceptions by soliciting builder expertise prior to bidding, *and* to increase the construction manager's risk obligations, CM@R was developed. CM@R takes a major step in building early relationships with designers, builders and owners to review project risks, bringing broader expertise to problem solving, and sharing experiences to better anticipate project outcome.

Design-Build (DB): The designer and builder's risks can be very different when contractually tied, as in a DB delivery, then when selected and contracted separately. Design-Build teammates must have the ability to create partnerships that understand and accommodate each other's typical risk profile including errors and omissions, insurances, bonding, milestone liabilities, staff qualifications, etc., and ideally, assist aggressively in mitigating those risks now that all risks are shared (or segregated).

Identifying risk profiles is not complete without understanding the respective mechanisms for earnings by the designer and builder. Discovering what is critical for each partner for meeting earnings commitments must be unveiled within the partnership so both parties can assist the other in financial success.

Integrated Project Delivery (IPD): Integrated Project Delivery was developed to address cost/schedule overruns and inefficiencies in management arising from traditional project delivery systems. Within the industry, there was a desire for:

- better relationships among project parties
- more collaboration throughout project life cycle
- more leadership from owners
- better project definition and design
- more involvement of contractors, subs, suppliers during design

IPD is the response to these real or perceived needs. It requires close collaboration and integration of people and processes. IPD is implemented utilizing a single agreement among core team members (owner, designer, builder). The agreement shares both risks and rewards through a new basis of reimbursement model known as *Target Price* as illustrated in Figure III-1.

The mutual agreement has provisions for efficient dispute resolution and a pledge to avoid litigation between core team members. The goal of IPD is to share the "pain" and the "gain" by all parties taking whatever steps necessary to achieve efficiencies and meet cost and schedule goals.

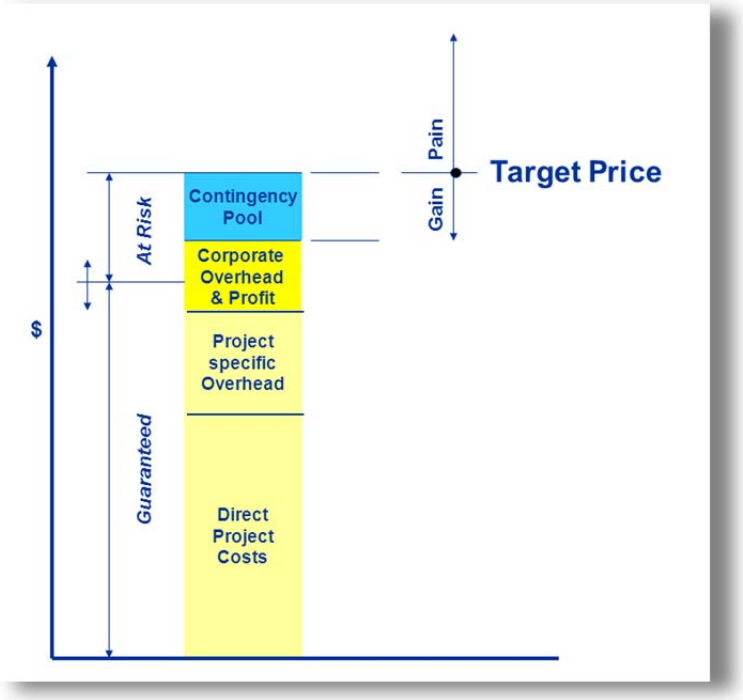


Figure III-1: Target Price

In this way, an owner will share and mitigate risks with the designer and contractor but may also limit their potential cost savings due to the contractual sharing arrangement.

D. PDS and Shifting Roles and Responsibilities

Similar to how risks associated with the available project delivery systems vary between systems, there are also varying roles and responsibilities for each of the players depending on which PDS is selected. Following are some key examples of how these roles and responsibilities shift from one delivery system to another that must be considered in the PDS selection process.

Design-Bid-Build (DBB): Using Design-Bid-Build, in which the owner contracts with the designer and constructor separately, may be used as a baseline for owner-designer-builder roles. The Design-Bid-Build PDS affords no opportunity for the constructor to contribute to or influence the design of the project. Both Construction Management at-Risk and Design-Build, however, afford the builder access to the design professionals early in the design process.

Construction Management at-Risk (CM@R, CMAR or CM/GC): Using a CM@R project delivery system, the builder typically works with the designer and the owner at some stage in the design process to share technical expertise, resulting in better documentation, more accurate estimates and more experience-based scheduling. It also allows more frequent communications and a greater sense of shared responsibilities.

Design-Build (DB): Using a Design-Build project delivery system, the designer is usually a sub-consultant to the builder. This project delivery system ensures that the builder is heavily involved in the design process from the beginning. This is a unique relationship that requires adaptation and the commitment of both parties relative to assignment of design and construction performance. Most commonly in the Design-Build approach, the builder is contractually responsible to the owner for the architect's design and performance (as well as the construction completion), though the designer is seldom contractually obligated to take on the builder's construction risks. The impact of these relationships can be profound, both positively and negatively, and must be addressed in the nascent days of project start-up to ensure clarity by both parties.

Integrated Project Delivery (IPD): Integrated Project Delivery brings together the owner, designer and builder in a multi-party agreement which is managed using an integrated leadership approach. Integrated leadership is characterized by:

- Transparency – full, open sharing of information
- Owner engagement – with experienced staff, or by hiring experienced PM
- Management committees (owner and core team members with significant stake in the outcome)
- Consensus decisions
- Collaborative selection procedures

Required positions on the team are filled by the best candidate from all of the organizations on the team by means of a collaborative selection process. The IPD strives to:

- Remove barriers to communication and sharing
- Get project parties involved earlier into the planning and design
- Use integrated information tools and processes to promote more collaboration and teamwork

Integrated Project Delivery requires a change in the behavior of the project participants. It means putting team goals and behaviors ahead of company affiliations. It is working collaboratively to achieve the best in quality, cost, schedule and safety for the project.

Using an Integrated Project Delivery (IPD) delivery method, the owner-designer-contractor team is typically contracted under a multi-party agreement best characterized by its sharing of

risk and reward. Since this contracting approach is still relatively new and untested, the full understanding of the risks associated with this approach is likely to take a number of years.

Generally, with regard to the owner's risk, there are two schools of thought emerging:

1. The owner is taking some of the risk that they have traditionally allocated to others back, and in return, getting a higher level of collaboration and a corresponding higher value and return on their investment. (This school of thought implies the owner is taking MORE risk.)
2. The owner may be taking some of the risk back; however, the contractually driven collaboration leads to a "collaborative risk management" approach. When looked at through the traditional way we look at the process, what appears to be taking more risk in fact turns out to be LESS risky under this enhanced delivery approach. (This school of thought implies that the owner is taking LESS risk.)

Knowing which of these schools of thought is more accurate, only time will tell. It is worth noting that the early anecdotal feedback from some of the owners who have completed projects with the multi-party contract believe that they, in fact, are taking less risk (school of thought #2), and that a team properly incentivized working collaboratively to manage their risk does indeed lower their risk.

The design team, on the other hand, under a multi-party contract is typically asked to place some portion or all of their profit at risk. The at-risk portion of the design team's profit is tied to the overall project's success and in addition to taking a higher risk (potential pain), they are typically also given the opportunity to share in the project savings (potential gain). The definition of "project success" is defined on a project-by-project basis and the amount of risk and reward can be tied to achieving specific elements and milestones mutually agreed to by the entire project team. Similarly, the contractor (and potentially other key members of the project team that sign the multi-party agreement) also places some portion or all of their corporate overhead and profit at risk. The construction team's profit is also tied to the overall project's success. They also share in the potential savings by pooling their contingencies and working collaboratively to try and avoid unnecessarily spending the contingency.

The collaborative behavior is contractually required by the multi-party contract. There are a number of industry standard multi-party contracts; one endorsed by dozens of associations is the ConsensusDOCS® 300 agreement.

IV. Implementing the Chosen Project Delivery System

A. Contract Types

Regardless of the type of project delivery system selected, the contractual arrangement by which the parties are compensated must also be established. This is part of the owner's overall project management responsibilities, separate from but related to, selection of the project delivery system. The basis for compensation is dependent and conditioned upon, and must be consistent with, the project delivery system selected and its associated distribution of risk and responsibility between the owner and those delivering the project.

The basis of compensation type relates to the financial arrangement among the parties; as to whether the designer or builder is to be compensated for their services at a set amount (i.e. firm fixed price [lump sum]), on a reimbursable basis for the cost of time and materials plus overhead and profit, on a reimbursable basis up to a guaranteed maximum amount, on an incentive or award fee basis, or any number of variations of these general contract types. The three primary or common types of compensation approaches include:

- Firm Fixed Price/Lump Sum (FFP, LS)
- Reimbursable Cost Plus (CP)
- Guaranteed Maximum Price (GMP)

A firm fixed price or lump sum contract is an arrangement where the builder agrees to construct the defined scope of work for a set price. The builder assumes the risk of cost overruns in the construction, realizes any cost savings as profit, and expects to be paid extra for any changes outside its control. In this type of contract, the owner's risk of cost overrun is minimal (assuming no changes, design errors or external impact events like fire or flood, etc.). The builder has incentive to be efficient and lower costs because it can both be more cost competitive at bid time, and also can increase its own profit during construction. The owner does not share in the construction cost savings (unless the contract includes such incentives).

At the other end of the spectrum, a reimbursable or cost plus contract is defined by a schedule or list of fees, unit prices, rates and markups, under which both the designer and builder perform the work as requested and defined by the owner during the course of the project. The owner assumes the risk of cost overruns in the construction (excluding builder mistakes), the owner realizes any construction cost savings, and the builder is necessarily paid for any changes outside its control. In this contract type, the owner's risk of cost overrun is somewhat greater, however the cost for changes is somewhat controlled by the pre-established unit prices and

rates. The builder has little incentive to be particularly efficient or save cost for the owner unless specific contract incentives are defined.

Between the firm fixed price and reimbursable contract types is the guaranteed maximum price contract where the builder and owner agree on a target or maximum price for the construction. The builder assumes the risk for cost overruns and the owner realizes savings if the work is completed for less than the target price. Oftentimes in a GMP contract, the construction initially proceeds on a reimbursable basis using an incomplete design. Once the design is complete, a negotiated maximum price is established. In this case, the cost risk of the incomplete design is managed by the owner, yet the overall construction completion cost risk is finally assumed by the builder, ideally resulting in the lowest overall final cost to the owner. In a GMP, much of the cost benefit is to the owner as the cost to the owner is capped and the owner also pockets any construction cost savings. An owner may also choose to incentivize the builder by sharing the construction cost savings as a means to better manage the project performance. The basic differences described above are shown in the Table IV-1 below.

Contract Type	Cost Risk to Owner	Construction Cost Savings
Firm Fixed Price	Capped	To the Builder
Reimbursable	Not capped	To the Owner
Guaranteed Maximum Price	Capped	To the Owner or shared with Builder

Table IV-1

These three primary contract types can be modified in any number of ways to best suit a specific project situation and use each type's strengths to best advantage. Each of the above contract types may be used with competitive bidding or negotiated costs, since this is more a matter of selection type than contract type. Each may be modified through the use of incentives or award fee arrangements to promote certain benefits or manage risk more effectively for the owner. For example:

- Bid or negotiated firm fixed price or lump sum with incentive/award fee (FPIF, FPAF, LSIF, LSAF)
- Bid or negotiated reimbursable or cost plus with incentive/award fee (CPIF, CPAF)
- Bid or negotiated guaranteed maximum price with incentive/award fee (GMPIF, GMPAF)

As discussed earlier in the section on selecting the best project delivery system for a specific project, the type of contract and the compensation approach should be selected to best suit the project situation and the needs of the owner and its various design and construction service providers. While use of a specific project delivery system does not mandate use of a specific contract type, the selection of contract type should be consistent with the allocation of risk and responsibility defined in the selected project delivery system. For example, a DB project delivery system can be executed using a LS, GMP, or other similar type of contract, but may not make as much sense with a cost plus arrangement.

With a lump sum contract, if the design or scope of work is not well-defined or complete at the time of the contract, there is risk that the cost to construct the work may increase significantly. Who assumes that risk and how it is allocated is an important consideration in selecting the type of contract. If an owner attempts to transfer that risk to the builder, the lump sum price will likely be higher to cover the builder's cost risk for the incomplete design. Additionally, an owner may still face costly change orders for final design elements not reasonably inferred from the incomplete design documents. In the case of an incomplete scope of work, a lump sum contract may not result in the lowest final total cost to the owner or be the best option. In such instances, a cost plus reimbursable, guaranteed maximum price (GMP) or other type of contract may be the best options to consider.

The following Figure IV-1 from the 2010 report "Integrated Project Delivery for Public and Private Owners"[3] provides some guidance on the cost and risk associated with level of design completion.

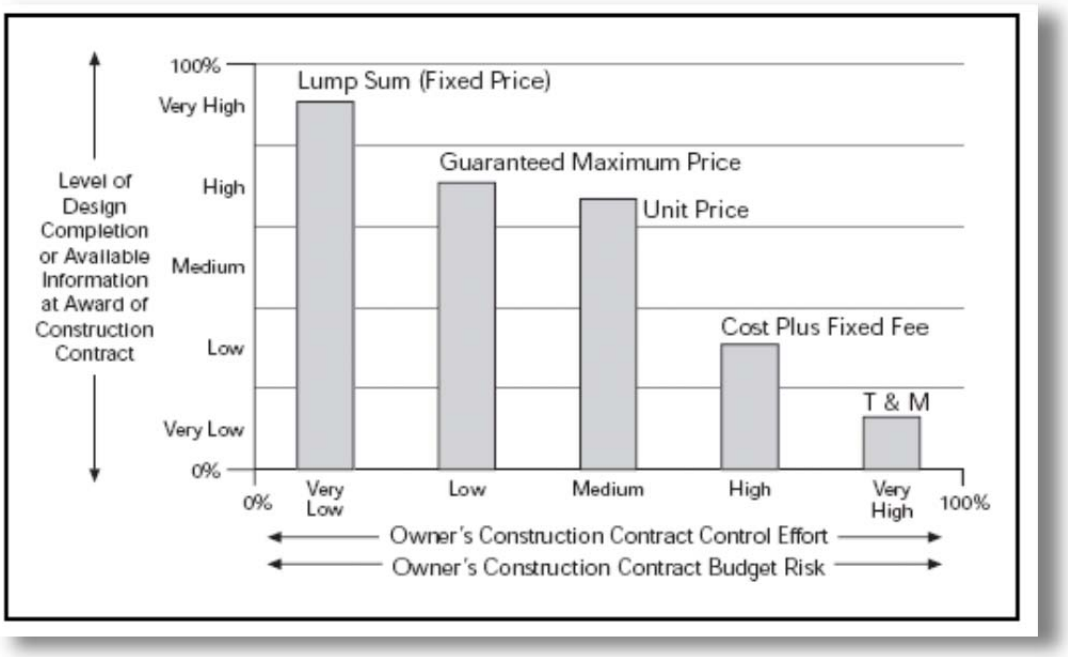


Figure IV-1: Sample Compensation Approach Chart

Selection of the compensation method should strongly consider factors such as the degree of design completion, scope definition at the time of the contract and the parties' tolerance for cost risk.

The various tradeoffs to consider in regard to compensation method selection revolve around overall cost risk, the cost of changes and the incentives to control those costs. A lump sum contract is generally beneficial when the design is well-defined and a cost plus when it is not. Incentives can be used to enhance the risk management benefits of cost plus contracts.

Other cost risk factors to keep in mind relate to how each contract type may promote cost control. By its nature, a lump sum contract incentivizes the builder to control cost because the builder reaps the savings and can offer more competitive pricing to the owner. Because the builder also assumes the cost risk for overruns, however, changes to the design or other changes to the work may be costly for the owner. With a cost plus contract, however, the owner's cost for such changes may be lower because the builder is not at risk. Without separate incentive clauses, the builder is less motivated to be efficient.

B. Contract Language

The purpose of the formal contract is to memorialize the agreement of the parties regarding the selected project delivery system approach, the allocation of work scope, responsibilities, and risk, the arrangements for financial compensation, and similar aspects of the project. It is important to ensure that the terms and conditions of the contract reflect the goals, objectives, issues and expectations for the project and document all the various associated understandings.

A contract typically includes several separate sections including a basic agreement of general terms and conditions, additional or special conditions unique to the project, and the terms for payment, PLUS all other supporting documents necessary to further define the nature and extent of work such as the schedule, the drawings, specifications and any other technical requirements for the work. Generally, these supporting documents represent deliverables prepared by the design team.

The basic contract often begins with the owner's standard contract terms and conditions, if developed. In lieu of an owner's form, there are several readily available general contract forms such those prepared by ConsensusDOCS® (a coalition of 35 construction industry associations), the American Institute of Architects (AIA) and the Engineers Joint Contract Documents Committee (EJCDC). A list of contract documents is provided in **Appendix E – Contract Document List**.

These basic starting documents should be carefully reviewed and edited to tailor them for consistency with the specifics of the project and with the various documents discussed above. The resulting contract and all its supporting documents should be read and reread to exclude conflicting language and requirements, ambiguous language and requirements, and exculpatory language that are inconsistent with the agreed upon allocation of risk and responsibility.

