Preparing for Design-Build Projects

A Primer for Owners, Engineers, and Contractors

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Preface

The delivery of public and private construction projects using design-build (DB) has been steadily increasing for nearly two decades. Proven DB success in the private sector is encouraging public owners to utilize this innovative process. As a result, many of the traditional relationships that exist in the architect/engineer/construction community are being reforged to permit them to function in projects that are being delivered using alternative methods such as DB. DB is no longer a new project delivery method; it is being institutionalized on a large scale throughout the world. As a result, many designers and builders will find themselves being drawn into DB projects due to owner pressure to compress project delivery time frames. Thus, these design professionals must be prepared to alter their business practices to accommodate the changed relationships within DB contracts. These facts are the genesis of this book.

Much of what has been written on the subject of DB is about the mechanics of the contracts (see Appendix 3). While this is necessary information, nothing has been published about how to actually write the technical portions of the DB contract. Those portions are essentially defined by the owners' Request for Proposals (RFPs) and the winning design-builders' proposals. Consulting engineers, architects, and construction contractors are finding that new roles have been created with the advent of DB project delivery. Designers are the most affected because with this project delivery system the designer must decide whether it will remain on the owner's team and assist it by preparing the DB request for proposal, or join forces with a construction contractor and become the designer-of-record (DOR) on the DB team. Construction professionals must also recognize and understand the impact of these new roles. Design-build creates a single point of responsibility for both design and construction and gives it to the DB team. Thus, this book will explore in depth the implications of the culture shift associated with the move to a scope-driven, performance-based project delivery system.

Under the auspices of the American Society of Civil Engineers (ASCE), the authors developed and, since 1996, have been delivering a professional continuing education seminar, titled Design-Build Contracting, across the nation and in several foreign countries. The one element that seems to be common to all those classes is the pressing need of engineers who work for owners, consulting firms, and construction companies to better understand the technical side of the DB process and be able to put it into context with the contractual side. Based on this experience and the authors' personal experiences on a variety of DB projects, this book was developed to flow from an introduction to and history of DB, through the preparation of an RFP, and end with guidance on how to interpret that document and develop a winning proposal.

The first two chapters set the stage and detail the owner's major task of developing the project's scope of work and configuring it in a way that facilitates the development of definitive performance criteria, which is covered in great detail in Chapter 3. Next, the interconnection between the performance criteria and remainder of the RFP is covered in Chapter 4, followed by a synthesis of the salient points of the first half of the book illustrated through a series of actual DB case studies.

The book then moves on to the crucial stage of DB evaluation planning (Chapter 6). In this chapter, the latest research on evaluation planning is reported in a fashion that allows all parties to understand the dynamics of this critical step in the DB process. This is followed by another series of case studies relating to the interaction between the owner's RFP and the design-builder's proposal. Chapter 8 describes how to interpret the RFP and write a winning DB proposal. Finally, the book concludes with two essays contributed by experienced design-builders on what, based on their first-hand experiences, is important about the RFP from the perspectives of the building and transportation industries.

This book is intended to be a resource for owners, engineers, construction contractors, and architects who find themselves in need of guidance in developing a DB project. It is unique in that previous books have either taken a global approach to the subject or have concentrated on the legal aspects of the contracts themselves. This book is intended to help those professionals who must actually do the designing, building, and contract administration. It lays out all the options in a comparative manner that highlights the advantages and disadvantages of each option, so the reader has all the information necessary to make the business decisions inherent in the DB process.

We would like to thank all of the DB professionals around the country who helped us gather case studies and allowed us to bounce ideas off them. Special thanks go to Dr. Barbara Jackson of California Polytechnic State University, San Luis Obispo, California, and Larry Hurley of CH2M-Hill Constructors, Inc., for their insightful essays regarding the design-builders' perspective on the importance of RFP documentation.

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ONE

Introduction to Design-Build Contracting

In the last decade of the twentieth century, design-build (DB) contracting became more widespread across the United States as well as around the world. Forming a contract where the project's owner contracts for both design and construction from a single entity significantly alters the project delivery culture; it moves the designer-of-record position in the project delivery process from being a direct, contractual advocate for the owner to some contractual relationship with the builder. Many design professionals and owners feared that this would result in the destruction of the designer's responsibility to furnish a design that maximizes quality within the project's budgetary constraints. To use the vernacular, the fox would be guarding the henhouse.

As the process evolved, this concern was found to be groundless. However, owners found that ensuring project quality created a shift from the design-bid-build (DBB) prescriptive specification culture to the DB performance criteria culture. Owners also found that the technical portion of the DB contract was developed during the preparation of the project's request for proposal (RFP) and further defined by the winning design-builder's proposal design approach. Thus, to effectively accrue the potential benefits of using this project delivery approach, both public and private owners need guidance based on practical experience to prepare their RFP, and the design and construction professionals who form DB teams need guidance in how to properly interpret DB RFPs and to responsively prepare their own DB project proposals. This book is an attempt to furnish that guidance and the necessary background to implement it.

The book has three major objectives. First, it will disaggregate the DB process, define and quantify each component to the process, and then present them in an integrated method that allows the reader to follow the DB RFP development process in an orderly fashion. This is done to give the reader an in-depth analysis of the subtleties and nuances that are inherent in DB project delivery and an understanding for the potential impact of the myriad technical and business decisions that must be made to successfully promulgate a DB project. Next, the book will give design-builders and their design and construction professionals an inside look at the owners' thought processes and an understanding of the methodology by which risk is distributed in DB contracts. This will allow them to more carefully and responsively prepare winning DB proposals. Finally, the book will present case studies from actual private and public DB projects that illustrate various key points in an instructive fashion that allows the reader to synthesize the common issues that arise in most DB projects. This is done in a manner that promotes the passing on of lessons learned from the industry's past experience and allows both owners and design-builders to profit from the experiences of past projects.

Design-Build: What and Why

Although widely accepted, DB project delivery is not the traditional system in the United States. It requires a slightly different lexicon (set of terms) that is critical to establishing a common understanding of the process. An historical analysis of delivery systems provides a perspective of the motivation of project delivery nuances. A fundamental premise found throughout this book is that DB has advantages and disadvantages. It has a greater potential for success on some projects but is, in fact, not appropriate for all projects. Several national and international studies describe better-than-average project performance with the use of DB, but confirm that certain project characteristics are indicators that a project may not be well suited for DB delivery. Lastly, there are several consistent project characteristics that have been seen repeatedly on successful projects.

Design-Build Defined

Single Point of Responsibility

Design-build delivery takes many forms. Differences in financing structures, procurement procedures, the level of design at the time the design-builder is hired, the teaming arrangements internal to the DB team, and the responsibility for the operation and maintenance of the end facility are just a few of the differences that cloud the DB definition. However, there is one common thread that all DB delivery systems share—a single point of responsibility for both design and construction. The owner is seeking a "one-stop shop" for the design and construction requirements and the design-builder assumes the risks and responsibilities for this contractual arrangement. Figure 1-1 illustrates the concept for the DBB and DB delivery models.