The contract should clearly describe the various agreements with specificity, because generality becomes ambiguity and ambiguity is a major source of disputes in construction matters. Specificity helps avoid disputes. Specificity also requires one to think through the various components of project execution, a valuable exercise that exposes conflicts, omissions and misunderstandings regarding the roles and responsibilities of the parties. This exercise promotes recognition of the practical ramifications of what the parties are about to agree to in

terms of their execution risks and responsibilities. From that risk perspective, exculpatory language, which sometimes is used to transfer unreasonable risk to the other party, should be reconciled with the risk allocation intended by the selected PDS and related agreements.

One particular note, regarding contract language when specifically using a DB approach, concerns state rules governing the practice of architecture or engineering that may preclude a construction firm (not also licensed as an architect or engineer) from leading a DB team or executing a DB contract. Similar concerns relate to professional liability E&O insurance coverage exclusions for design firms participating in DB projects and the potential inability of the DB firm, with whom the owner's contract is written, to obtain its own E&O coverage.

Furthermore, all parties need to recognize that disputes over scope, quality and other issues may still arise, particularly in today's complex, fast-paced projects. Consequently, it is important that the contract define how such disputes will be handled to minimize disruption and cost/schedule impact to the project. One method is to consider the use of alternate dispute resolution (ADR) approaches such as Project Neutral®, dispute review boards or other approaches focused on quick problem resolution. For example, if changes during construction are anticipated, the contract language should define how those changes will be managed and their cost and schedule impact minimized.

Finally, owners can consider engaging legal assistance by attorneys experienced in construction matters for crafting effective contract language. Additionally, an internal or external independent review by construction or dispute resolution experts can be beneficial; especially by someone who has done it before successfully or, perhaps of more benefit, by someone who has seen how not to do it.

C. GMP Contracts

In the purest sense, a Guaranteed Maximum Price (GMP) contract is one in which the contractor commits to an agreed-upon price for completion of the work. According to the Associated General Contractors of America (AGC) publication "Project Delivery Systems for Construction—3rd Edition,"[4] Guaranteed Maximum Price (GMP) is defined as "a basis of reimbursement sometimes referred to as a "GMP" or "G-Max", [which] is a price mechanism sometimes used in construction contracts. The owner agrees to reimburse the cost of the work-up to a prescribed ceiling amount — the Guaranteed Maximum Price."

GMP is a contracting mechanism most commonly used with CM at-Risk and Design-Build. In most GMP situations, the contractor interfaces with the owner and designers during the design phase, serving as a consultant typically for estimating and constructability services. A GMP is established for the purpose of price certainty; the optimal time for establishing a GMP is at the discretion of the owner. While the GMP can be set at any time, there are advantages to any option; therefore careful analysis by the owner to analyze its own priorities is important.

Generally speaking, when the GMP is set early in the design process, the contractor's contingency will be higher to cover the greater unknowns. Conversely, the GMP can be set later - even after design is complete and subcontractor pricing is received - which offers higher accuracy in final pricing, but eliminates the benefit of using the GMP as a control mechanism for ongoing changes. Later pricing also creates the potential for additional issues if a GMP cannot be agreed upon. Failure to negotiate the GMP in a timely manner may affect the project schedule and increase the project costs. However, the owner always has the option to cancel the contract, pay the contractor for its preconstruction services, and put the construction project out for bids with the completed design.

A key element of the GMP contracting method is the fundamental relationship change which takes place between the owner, designer and contractor once the GMP is set. As mentioned above, prior to the establishment of the GMP the contractor serves as a consultant to the owner and designer - often providing input on estimating, scheduling, life cycle costs, construction phasing and constructability issues. However, once the GMP is established, the contractor takes on the risk of both schedule and price. Therefore the GMP is likely used by the contractor as a control mechanism to meet its commitments made in the GMP.

Typically a GMP is comprised of several elements as follows:

- Contractor General Conditions
- Cost of the Work
  - Executed subcontracts
  - Cost of self-performed work if any
  - Subcontracts Purchase Orders defined but not yet executed
- Contractor Fee
- Allowances (for unit pricing and undefined design elements)*
- Assumptions and Exclusions
- Contingencies (construction)

* The Construction Specifications Institute (CSI) "Manual of Practice"[5] defines an allowance as "a monetary sum…included in the price of the project to pay for products that are unspecified at the time of pricing." The owner must be diligent to make sure the contract properly defines - and all parties understand - what constitutes an allowance.

The contract document includes key assumptions made by the contractor upon which the GMP was based.
GMP contracts will often contain contingency to address uncertainty. The contingency can be an identified line item to be used by consent of the owner to address uncertainty or risk for increased construction costs not covered in the development of the GMP.

Despite the name, a GMP is not an absolute guarantee of the contract price. A GMP guaranties the price for a specific scope of work. If that scope changes, the GMP-contractor is generally

entitled to increases in the GMP. That is, to the extent an allowance is exceeded, the design scope deviates from a stated assumption, or there is an owner-directed scope change, the GMP-contractor may be entitled to a change order increasing the GMP. This concept is addressed in Article 5.2.5 of AIA Document A102[6]:

> *5.2.5 – To the extent that the Drawings and Specifications are anticipated to require further development by the Architect, the Contractor has provided in the Guaranteed Maximum Price for such further development consistent with the Contract Documents and reasonably inferable therefrom. Such further development does not include such things as changes in scope, systems, kinds and quality of materials, finishes or equipment, all of which, if required, shall be incorporated by Change Order.*

The above identifies an initial issue that must be realized and understood when using a GMP -- what is and is not included in the GMP. The primary misunderstanding or dispute when using a GMP is what constitutes design development which is covered under the GMP, and what constitutes a change in scope which entitles the contractor to a change order. For this reason the parties to the GMP must pay particular attention to the allowances, exclusions and assumptions so the parties have a clear understanding of what is, and what is not, included in the GMP.

As an incentive to deliver the project within the GMP and in the most cost effective manner many GMP contracts, particularly private contracts, contain a shared-savings clause. These clauses typically allow a contractor to share in some portion of the savings if the actual final project costs are below the GMP. Before implementing such a clause, it is important to understand that contractors will work tirelessly for such an opportunity and the owner must be prepared for the consequences.

As with any contracting method, the owner must evaluate the risks, costs, benefits and comfort level based upon its own internal organization before choosing a GMP-type contract.

Progressive GMP Contracts

An alternative to the establishment of a single point in time that a Guaranteed Maximum Price is set for a contract, a hybrid form of GMP that has been successfully implemented on a number of airport projects, namely a progressive GMP. Most projects that are being implemented under a GMP also have an identified maximum budget that represents the total amount of funds that the owner has available for a project. This budget is often used to define the general magnitude of a project for a design to cost contract with the design consultant.

For complex projects that are being implemented on a fast-track basis, early construction packages are issued for bid and implementation while design of subsequent construction works continues. The early construction packages represent a step in the project implementation

when a GMP can be established for that portion of the work that is well defined and for which the owner and contractor can agree on the maximum price. The owner benefits from the ability to obtain maximum cost certainty on a portion of the work and the contractor benefits from obtaining a contracted price certainty for the work. The collaborative team then proceeds with designing, packaging and bidding the balance of the project work that is not fully defined.

A primary driver of the use of a progressive GMP is the point at which the contractor takes primary control of the work. As stated above, when a GMP is established on a project, the contractor's role typically shifts from a collaborative advisor on cost schedule and scope to the role of a pure construction contractor for the priced works. Execution of a GMP on a portion of the work appropriately transfers this portion of work from design to construction. The owner thus maintains overall control of the key decisions for the balance of the project. The contractor continues in the advisory role as the subsequent portions of the design are advanced to construction documents, bid and contracted. This enables ongoing owner management of the overall scope of the project to keep it within the maximum budget.

This "progressive" approach continues with the design, packaging, bidding and contracting of the work until the project reaches the point where the owner is comfortable with negotiating the final GMP for the entire project and turning the responsibility to the contractor to complete construction and delivery of the project into operation. Ongoing tracking of the total project budget, with reconciliation of the estimated value of the progressive GMP packages with the actual contracted prices must be performed to keep effective control over the project scope and cost throughout execution of the work.

D. Management Execution

Management refers to the method by which the owner coordinates and oversees the planning and execution of the overall project including conceptualization, budgeting, scheduling, design and construction, and major decision-making. In short, it refers to how the owner carries out its responsibilities as compared to how the design and construction firms carry out their collective responsibilities.

At the time the contracts for design and construction are about to be executed, it can be beneficial for the owner to take a brief step back from the specific project details and view the project from an overall perspective. Review the selection criteria that drove the choice of project delivery system, including those relating to owner involvement, ability to manage and oversee the work, staff availability, staff experience, desired degree of involvement in design decisions and desired level of construction oversight.

Effectively communicate to your various team members (design professionals, construction managers, builders and consultants) the goals, objectives and issues that drove the selection of the chosen project delivery system. It is important they understand and commit to the owner's expectations. Consider holding a reconciliation meeting with the selected builder to confirm

everyone's understanding of roles, responsibilities, risks and expectations and to ensure they are clearly defined and measurable. Walk through the project to determine how project interactions will be managed on a daily basis. Such meetings have proven effective in exposing potential misunderstandings, problems and disputes.

Define review and approval processes, the turnover and acceptance process, handoffs and transitions of responsibility, and similar interfaces. Take the time to "iron out" the details and tough spots as to how it's to work. Avoid easy deferrals such as "we'll deal with that if it happens". Assess potential risks and plan how you will manage the overall program, internally or as applicable, via a program management consultant. It's significantly better to thoroughly plan how the project delivery will be managed and how problems will be managed proactively rather than reactively.

Equally important as having an owner's implementation and management plan is to recognize that the plan may have to be significantly different from an owner's traditional or typical management approach, depending on the project delivery system selected. For example, if an owner's internal design and engineering staff typically participate in detailed design reviews, material and equipment selection, or dictate construction quality and requirements, AND the owner is undertaking its first Design-Build project; a change or adjustment in management style is imperative to project success. Depending on the PDS chosen by an owner, adjustments to philosophical and behavioral attitudes within the owner's organization may be appropriate.

For example, by selection of the Design-Build approach, the owner delegates or assigns responsibility AND authority for many of the reviews, approvals and decisions to the Design-Build entity, in return for contractually promised reductions in project cost and schedule. If the owner continues to manage and interject itself into the project as if it is a DBB project, the benefits and success of the DB process likely will be compromised. Commit to the appropriate level of owner involvement (e.g. support a planned heavy owner involvement with timely and informed decision-making so as to not delay or impact the project). Conversely, avoid imposing owner changes or controls on DB contracts.

V. Financing and Project Delivery Systems

Airport owners should choose a project funding plan using a similar approach to the one they use to establish the appropriate project delivery system for a project; projects where the airport wants the most control over should be funded by airport revenue sources, and those projects that are regulated heavily by the federal government should use federal funding. Such a clean decision rule, however, does not always work, due to limited funding and projects that serve multiple needs.

There is a broad spectrum of financing options for airports, as detailed below, and more options continue to evolve as needs and opportunities arise. However, airports have typically relied on five primary sources of funding as follows:

- Federal Funding (FAA and Transportation Security Administration (TSA))
- State Funding
- Passenger Facility Charges (approved by the FAA)
- Airport Cash Flows for Project Finance
- Debt Financing / Airport Revenue Bonds

In addition, innovative financing, such as special facility bonds, public-private partnerships (P3) and subsidized/subordinate loan programs have also been used to develop airport projects.

The following text discusses the various funding sources and financing mechanisms available to airports, including the circumstances under which each is most appropriate and links financing methods to project delivery.

A. Federal Funding

Federal funds for eligible airport projects are provided primarily through the FAA-administered Airport Improvement Program (AIP) as described in **Appendix F – FAA Grant Program/Airport Improvement Program (AIP)**, and funded from the Airport and Airways Trust Fund. AIP provides entitlement funds to airports with at least 10,000 enplanements, in addition to discretionary grants through competitive processes.

AIP funding typically must be requested annually. Multi-year discretionary grants are possible through the AIP Letter-of-Intent (LOI) program for capacity enhancing projects. A detailed benefit-cost analysis (BCA) is required prior to an LOI if discretionary funding exceeds $10 million. Therefore, cash flow and compliance with an FAA-approved schedule are important. There are other "strings attached" to federal grant monies in the implementation of projects, all identified as guidelines in the FAA Advisory Circulars, such as competitive pricing of construction services, compliance with the Davis-Bacon Act, and good faith efforts to include disadvantaged business enterprises.

Furthermore, AIP funds can only be used on eligible projects, generally defined as projects required for compliance with mandatory federal regulations and that directly benefit the flying public, and that generally will not generate revenue (e.g., airfield improvements). Non-hub and smaller airports, however, can use limited AIP funds for some terminal projects.

AIP grants are not required to follow Federal Acquisition Regulations (FARs) for accounting. However, some recent Memorandums of Understanding from the TSA for security upgrades have been somewhat unclear on the regulatory expectations relative to accounting. If FAR compliance is required, it means a significant amount of documentation is required by the owners and their consultants. Therefore the selection of the proper project delivery system, and the selection of firms that an airport can rely on to meet the procedural requirements, are important.

There are rules associated with government audited overhead rates, fee allowances, etc. Thus, "FAR-compliant" projects should use delivery systems that lend themselves best to government audit and government accounting procedures, such as security work with security contractors. The delivery system might be best determined based on simplicity, rather than complexity due to the serious consequences of non-compliance.

Recognizing that the airport owner is ultimately responsible for compliance with all associated grant regulations, owners must ensure that all expectations are clearly written into the project delivery contract, particularly when a Design-Build or CM at-Risk project delivery system is employed. The owner should identify appropriate checks and balances since most of the "compliance control" is transferred to the builder during construction.

B. State Funding

To supplement federal funding, some states offer grant assistance for capital improvement projects through various programs. The state programs vary greatly; many are limited primarily to providing matching funds for federal grants or for maintenance projects. Others, such as Florida, distribute significant grants to state airports for projects that may or may not have a federal component. In addition, states may have funds that are not dedicated to a particular transportation mode, but for which certain airport projects are eligible.

Similar to the obligations under a federally funded project, state assistance can also add another layer of compliance such as the following: pre-approval of project expenditures, competitive pricing of construction services, auditing and monitoring rules, required project record retention, involvement by the state in the airport's selection process of professional consultant services, compliance with the Equal Employment Opportunity Act, Davis-Bacon Act, the Civil Rights Act, American with Disabilities Act and related laws.

For example, the sponsor may experience limitations such as not being allowed to execute any contract or to obligate itself in any manner requiring disbursement of the state's funds without

the agency's prior approval. These assurances could apply to third-party agreements such as consultant, construction or purchase of commodities contracts or amendments thereto. Failure to comply with these requirements could jeopardize the state's intended payment to the airport. Some states for example, reserve their right to review the qualifications of any consultant or builder and to approve or disapprove the employment of the same.

Grant acceptance agreements for state funded programs, similar to those providing federal assistance, recognize the airport owner as the entity to be ultimately responsible for all compliance associated with its grants. This burden positions the owner to incorporate all such requirements within the respective contracts to protect eligibility and reimbursement of project costs.

C. Passenger Facility Charges (PFCs)

First approved through federal legislation in 1990, Passenger Facility Charges (PFCs) can only be used for eligible projects, similar to AIP-eligible projects, but include expanded eligibility for certain terminal areas (dependent on the size of the airport). PFCs are locally generated on a per-enplanement basis, and therefore are not part of the competitive process or subject to federal budget authorization. However, the collection and use of PFCs must be approved by the FAA via an application process that includes air carrier comments and, at larger airports, a competition plan to ensure access to the airport. Nearly all larger commercial airports collect PFCs (99 of the top 100), and in total more than $2.7 billion was collected in 2010. PFC funds can be used to finance eligible airport-related projects and, unlike AIP funds, can be used to make payments for debt service.

PFCs can be $1.00, $2.00, $3.00, $4.00 or $4.50 per enplaned passenger, with a maximum total charge of $12.00 per round-trip itinerary. However, large and medium hub airports charging more than a $3.00 PFC are required to forego up to 75% of their AIP entitlement funds (up to 50% for PFC levels up to $3.00). In addition, PFCs of $4.00 or $4.50 at large and medium hubs may only be used for projects that improve air safety and security, increase airline competition, reduce congestion or reduce noise impacts.

The financial markets have accepted PFCs as a reliable revenue source, and bonds backed only with PFC revenue are now common, particularly at larger airports. At smaller airports, where passenger levels may be inconsistent, PFCs are often pledged for debt in conjunction with other revenue streams to back debt issuances. PFCs are such an important part of airport funding, that some large airports favor forgoing AIP support in return for removing the $4.50 maximum cap on PFCs. Having large passenger charges and little federal funding is similar to the approach Canada has taken to funding airports.

D. Airport Cash Flows for Project Finance

Where federal and state grants are insufficient to pay for a project, or the airport chooses to maximize control over the project, local airport revenue streams can be utilized. The primary sources of local revenue include the following:

- Airline rates and charges (landing fees, terminal rents, apron and jetway charges, etc.)
- Terminal revenues (retail and food/beverage concessions, advertising, etc.)
- Auto parking and ground transportation fees
- Car rental car fees (concession fees, customer facility charges)
- General aviation fees (hangar and FBO rentals, fuel flowage charges, etc.)
- Land leases for aviation and off-airport uses
- Aircraft fuel throughput fees
- Other income

These funds can be used on a pay-as-you-go basis or pledged as debt repayment for airport borrowing. Effective financial project management requires internal controls, accuracy, use of quality consulting firms, consistently meeting commitments and complying with reporting requirements.

Airports that have significant cash reserves or have steady revenue streams are in the best position to select the funding program most appropriate for their project. The greatest risk when funding a project through airport revenues is the volatility of airlines, airline operations and lease agreements. Although airports have drafted very short-term leases and developed shared-use facilities to maximize flexibility in dealing with the airlines, the downside to flexibility is volatility. When a multi-year program requires significant funding, and the funding needs to be in place as the work proceeds, volatility can be a challenge. Therefore, although funding projects with annual airport revenue may not affect a project delivery system, it may affect the type of project that it funds. For instance, smaller projects of shorter durations might lend themselves best to pay-as-you-go funding.

E. Debt Financing/Airport Revenue Bonds

Airports may leverage available cash flow streams through debt instruments to help pay for projects upfront. While many debt instruments are available, as discussed below, the airport should first consider whether the project is best financed on a stand-alone (non-recourse) basis or as part of a general obligation of the airport or the municipality owning the airport. The distinction is as follows:

1) *Non-Recourse Debt:* In this case, selected revenue streams are identified (e.g., PFCs, CFCs, lease revenues, etc.) and no other funds will be used even in the event of default. A common example is the use of rental car customer CFC revenue to back debt for a

consolidated rental car facility. Other examples include special facilities, such as maintenance hangars, that can make use of their dedicated lease revenues.

2) *General Airport Revenue Bonds (GARBs) and General Obligation (GO) Bonds:* As the name implies, GARBs pledge revenue from all available airport sources. This gives the purchaser of the debt greater certainty of repayment, reducing borrowing costs, particularly since the bond covenants typically require increases in rates and charges if debt service coverage ratios are not met. However, such debt will be considered in the airport's credit rating, and typically impacts air carrier rates and charges. Further, the airport is typically obligated to increase revenue and/or cut expenses to repay the debt if necessary. GARBs are often appropriate when obtaining a strong credit rating that otherwise would be difficult, where projects cut across many airport cost centers, and in cases where the project does not produce revenue, such as safety enhancements. Particularly at smaller airports, GARBs may include a secondary pledge from other sources, such as the municipality that owns the airport (a so-called "double-barrel" bond). General Obligation Bonds may be issued by the city, county or other public owner of the airport pledging tax revenue as a backup to pledged airport funds.

Once the pledged revenue for airport bonds is determined, a wide variety of financing arrangements may be available, including:

- Fixed rate bonds
- Variable rate bonds
- Grant anticipation notes, particularly to advance funds from a letter-of-intent for multi-year financed projects
- Commercial paper and other short-term financing
- Bank loans directly with a lending institution
- Other bond programs. The federal government may allow airports to use vehicles such as tax credit bonds (where the holder gets a credit on federal taxes rather than interest from the issuer), Build America Bonds (if reauthorized) and others.

ACRP Synthesis 1, "Innovative Finance and Alternative Sources of Revenue for Airports"[7] provides details on these and other financing alternatives. The report can be viewed online at http://onlinepubs.trb.org/onlinepubs/acrp/acrp_syn_001.pdf.

The selection of the appropriate financing mechanism depends on the airport's financial position, strategic goals, and selected project delivery system. In addition to achieving the lowest cost of financing a project, the airport will want to consider the impact on its ability to fund future projects, its tolerance for risk, and the concerns of airport stakeholders. The following criteria should be considered in selecting the appropriate plan of finance:

1) *Project Type:* Facilities that are revenue-producing, particularly where one or more tenants will hold exclusive rights, lend themselves to non-recourse financing. Examples

include parking garages, cargo and maintenance facilities, and non-aviation development such as industrial parks or hotels. On the other hand, facilities that have general use or those that do not directly produce revenue are more appropriate for GARB funding.

2) *Project Size:* Due to the higher transaction costs of innovative financing approaches, such solutions are generally appropriate only for debt issuances of at least $50 million, and preferably $100 million and over.

3) *Project Risk Profile:* Non-recourse financing requires greater cost certainty due to fixed funding pools available for debt repayment. Guaranteed maximum price contracts are, therefore, ideal, but are usually available only for lower risk projects. Projects with greater uncertainty, such as those that require major geotechnical work or redevelopment of existing complex facilities are more difficult to finance on a non-recourse basis.

4) *Access to Capital Markets:* Smaller airports, in particular, often are unable to obtain investment-grade credit ratings, and therefore lack access to capital markets. Here, a "double-barrel" bond backed by a higher-rated entity (typically the municipality or county owning the airport) may be needed to issue debt. Furthermore, the recent financial crisis has limited the access of smaller airports to capital markets:
   - Lack of bond insurance: Prior to the financial crisis, municipal debt was typically enhanced through the purchase of insurance from a bond insurer. The bonds took on the rating of the insurer, rather than the airport, making them easier to sell. The collapse of the bond insurance market means that credit support is generally no longer available.
   - Enforceability of lease agreements: The days of long-term, ironclad airline agreements have long since passed. During bankruptcy events, airlines can and have, abandoned airports and special facilities for which they had leases. This leaves the airport to renegotiate the agreement, or in a worst case, pay the debt itself.
   - Traffic risk: Airline consolidation has put some connecting hub airports and smaller airports at risk of reductions in air service. Rating agencies typically will not assign an investment grade rating to non-hub or smaller hub airports.

5) *Cost of Capital:* Keeping financing costs as low as possible maintains flexibility if the project changes and maintains funds to complete future projects. A myriad of potential debt structures may be available depending upon the characteristics of the airport and the project; selecting the appropriate structure will be a joint effort of the airport staff, financial advisor and underwriter. Some issues to consider in reducing cost of capital include the following:
   - Short-term versus long-term financing: In general, the length of financing should be tied to the useful life of the asset.

- Fixed versus variable rate debt: Prior to the recent financial crisis, many airports held variable rate debt (such as variable rate demand notes or VRDNs) in order to minimize interest costs and increase flexibility (since long-term fixed rate bonds have restrictions on refinancing and variable rate instruments, such as commercial paper, allow the airport to coordinate financing needs with the exigencies of the construction program). Sophisticated instruments such as credit swaps were not uncommon. The collapse of the financial markets spurred VRDBs to be called and/or interest rates to be increased overnight. Variable rate debt still has a place in financing airport projects, but is more commonly used for construction financing through commercial paper or bond anticipation notes, than as a long-term financing source.

F. Innovative Financing

As traditional financing has become more difficult or expensive due to the issues discussed above, public infrastructure project sponsors have turned to innovative mechanisms to finance projects, such as:

- Subsidized loan programs: Many states have developed State Infrastructure Banks (SIBs) to fund capital projects. While SIBs are typically used to fund surface transportation, airports are also eligible in many states. For example, the new Northwest Florida Beaches International Airport in Panama City, FL, utilized $45 million in Florida SIB loan funds for construction of a new airport.
- If there are intermodal aspects to the construction project, funds targeted for surface transportation may be utilized. One example is the use of the Transportation Infrastructure Finance and Innovation Act (TIFIA) loan program, a subsidized, subordinate program that has funded airport/rail connection projects in Miami, FL, and Providence, RI. Another example is the use of federal bridge funds for a pedestrian walkway connecting the Warwick consolidated intermodal center to T.F. Green Airport in Providence, RI.
- There is much discussion at the federal level currently about the creation of a National Infrastructure Bank or similar facility to provide loans/credit for critical infrastructure. Whether housed in the executive branch (e.g., U.S. DOT) or as a stand-alone entity, airports may be able to avail themselves of a new source of financing.

Private funding is another potential innovative solution. Refer to Chapter VI, Emerging Trends, Section C of this paper for a discussion on privatization and public-private partnership financing.

G. Linking Financing to Project Delivery

Selecting the appropriate funding source and financing mechanism for a project involves consideration of the many factors discussed above. Matching a flexible project delivery system to a flexible funding source will lead to the greatest efficiency. For example, contracting laws

may make using grant funds more difficult for a Design-Build or CM@R project; therefore, leveraging airport cash flows may be a more appropriate option. Similarly, local airport funds limit outside influence where the airport wishes to have the greatest control over the project from a design and construction standpoint. On the other hand, for projects that have a high degree of regulation, such as airfield projects, grant funds will not add significantly to the administrative burden.

Availability payments are an option to transfer construction and maintenance risk to a private developer without transferring control of cash flow to the private party. Under this arrangement, a private developer constructs and maintains the asset for a fixed time period and receives milestone payments from the airport sponsor, so long as the asset is open and meeting performance goals.

Common in the highway industry, availability payments can incentivize high-quality construction and maintenance, shortening development timeframes without many of the complications of private ownership. Because the contracts are performance based, availability payment concepts naturally combine with the more flexible project delivery mechanisms, such as Design-Build.

VI. Emerging Trends

The following emerging trends represent phases, tools, processes and motivations that impact project delivery, but are not project delivery systems as defined in this white paper. The common thread that weaves most of these emerging trends together is the willingness and necessity of collaboration of the team. Times have changed; funding sources, design considerations and legislation have necessitated change in how projects are delivered. For the purpose of this white paper, we have divided the emerging trends topics into two broad categories, A) Alternative Contracting Methods, B) Technologies and Processes to Assist in Project Delivery and C) Privatization and Public-Private Partnerships (PPPs or P3s).

A. Alternative Contracting Methods

Task Order Contracting and Indefinite Delivery/Indefinite Quantity (IDIQ)

Although not meeting the standard definition of a project delivery system, many owners reach out to designers and builders to provide services on a task order basis. While the designer or builder may be selected to provide services for a period of time and for a range of services under a master or framework agreement, each specific task is authorized separately.

In many procurement systems, these are sometimes referred to as Indefinite Delivery/Indefinite Quantity contracts (IDIQ) and other similar contracting instruments. Under the most common approach to this type of contracting, the owner would procure services for an annual need such as paving or floor finishing (there could be many areas adaptable to this form of contracting). The owner would estimate a ceiling amount and most frequently a maximum amount per order. The contract is also procured on the basis of criteria such as standard fees or unit rates and provides the standard contract clauses. When a builder is needed for a relatively small job within the category, the builder and owner will negotiate by applying the agreed upon fee against the scope of the specific project.

Under FAA rules, task order contracting is permitted if the sponsor follows FAA competitive selection procedures and no further competition is necessary if the task order contract is completed within the same year. If a sponsor wishes to use this tool beyond a 12-month period, FAA Region and District Offices (ADOs) should advise sponsors that such action would require agreement with the FAA in order for the cost to be found allowable. The most important factor is a determination that there is no necessity to redraft the agreement due to similar economic conditions, stability of wages and fringe benefits under Davis-Bacon determination and similar cost areas.

A typical example of an IDIQ contract is for a base year with four individual option years (each of which must be approved and executed by both the owner and the builder), with a guaranteed minimum of $25,000 per year and a contractual maximum of $5 million. The builder is not required to accept any delivery order less than $5,000, and there is a maximum value of $1 million per delivery order. IDIQ contracts have proven useful in providing airports

with on-call contractors who understand the complexities of working in their facilities environment.

Many of these contract structures include relationship, responsibility, selection and pricing approaches analogous to the project delivery systems outlined for larger projects. Some IDIQ approaches are distinguished more as a procurement method than as a separate project delivery system. But some of them entail a distinct project development process that could be considered its own project delivery system.

- **T&M:** The simplest form of an IDIQ contract is a Time and Materials (T & M) contract. It is based on burdened labor rates for a variety of construction and facilities trades, and a contractual markup on actual material costs.
- **MACC/MATOC:** Another common contract structure is often called a Multiple Award Construction Contract (MACC) or a Multiple Award Task Order Contract (MATOC). This type of contract establishes a pre-qualified pool of builders to bid on projects throughout the term of the contract.
- **Job Order Contract (JOC):** Another IDIQ contract structure is a Job Order Contract (JOC). JOC traditionally relies on unit prices, though some JOCs are appearing with alternative pricing structures. A JOC is typically based on a Unit Price Book (UPB) which establishes pricing for tens of thousands of construction tasks. The unit prices are all-inclusive, capturing not only labor and materials but general conditions, overhead and profit, as well as incidental costs such as bonds and permits.

Selection of an IDIQ builder can be based on low bid, best value or Qualifications Based Selection (QBS). Since the contracts result in a multi-year relationship, some consideration of qualifications is often preferred. In selecting an IDIQ contract structure, an airport must consider the procurement requirements of all funding entities to ensure maximum flexibility. MATOCs, MACCs and JOCs are all compliant with Federal Acquisition regulations, but it is important to understand state and local procurement requirements as well. Many states have provisions for indefinite quantity construction contracts that will govern contract structure.

B. Technologies and Processes to Assist in Project Delivery

Building Information Modeling (BIM)

BIM is not a project delivery system, but a tool that helps all forms of project delivery systems to be executed in a more efficient manner with benefits to the designer, builder and owner. It is a tool that enhances collaboration among designers and builders, and allows owners to have a clear vision of where a project is heading.

BIM is a design product that emphasizes the importance of gathering life-cycle information from the start of conceptual design of a project through its construction and potentially into its operation and maintenance. The BIM technology is also a tool to be used by project teams to

enhance communication, improve collaboration, streamline decision-making and manage deliverables.

The use of BIM is the trend for all types of design and construction project delivery systems, but has become a key component of most Design-Build projects, as well as a critical feature of successful IPD projects.

Lean

Lean is an approach to construction, not an acronym or a specific tool for construction. Lean has been developed to restructure the architecture/engineering/ construction relationship to find best practices and creative thinking to 'minimize waste' in the delivery process. Overall project performance is measured, rather than any specific element (cost, speed, etc.). Ultimately, the lean process means working as a unit to optimize efficiency and change behaviors to cut costs and time, while maintaining quality and performance.

Last Planner®

The Last Planner System® was conceived by Glenn Ballard and Gregory Howell, and then developed by the Lean Construction Institute, which holds the trademark. The origins are based on learned behaviors by the prime and subcontractors. Prime (general) contractors may be concerned that subcontractors will start later than promised, and subcontractors may delay mobilization based on concerns that the site will not be ready when promised. The result is padded schedules and inefficiencies.

The Last Planner System® was developed as a systematic, *inclusionary* approach to establish a work flow. From trade foremen to design captains, the responsible individuals collectively establish the schedule and work flow – then commit to the resultant plan. The Last Planner System® mandates that every participant has a voice, with the responsibility to speak- up, make and deliver on promises, and say "no" when required.

The Lean and Last Planner System® summaries above are taken directly from the paper, "Managing Integrated Project Delivery", by the Construction Management Association of America (CMAA)[8] and is available at www.cmaanet.org. Please refer to CMAA, the Lean Construction Institute, or AGC for further discussion.

Sustainability

Clearly, there has also been a focus on sustainability in aviation and airports as there has been across all industries. Relative to project delivery, the impact is that to meet the goals of sustainability, the team must come together in the most collaborative ways. So in this context, sustainability is not 'being green', but a requirement to work together - owner/designer/builder - in ways not previously experienced.

For example, most new airport terminal projects require that a certain level of environmental quality be built into the project, most often measured by a LEED® Rating standard set by the

Green Building Certification Institute. To achieve the goal, the design team must first set the environmental standards and approach which has to be implemented by the builder and then operated by the owner to LEED® standards. While this process can be achieved using any project delivery system, the system that reinforces collaboration is the most likely to achieve sustainability goals.

Since the 1st Edition of this paper was written, project delivery systems have been refined and developed. They are now better understood with more developed legal/contract language. Many owners, designers and builders now have real project experience (both good and bad) with the implementation of these alternative systems.

The clearest emerging trend in project delivery, perhaps best captured in the principles of IPD, is that collaboration is key to a successful project - no matter how it is delivered.

C. Privatization and Public-Private Partnerships (PPPs or P3s)

> *"Private sector participation in airports…can take many forms, including outright sale of assets; management contracts; public-private partnership (P3) agreements; long-term leases; design-build-finance-operate; and other private finance initiatives."*
>
> - from the abstract "Considering and Evaluating Airport Privatization," *Transportation Research Board ACRP 01-14 (Active)*

When thinking of privatization, many people jump to the sale or long-term lease of assets. However, privatization can also include many activities airports regularly undertake, such as the management of services (e.g., janitorial, parking operations or concessions) or construction of individual assets (e.g., hangars or parking garages). These smaller public-private partnerships are easier to implement than full privatization and can offer many of the same benefits.

Below are definitions of terms and information on related financing, but greater depth on the topic can be found in publications dedicated to the subject. Many such studies are available as consultant reports or for purchase. Some recommended source material includes the following:

- Airport Privatization Pilot Program: Application Procedures, Federal Aviation Administration, Docket No. 28895, available online at http://www.faa.gov/airports/resources/publications/federal_register_notices/media/obligation_private97.pdf
- Airport Cooperative Research Program 01-14, due out in Spring 2012
- ACRP Legal Research Digest 7, *Airport Governance and Ownership*, August 2009
- *Annual Privatization Report 2010: Air Transportation,* Reason Foundation annual report

- The National Council for Public Private Partnerships has consultant presentations and reports on airport privatization available on its website, ncppp.org
- Reports for Purchase include
  - *World Airport Privatisation 2008 And Beyond*, David J Bentley, Big Pond Aviation
  - Airport Privatisation, Frost & Sullivan, April 25, 2006

Privatization

The FAA since 1997 has had a pilot program to approve a limited number of airport privatizations. To date, this program has met with only limited success due in part to the complexity of the federal program, the concern by airport owners of 'losing control', and the challenges of large organizations accepting and implementing change. In the context of this paper, it is important to note that privatization is not a project delivery system. It is a change in management. Delivery methods, financing options and contracting options are available to a private owner, as defined in the FAA program, http://www.faa.gov/airports/airport compliance/privatization/.