Figure 1-1 depicts the DBB model in which there are two contracts—one between the owner and the designer and one between the owner and the contractor. This separation of contracts provides for checks and balances between design quality and construction cost but it also often results in an adversarial relationship between parties, particularly between the contractor and the designer with whom there is no contractual relationship. Design-build, on the other hand, provides for one contract and one line of communication between the owner

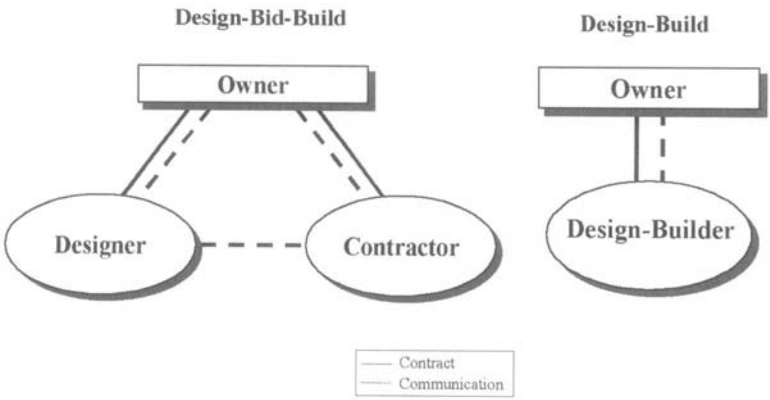

Figure 1-1 Contractual relationships for design-bid-build and design-build.

and the design-builder, resulting in a sole source of responsibility for design and construction. Whether or not the design-builder is an integrated entity or a consortium of members, this single-source concept exists. Likewise, regardless of whether the project involves integrated services for financing, maintenance, or commissioning or alternative contracting with incentives or warranties, the DB single source is the foundation of the project delivery system.

Delivery Systems, Procurement, and Contract Methods

Owners and professionals in the architecture, engineering, and construction industries often misuse the term design-build. While the foundation of the delivery system is the DB contract, DB is, more holistically, a project delivery system of which the contract is just one component. Owners, particularly public sector owners, often refer to DB as a procurement method but this is not accurate. Similar to contracting, DB procurement is one element of the DB project delivery system; Chapter 6 discusses multiple methodologies for DB procurement. Contract payment methods are also an element of the project delivery system, and any payment method that works in the DBB delivery system can apply to DB delivery. These payment methods may include firm-fixed price, unit price, and cost-reimbursable contract payment methods with any combination of maximum price guarantees, incentives, and disincentives in appropriate situations. Three key concepts are essential for a discussion of DB project preparation.

Project Delivery System: The process by which a construction project is comprehensively designed and constructed for an owner, including

- Project scope definition,
- Organization of designers, constructors, and various consultants,
- Sequencing of design and construction operations,

- Execution of design and construction,
- Closeout and start-up.

Procurement Method: The process of choosing designers, constructors, and various specialty consultants, including

- Assessment of technical qualifications,
- Assessment of price proposals,
- Definition of the "best value,"
- Final selection of project participants.

Contract: The form of agreement in a construction project, including the participants'

- Requirements, obligations, and responsibilities,
- Allocation of project risk,
- Payment procedures.

The Design-Build Contract

A DB contract fundamentally differs from a DBB contract in the manner in which risk and responsibility for design details are shifted from the owner to the design-builder. In a DBB contract, the owner contracts a designer to develop the final construction drawings, as depicted in Figure 1-1. The owner, in essence, owns the details of the design and guarantees that the plans are constructable and free from design errors and omissions. In a DB contract, on the other hand, the design-builder, in essence, owns the details of the design and is responsible for providing design documents as well as a constructed facility that is free of defects. In both delivery systems, the designer-of-record is legally obligated to deliver a project that meets all applicable codes and standards within a reasonable standard of care. Figures 1-2 and 1-3 depict simple models comparing DBB and DB contracts and their place in the design and construction process. The models are an oversimplification of the process but they very clearly convey several important nuances of the delivery systems. Appendix 3 contains a list of the model contract formats developed by the Engineers Joint Contract Documents Committee (EJCDC).

The fundamental difference between the contract modes is how and when the construction plans and specifications fit into the contact. In the DBB system, the final plans and specifications form the technical basis of the contract and define the scope of work and the price proposal. A fundamental assumption of this system is that the plans are complete, constructable, and free from defects—often a difficult task. In the DB system, the plans and specifications are a *deliverable* of the contract; the owner's RFP and the corresponding design-builder's technical and price proposals form the technical basis of the contract. This is a fundamental difference. The owner's RFP can range from a verbal request to one, single design-builder, to a formal, printed RFP that may contain boilerplate contractual language and substantially complete plans and specifications. Likewise, the

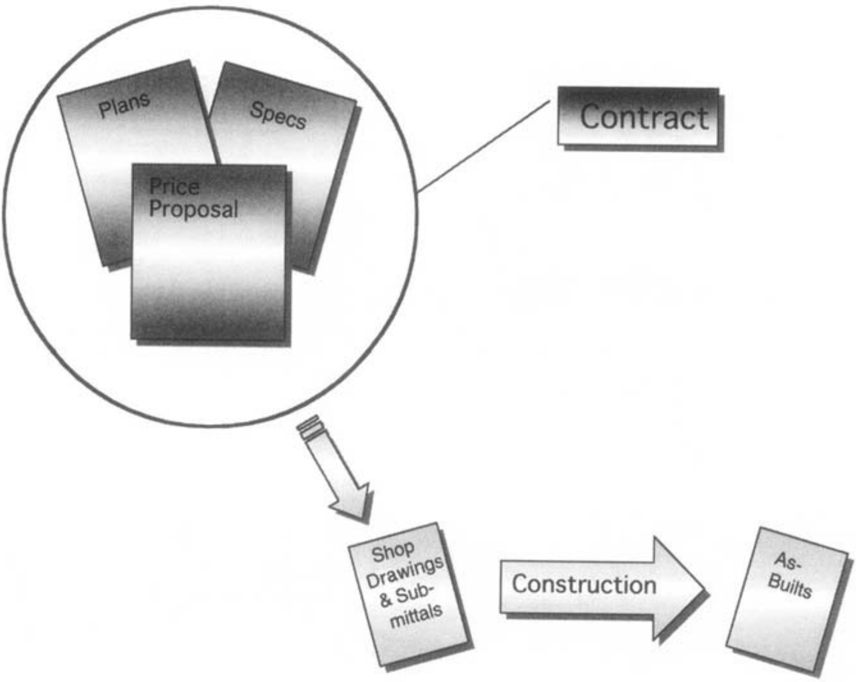

Figure 1-2 Design-bid-build contract model.

technical and price proposals can vary greatly in detail depending upon the owner, the design-builder, and the project. The following chapters greatly expand on the details of the DB contract, focusing on comprehensive RFPs, technical proposals, and price proposals and the interrelationships between them.

Performance Criteria

Design-build is not the primary delivery system in the United States, although some owners, architects, engineers, and contractors apply it exclusively or consider it their default delivery mechanism. Generally, DB is considered an alternative delivery system. As such, owners must consider why they are choosing to use DB delivery rather than their traditional method or another alternative delivery methods. Likewise, architects, engineers, and constructors must carefully consider which aspects of their standard practice may be applicable to DB delivery and which practices must be adopted to successfully implement this alternative delivery system. This book focuses on those aspects of DB that are different from DBB and can improve the potential for project performance and success, particularly in the area of preproject preparations.