The privatization of entire airports, while common overseas, has had limited success in the U.S. The long-term lease at Stewart/Newburgh Airport, the only airport to successfully navigate the FAA's Pilot Privatization Program, was sold back in 2007 to a public entity, the Port Authority of New York and New Jersey. The only U.S. privately developed commercial service airport, Branson Airport, has not proven to be a financial success to date, with its owner reporting annual losses and negotiating with bondholders to avoid the institution of remedies.

Many benefits of privatization of specific services can be achieved through operating agreements for terminals or other assets. Examples include Indianapolis and Harrisburg, which had been managed by the British Airport Authority (BAA) before reverting to public operation. Agreements to run concessions operations, parking, maintenance and custodial services are also common and confer some benefits of private involvement. As turbulence continues to surround the Transportation Security Administration (TSA) for its role in keeping the traveling public safe, consideration is being given to expanding the use of private security companies for passenger and baggage screening beyond San Francisco and Kansas City.

Public-Private Partnerships (PPPs or P3s)

If privatization means selling airport assets to third-party caretakers, then Public-Private Partnerships (PPPs or P3s) are sharing ownership and operational responsibilities with third party (private) entities. Examples include the following:

- Indianapolis International Airport has used a private third party for operational oversight of its old airport
- John F. Kennedy Airport has created opportunities for carriers to enter into PPPs with the Port Authority of New York and New Jersey
- Many airports depend on third parties for maintenance services like fueling and general aviation

These 'deals' are outside of the FAA Pilot Program and are typically created to meet some specific need (with associated ability) to find creative cash flow and revenue opportunities for the airports.

PPP Financing

There has been increasing discussion recently of PPP or P3 financing for airport projects as a response to the tightening of availability of financial resources for airports, airlines, and at all levels of government. Private developer funds have been used at some U.S. airports for major capital programs, though the most frequent use of developer-led projects are for ancillary facilities where design aesthetics and owner control is non-critical. Since PPPs/P3s transfer partial risk and control to an outside entity, it generally makes sense to have a project delivery system that does the same, such as Design-Build if managed by a PPP.

While in the right situation PPPs/P3s can be a powerful tool to advance projects in time or develop projects with uncertain risk profiles, PPPs/P3s are not a silver bullet to solve financing problems. In particular, PPPs/P3s must make sense for the private investor; including having a reasonable rate of return that recognizes the risks of investment.

The most successful PPPs/P3s for airports are likely to be for the development of exclusive facilities such as cargo and maintenance facilities, or facilities that have their own profit/loss statement (PNL), such as parking and deicing facilities. For example, Denver International Airport has used a P3 to develop a deicing facility that accesses revenue from the recovery of glycols.

Airlines may be willing to directly invest in terminal assets at key hub airports. While major terminals, such as JFK Terminal 4 have been developed with private funding, smaller examples are also available. For example, Allegiant Airlines provided funding for a $1 million terminal expansion at its focus city of Phoenix-Mesa Gateway Airport. The loan is repaid at a rate of $1 per enplaned passenger. However, direct airline funding is complicated by the current economic conditions, which include limited available capital for most airlines.

VII. Conclusion

The use of Alternative Project Delivery Systems for performance of the broad range of airside, landside and building projects at airports is rapidly expanding. Airport owners are increasingly looking for alternative ways to deliver projects in a more cost-effective and risk mitigated manner. As the number of projects successfully delivered using alternative project delivery systems grows, the pace of the transition to these solutions will also grow.

It is imperative that the collective teams of the consultants, contractors and owners fully understand the opportunities and challenges associated with choosing and using any alternative project delivery system. Identification of the specific requirements of a project is generally defined in terms of the principle scope, budget and schedule factors of the work. Other factors, such as the number of parties involved in and the ultimate control over timely decision making, the point at which key parameters of the project will be fixed and the level of external influences on a project, must be completely examined in the context of the chosen system. While the success of any project requires consideration of these factors, selection of a delivery system that reduces the project schedule makes these factors even more critical.

The information contained in this document is intended to offer a valuable composite of knowledge on the definition, evaluation, selection and use of alternative project delivery systems. Given that every project represents a unique set of conditions, care must be taken to perform that level of detailed analysis needed to thoroughly vet the delivery options and requirements prior to proceeding with project implementation.

Thank you for taking the time to read this document. It is the result of many hours of dedicated work from the authors of and contributors to this publication. We all wish you the very best success with the performance of your projects.

Appendices

Appendix A – Industry Studies Comparing Project Delivery Systems

In the 1990s and early 2000s, usage of alternative project delivery systems had been increasing. Industry professionals and researchers began to report on the success of alternative project delivery systems relative to traditional Design-Bid-Build.

A survey was performed to identify industry performance data available in existing studies, reports, assessments and similar evaluations by industry groups, universities, and business and industry professionals. A number of good references were identified that present the results of studies comparing the performance of various project delivery systems. While these references are now somewhat dated, they do provide a baseline for comparison to more recent industry findings presented later in this appendix.

For example, the University of Colorado published the results of a study in 1997[9] that found:

> *…owner's most frequently select Design-Build to shorten schedule duration. Owners expect that the single point of responsibility and the ability to fast-track design and construction inherent in the Design-Build process will shorten the delivery process.*

Also in 1997, at the Design-Build Institute of America's annual conference, the Construction Industry Institute presented findings from a national study (Research Summary 133 -- 1)[10] which evaluated three project delivery systems – DBB, DB, and CM@R. The findings of that study are summarized in Figures A-1 to A-3 which found DB to have the lowest cost and schedule growth and the shortest schedule duration followed by CM@R and lastly followed by DBB.

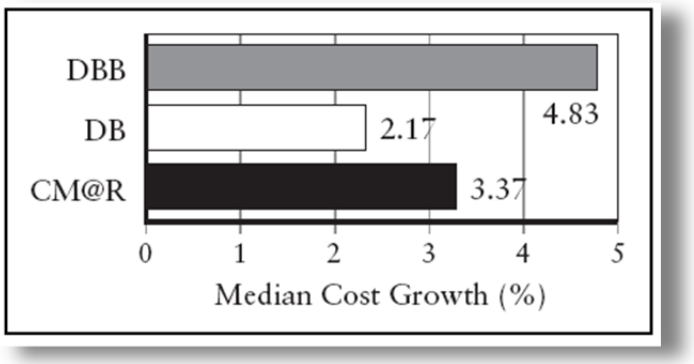


Figure A-1: Design and Construction Cost Growth

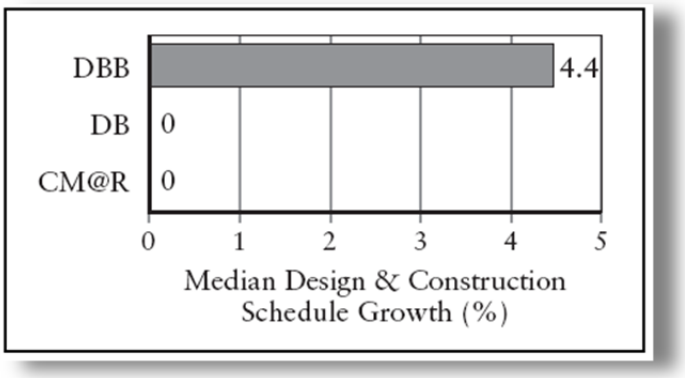


Figure A-2: Design and Construction Schedule Growth

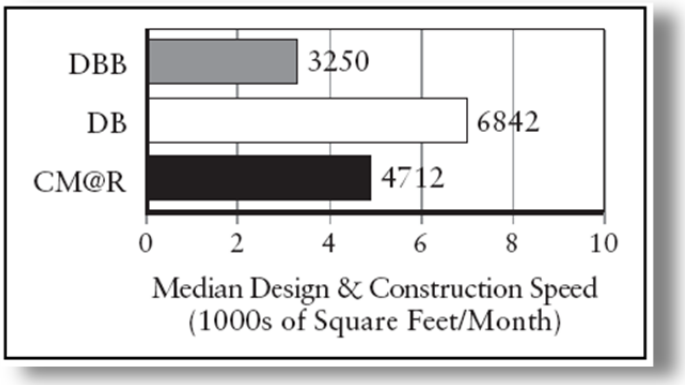


Figure A-3: Design and Construction Speed

In November 2002, the National Institute of Standards and Technology[11] compared DB and DBB by measuring the impacts of the delivery system on project performance. In performing the study the researchers solicited opinions from both owners and builders. While the results are generally consistent between the two, some disparity was identified indicating a difference in perspective between owners and builders as to which project delivery system outperformed the other.

The findings in Table A-1 indicate the use of the DB project delivery system tended to outperform DBB in the opinion of owners, exhibiting better performance in terms of cost, schedule, changes and rework. The results were not as clear-cut for builder-submitted evaluations where DBB projects outperformed DB projects in schedule, although DB projects had better performance in changes and rework.

	Cost		Schedule		Safety	
	Owner	Contractor	Owner	Contractor	Owner	Contractor
Overall	DB[1]	--	**DB**	**DBB**	--	--

	Changes		Rework		Practice Use	
	Owner	Contractor	Owner	Contractor	Owner	Contractor
Overall	**DB**	**DB**	**DB**	DB[1]	**DB**	DB[1]

[1] Observed difference, not statistically significant
-- No difference in performance
Bold indicates significant difference, $p \leq 0.05$

Table A-1: Summary of Overall Performance and Practice Use Outcomes

The details of the study also are quite interesting in highlighting deviations from the above summary level findings based on the specifics of the project type, size and complexity and whether the project is grass-roots or renovation/modernization.

Among the most comprehensive and informative assessment is a study published in April 2002 by the State of Illinois[12]. The study evaluated single prime versus multiple prime and Design-Build versus Design-Bid-Build, compared the project outcomes and opinions of various agencies, owners and builders, and further surveyed the practices and opinions of half of the 50 U.S. states and several major cities. The particulars of the survey responses are most informative in highlighting the perceived relative advantages and disadvantages of the project delivery systems studied. Again, a difference in perspective was noted between builders and owners and particularly between general contractors and specialty contractors.

In comparing a single-prime versus multiple-prime contract management approach, the study found that the multiple-prime project approach cost 10% more than single prime, and that the multiple prime approach results in higher bid costs, increased administration, more change orders and poorly coordinated work. It was noted that single-prime general contractors are skilled and experienced in coordinating the various subcontractors and suppliers, and further provide a single point of contact for responsibility to the owner. The use of the single-prime project delivery system can be expected to decrease design cost, change order cost and litigation cost with no significant increase in construction cost. The study reported the results of a survey wherein 26 of 32 states contacted responded they primarily used the single-prime project delivery system and only five used multiple-prime.

As shown in Figure A-4 below, the Illinois study reported the findings of other studies that preferences and opinions regarding single- vs. multiple-prime seem to be driven largely by the particular interest of the party, i.e. general contractor, specialty contractor or owner. For example, New York City reported that single-prime is less expensive, while the Illinois Mechanical and Specialty Contractors Association concluded that multiple-prime is less expensive.

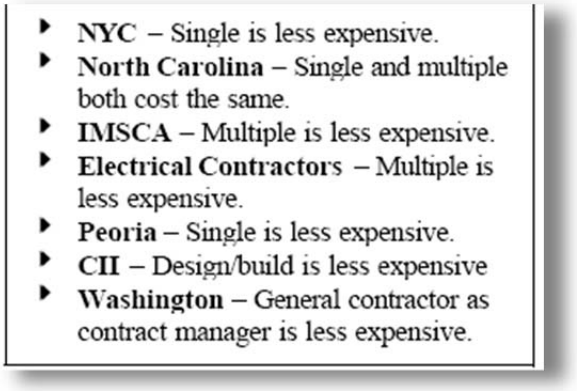


Figure A-4: Overall Conclusions

The study also compared DB versus DBB reporting that more than 80% of the states that responded to the survey had used DB although such use was often reserved for uncomplicated projects or projects that needed to be completed quickly. Federal government agencies such as the U.S. General Services Administration (GSA) use DB for approximately 10% of their projects.

The DB approach was found to require early and clear definition of project scope and functionality requirements by the owner because later changes were deemed more expensive than for DBB. This was viewed as a disadvantage by owners who anticipate requiring design changes late in the project. It was generally reported by most of the states using DB that project delivery was quicker and required fewer owner resources to manage. The reporting states also noted their reduced ability to provide owner input and control, so clearly there are trade-offs.

These early studies just discussed provide a baseline for comparison to more recent industry findings. As seen in the following reports, those early findings are confirmed in the reports below.

In a 2007 presentation by Wylie Bearup, then City Engineer for the City of Phoenix, given at the 2nd Annual ACI/ACC/AGC Airport Project Delivery Systems Summit[13], an analysis of 59 projects completed by the City of Phoenix between 2000 and 2006 compared the relative performance of DBB, CM@R and DB. That study showed that in terms of cost and schedule performance, DB outperformed CM@R which in turn outperformed DBB, as illustrated in the following Figure A-5 charts.

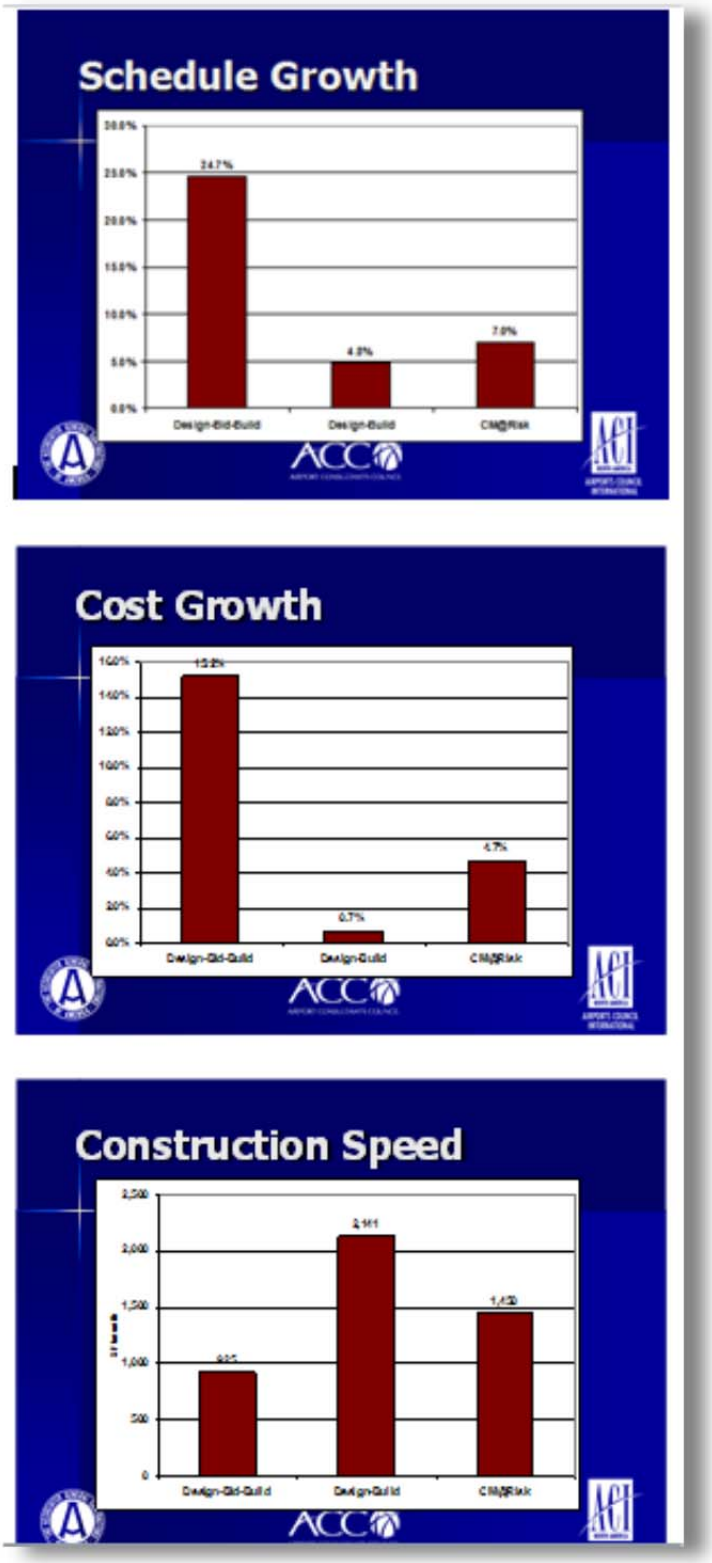

Schedule Growth
24.7%
4.3%
7.0%
Design-Bid-Build
Design-Build
CM@Risk
ACCO
Cost Growth
15.2%
0.7%
4.7%
Design-Bid-Build
Design-Build
CM@Risk
ACCO
Construction Speed
2,111
1,430
Design-Bid-Build
Design-Build
CM@Risk
ACCO

Figure A-5

The City's overall conclusions were that better performance and better quality were obtained when using alternative project delivery systems, primarily through the ability to select the best qualified builder rather than the lowest bid. When considering such conclusions it should be noted that these results are driven more directly by the procurement method than the project delivery system chosen. It is often the case, however, that the ability to select a PDS using a procurement method that considers qualifications is necessarily tied to the statutory ability to use an alternative project delivery system.

In a paper published in the March 2010 Journal of Construction Engineering and Management (JCEM)[14], the authors compare traditional DBB under various types of contract methods and DB with very interesting results. Their findings shown in Table A-2 below report that a typical low bid DBB project compares poorly with DB in terms of cost growth, but is similar for schedule growth. Significantly, certain DBB projects using a cost-plus contracting approach actually outperformed DB in both cost and schedule growth reinforcing the position of this paper that all project delivery systems can be used successfully.