Another critical aspect of the DB contract model in Figure 1-3 is the concept that the project scope is described by definitive, project-based performance criteria rather than comprehensive construction plans and specifications. This is

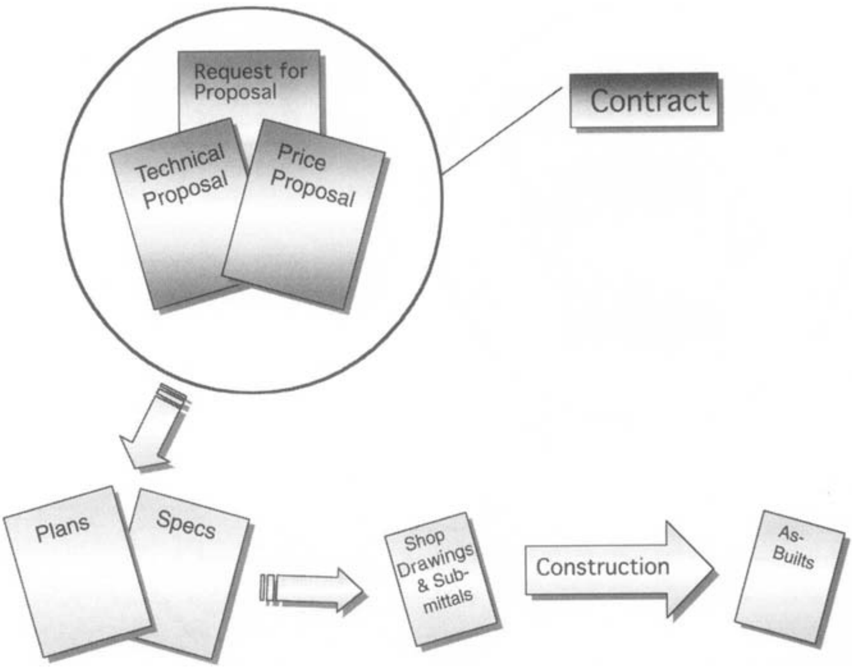

Figure 1-3 Design-build contract model.

a fundamental shift from DBB for both owners and contractors. Owners must learn to define the project scope in terms of performance criteria rather than detailed drawings. This is often a difficult change, particularly when an owner's company culture, contract documents, and administration practices may formerly have focused on complete construction drawings at the time of construction procurement. In the case of public sector owners, these cultures and practices may have been created over the last 50 years and they will not be changed quickly. Architects, engineers, and constructors also need to learn how to work from a scope defined by performance criteria rather than complete construction documents. Designers must often acquire a new sense of discipline when designing to a budget and scheduled defined in the RFP, technical proposal, or price proposal. Constructors must often learn how to be attentive to the owner's needs and changes in scope, from which they were insulated in DBB environments. All parties must learn how to embrace performance criteria as the definitive project scope due to the risk of costly scope creep as the project proceeds to completion.

Best-Value Procurement

Design-build creates a challenge to the traditional procurement paradigm. However, many owners and design-builders have turned this challenge into a great asset because they can now base their selections on qualifications and technical

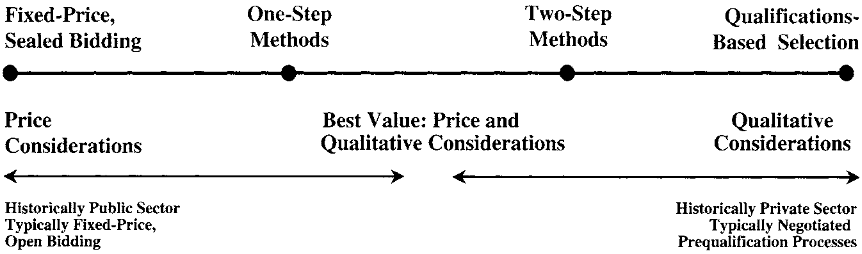

Figure 1-4 The procurement methods continuum.

proposals rather than solely on the lowest bid. Traditional procurement practices select designers based on qualifications and select construction contractors based on a sealed, fixed-price low bid. Design services are not selected based on price because the scope of work is difficult to define in the early stages of design. Also, because the public's health, safety, and welfare are at risk, forcing engineers to bid on design would not be prudent practice as the quality of the design could suffer (NSPE 1999). In the federal sector, Brooks Act legislation has mandated that cost cannot be used in the selection of design services (Quatman 2001). Conversely, the predominant procurement method for construction services has been the sealed, fixed-price bid based on a completed design. Selection of general contractors and their trade subcontractors for construction by sealed bidding has been a predominant method in the public sector. However, DB requires the selection of both designers and constructors under one contract.

Figure 1-4 depicts a procurement continuum, which is more fully explained in Chapter 6. The combination of design and construction under one contract forces owners to develop new procurement procedures. To realize the schedule reduction and constructability enhancements inherent in the DB process, selection of design-builders must occur well before the construction documents are 100% complete (Molenaar et al. 1999). The private sector has the option to negotiate with a single participant in these situations but public sector policy typically requires a competitive selection process. In the private sector, contract awards are based on criteria such as the quality of the firm's personnel, experience, past performance, and other assets that may benefit the project (Gransberg and Ellicott 1997; Napier and Freiburg 1990). Although the sealed, fixed-price bid has been the competitive method of choice in the public sector, competitive selection does not exclusively dictate low bid selection. Many public sector agencies are utilizing forms of competitive selection that fall somewhere between being qualifications-based and low bid-based. A continuum with fixed-price, sealed bidding on one end and sole-source selection on the opposite end can be formed, with a multitude of choices between them.

One-step and two-step methods are procedures that fit into the larger category of so-called best-value selection. "Best value" is a term that describes owners selecting DB teams via some combination of price, qualifications, and other pertinent factors. The one-step procedure provides for competitive evaluations of qualifications and technical proposals in addition to price, with the contract award decision based on best value as determined by the owner. This best-value determination is for the combination of evaluated technical merit and associated price, but not necessarily the lowest cost alone. Two-step procedures separate the qualifications-based selection from the final selection. First, proposals of qualifications are received and qualified offerors are prequalified (short-listed). Next, the qualified offerors submit technical and price proposals and the award is based on price or best value (Napier and Freiburg 1990). The method by which price and technical proposals are combined varies with almost every private owner or public agency. Variations of these methods are the focus of Chapter 6.

During the procurement phase, DB delivery creates an opportunity to award projects based on a combination of price and technical proposals. Best-value procurements focus on selecting the contractor with the offer most advantageous to the owner, the best price, and other factors considered. Best-value procurements allow owners to evaluate offers based on total procurement costs, technical solutions, completion dates, and other criteria. The goal for a best-value selection is to obtain the optimum combination of price and technical solution for the owner. When used correctly, a best-value selection rewards offerors for proposing innovative concepts that enhance product quality without penalizing them for incremental increases in the price for providing enhanced quality. When used incorrectly, owners may introduce inappropriate biases into the selection process or add cost to the procurement. Owners must think carefully about what is valuable in the product, not just what is important or required in the selection process. Using technical, managerial, or performance elements in selection that are important or required but have indeterminate value clouds the issue. Owners should only base best-value selection criteria on project elements that add measurable value to the project. Likewise, design-builders must determine what is valuable in the owner's eyes and propose a project scope that meets or exceeds the owner's expectations. Design-builders should be able to make this determination through a careful examination of the solicitation documents, but an open discussion with the owner is always in the best interest of all parties.

The Design-Builder as a Professional

A central theme throughout this book is that the DB entity is a professional. This view begins with the fact that design-builders are frequently hired based on qualifications or best value. Construction contractors have traditionally been selected on a low-bid basis and, therefore, construction is viewed as a commodity. Conversely, the DB team is viewed as a professional entity rather than a commodity. The design-builder is a group of individuals and companies that work together to provide a service for the owner. Thus, as the owner no longer has a direct contract with the lead design professional on the project, that responsibility is necessarily imputed to the holder of the DB contract without regard to that entity's specific professional qualifications. The intent here is to ensure that the design is completed by a qualified design professional while preserving privity of the DB contract. As a result, the prime contractor in a DB project is accorded the responsibility to lead this team of professionals and must work diligently with the other design and construction professionals to fulfill the DB team's goals, ensuring that the project is designed in accordance with good practice and that all work is completed within the project's time and budget constraints.

Design-Build Stipends

Stipends (honoraria) are sums of money that are awarded to unsuccessful proposers to partially compensate them for their design effort in a DB procurement that involves a substantial technical proposal. Preparing a technical proposal is not like preparing a bid. Constructors and designers do not include these proposals in their normal cost of doing business, as a construction contractor would for traditional bid preparation. Typical technical proposals require a substantial amount of design effort. Designers do not build this design effort into their overhead pricing structure; to survive, they must be compensated for this design effort. In return, the owners get multiple competing designs to evaluate rather than the single solution that comes out of a traditional design contract.

Given that stipends are a necessity, the question arises as to the appropriate level of stipends. The stipend should be large enough so that offerors are compensated for their substantial design effort in preparing proposals. However, the stipend should not be set so high that offerors will make proposals just to profit from the stipend. In ad hoc discussions with the DB community, the consensus seems to be that in a two-phase process with three to five offerors, the stipend should equal approximately one-third of the cost of the design effort. In fact, stipends can be offered as a reimbursement at one-third of the offeror's auditable design hours. This level will offset the designer's actual costs without decreasing competition. Owners should be cautious of simply applying a set percent (e.g., 0.2% of the project cost) because the amount of design effort varies from proposal to proposal. An estimate of actual design effort or the use of auditable hours is the most equitable way to accurately determine stipends.

Some state departments of transportation and other public sector owners do not pay stipends because they believe that they are legislatively prohibited from paying for a design if they do not intend to use it. Other public agencies use the stipend to pay for the ideas of the unsuccessful proposers and state in their RFPs that they may choose to incorporate these ideas into the final project. In these cases, the unsuccessful proposer may choose not to accept the stipend and thus retain these ideas as intellectual property. This is a good concept but in implementation it can have many flaws. In practice, unsuccessful proposers may not be fully compensated for their design and their intellectual capital is then given to their competitors. The design-builder will obviously give serious thought to this issue when proposing on a project with this type of contract clause.

Stipends allow for more competition and more competitive designs because they reduce the financial impact of the risk of losing the project. If owners choose not to provide stipends, they should be cautious as to the amount of design effort they require to produce responsive proposals from the DB community. Likewise, design-builders must carefully consider their investment when making the decision whether to propose or not to propose.

Roles of Key Players

Many owners and practitioners incorrectly think that DB is merely a reorganization of the players in the system. Although it is true that the many of the same professionals participate in both DB and DBB processes, their roles and responsibilities are vastly different in the two contexts. In DB processes, the owner and designer-of-record have new responsibilities concerning the ownership of the details of design. The design-builder is a single point of responsibility and thus must manage both the design and construction. Figure 1-5 shows the breakdown of roles in the DB process.

Owners in DB projects can perform many activities but their key role is to fully define the project scope in functional terms. The owner entity, no matter what its organizational structure, is the customer for the project and the design-builder should strive to understand the owner's organization completely so that they may best satisfy their customer. Public owners often have the most complex management structures, which may have been developed around the DBB process over the last 50 years (as is the case in most federal and state construction agencies). In addition to the facility users or tenants, public owner teams can consist of architects, engineers, inspectors, legal sections, project managers, contracting officers, and in-house construction administration staff. Complex owner structures often must be realigned for the DB process. All of these players need to be involved but they must now be involved at different decision points in the process; they may also need to take on new roles in project definition and oversight. Private owners typically have less cumbersome organizational structures, unless in their core business they complete numerous capital projects. In such cases they may resemble the public owner described above. The typical

Owner
Public
- Users/Tenants
- Designers
- Legal Counsel
- Contracting Project Management
- Construction Representative

Private
- Users/Tenants
- Engineers/Technicians
- Construction Manager

Consultant
- Design Criteria Consultant
- Bridging Consultant
- Oversight Consultant

Design-Builder
- Constructor
- Designer-of-Record
- Design-Build Project Manager
- Design Manager
- Construction Manager
- Specialty Consultants
- Suppliers

Figure 1-5 Design-build roles.

private owner (and some smaller public owners) have a less complex structure, typically consisting of the users or tenants, a construction manager, and any engineers or technicians kept on staff. Private owners and smaller public owners often employ consultants to help them prepare for DB projects.

Design and construction management consultants have found new roles in the DB process. Consulting roles that became more common in the 1990s are the DB criteria consultant, the bridging architect, and the oversight consultant. The newest role to emerge is the DB criteria consultant, who works with the owner to help develop the request for qualifications (RFQ) or RFP at the earliest stages of the process. Such consultants play much the same role as a programming architect in a traditional building project or the preliminary engineering consultant in a highway or infrastructure project. The primary difference is that they are experts in the DB process, particularly in authoring definitive performance criteria.

The DB bridging consultant is similar to the criteria consultant but takes a much more active role in developing the design content of the RFP. Bridging consultants are typically licensed architects or engineers who work with the owner to define a set of bridging documents. These are design documents that carry the project design to approximately 15%–50% completion. The owner then uses these documents in the RFP to communicate to the design-builder the specific intent of the project's design. The American Institute of Architects promoted the bridging concept heavily in the early 1990s but has since focused on promoting designer-led DB in lieu of the bridging concept. Owners must understand that the design-builder, not the bridging consultant, is the final designer-of-record in the process.

The third primary consulting role is that of the oversight consultant. This consultant may assist the owner with design review and construction inspection to add checks and balances to the DB process. The oversight consultant may have also been involved in authoring the RFQ or RFP. Oversight consultants are very common in the transportation (Gransberg and Senadheera 1999) and water/wastewater sectors; many major engineering firms offer this service. Construction management consultants often perform this function in the building sector and the Construction Management Association of America promotes these types of services among its members.

Although Figure 1-1 depicts DB as one sole source of responsibility, the design-builder is always a group of professionals acting as one entity. Four types of design-builder organizational structures are commonly found

1. The integrated design-builder,
2. The joint venture,
3. The designer-led design-builder,
4. The builder-led design-builder.