Procurement Method	Cost Growth (%)	Schedule Growth (%)
Traditional lump sum	13.9	11.3
Traditional lump sum (incentive)	12.1	10.7
Traditional cost-plus fee contracts	4.7	7.7
Traditional cost-plus fixed fee contracts	15.0	12.5
Traditional cost reimbursement	5.7	15.4
Traditional with provisional BOQ	8.7	8.2
Design and build (GMP)	7.4	11.3

Table A-2: Cost and Schedule Growth for Procurement Method Type

In terms of project quality, as measured by the cost of rework, the study reported little difference in quality between a typical low bid DBB project and a DB project, and both were outperformed by DBB projects using a cost plus contracting approach.

Another JCEM study published a year earlier in July 2009[15] examined cost growth for DBB and DB projects and found cost growth averages of 6.6% for DBB and 3.1% for DB. The average number of changes was 25 and 14, respectively. This result is in general agreement with the other studies referenced herein that low bid DBB tends to incur more cost growth than DB. The JCEM study, however, also references a U.S. DOT 2006 Design Build Effectiveness Study citing cost growth for DB projects of 6% as compared to 4.3% for DBB. Based on these recent studies, either project delivery system can succeed.

In the same issue of the JCEM, another study[16] compared DB and DBB project delivery systems for building projects only finding that DB projects take less overall time and have less schedule

and less cost growth. Overall cost was similar, but cost growth was two times greater for DBB. Overall duration was two times greater for DBB and schedule growth also was two times greater for DBB. This and other studies demonstrate the importance of being clear as to whether the comparison is between project duration and growth in the planned project duration (planned versus actual), and whether overall cost or cost growth are being compared.

Owner perceptions of value and benefit from the use of alternative project delivery systems and the ability to consider builder capability and experience in the selection process are also supported in a 2009 report by the Massachusetts Office of the Inspector General[17] evaluating the state's experience with CM@R projects. The study showed that public owners are satisfied with CM@R, reporting that the quality of design and budget estimates improved, schedules were shortened, the number of experienced builders competing for the work increased and projects benefited as a result of the preconstruction services phase of using CM@R.

The Massachusetts' study also presented the interesting observation that most of the owners deferred the negotiation of the final GMP price until design was 100% complete and much of the subcontract work was contracted, thereby negating the benefit of construction cost risk transfer normally gained in the CM@R approach. The authors concluded that the owners put greater priority on reducing the risk contingency cost in the GMP and in return were willing to assume the risk of higher construction cost.

As part of a survey of public and private owners, the Annual FMI/CMAA Survey of Owners often includes alternative project delivery systems, contracting and procurement methods in its queries. The 2010 FMI/CMAA 11th Annual Survey[18] included several interesting observations. In terms of frequency of use of alternative project delivery systems, "Fifty-five percent of owners indicated that they use Design-Bid-Build as the predominant project delivery system, which is highly consistent with the 2007 results for the same question." As compared to earlier surveys, it shows that use of alternative project delivery systems has increased significantly since the early 2000s, primarily as the result of legislative changes allowing their use on public projects.

Similar results are reported by a survey presented in a JCEM paper titled "Owners Respond: Preferences for Task Performance, Delivery Systems, and Quality Management"[19]. Those findings showed 65% of the owners used DBB most of the time, 18% mostly used CM@R and 16% mostly used DB.

The FMI/CMAA surveys do note a slight reduction in the use of DB consistent with an increase in the use of priced bids, all believed to be the result of increased price pressure in our current economic conditions. It appears that owners believe they get better pricing from the traditional DBB low bid approach. This result, however, does not necessarily mean that owners do not perceive value in alternative project delivery systems as shown in an earlier 2005 FMI/CMAA 6th Annual Survey[20] illustrated in Figure A-6 shown below.

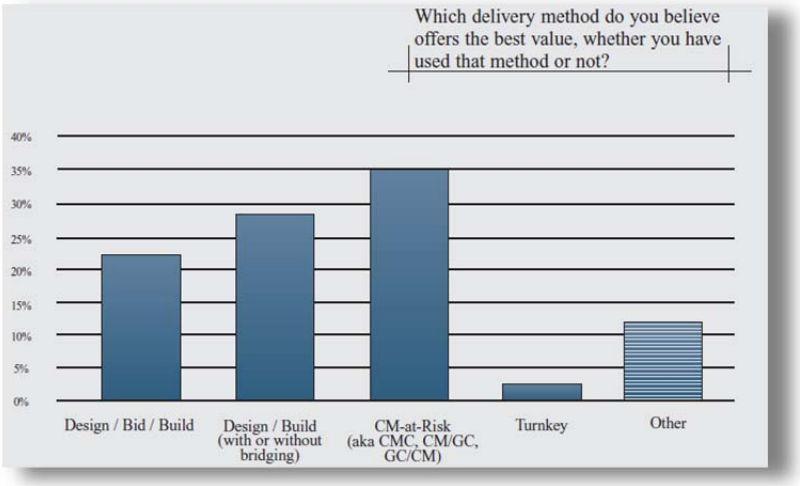


Figure A-6

Finally, in the 2010 "Integrated Project Delivery for Public and Private Owners" paper discussing Integrated Project Delivery[3], project delivery systems were evaluated as to their ability to successfully deliver green projects. The comparisons used the U.S. Green Building Council sustainability rating system and found that CM@R was the most successful project delivery system at 94%, DB was 82%, low bid (understood to mean DBB) was 77%. QBS was the most successful selection type at 95%, with best value at 87% and low bid at 78%.

After considering all these studies and reports, it is clear that no particular delivery system is best at all things. All the various delivery systems have their benefits, and all of them can be implemented successfully under the right circumstances. The challenge is to match owner priorities to the system best able to achieve those priorities, and to effectively manage the project throughout the planning, design and construction process.

In summary, the findings of all of these various reports, studies and surveys reviewed herein appear to corroborate the trends and comparisons presented on the charts subjectively and intuitively developed in this analysis. The referenced reports and studies do include significant detail and report performance results actually experienced by private and public sector owners across the U.S. providing important insights for consideration when selecting a PDS. Nonetheless, the selection process remains a challenging one for owners and developers given the myriad of considerations discussed in this analysis and in the referenced reports.

Appendix B – PDS Lessons Learned Questionnaire

Have you ever used **Design-Bid-Build** (if no, skip to Question 11)?

1. How many times have you used this PDS on a construction project?
2. Why did you choose this PDS?
2. What were the actual benefits of using this PDS?
4. What were the drawbacks?
5. What challenges/obstacles surfaced as a result of this PDS?
6. Will you use this PDS again?
7. If so, what will you do differently?
8. What management approach do you prefer to use when implementing this PDS?
9. What contracting methods do you prefer to use with this PDS?
10. What procurement method do you prefer to use with this PDS?
11. If you haven't used this PDS:
    - Why haven't you?
    - What do you perceive the benefits to be?
    - What do you perceive the drawbacks to be?

Have you ever used **Construction Management at-Risk** (if no, skip to question 11)?

1. How many times have you used this PDS on a construction project?
2. Why did you choose this PDS?
3. What were the actual benefits of using this PDS?
4. What were the drawbacks?
5. What challenges/obstacles surfaced as a result of this PDS?
6. Will you use this PDS again?
7. If so, what will you do differently?
8. What management approach do you prefer to use when implementing this PDS?
9. What contracting methods do you prefer to use with this PDS?
10. What procurement method do you prefer to use with this PDS?
11. If you haven't used this PDS:
    - Why haven't you?
    - What do you perceive the benefits to be?
    - What do you perceive the drawbacks to be?

Have you ever used **Design-Build** (if no, skip to question 11)?

1. How many times have you used this PDS on a construction project?
2. Why did you choose this PDS?
3. What were the actual benefits of using this PDS?
4. What were the drawbacks?
5. What challenges/obstacles surfaced as a result of this PDS?
6. Will you use this PDS again?
7. If so, what will you do differently?
8. What management approach do you prefer to use when implementing this PDS?

9. What contracting methods do you prefer to use with this PDS?
10. What procurement method do you prefer to use with this PDS?
11. If you haven't used this PDS:
    - Why haven't you?
    - What do you perceive the benefits to be?
    - What do you perceive the drawbacks to be?

Have you ever used **Integrated Project Delivery** (if no, skip to question 11)?

1. How many times have you used this PDS on a construction project?
2. Why did you choose this PDS?
3. What were the actual benefits of using this PDS?
4. What were the drawbacks?
5. What challenges/obstacles surfaced as a result of this PDS?
6. Will you use this PDS again?
7. If so, what will you do differently?
8. What management approach do you prefer to use when implementing this PDS?
9. What contracting methods do you prefer to use with this PDS?
10. What procurement method do you prefer to use with this PDS?
11. If you haven't used this PDS:
    - Why haven't you?
    - What do you perceive the benefits to be?
    - What do you perceive the drawbacks to be?

Appendix C – Alternative PDS Selection: An Owner's Example

Preparation of this document included research into the actions currently being taken by airport owners to research, analyze and select the best project delivery system for their particular project, within their airport's operating environment. Operating environment in this context is meant to represent the governing legislation, policies and procedures by which the airport implements capital improvement projects. This Appendix C contains details on the approach one airport management team used to prepare themselves for use of the set of project delivery systems routinely being used for performance of airport projects. The information is provided as an example of the detailed process used for identification and analysis of the enabling and constraining conditions within the existing airport's policies and procedures. Actions taken to strengthen the enablers and remove the constraints to alternative PDS implementation are also detailed in the text.

Alternative Project Delivery Selection

Selection and implementation of an alternative delivery system for performance of a project must not be taken lightly. A detailed analysis of the organization's administrative and technical policies and procedures, plus the rational or motivating factors for considering the use of an alternative project delivery system must be undertaken. Additionally, the specific requirements of the project, in terms of scope of work, complexity, budget and schedule must be evaluated and integrated into the delivery system analysis.

Three key sets of actions should be taken to effectively analyze, understand and structure an organization for maximizing the successful implementation of a project using alternative project delivery systems. These actions include:

- procurement and contracting issues
- roles and responsibilities
- delivery system selection criteria

The following text discusses each of these actions through the use of a set of tables prepared by the staff of an organization that had not previously executed an alternative delivery project. The tables reflect the analyses and findings they compiled during advanced preparation for use of alternative delivery systems. Readers of this document may consider using these materials as the basis for their own preparations. These documents, however, must be carefully reviewed and adjusted to reflect the conditions present in the reader's organization.

Procurement and Contracting Issues

To enhance the ability of the airport management to maximize the benefits of the use of alternative project delivery systems, a detailed review of their current policies and procedures must be performed to ensure they both enable the use of alternative systems of delivering projects and are also defined/structured so as to enable efficient and effective implementation of the selected delivery system. As appropriate, adjustments to the policies and procedures

should be made to streamline project implementation by enabling rapid actions to be taken in execution of the work. Failure to make these revisions may significantly reduce the benefits offered by the fast-track delivery systems in the area of schedule shortening and the associated potential cost savings.

In many cases, an operational and functional paradigm shift will be required for the staff to effectively deal with the demands caused by the implementation of a project/program using fast-track alternative project delivery systems. This is especially true for the business practices, including procurement, contract and financial management. In many cases, the governing bodies of the airport are typically unfamiliar with the requirements for implementing alternative project delivery systems. As such they will most likely need to participate in workshops to help build the confidence they need to grant sufficient authority to the airport staff to ensure adequate decision making is delegated to the appropriate level of management to effectively maintain the progress of the work.

An inefficient or slow decision making and/or work authorization process can eliminate any benefits of the alternative delivery system. Worse yet, it can result in management costs that will not be recovered from the intended savings associated with schedule compression that is a primary benefit of alternative project delivery systems.

An analysis should be performed to compare the various delivery systems with typical procurement, contracting and approval processes. The matrix presented in Table C-1 provides an example of an approach for comparing routine processes with the actions needed for efficient execution of various alternative project delivery systems. This matrix presents a typical set of issues to be addressed when performing projects/programs, including:

- Prequalification
- Solicitations
- Selection/Award Process
- Steering Committee Responsibilities (if established for the project/program, see below)
- Governing Body (Board) Procurement Approvals
- Change Orders/Approvals

This example matrix includes the use of prequalification of consultants and contractors for the CMR and Design-Build delivery systems. The title “Executive Director” is used to define the senior most staff member within the airport management structure. The term “Board” defines the entity/body that provides overall control of the airport organization. This body could be an independently appointed board, as is the case in this example matrix; a county, city or other municipal council/commission; or any other governing entity that sets the overall policies and procedures for the organization. This entity will also routinely provide oversight and approvals of significant staff actions for the airport. Based on the information presented in Table C-1, the primary areas of focus include:

Issues			A Design-Bid-Build (DBB) Traditional Approach	B DBB Fast Track (DBB/FT)	C Construction Management at Risk (CMR w/progressive GMP)	D Design Build (DB)	
Prequalification	Policy	Consultant	Not required; not deemed necessary due to RFQ process; Executive Director determines need to pre-qualify	Not required; not deemed necessary due to RFQ process; Executive Director determines	Not required, not deemed necessary due to RFQ process; Executive Director determines	Not required, but desired to obtain qualified DB teams; Executive Director determines	1
		Contractor	Not required, but desired to obtain qualified contractor; Executive Director determines	Not required, but desirable to obtain qualified contractors; Executive Director determines	Not required, but desired to obtain qualified CMs; Executive Director determines	Same as above.	2
	Impact		None	None	None	DB teams are composed of both consultant and contractor elements and attention needed on establishing qualification criteria	3
	Mitigation		None required	None required	None required	Prequalify both consultants and contractors separately. Allow consultants and contractors to form their own teams	4
Solicitations	Policy	Consultant	RFQ process, potential firms are evaluated and ranked by the Authority committee and sent to the Executive Director	RFQ process, candidate firms evaluated and ranked by committee sent to Executive Director	RFQ process candidate firms evaluated and ranked committee. Sent to Executive Director	RFQ process (qualifications based). Candidate teams are evaluated ranked by committee. Short list sent to Executive Director	5
		Contractor	RFB's process	RFB process	Qualifications based for contractor, evaluated and ranked by committee. Sent to Executive Director	Same as above.	6
	Impact		None	Timing is critical due to phased nature of bids	Both design consultant and CMR contractor selected at same time	DB teams are composed of design and construction groups, and consequently, the solicitation is easier on Airport staff, but criteria must be more comprehensive to handle the breath of capabilities needed	7
	Mitigation		None required	Early stakeholder buy-in. Minimize number of packages	Prequalify CMRs. Assistance for procurement staff. Early buy-in of stakeholders	Require only pre-qualified firms (consultants and contactors) to team. Early buy-in of stakeholders	8
Selection/Award Process	Policy	Consultant	Executive Director selects, negotiates cost	Executive Director selects from the short list, negotiates cost (not to exceed)	Steering Committee selects from short list, staff negotiates cost. Board awards contract	Steering Committee approves short list, staff negotiates design phase services. Board awards design and GMP for construction. Steering Committee oversees trade contractor procurement	9
		Contractor	Bidding process by Airport staff; lowest responsive and responsible bidder; lump sum contract	Bid process results in lowest responsible/responsive bidders, lump sum contracts	Board award pre-construction phase; GMPs approved by Board	Same as above.	10
	Impact		None	Awards of early construction overlap with design allowing schedules to be reduced at the risk of increasing changes. Timeframe to get contracts to Board are critical	Competitive bid process (some form) required in CA. Pure QBS may result in legal challenges	Process will require pre-qualifications. Need three teams	11
	Mitigation		None required	Reduce the number of major packages to minimize package coordination. Obtain delegated authority from Board	None required	None required	12
Steering Committee Responsibilities	Policy		Approves draft RFQ/RFP provides oversight through monthly reviews during implementation; inputs on packaging	Approves draft RFQ/RFP provides oversight through monthly reviews during implementation; inputs on packaging	Determines use of CMR method; approves draft RFQ/RFP provides oversight through monthly reviews during implementation; inputs on packaging	Determines use of D-B method; approves draft RFQ/RFP provides oversight through monthly reviews during implementation; inputs on packaging	13
	Impact		May slow process of Board/decision making	May slow process of Board/decision making	May slow process of Board/decision making	May slow process of Board/decision making	14
	Mitigation		Reduce impact through effective status reporting	Reduce impact through effective status reporting	Reduce impact through effective status reporting	Reduce impact through effective status reporting	15
Board Procurement Approvals	Policy	Consultant	Board adopts plans/specifications; Board informed at selection; Board awards contracts	Board adopts plans/specifications. Board awards contract. May have approval action at selection	Board awards. May require approval actions at selection	Board awards preconstruction and design, and multiple approvals for GMPs. Potential delays due to processing Board awards	16
		Contractor	Board approval required at award	Board awards	Board awards CM at selection and GMP	Same as above.	17
	Impact		None	Separate Board approvals required for award of consultant, and all multiple prime contractors. This would pose timeframe and potentially delay start of work	Board award required for A/E, CMR award, GMP awards. Potential delays due to processing Board awards	Only one approval required for both design and construction, however, multiple approvals still required for GMPs	18
	Mitigation		None required	Possible delegation of approval to Executive Steering Committee	Possible delegation of approval to Executive Steering Committee	Possible delegation of approval to Executive Steering Committee	19
Change Orders/Approvals	Policy	Consultant	Executive Director can approve and execute changes/Board approval when contract and change exceeds $110k	Executive Director can approve and execute changes/Board approval when contract and change exceeds $110k	Executive Director can approve and execute changes/Board approval when contract and change exceeds $110k	Executive Director can approve and executute changes, but Board approval is required when changes exceed 4% of constuction cost; Board must be notified of all changes	20
		Contractor	Executive Director can approve and execute changes/Board approval when changes exceed 4%; must be notified of changes	Executive Director can approve and execute changes/Board approval when changes exceed 4%; must be notified of changes	Executive Director can approve and execute changes/Board approval when changes exceed 4%; must be notified of changes	Same as above.	21
	Impact	Consultant	Restricts management of consultant	Restricts management of consultant	Restricts management of consultant	Slow processing and approval of changes can be mitigated through owner/DB team collaboration. Not as effective in terms of visibility because the A/E is within DB team	22
		Contractor	Slow change order approval process works to advantage of contractor. Immediate response needed to keep progress moving in the field. Authority has no cost visibility below general prime level	Slow change order approval process works to advantage of contractor. Immediate response needed to keep progress moving in the field. Increased changes should be anticipated due to separate prime packages over DBB	Slow processing and approval of changes can be mitigated through owner/CM/trade contractor collaboration. This method allows open book processing and improves process time and visibility	Same as above.	23
	Mitigation		Aggressive estimating and responsive change approval system needs to be established. Delegate change approvals down to Steering Committee level to allow quicker authorization of work in the field	Aggressive estimating and responsive change approval system needs to be established. Delegate change approvals down to Steering Committee level to allow quicker authorization of work in the field	Aggressive estimating and responsive change approval system needs to be established. Delegate change approvals down to Steering Committee level to allow quicker authorization of work in the field	Aggressive estimating and responsive change approval system needs to be established. Delegate change approvals down to Steering Committee level to allow quicker authorization of work in the field. Less opportunity for change visibility compared to CMR process	24

Table C-1: Procurement and Contracting Issues Analysis

Solicitation – For CMR and DB systems, qualification-based procurement processes will typically be required, necessitating significant support of the procurement staff to manage the solicitation processes to procure the consultants and contractors in a timely fashion.