The advantages and disadvantages of these organizations are discussed throughout the book. Needless to say, it is difficult to maintain licensed designers and bonded construction contractors in one firm. The design-builder should be the best mix of professionals for the given project needs.

Regardless of which legal structure the design-builder takes, the owner is seeking one sole source of responsibility. As such, the design-builder must have a DB project manager whose responsibilities include coordination of design and preconstruction activities and who acts as the general owner liaison, from initial client contact through project completion. The DB project manager should thereafter be responsible for oversight of owner relations. This person can have a construction contractor or designer background but must understand the cost and schedule implications of working under a construction contract while also understanding the iterative nature of architectural and engineering design. These individuals are today's master builders and are the most important members of successful DB teams. The DB project manager typically requires the help of a construction manager and a design manager to coordinate the complex activities of the process. These managers take on much of the traditional role of coordinating designers and construction professionals, both within the design-builder's own workforces and with specialty designers and trade subcontractors.

A key member of the DB team is the designer-of-record. The designer-of-record is responsible for the professional quality, the technical accuracy, and the coordination of all designs, drawings, and specifications. While the legal responsibilities listed above fall to the DB entity, it is important to understand where the designer-of-record fits into the DB team; it may be prudent to empower that person with certain clauses in the contract so that there are adequate checks and balances in the delivery system. The designer-of-record's role is discussed in detail throughout this book, with particular focus in Chapter 4.

The final groups on the DB team are the specialty consultants and contractors. The DB process can give these players new input into the construction process. For example, a steel fabricator may be a member of the DB team when the owner selects the design-builder. At this point, there is little need for the architect to detail the steel connections in the drawings, as would be required in a traditional design that is being bid by multiple fabricators. The fabricator's shop drawings can be elevated to formal design drawings if approved by the designer-of-record. The DB process allows for substantially more specialty consultant and supplier input than the DBB process does, which can result in substantial time and cost savings.

To date, there is no DB specific licensure or certification for consultants or design-builders. However, owners should seek firms that have licensed architects, engineers, or certified construction managers in this role. Additionally, in 2002 the Design-Build Institute of America (DBIA) implemented a designation program to identify DB professionals. This program is similar to many professional certification and registration programs in that it requires a combination of education, experience, and passing a national-level exam to achieve the designation; this will become helpful in establishing the credentials of DB professionals. While the DBIA Design-Build Professional designation does define and promote an industry-wide body of knowledge, there are very few members of the DB industry who have the designation at this time; it should be only one element in an owner's assessment of qualifications.

Historical Perspective

Design-build is not a new concept. Figure 1-6 presents a brief history of DB that traces its roots back to the master builder concept, through the separation of designer and builder, and full circle back to the DB concept. A very brief historical perspective is presented in this book to provide the context for some of today's project delivery variations.

The Master Builder

Construction projects have been immortalized in books and art throughout history. In fact, such projects represent history itself as snapshots in time, created by the vision, craftsmanship, and materials that built them. These projects vary in concept, use, funding, and procurement, yet they all have two things in common: each project was designed and constructed. This process was originally achieved through one entity, known as the master builder, who was charged with both project design and construction. Projects have varied in size from the pyramids in Egypt and the Parthenon in Greece to houses for everyday people (Loulakis 1999). The first set of codes written regarding structure design and construction was the Code of Hammurabi written in 1765 BC by the Babylonian ruler Hammurabi (1795–1750 BC). This code references a single source of responsibility for the design and construction of structures (Beard et al. 2001; Beard 2003). The original industry handbook was written by Marcus Vitruvius Pollio, a Roman writer, engineer, and architect who lived in the first century BC. This handbook, entitled *De Architectura Libri Decem* (*Ten Books on Architecture*), described the then-existing practices of design and construction. Details regarding many of what remain as today's engineering disciplines were given, including buildings, roads, and bridges, as well as the manufacturing of materials, machines for heating public bath water, and sound amplification in amphitheaters (Beard et al. 2001). This combined effort of design and construction continued until the Renaissance.

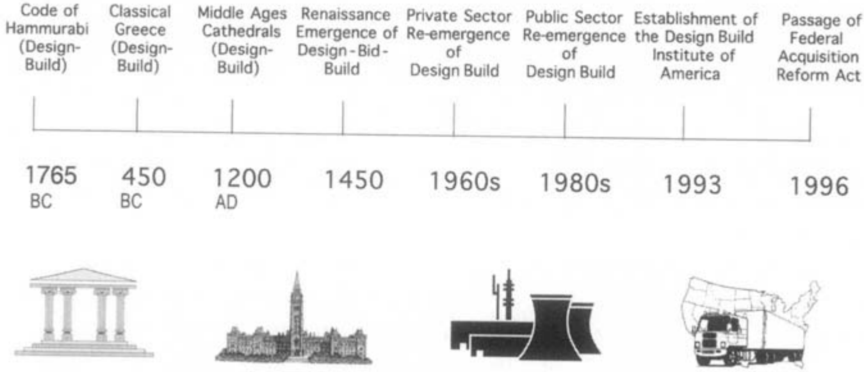

Figure 1-6 The history of design-build.

The Separation of Design and Construction

During the Renaissance two separate schools of thought formed: the traditional belief of design and construction being integrated (DB), and the new perspective that design and construction should be completed by separate groups (DBB). Two Italian master masons, Filippo Brunelleschi (1377–1466) and Fransesco Borromini (1599–1667), had suspicions about the abilities of architects who did not actually build their own work on a project (Cunningham and Reich 1998; Loulakis 1999). Brunelleschi was best known for his design and construction of the dome of the Church of Santa Maria del Firoi (Cathedral of Florence) that was started in 1420. During Brunelleschi's lifetime there began to be changes in the traditional views of the link between design and construction. Leone Battista Alberti (1404–1472), known for drawing buildings for papal commissions, convinced Pope Eugene IV that he (Alberti) could design a building and then, using these sketches, a Clerk of the Works could perform the construction phase. This new system was used to build a new facade for the Santa Maria Novella Church in Florence, which is the first known use of separated design and construction tasks. Alberti later wrote *De re Aedificatoria* (*On Edifices*), which distinguished the design process from construction (Beard 2003; Loulakis 1999).

Design and construction were not recognized as two distinct separate phases in project development until the Industrial Revolution. This was due in large part to mechanization, use of equipment, increased productivity needed, and increased specialization in the construction industry (Beard 2003; Loulakis 1999). From the late 1700s to the mid-1800s the distinction between design and construction was further accentuated by the organization of professional societies. In 1793 a society of civil engineers formed in England, which later became the Institution of Civil Engineers. The Royal Institute of British Architecture formed in London in 1835. The first professional engineers' society to form in the United States was the Boston Society of Civil Engineers, which formed in 1848. The American Society of Civil Engineers and Architects formed in New York in 1852, followed closely by an offshoot, the American Institute of Architects, which formed in 1857. Upon the separation of the architecture and engineering professions, the American Society of Civil Engineers and Architects was renamed the American Society of Civil Engineers (ASCE), with a mission to advance professional knowledge and improve the practice of civil engineering across the globe. The first construction contractors' group was formed in 1887, and the Associated General Contractors formed in 1918. The passing of professional licensing laws in the United States during the 1920s and 1930s further emphasized this separation of design and construction (ASCE 2002; Beard 2003).

Design and construction were also separated through procurement laws for each that were passed in the United States. The early laws regarding procurement by the government were military acquisition regulations that date back to the establishment of the Commissary General and Quartermaster General in 1775. In 1777 an act was passed that required separate departments for purchasing and issuing within the military. This act also required that a record be kept that detailed the quality and quantity of material and services. In 1781 Robert Morris, Superintendent of Finance, started a system for mercantile contracts that used a competitive sealed-bid process, with awards being biased toward unit cost. It was not until 1825 that the general regulation required that all supplies for the military be procured through formal advertisement and sealed proposals that would not be opened until the proposal submittal period had expired.

In 1893 a Congressional act was passed that formally separated the design and construction phases. In 1926 the Omnibus Public Buildings Act required that before construction could begin, all plans and specifications had to be approved by the relevant federal department heads. All acts were amended during periods of war to allow for faster acquisition of supplies and services. The Armed Services Procurement Act of 1947 limited the military to purchases of architectural/engineer (A/E) services to negotiated contracts and construction contracts to be awarded based on formal advertisements and low bid. In 1949 this was extended to all government civilian agencies. In 1972 the Brooks Architect-Engineers Act was passed, which called for the design of projects to be awarded based on qualifications (Beard 2003; Charles 1996).

The Design-Build Revolution

In the 1960s and 1970s, owners began to openly express their dissatisfaction with the DBB project delivery system. They expressed concerns regarding the lack of cost, time, and quality controls on projects. This lack of controls was partially due to the need to expedite the design process in an attempt to get projects out to bid

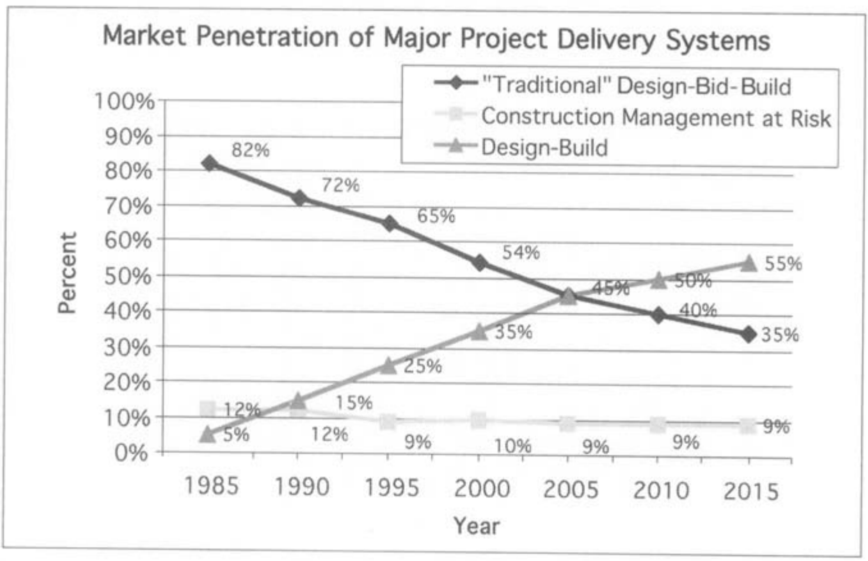

Figure 1-7 Past and projected project delivery method usage (*courtesy of the Design-Build Institute of America 2000*).

quickly to beat some of the effects of inflation. In 1969 the U.S. Congress and the Secretary of Defense authorized the use of turnkey construction to deliver military housing. The Department of Defense (DoD) sought to draw upon the knowledge of speculative builders to shorten schedules and lower costs (Cook and Smith 1984). Success of this early DoD initiative germinated the government's use of alternative procurement methods, particularly DB. Public sector DB expanded in the 1980s into dormitories, lodges (motels), bowling alleys, warehouses, courthouses, mail distribution facilities, vehicle maintenance facilities, laboratories, medical clinics, federal courthouses, and highways (Federal Construction Council 1993; Myers 1994; Yates 1995).

Recent growth of DB is well-documented (Yates 1995). The DBIA was established in 1993 to promote DB as a delivery method and lobby for changes to federal, state, and local legislation that prohibited or discouraged DB. The

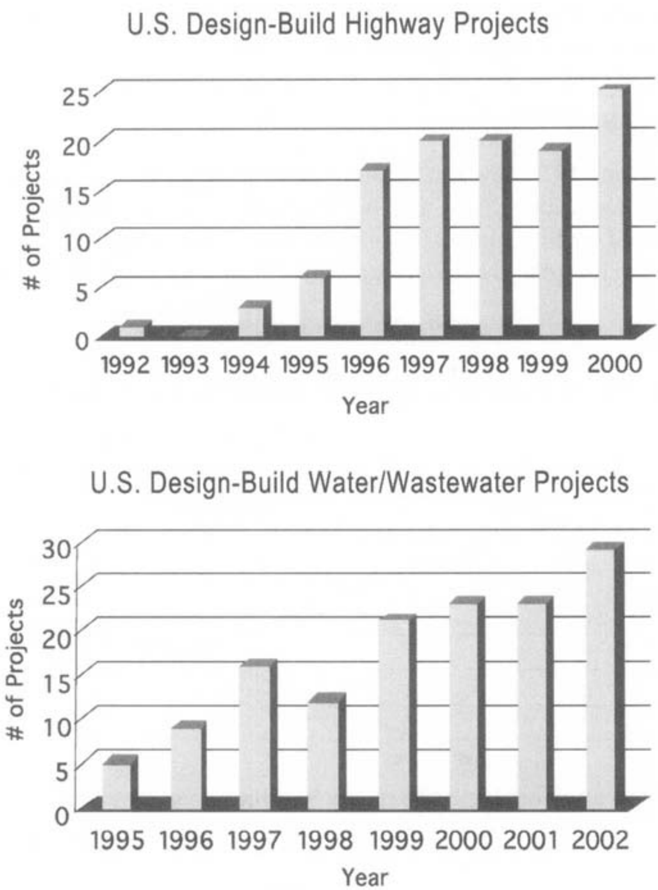

Figure 1-8 Growth in design-build project delivery in transportation and water/waste water projects in the United States.

enactment of the Federal Acquisition Reform Act in 1996 authorized the use of DB for federal projects, guaranteeing continued growth of public sector DB methods (Molenaar et al. 1999).

Today DB continues to grow in popularity among owners. Figure 1-7 has been developed by DBIA to show the growth in market share of the DB project delivery method. The graph was developed in the late 1990s, so the lines beyond 2000 are DBIA's projections. While some have called these projections into question, there is no denying that the market embraced DB in the 1990s. Figure 1-8 provides DB growth trends in the federally funded transportation (FHWA 2002) and water/wastewater markets (Molenaar et al. 2003). While it is difficult to predict if DB use will continue to increase, these trends indicate that DB has established a strong foothold in today's market.

Why Use Design-Build?

Owners are driving the increasing use of DB. Design-build delivery offers distinct advantages over DBB and other project delivery methods. Until the late 1990s there was very little quantitative evidence pertaining to why owners were selecting DB and how it performed in comparison to other project delivery methods in terms of time, cost, and quality. This section presents the results of research into these two questions.