Contracts – The various delivery systems require contract provisions that are not contained in standard design, bid and build contracts. The contracts must be prepared to address the unique aspects of each alternative delivery system; as one contract will not fit every delivery system. Unless the organization has existing contracts prepared for each project delivery system, new contract documents will be required for CMR and DB contracts. Contract language is available from Architectural, Engineering and Construction trade groups as well as airports and governmental agencies that have accomplished projects with these delivery systems.

Many organizations have made the mistake of simply revising existing design-bid-build contract documents, finding that they lack key provisions required to successfully execute an alternative delivery system project during execution of the project. The time to prepare a well-conceived contract is before the start of the first project, not during the project or after the failed execution of a project. It is also important to understand how the provisions of the contract relate to the specific policies and procedures of your specific organization. Simply accepting the boilerplate language of the above identified trade organizations or using a contract provided by a colleague from another organization, without aligning the language with your organization is discouraged and risky. The thoroughly reviewed and refined contract is a key element of successful project delivery under any selected methodology.

Project/Program Steering Committee (Steering Committee) – For large projects or programs, a dedicated group of senior management staff is routinely established to provide oversight and management of the staff responsible for the day-to-day management of the work. The Steering Committee will need to establish a set of administrative, operational and functional procedures that ensure their review and decision-making processes effectively promote progression of the work. It is anticipated that any of the alternative project delivery systems that use a fast-track approach will place a significant workload on the Steering Committee.

The roles and responsibilities of the members of the Steering Committee, as well as the procedures used by the committee to facilitate oversight and management of the project/program will need to be identified and enabled in accordance with the specific requirements for implementation of the individual project/program and associated delivery system under the committee's control. If more than one project is handled by the steering committee, the actions of the committee must reflect the specific needs of each project, recognizing that different projects may well have different requirements.

Board Approvals – The Board approval processes for major contracts must be reviewed. Policy revisions that delegate authority to execute contracts to the Executive Director, based on the selected delivery system, may need to be established and acted on by the Board. This is especially true for the CMR and DB systems. An example of this point is that numerous trade subcontracts for a project will be executed by the prime contractors. The airport management staff may have the right to perform review of these subcontracts, but actual contracts will typically be held by the prime contract, not the airport. While it may be believed that these contracts with subcontractors, which are not held directly by the airport, would not need Board action, any policies that would include a requirement for Board approval for each subcontract would cause significant delay to the program.

Change Order Approval – Probably the single most significant revision that will be required for any organization's policies and procedures is associated with staff authorization for change orders. Most organizations require that change order approval remains at the highest levels of airport organization. Additionally, board (or governing entity) approval is required after limited thresholds are exceeded. Slow change order approval can create delay in the program, and have a compounding effect on cost. Additional approval levels should be considered as needed to facilitate delegation of a tiered change order authorization structure below the senior/executive staff level. Additionally, board approval thresholds will need to be reviewed with respect to the magnitude of the project/program being undertaken.

Roles and Responsibilities

In addition to the issues associated with the procurement and contracting processes used for performance of the various alternative project delivery systems, the roles and responsibilities of the key participants, namely the owner, consultant (A/E), and the contractor must be reviewed and fully understood as they relate to the selected delivery system. Choice of delivery system significantly changes the roles and responsibilities of the respective parties, as depicted in Table C-2. This figure provides a compilation of the typical project/program parameters associated with implementation of all aspects of the work, including:

- Procurement Process
- Procurement Approval Process
- Pre-Construction Services
- Visibility (project performance)
- Cost/Schedule Validation
- Contractor Bidding/Subcontracting
- Change Management Involvement (unforeseen/owner/contractor)
- Payments (based on no agency PMCM)
- Permitting
- Design Coordination/Review
- Commissioning/Certification
- Constructability Review
- Errors and Omissions
- Information Flow
- Management of Cost/Schedule Drivers
- Management of Long Lead Items
- Control of Quality

The 17 parameters identified above and contained in Table C-2 were selected by the example organization as representing all of the key aspects of project undertaken using the Design-Build delivery system. Further, the roles and responsibilities reflect the policies and procedures of the organization and the terms and conditions of the contract prepared by the organization for performance of design-build projects. Each of the above defined parameters must be evaluated in terms of which party performs and has responsibility for the actions in accordance with the selected alternative project delivery system, executed within the policies, procedures and contract language used by your organizations.

		A	B	C	D	
Parameters	Players	Design-Bid-Build (DBB) Traditional Approach	DBB Fast Track (DBB/FT)	Construction Management at Risk (CMR w/progressive GMP)	Design Build (DB)	
Procurement Process	O	QBS w/A/E; RFB w/Contractors	QBS w/A/E; RFB w/multiple Contractors	QBS for A/E & CM - prequalifications for both for preconstruction GMP for CM in construction. Visibility of Trade contracts (open book)	QBS for DB team (A/E + C) - prequalify A/E's /C independently; GMP for construction; visibility of trade controls	1
	A/E	Responds w/proposal/interviews/negotiation cost	Responds with proposal/interview/negotiated cost	Responds with proposal/interview/negotiated cost	DB team responds to tech proposal in preconstruction. Solicits/award lump sum to trade contractors	2
	C	Responds w/bid	Multiple Contractors respond w/bids	Responds with proposal for pre-construction; GMP for construction cost; solicits awards trade contracts using open book lump sum.	Same as above.	3
Procurement Approval Process	O	Board approval for AE and Contractor	Board approval for A/E and Contractors	Board approval for A/E and Contractor in preconstruction; and for GMP	Board approval for D/B team and for GMP	4
	A/E	Approval needed for design (industry standard)	Approval by Board for design (industry standard)	Board approval for A/E (industry standard)	Board approval for GMP's	5
	C	Board approval needed after bid	Board approval for multiple Contractors	Board approval for GMP's	Same as above.	6
Pre-Construction Services	O	Available from PM	Available from PM	Available from PM and CM	Available from PM and DB team	7
	A/E	Limited	Limited	Engaged	Fully committed	8
	C	None	None	Fully committed	Same as above.	9
Visibility (project performance)	O	Strong w/A/E; low for Contractor in construction	Strong w/A/E; low for multi Contractors in coast changes high due to interfaces	Strong w/both A/E and CM; can obtain a balanced view; open with Trade contractors	Excellent w/DB team; harder to reach direct A/E feedback. After GMP established, more limited	10
	A/E	Strong w/owner; limited w/Contractor	Strong w/owner; limited w/multi Contractors in construction	Strong w/Owner; limited w/CMR	Excellent w/Owner; trades & A/E are within DB team	11
	C	No visibility in design; closed book w/Owner	No visibility in design; interface problems in construction due to multiple Contractors	Excellent w/Owner & A/E; controls trades	Same as above.	12
Cost/Schedule Validation	O	Approve budget and schedule	Approve budget and schedule	Approve budget and schedule and GMP (progressive); sign off on trades (open book)	Approve budget and schedule; approve GMP; sign off on trades (open book)	13
	A/E	Provides engineer's estimate; design to cost	Provides engineer's estimate on contract packages; design to cost	Provides engineer's estimate; design to cost	Fully engaged - prices obtained from trade community	14
	C	None	None	Fully engaged - prices obtained from trade community		15
Contractor Bidding/Subcontracting	O	Bids prime Contractor; but limited visibility to subs	Bids RFB to Contractor; but limited visibility of subs	Has good visibility of trades (open book)	Reviews bids for trades/trade community signs off for payment	16
	A/E	None	None	None to limited	Open book for construction trades	17
	C	Controls subs for trades; closed book on costs to Owner	Controls subs; closed book on costs to Owner	Contracts with trades (open book)	Same as above.	18
Change Management Involvement (unforeseen/owner/contractor)	O	Board required approval of changes when thresholds are exceeded	Board required approval of changes when thresholds are exceeded. Increased change exposure due to multiple contracts	Owner is arbitrator/changes will be fewer due to CMR's participation in design	Owner has less involvement with changes - releases more control to DB team	19
	A/E	Performs design for changes	Performs design for changes; flexibility reduced due to multiple C's	Has a collaborative involvement until design is complete	DB manages design specifications with the owner and sub trades/cost and schedule issues primarily with the sub trades	20
	C	High interest in maximizing profit from "changed conditions"	High interest in maximizing profit from "changed conditions"/more changes anticipated	CMR negotiates with sub trades unless items are clearly user generated or outside CMR responsibility	Same as above.	21
Payments (based on no agency PMCM)	O	Payments approvals for Contractor and A/E	Payment approvals for A/E and Contractors	Payment approvals for A/E and CM	Payment approvals for DB team	22
	A/E	Prepares invoices for A/E work	Prepared invoices for A/E work	Prepares invoices for AE work	Prepares pay application	23
	C	Prepares payments application	Prepares payment applications (multiple packages)	Prepares payment applications (multiple packages)	Same as above.	24
Permitting	O	Obtain coastal permits/oversight of A/E and Contractor	Obtain coastal permits/oversight of A/E and Contractor	Coastal permit/oversight of A/E and CM	Coastal permit/oversight of DB team	25
	A/E	Manages document submission and approval process for City/Code permitting	Manages document submission and approval process for City/Code permitting related to multiple work packages	Manages document submission and approval process for City/Code permitting related to multiple work packages	DB team handles both submission of design for permits and pulls permits	26
	C	Pulls permits	Pulls permits	Pulls permits	Same as above.	27
Design Coordination/Review	O	Oversight of process with A/E	Oversight of process with A/E	Oversight of process w/AE; and CM support	Extensive owner involvement on conceptual and performance specification development	28
	A/E	Responsible for accomplishing	Responsible for accomplishing/multiple packages	Responsible for accomplishing/multiple packages	DB team coordinates owner decisions as required.	29
	C	No involvement	No involvement	CM fully engaged with early constructability input	Same as above.	30
Commissioning/ Certification	O	Writes plan; oversees implementation	Writes plan; oversees implementation	Writes plan; oversees implementation	Writes plan; oversees implementation	31
	A/E	Designs to plan	Designs to plan	Designs to plan	Design and execution of plan; selective collaboration	32
	C	Execution of plan; certification and training	Execution of plan; certification and training	Execution of plan; collaboration during design process	Same as above.	33
Constructability Review	O	Fully responsible	Fully responsible	Responsible; with support from CM	Reviews/oversees w/selective collaboration w/DB team	34
	A/E	Limited - provides inputs into design	Limited - provides inputs into design	Limited; provides inputs into design	DB team performs constructability	35
	C	No involvement	No involvement	Collaborative with inputs during design phase	Same as above.	36
Errors and Omissions	O	Responsible for resolution	Responsible for resolution	Responsible for resolution	Responsible for resolution	37
	A/E	Corrective action	Corrective action	Corrective action	More difficult for discovery by owner, DB team responsible for correction	38
	C	Discovery during construction/bidding	Discovery during construction/bidding	Discovery during design and construction (reduced cost impact)	Same as above.	39
Information Flow	O	Responsible - oversees flow	Responsible - oversees flow	Responsible - oversees flow	Selective engagement; monitors	40
	A/E	Respond to RFI's design package, submittal review	Respond to RFI's design package, submittal review	Respond to RFI's design package, submittal review; collaborative w/fewer RFI's	DB team only provides owner required submittals, manages flow	41
	C	Generates RFI's, provides submittals, generates change requests/reports status	Generates RFI's, provides submittals, generates change requests/reports status; interfaces with other contractors	Generates RFI's, provides submittals, generates change requests/reports status; collaborative w/fewer RFI's	Same as above.	42
Management of Cost/Schedule Drivers	O	Timely decision making, change approval, payment approval, checks cut	Timely decision making, change approval, payment approval, checks cut	Timely decisions; smarter about A/E and CMR interface	Less decisions, must be more timely in decisions, must be more informed	43
	A/E	Design, delivery E&O, RFI responses, submittal turn-around	Design delivery E&O, RFI responses, submittal turn-around	Design delivery E&O, RFI responses, submittal turn-around, but is more collaborative, and must be more timely	DB team - A/E linked to contractor success	44
	C	RFI's, submittals, changes submitted timely, coordination	RFI's, submittals, changes submitted timely	Must provide high quality information and better communication	Same as above.	45
Management of Long Lead Items	O	Responsible to initiate procurement	Responsible to initiate procurement	Authorizes	Authorizes	46
	A/E	Identifies items	Identifies items	Specifies/designs	DB team helps identify, design and procures	47
	C	Not available	Not available	Identifies/initiates procurement	Same as above.	48
Control of Quality	O	QA	QA	Quality program oversight/some testing	Quality program oversight/some testing	49
	A/E	QC in design phase	QC in design phase	QC in design; some QA in construction	QA/QC in both design and construction	50
	C	QC in construction phase	QC in construction phase	QA/QC	Same as above.	51

Table C-2: Roles and Responsibilities

Delivery System Selection Criteria

This subject was intentional addressed last as the selection criteria used by any organization must reflect all of the policies, procedures, roles and responsibilities identified in the previous sections of this text. As previously stated, the specific requirements of a project must be fully understood when using an alternative delivery system. This is also a key consideration in the selection of the most applicable delivery system for performance of a project. Materials provided by the example organization are used to provide a framework for understanding this action step. To provide context, Table C-3 represents the selection matrix used by the organization to select a delivery system of a large building and civil construction project that was being executed during period of high construction cost escalation. The building project was deemed to be highly complex and would require active engagement of the airport staff during preparation of the design. The airport staff had previously prepared a detailed project definition document (sometimes called performance document), that provided details regarding the overall project requirements.

			Design-Bid-Build			Design-Bid-Build (Fast Track)			CMR (w/ Progressive GMP)			Design-Build (w/ Progressive GMP)		
	Evaluation Criteria/Raters	Wt.	Total	Ave	Wt'd.	Total	Ave	Wt'd.	Total	Ave	Wt'd.	Total	Ave	Wt'd.
1	Shortest Schedule	1.5	11	1.00	1.50	32	2.91	4.37	36	3.27	4.91	42	3.82	5.73
2	Least First Cost	1	44	4.00	4.00	30	2.73	2.73	21	1.91	1.91	10	0.91	0.91
3	Minimum Cost Growth (Change Orders)	1	12	1.09	1.09	12	1.09	1.09	30	2.73	2.73	36	3.27	3.27
4	Reduce Claims	1.2	11	1.00	1.20	6	0.55	0.66	33	3.00	3.60	40	3.64	4.37
5	Least Final Cost	1.5	14	1.27	1.91	13	1.18	1.77	32	2.91	4.37	36	3.27	4.91
6	Timing of Cost Certainty	1	38	3.45	3.45	25	2.27	2.27	23	2.09	2.09	20	1.82	1.82
7	Owner Influence on Quality	1.3	28	2.55	3.32	24	2.18	2.83	31	2.82	3.67	20	1.82	2.37
8	Spread the Work	1.2	20	1.82	2.18	24	2.18	2.62	34	3.09	3.71	23	2.09	2.51
9	Flexibility to Handle Complexity	1.4	15	1.36	1.90	9	0.82	1.15	32	2.91	4.07	36	3.27	4.58
10	Constructability	1.3	14	1.27	1.65	16	1.45	1.89	37	3.36	4.37	40	3.64	4.73
11	Owner Control	1.3	36	3.27	4.25	25	2.27	2.95	32	2.91	3.78	15	1.36	1.77
12	Owner Risk Exposure	1.4	11	1.00	1.40	7	0.64	0.90	35	3.18	4.45	36	3.27	4.58
	Total			23.08	27.85		20.27	25.23		34.18	43.66		32.18	41.55
	Average			1.92	2.32		1.69	2.10		2.85	3.64		2.68	3.46
	Weighted Average	**15.1**			**1.84**			**1.67**			**2.89**			**2.75**

Strong Advantage	4
Moderate Advantage	3
Neutral Advantage/Disadvantage	2
Moderate Disadvantage	1
Strong Disadvantage	0
# of Raters	11
# of Evaluation Criteria	12

Table C-3: Delivery Systems Advantages/Disadvantages

In many cases, an owner will lack the level of understanding of how the various delivery systems affect and/or respond to the set of selection criteria. It is recommended to engage a team of industry experts during the preparation and performance of the delivery system selection process. These industry experts will be able to assist the owner's management team with defining and using selection criteria. Based on the requirements for the specific project for which a delivery system is being selected, a weighting factor will be used to place the appropriate level of importance of each selection criteria. Recognize that use of a weighting factor will significantly influence the delivery system selection. The rational for establishment of the set of weighting factors for the project should be discussed and agreed upon by the management team and be documented in the project records.