Owner Design-Build Selection Factors/Advantages of Design-Build

In 1996, the University of Colorado conducted an owner survey to determine DB selection factors for both public and private owners (Songer and Molenaar 1996). In essence, this research quantified owners' opinions on the advantages of DB. Owners with experience in at least one DB project were qualified to respond. One hundred and eight owner responses were analyzed, 63% from the public sector and 37% from the private sector, as displayed in Figure 1-9. Figure 1-9 also displays the type of construction in the sample: 83% building construction, 14% industrial, and 3% heavy and highway.

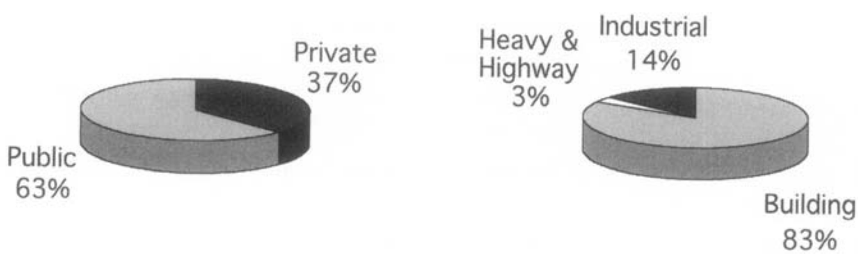

Figure 1-9 Sample population for owner design-build selection factors research (*Songer and Molenaar* 1996).

The cumulative construction experience of the owners responding to the questionnaire is 1,683 projects totaling more than $12.75 billion of construction. The sample represents over 90 separate public agencies and private companies.

Data collection focused on identifying owner DB selection factors and determining associated priority rankings. An exhaustive literature search produced seven DB selection factors (perceived advantages of DB). Table 1-1 lists these factors and a more in-depth discussion follows.

The following are the detailed definitions used in this research:

- *Establish Cost:* Some owners choose DB to secure a fixed construction cost. By allowing one entity total control over design, scope, and budget, there is less opportunity for scope-related change orders. Also, improved relations among designers and construction contractors reduces liability issues associated with increasing project cost.
- *Reduce Cost:* Although very little empirical data existed at the time of this survey to show a correlation between DB project delivery and cost reduction, there was sound reasoning for an overall cost reduction. This cost reduction stems from two main components: the shortening of project duration and the introduction of the constructor's knowledge into the design (see *Reduce Schedule* and *Constructablity/Innovation,* below).
- *Establish Schedule:* For the same reasons that some owners choose DB to establish cost, they may choose DB to set the project delivery schedule. A majority of the schedule growth seen in the traditional

Table 1-1 Design-Build Selection Factors and Definitions

Selection Factor	Definition
Establish Cost	Secure a project cost before the start of detailed design.
Reduce Cost	Decrease the overall project cost as compared to other procurement methods (design-bid-build, construction management at risk, etc.).
Establish Schedule	Secure a project schedule before the start of detailed design.
Shorten Duration	Decrease the overall project completion time as compared to other procurement methods (design-bid-build, construction management at risk, etc.).
Reduce Claims	Decrease litigation due to separate design and construction entities.
Large Project Size/ Complexity	The project's sheer magnitude is too complex to be managed through multiple contracts.
Constructability/ Innovation	Introduce construction knowledge into design early in the process.

Source: Songer, A. D., and Molenaar, K. R. (1996). "Selecting design-build: private and public sector owner attitudes." *J. Engrg. Mgmt.*, ASCE, 12(6), 47–53.

method stems from communication problems between designer and constructor (e.g., requests for information, design errors, design omissions). Allocating responsibility to one entity minimizes these issues.

- *Shorten Duration:* Design-build promotes schedule reduction. Overlapping of design and construction results in substantial savings in comparison to the linear nature of DBB. A single contract for both design and construction greatly improves communication. The results are a reduction in design and construction cycle times and encouragement of fast-tracking.
- *Reduce Claims:* Implicit in the DB process is an owner's shelter from liability. The designer no longer performs as an agent of the owner. Design errors and omissions are solely the responsibility of the design-builder. Design-build is not a magic cure for the construction industry's litigation problems but it does inherently promote a nonadversarial relationship between the designer and builder.
- *Large Project Size/Complexity:* Dealing with one entity reduces administrative burden. Many owners do not have the staff or experience to manage the traditional triad of owner–designer–builder. Taking one player out of the game lessens managerial tasks on large or complex construction projects. It should be noted, however, that the DB increases owner's involvement early in the process (Molenaar and Songer 1998) and there is a loss of the designer as an independent professional (ASCE 1992).
- *Constructablity/Innovation:* Early involvement of the contractor is inherent in the DB process. Interjecting construction contractor knowledge early into the design fosters creative design and construction solutions. If used correctly, DB promotes constructability and innovation in the same manner as formal value engineering and constructability programs.

Notably missing from this list is the concept that owners select DB because it establishes a single source of responsibility. This is the definition of DB and encompasses all of the selection factors. It was determined early in the research not to use single source as a reason for selecting DB because it is too general and would not offer insight into the true motivation for choosing DB.

Using these seven factors as the list of possible reasons to select DB, the owners were asked to assign the most important selection factor a 1 and the least important a 7. Table 1-2 summarizes the results of the survey, presenting the factors in order of ascending mean score. Rankings for median score are shown as well. While the mean and median rankings agree, the mean score offers more insight into the relationship of the ranking. For example, there is only one number 3 ranking by mean score, but there are four number 3 rankings by median score. The minimum and maximum scores are also shown.

The individual rankings of the seven success criteria yield a mean score that can be used to determine an overall ranking, which is shown graphically in Figure 1-10. Note that lower mean scores indicate greater importance for selection.

Table 1-2 Results of Design-Build Selection Factors Survey

Selection Factor (1)	Mean (2)	Rank (3)	Std Dev (4)	Median (5)	Rank (6)	Min (7)	Max (8)
Shorten Duration	2.48	1	1.68	2	1	1	7
Establish Cost	3.26	2	1.73	3	2	1	7
Reduce Cost	3.82	3	1.60	4	3	1	7
Constructability/ Innovation	3.94	4	1.88	4	3	1	7
Establish Schedule	3.99	5	1.80	4	3	1	7
Reduce Claims	4.58	6	1.91	5	6	1	7
Large Project Size/ Complexity	5.92	7	1.58	7	7	1	7

Source: Songer, A. D., and Molenaar, K. R. (1996). "Selecting design-build: private and public sector owner attitudes." *J. Engrg. Mgmt.*, ASCE, 12(6), 47–53.

Figure 1-10 illustrates that there is one primary reason why owners select DB: to shorten duration. Owners do not feel strongly inclined to choose DB due to having large project size/complexity. Although the owners only feel strongly about two of the seven factors, all factors scored at least one 1 ranking. This illustrates that for any particular project, any one factor can be a significant reason for choosing DB. Therefore, owners generally select DB to shorten duration, but for specific projects the motivation for choosing it may be to establish cost, reduce claims, or any of the other reasons.