Successful implementation of projects/programs using any project delivery system requires a thorough review of the controlling policies and procedures. Airport owner staff should take the time needed to fully perform the research and analyses needed to compile matrices similar to those shown in Tables C-1 through C-3 for their respective organizations and projects. Effective use of the set of key procurement and contracting issue and the project implementation roles and responsibilities, in combination with the use of a structured selection process will place the project in the best position for success.

Appendix D – PDS Selection Tools

A number of project delivery system selection tools have been developed to assist owners with selecting the best PDS for their project. The Joint Committee has selected three of the most representative examples and summarized them below to demonstrate their approach and applicability to the project delivery system selection process. Additional documents that describe similar tools are referenced at the end of this section.

Airport Cooperative Research Program (ACRP) "Report 21: A Guidebook for Selecting Airport Capital Project Delivery Methods", Project 01-05 Panel, Field of Administration, ISSN 1935-9802; ISBN 978-0-309-11804-0, Library of Congress Control Number 2009937631, © 2009 Transportation Research Board.

This document describes various project delivery systems for major airport capital projects. The guidebook also evaluates the impacts, advantages and disadvantages of these various project delivery systems. The project delivery systems discussed include Design-Bid-Build (DBB), Construction Management at-Risk (CM@R) and Design-Build (DB). The guidebook offers a two-tiered project delivery selection framework that may be used by owners of airport projects to evaluate the pros and cons of each project delivery system and select the most appropriate PDS for their project.

- **Tier 1** is an analytical delivery decision approach that is designed to help the user understand the attributes of each project delivery system and whether the PDS is appropriate for their specific circumstance.
- **Tier 2** uses a weighted-matrix delivery decision approach that allows users to prioritize their objectives and, based on the prioritized objectives, select the project delivery system that is best suited for their project.

The report will be helpful to airports in determining the most appropriate PDS (e.g. DBB, CM@R or DB) for various types of airport capital projects.

Below are the diagrams from this reference that show the Tier 1 and Tier 2 processes described above.

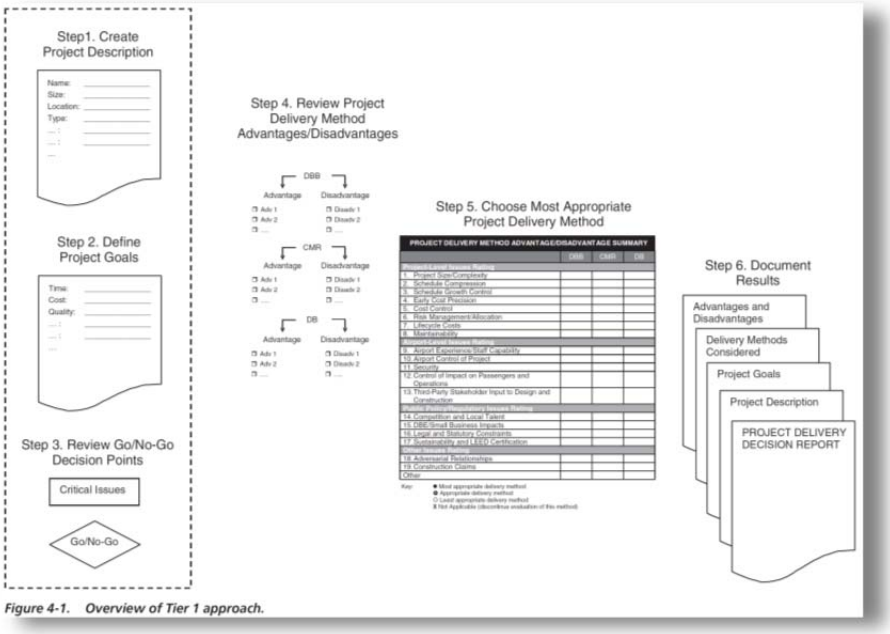


Figure D-1: Tier 1 - Analytical Delivery Decision Approach

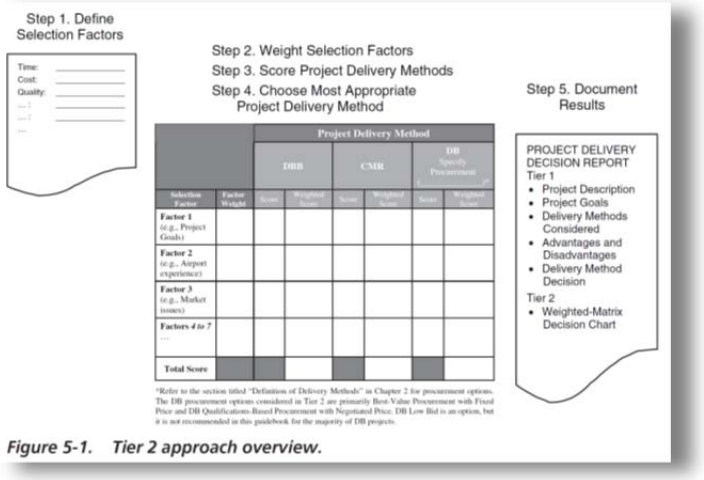
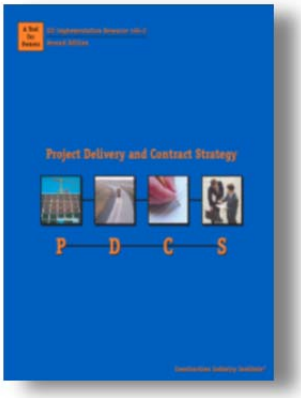


Figure D-2: Tier 2 - Weighted-Matrix Delivery Decision Approach

To obtain a copy of this reference document, please visit the following website:

http://www.trb.org/Main/Blurbs/A_Guidebook_for_Selecting_Airport_Capital_Project_162449.aspx



Construction Industry Institute (CII) (2003). "Owner's Tool for Project Delivery and Contract Strategy Selection". Implementation Research Summary RS 165-2, Second Edition, CII, Austin, TX.

The procedure described in this publication for selecting an integrated project delivery and contract strategy (PDCS) for capital projects should be used on a project-by-project basis. The central component of the procedure is a **decision support tool** that consists of Excel® spreadsheets for selecting integrated PDCS alternatives. Compensation approach charts also are provided for reviewing and selecting the compensation approach for each owner-builder relationship for any given project.

The purpose of the procedure is to facilitate maximum achievement of the owner's project objectives. Therefore, for a project under consideration, the selection criteria should be based on the owner's objectives for that project. Other factors that may influence successful project execution also should be considered in the selection process. The integrated PDCS alternatives are presented in Appendix 1 of this reference document. Industry-wide selection factors are presented in Appendix 2 of this reference document.

Each of the 12 integrated PDCS alternatives includes default compensation approaches, as shown in Appendix 1 of this reference document. Once an integrated PDCS is selected using the Excel® spreadsheet, default compensation approaches are obtained for all the contractual relationships defined for that PDCS alternative. The user may choose to use the default compensation approaches or select more suitable approaches using the compensation approach charts.

The procedure consists of a four-part process as follows:

- **Part 1:** Ratings for all the PDCS alternatives are obtained from the PDCS spreadsheet tool, based on selection factors derived from project objectives and project conditions. The three PDCS alternatives with the highest ratings are selected.
- **Part 2:** The strengths and weaknesses of the highest rated PDCS alternatives are analyzed.
- **Part 3:** The default compensation approaches that are associated with each of the three PDCS alternatives are reviewed for suitability, using the compensation approach charts. The default compensation approach would be replaced if an approach that is more suitable to the project under consideration is obtained from the compensation approach charts.
- **Part 4:** This is the final decision-making step. In this step, special factors that are peculiar to the owner, if any, are considered and one of the three PDCS alternatives is selected for the subject project.

A flowchart illustrating the procedure for selecting integrated project delivery and contract strategy for a capital project is presented in Figure D-3 below for illustration purposes.

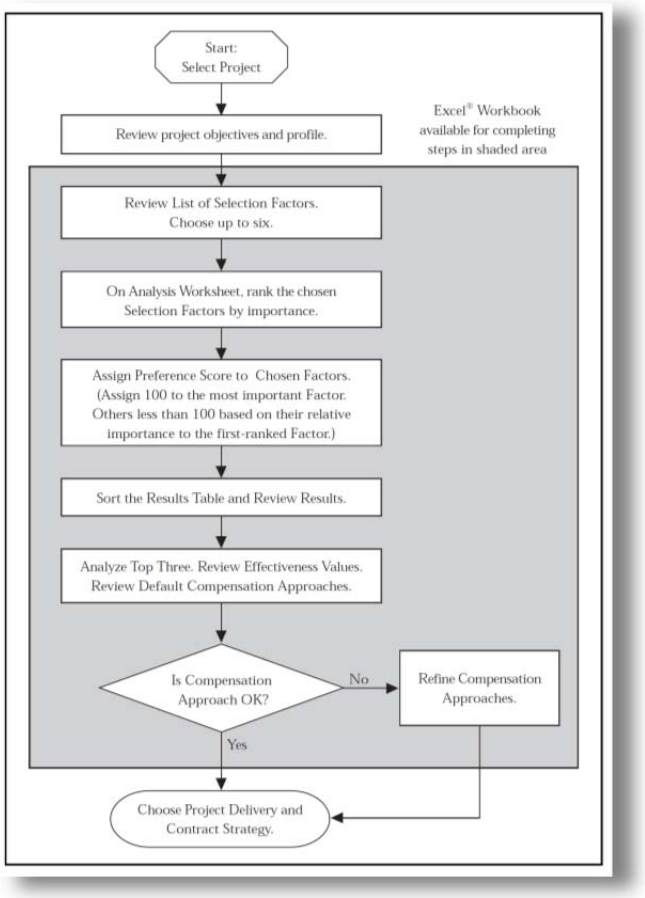
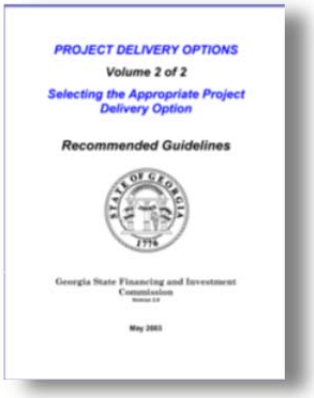


Figure D-3: Process Flow Chart

To obtain a copy of this reference document, please visit the following website:

https://www.construction-institute.org/source/Orders/index.cfm?section=Orders&task=1&continue=1&SEARCH_TYPE=find&FindIn=5&FindSpec=165-2



Georgia State Financing and Investment Commission (May 2003) "Project Delivery Options – Volume 2 of 2: Selecting the Appropriate Project Delivery System, Recommended Guidelines".

This edition of the Project Delivery Selection Guidelines is intended to assist the client agency during the development of their Implementation Plan during the Predesign Phase. This document, originally published as one section in August 2001, was re-published in 2003 as two separate volumes. Volume 1, "Project Delivery Methods, Understanding Your Options," is intended to give client agencies an understanding of the project delivery options available to them. This volume, Volume 2, "Selecting the Appropriate Project Delivery Option," is intended to provide some guidance to the client agency during their pre-design phase when trying to determine which option to recommend.

The goal of this section of the manual is to assist the client agency in selecting the most appropriate project delivery option to recommend as part of the Predesign Study's Implementation Plan. To be able to recommend the most appropriate option, experience with going through the thought process of applying the factors outlined in this chapter is essential. It is even better and widely considered to be good practice to use the counsel of a group of trusted advisers who can help to be sure that all the factors and their interrelationships are as fully evaluated as possible.

The client agency should consider the major factors influencing the project in question and then consider the requirements of the project in light of the unique characteristics of each of the various project delivery options. By applying these factors, the client agency should be able not only to recommend a delivery option, but also be able to answer the question, "Why am I recommending a particular delivery option?"

Just selecting the "right" project delivery system is not enough. There are numerous details to be addressed in order to ensure the desired results are achieved. Requests for proposals that clearly spell out expectations and match the right selection criteria with the right project delivery system are examples of the type of issues that must be addressed when selecting and implementing any project delivery system. With a list of options and list of major factors to consider, the goal is to determine through a process of elimination, "Which project delivery systems are least appropriate to recommend on my project?"

The following examples are intended to illustrate how the major factors can be applied to real projects. As the factors are considered, how they relate to the matrix shows how options have been eliminated. Since every project is unique, which factors apply and the weight they need to be given is also unique on every project. Therefore, these examples are offered for illustration purposes only.

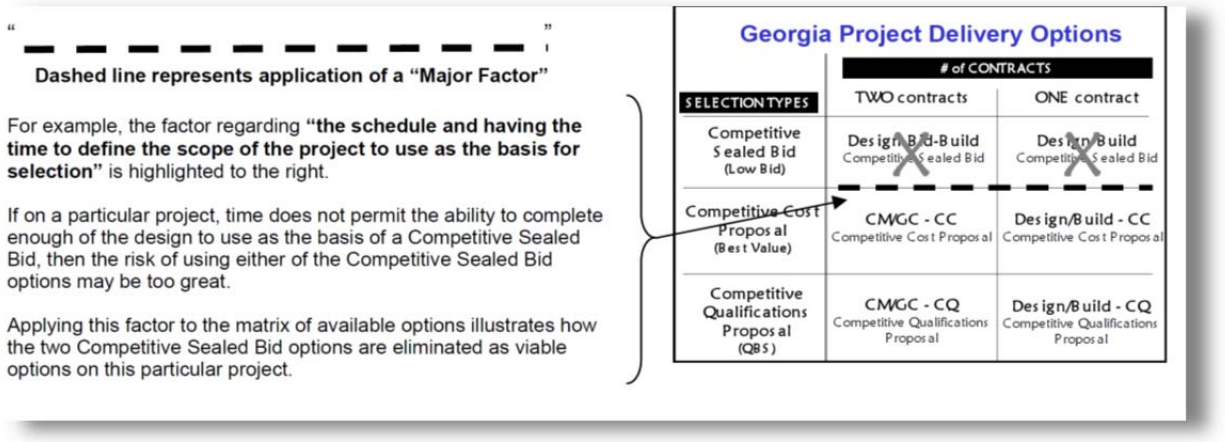


Figure D-4: Georgia Project Delivery Options

To obtain a copy of this reference document, please visit the following website:

http://architecture.mt.gov/content/designconstruction/docs/Georgia_Project_Delivery_Options_Vol2.pdf

Following is an expanded list of other suggested project delivery system selection tools.

1. Associated General Contractors of America (2011). "Project Delivery Systems for Construction—3rd Edition"
2. AGC, AIA, COAA, NASFA, APPA (2010). "Integrated Project Delivery For Public and Private Owners"
3. Bearup, W., M. Kenig, and J. O'Donnell (2007). "Alternative Delivery Methods, a Primer." Proceedings. ACI/ACC/AGC Project Delivery Systems Summit II, Chicago, IL.
4. Gordon, C. M. (1994). "Choosing Appropriate Construction Contracting Method." Journal of Construction Engineering and Management, Vol. 120, No. 1, 196–210.
5. Konchar, M. and V. Sanvido (1998). "Comparison of U.S. PDS." Journal of Construction Engineering and Management, Vol. 124, No. 6, 435–444.
6. Loulakis, M. C. (2005). Construction PDS: Evaluating the Owner's Alternatives (CD-ROM). A/E/C Training Technologies, Reston, VA.
7. Mahdi, I. M. and K. Alreshaid (2005). "Decision Support System for Selecting the Proper Project Delivery Method Using Analytical Hierarchy Process." International Journal of Project Management, Vol. 23, No. 7, 564–572.
8. Skitmore, R. M. and D. E. Marsden (1988). "Which Procurement System? Towards a Universal Procurement Selection Technique." Construction Management and Economics, 6, 71–89.
9. Touran, A., D. D. Gransberg, K. R. Molenaar, K. Ghavamifar, D. J. Mason, and L. A. Fithian (2009). TCRP Report 131: A Guidebook for the Evaluation of Project Delivery Methods. Transportation Research Board of the National Academies, Washington, DC.
10. Warne, T. R. and J. L. Beard (2005). PDS Owner's Manual. American Council of Engineering Companies, Washington, DC.

Appendix E – Contract Document List

The following lists the key contracts and forms for the delivery models discussed in this document. Please refer to the following websites for a complete list of contracts and related documents as well as current updates: www.consensusdocs.org and www.aia.org/contractdocs. Note that AIA-developed contracts begin with either A, B or C, and AGC-endorsed contracts begin with ConsensusDOCS®.

Design-Bid-Build (DBB)

- A101™–2007, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum
- A102™–2007, Standard Form of Agreement Between Owner and Contractor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price
- A103™–2007, Standard Form of Agreement Between Owner and Contractor where the basis of payment is the Cost of the Work Plus a Fee without a Guaranteed Maximum Price
- A105™–2007, Standard Form of Agreement Between Owner and Contractor for a Residential or Small Commercial Project (including general conditions)
- A107™–2007, Standard Form of Agreement Between Owner and Contractor for a Project of Limited Scope (including general conditions)
- A201™–2007, General Conditions of the Contract for Construction
- B101™–2007, Standard Form of Agreement Between Owner and Architect
- B103™–2007, Standard Form of Agreement Between Owner and Architect for a Large or Complex Project
- B104™–2007, Standard Form of Agreement Between Owner and Architect for a Project of Limited Scope
- B105™–2007, Standard Form of Agreement Between Owner and Architect for a Residential or Small Commercial Project
- ConsensusDOCS® 200 Owner-Contractor Agreement & General Conditions—Lump Sum
- ConsensusDOCS 205 Short Form Owner-Contractor Agreement & General Conditions—Lump Sum
- ConsensusDOCS® 235 Short Form Owner-Contractor Agreement & General Conditions—Cost of Work
- ConsensusDOCS® 240 Owner-Architect/Engineer Agreement
- ConsensusDOCS® 245 Short Form Owner-Architect/Engineer Agreement

Construction Management at-Risk (CM at-Risk)

- A133™–2009, Standard Form of Agreement Between Owner and Construction Manager as Constructor where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price
- A134™–2009, Standard Form of Agreement Between Owner and Construction Manager as Constructor where the basis of payment is the Cost of the Work Plus a Fee without a Guarantee Maximum Price
- B103™–2007, Standard Form of Agreement Between Owner and Architect for a Large or Complex Project
- A201™–2007, General Conditions of the Contract for Construction
- ConsensusDOCS® 500 Owner-Construction Manager Agreement & General Conditions—GMP with option for Preconstruction Services
- ConsensusDOCS® 510 Owner-Construction Manager Agreement & General Conditions—Cost of Work with option for Preconstruction Services

Design-Build (DB)

- A141™–2004, Agreement Between Owner and Design-Builder
- A142™–2004, Agreement Between Design-Builder and Contractor
- B142™–2004, Agreement Between Owner and Consultant where the Owner contemplates using the design-build method of project delivery
- B143™–2004, Standard Form of Agreement Between Design-Builder and Architect
- ConsensusDOCS® 400 Preliminary Owner-Design-Builder Agreement
- ConsensusDOCS® 410 Owner-Design-Builder Agreement & General Conditions—Cost Plus with GMP
- ConsensusDOCS® 415 Owner-Design-Builder Agreement & General Conditions—Lump Sum

Integrated Project Delivery (IPD)

- A195™–2008, Standard Form of Agreement Between Owner and Contractor for Integrated Project Delivery
- A295™–2008, General Conditions of the Contract for Integrated Project Delivery
- B195™–2008, Standard Form of Agreement Between Owner and Architect for Integrated Project Delivery
- C191™–2009, Standard Form Multi-Party Agreement for Integrated Project Delivery
- C195™–2008, Standard Form Single Purpose Entity Agreement for Integrated Project Delivery
- C196™–2008, Standard Form of Agreement Between Single Purpose Entity and Owner for Integrated Project Delivery
- C197™–2008, Standard Form of Agreement Between Single Purpose Entity and Non-Owner Member for Integrated Project Delivery

- C198™–2010, Standard Form of Agreement Between Single Purpose Entity and Consultant for Integrated Project Delivery
- C199™–2010, Standard Form of Agreement Between Single Purpose Entity and Contractor for Integrated Project Delivery
- ConsensusDOCS® 300 Collaborative Agreement (Multi-Party Agreement)

Qualification Forms

- A305™–1986, Contractor's Qualification Statement
- B305™–1993, Architect's Qualification Statement
- ConsensusDOCS® 221 Contractor's Statement of Qualifications for a Specific Project
- ConsensusDOCS® 222 Architect/Engineer's Statement of Qualifications for a Specific Project
- ConsensusDOCS® 721 Subcontractor's Statement of Qualifications for a Specific Project

Airport Improvement Program (AIP) Handbook Revisions

In 2000, Congress approved a pilot program in the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR-21) which allowed up to seven projects to test the Design-Build project delivery system for projects funded through the Airport Improvement Program (AIP). The pilot program was necessary since a number of statutory restrictions made Design-Build contracting nearly impossible to use under AIP. Congress subsequently made permanent the use of Design-Build to all airports in 2003 in Sec. 181 of Vision 100 – Century of Aviation Reauthorization Act.

In Vision 100 Congress detailed the conditions the FAA must use in approving a DB contract, including:

- It must be permitted under state or local law;
- The Design-Build contract must be in a form that is approved by the Administrator;
- The Administrator must be satisfied that the contract will be executed pursuant to competitive procedures and contains a schematic design adequate for the Administrator to approve the grant;
- Use of a Design-Build contract that will be cost effective and expedite the project;
- The Administrator must be satisfied that there will be no conflict of interest; and
- The Administrator must be satisfied that the selection process will be as open, fair and objective as the competitive bid system and that at least three or more bids will be submitted for each project under the selection process.

During the evaluation of project candidates for the pilot program, FAA determined that although CM@R contracting was a form of alternative project delivery, it was not restricted by current statute and thus did not need to be approved through the Design-Build pilot program. Similarly, task order contracting was also approved outside the pilot program. In Vision 100, Congress indicated its agreement that neither CM@R nor task order contracting were to be considered Design-Build in the report accompanying Vision 100.

For this discussion, alternative PDS refer to DB and CM@R in contrast to the traditional DBB. All three PDS are acceptable under the AIP, but each has its own specific requirements and limitations. Task Order Contracting is also mentioned in FAA guidance as a project delivery system; however, under the definitions in this white paper, it is not considered a separate project delivery system, but rather it is a contracting method).

Whether or not specifically stated in the FAA regulations, any owner may be limited in its use of alternative PDS by local or state statute or procurement regulations. This essential authority to use alternative PDS is mentioned earlier in this white paper.

While airports have the capacity to use DB and CM@R for their projects funded through AIP, experience has shown that the application of these PDS has been limited to a relatively small number of projects.

There are challenges for sponsors interested in pursuing a project delivery system other than Design-Bid-Build for projects utilizing AIP. First and foremost is the fact that the FAA grant process is a mature program, and the regulations and protocols governing AIP have been in place now for many years. Most of AIP policies and guidance have centered on the traditional DBB project delivery system.

FAA personnel administering AIP grants are also intimately familiar with the DBB process, but have limited experience with DB and CM@R. As a consequence, sponsors can run into differing perspectives among the various regions and ADOs regarding DB and CM@R, and even among personnel within the same region.

The fact that certain FAA regions and ADOs have less experience with PDS presents a significant challenge for sponsors. There are opportunities, however, to educate the FAA and work with them to navigate the AIP grant approval process when using DB or CM@R, among them being to follow the lead of those regions that have successfully done it.

CM@R and DB Procurement and Contracting

The AIP Handbook, FAA ORDER 5100.38C, provides guidelines for the FAA to assure that statutory, regulatory and policy requirements are met in AIP grants. It primarily addresses limitations on the use of alternative PDS in Chapter 9 – Procurement and Contracting Requirements; however, several other limitations are referenced throughout the Handbook that can impact the ability to effectively use alternative PDS. (It should be noted that the Handbook is under significant revision at the time of publication of this updated white paper, and some of the current limitations on alternative PDS may have been resolved or clarified.)

In Chapter 9, the Handbook discusses CM@R as an acceptable alternative project delivery system with a two-phase contract where preconstruction consulting services are performed initially, followed by a second phase with a negotiated "ceiling" amount for the construction work. This has been interpreted by many to equate CM@R alternative PDS with a GMAX contracting method, which as presented earlier in this white paper, is not part of our CM@R definition. This is because CM@R can be contracted by other methods including lump sum (LS), which also provides the requisite "ceiling" amount to be FAA Handbook compliant.

From a procurement method perspective, all methods described in Article 904 are acceptable for CM@R; however, one must be careful to ensure that the preconstruction services and the consulting (professional services) portion of the CM@R is procured using appropriate QBS or Competitive Proposal methods, and the construction portion of the CM@R is procured in a manner that provides price competition, i.e. not negotiated. This requirement exposes an inconsistency or contradiction between Article 904 and Article 930a, and as a consequence, this

issue has been subject to some varied interpretation in particular FAA regions. In some cases, a CM@R negotiated price has been accepted as the basis for the grant while in other cases, competitively bid trade contracts have been required from the CM@R and self-performance by the CM@R has been precluded. To avoid problems, close coordination with the FAA region/ADO and preapproval of the sponsor's anticipated procurement and contracting methods are recommended.

In discussing the DB alternative project delivery system, Chapter 9 is much more specific where it states in Article 931 that DB may be contracted either by Qualifications Based Selection (QBS) or Competitive Proposal process. Again, one must be careful to ensure that the construction portion of the DB is procured in a manner that provides price competition as per the reminder in Article 904e.

The Handbook states that DB may be contracted using LS, GMAX, and even cost plus fixed fee (CPFF). Interestingly, there appears to be no requirement for any form of "ceiling" amount for the CPFF in a DB approach where for CM@R, a ceiling amount is required. Additional limitations/requirements mandated when the DB alternative project delivery system is used are listed in Article 931e of the Handbook.

Regardless of the project delivery system being utilized, sponsors should follow the FAA procurement standards outlined in 49 CFR 18.36 and standard FAA contract provisions contained in 49 CFR 18.36(i) should be included.

A challenge with both CM@R and DB is that most owners who use them rely on a negotiated guaranteed maximum price contracting method (GMAX), where the FAA has been clear in its preference for a competitively bid firm price. While a GMAX can be comprised of a series of competitively bid trade contracts, this usually requires the various designs to be complete and all work solicited for bidding, which requires a significant amount of time and compromises some of the time advantage of using CM@R and DB. For projects where the FAA funding component represents only a small portion of the project, a Region or ADO may feel comfortable issuing a grant for the eligible portion of the GMP. For larger FAA funding percentage projects it may be to the sponsor's advantage to extend the GMP until after trade bids (depending on grant timing). The FAA can reduce sponsor risk by adjusting funding (if possible) based on bids, and managed or phased grant releases are another option to allow early trade contract work to proceed while bids are solicited for the remaining work.

Limitations

Table F-1 below lists several limitations and requirements related to the Handbook's conditions for use of alternative PDS. The first four relate directly to AIP conditions for use of DB. The next five issues affect contract cost and are not directly related to DB and CM@R, but relate more the use of GMAX and CPFF contracting which are the most prevalent contracting methods used by airports when using DB and CM@R.

	Challenge/Limitation	Reference	FAA Position	Comment	DB or CM@R Issue
1	Analysis of cost or schedule savings required for DB	AIP Handbook Article 930	Required.	Statutory 47112(a)(4)	DB
2	Three bids (priced?) required for DB	AIP Handbook Article 930 & PGL 01 -- 2	Required unless sponsor meets other tough criteria.	Statutory 47114 (a)(6)	DB
3	DB must meet price competition req'mt for construction contracts	AIP Handbook Article 904	Required unless sponsor meets other tough criteria.	Regulatory 49 CFR 18.36	DB
4	Insurance cost not allowed unless part of contractor overhead	AIP Handbook Article 311	Specifically not allowed.	CGL not allowed but project specific hold harmless is OK	DB
5	Contingency costs not allowed	OMB Circular A -- 87	Specifically not allowed	Legal opinion based on statute 47108 (b)(3)	More a GMAX/CPFF Issue
6	Cost for allowances treated as a cap	Perception/practice	Required.	Applies to cost increases where there is no change to scope of work.	More a GMAX/CPFF Issue
7	Limited FAA acceptance of estimated costs for grant	Practice	An admitted FAA practice to prefer bid pricing.	Estimates ok for budget review	More a GMAX/CPFF Issue
8	Shared savings not allowed	OMB Circular A -- 87 ??	Not allowed		More a GMAX/CPFF Issue
9	Price escalation factors not allowed	AIP Handbook Article 921	Specifically not allowed	OK w/APP-1 approval	More a GMAX/CPFF Issue
10	Sponsor's ability to manage risk with CM@R and DB	Perception/practice	Admitted FAA concern influencing some of above.	Question if APDS system has adequate risk controls	DB/CM@R
11	Firm fixed price/lump sum preferred for consultant contracts	AIP Handbook Article 420 -- More restrictive than AC 150/5100 -- 14 D	Clearly stated as preferred		DB/CM@R

Table F-1: AIP Grant Process – APDS Challenges Matrix

The overall size of the project and the staffing capacities of sponsor also have a role in the FAA's approach to a project utilizing CM@R or Design Build. Large sponsors who can manage APDM projects in-house typically use FAA money for a smaller percentage of total project costs. These sponsors often have the expertise and manpower to control project costs/schedule/inspections, etc., and as a result the FAA's risk is lower. Alternately, FAA's financial exposure could be very high on large, high costs projects such as a $1 billion runway with $250 million in FAA money, which raises FAA's risk.

Small sponsors that may not have in-house personnel to manage APDM projects typically use FAA funds for a much larger percentage of total project costs. The ability of the sponsor to manage the project and prevent cost/schedule/quality problems raises the FAA's risk. Alternately, FAA's financial exposure is relatively lower compared to larger-scale projects (such as a $20 million terminal with $16 million of FAA money) which in turn lowers the FAA's risk.

As a valuable reference document, the 2009 Airport Cooperative Research Program (ACRP) "Report 21: A Guidebook for Selecting Airport Capital Project Delivery Methods" as referred to in **Appendix D – PDS Selection Tools**, provides additional insight into the limitations and benefits of alternative project delivery approaches. Those insights are, however, general in nature regarding use of DB and CM@R, and not specific to limitations relating to AIP funding and Handbook requirements.

Finally, from an overall perspective, it is very telling and important to note that the FAA views the AIP statute as a "permissive" or authorizing statute, i.e. only things identified in the statute can be funded and some projects, while worthwhile from an airport standpoint, may not be authorized for funding. Likewise, there are a myriad of statutes and regulations that apply to all Federal programs that must be complied with from a "process" perspective. Something that is not specifically mentioned or not specifically excluded in the Handbook is not automatically allowable but requires review to determine if it fits within the guidelines of the program.

Types of Projects Better Suited for AIP Approval of APD

Whether certain types of projects are more suitable than others when seeking AIP funding is not a simple question. A sponsor's tolerance for trying new approaches, local statutory and procurement requirements, and the local FAA regional office's openness and willingness to work with the sponsor are among the important variables. Nevertheless, some generalizations may be considered.

For example, projects where the design and construction is tied to proprietary equipment or systems such as with baggage screening and handling systems generally are good candidates for a DB approach. Similarly, projects where the required functionality is readily defined and not subject to wide interpretation of what will meet the specification criteria, such as video surveillance/security systems, glycol recovery and runway pavements generally may be considered good candidates for a DB approach.

Although still under debate, it is commonly held that CM@R is well-suited for situations where speed of overall project delivery is particularly important (although DBB can also deliver quickly if fast-tracked). Other generalities can be unclear, but the following variables may be considered.

- Vertical vs. horizontal projects
- Complexity of projects
- Accelerated schedule – natural disasters, pavement failure, safety, etc
- Duration of projects
- Ability to pre-fund through own funds/LOI
- Level of FAA funding participation
- Tie in/linkage with other projects (e.g. terminal/apron design; new taxiway/building relocation)
- Contract type – lump sum, firm fixed price are best suited; GMAX, reimbursable

Strategies for Working with FAA

While seeking FAA approval for DB or CM@R is difficult, sponsors can take steps to help facilitate the process. First and foremost, sponsors should be certain to follow the requirements and steps offered in the AIP Handbook. In general, the Handbook provides some broad guidance regarding the use of DB, but virtually no guidance is provided for CM@R

projects at this time. The pending update of the Handbook is expected to contain additional guidance on both PDS.

Regarding DB, the Handbook does contain specific information that sponsors must submit to the FAA, including:

1) A full description of the project together with general sketches of proposed work;
2) A description of the contracting process to be utilized as well as steps to be taken to assure that three or more companies will bid on the proposed project, including a statement that the type of project has an adequate number of firms involved regularly in the execution of Design-Build contracts;
3) An analysis of the cost-savings and/or time savings that will be gained by the use of the Design-Build project delivery system;
4) A statement describing what safeguards are in place to prevent conflicts of interest and that the process will be as open, fair and objective as the normal contracting process;
5) A statement citing specific references to the state or local law that permits the use of the Design-Build project delivery system.

Overall, sponsors need to make the case and demonstrate the benefits to the FAA from using DB or CM@R. CM@R follows normal grant requirements for which sponsors and consultants should be familiar. In the case of DB, there is special statutory language that permits reimbursement for costs incurred prior to a grant, including construction, (using discretionary and entitlement funding) when a grant is issued. One requirement is that the FAA must approve the use of DB prior to the DB contract. Specifically, section 47142(b) of title 49 states:

> *"(b) REIMBURSEMENT OF COSTS. — The Administrator may reimburse an airport sponsor for design and construction costs incurred before a grant is made pursuant to this section if the project is approved by the Administrator in advance and is carried out in accordance with all administrative and statutory requirements that would have been applicable under this chapter if the project were carried out after a grant agreement had been executed.*

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The assignment to prepare this "Airport Owner's Guide to Project Delivery Systems—2nd Edition" was accepted with the understanding that such an assignment is never truly completed and any resulting paper is never truly finalized. As new permutations of existing project delivery systems are developed and other forms of project delivery attempted, and as lessons learned from both project success and failure are factored into the selection and implementation process, guidance documents must be updated and modernized.

This philosophy is central to the Joint Committee. Such knowledge gained will be incorporated into future revisions of this paper.

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