While differences between the rankings of public and private owners exist, they are not as significant as one might think. In fact, only one statistically significant difference appeared in the sample population of public and private owners: public owners more often choose DB to reduce claims. This difference is most likely due to the fact that lawsuits are much more cumbersome to deal with in the public sector. There is more red tape involved with a public claim than a private one. The bureaucratic rules for the public owners do not permit negotiation as freely as for the private owners. Also, public owners come under much more scrutiny in legal claims because they are spending other people's money, namely, the taxpayers.

Performance Studies

At the time of the owner DB survey previously described (1996), there was no empirical evidence supporting the claim that DB project delivery correlated to a reduction in cost and schedule or an improvement in quality. Since that survey, a number of seminal research studies have been conducted that prove DB correlates to improved project performance. This section discusses three studies: the Construction Industry Institute (CII)/Penn State Project Delivery Study (Sanvido and Konchar 1999), the Reading Design and Build Forum Report (Bennett et al.

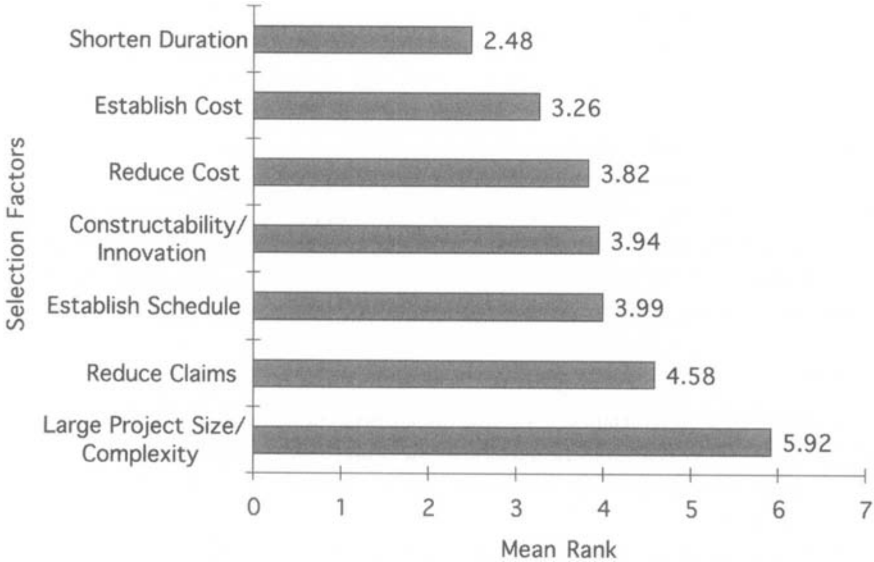

Figure 1-10 Results of design-build selection factors survey (*Songer and Molenaar 1996*).

1996) and the U.S. Navy in its Southwest Division, Naval Facilities Engineering Command (SWDIV NAVFAC) (Allen 2001). The University of Reading study, published in 1996, involved a review of more than 330 building projects in the United Kingdom. The CII/Penn State Project Delivery Study, published in 1999, evaluated 351 projects in the United States. The number of projects evaluated in these studies yielded statistically significant results. They both used statistical regression analysis to construct models identifying variables affecting project performance. Both studies provided similar performance comparisons and insights in terms of how to model, analyze, and measure performance. The NAVFAC study is smaller in scope (33 projects) but offers quantitative insights into federal agencies' experience with DB.

University of Reading Design-Build Study

In 1996 the Centre for Strategic Studies in Construction at the University of Reading (UK) evaluated the performance of a cross section of building projects to assess the performance of DB projects in terms of cost, quality, and time against the performance of projects procured using traditional DBB or so-called managed projects. The objectives of the study were to essentially answer three questions:

1. Is DB faster?
2. Is DB cheaper?
3. Does DB meet or exceed quality expectations?

To answer these questions, the researchers first defined performance measures. For example, the speed of project delivery was measured in terms of gross floor area divided by construction period. Then, all possible variables contributing to performance, including project procurement/delivery method, were factored into the analysis and ranked in order of importance. For example, key variables for time and cost models included project size, cost-per-area, building function, and complexity. Interestingly, the procurement approach was not the highest-ranking variable in order of importance for the time or cost models. The analysis then determined the effect of each key variable by holding the other variables constant. The key findings are summarized as follows:

Time

- Holding other variables constant, the construction speed of DB projects is 12% faster than traditional approaches and the overall project delivery speed (including design and construction) is 30% faster than traditional methods.
- Certainty of completion on time increases with the earlier the contractor is involved in the design process.

Cost

- 75% of DB projects were completed within 5% of budget, compared with 63% of traditional projects.
- Design-build projects are at least 13% cheaper than traditionally procured projects.
- Greatest cost certainty is achieved for DB projects when the owner's requirements are detailed.

Quality

- 50% of DB projects met clients' quality expectations, compared to 60% for traditional projects.
- The best result in meeting quality expectations occurred where owner requirements had minimal definition and the contractor's in-house designers undertook the design at an early stage.
- The worst result in meeting quality requirements occurred in projects where the designer was a subcontractor and a significant proportion of the design was completed by the owner in the RFP.
- Owners pay for a higher percentage of repairs for defects in traditional projects compared to DB.
- Design-build performs consistently better in meeting quality requirements for complex or innovative buildings rather than simple, standard, traditional buildings.

The conclusions of the study support commonly held opinions that DB can deliver building projects faster (particularly the overall delivery speed for design and construction) and cheaper than traditional procurements. The likelihood of success over time will improve with the earlier the design-builder is involved in the design process.

Construction Industry Institute/Penn State Project Delivery Study

A research study similar in scope to the Reading study was sponsored by the CII, conducted by Mark Konchar and Victor Sanvido of Pennsylvania State University and published in the ASCE *Journal of Construction Engineering and Management* in 1999. As in the Reading study, the objectives were to compare the cost, schedule, and quality performance of DB delivery with construction manager at risk (CMR) and DBB processes, using data from 351 projects in the United States representing a cross section ranging from industrial buildings to offices and multistory dwellings. The study also considered other key factors contributing to performance (e.g., project size, unit costs, project complexity, and percent design complete before construction). The analysis examined one variable at a time (univariate analysis) and the interaction of multiple factors (multivariate regression analysis) to determine, with a reasonable level of certainty, the contribution of the delivery system variable to project performance. As in the Reading analysis, the variables exerting the greatest influence on certain aspects of performance were not project delivery methods. For example, project size and costs per unit area were found to have a greater impact on construction speed and delivery speed than the delivery method. Table 1-3 summarizes the results for each of the performance metrics, holding the other variables constant.

The results indicate that DB projects performed consistently better than the more traditional delivery systems in terms of the unit costs of design

Table 1-3 Results of Construction Industry Institute Project Delivery Methods Study

Average Percent Differences among Project Delivery Systems				
Metrics	**DB vs. DBB**	**CMR vs. DBB**	**DB vs. CMR**	**Level of Certainty (%)**
Unit Cost	6% Less	1.5% Less	4.5% Less	99
Construction Speed	12% Faster	6% Faster	7% Faster	89
Delivery Speed	33% Faster	13% Faster	23% Faster	87
Secondary Comparisons				
Cost Growth	5.2% Less	7.8% More	12.6% Faster	24
Schedule Growth	11.4% Less	9.2% Less	2.2% Less	24

Source: Konchar, M., and Sanvido, V. (1999). "Comparison of U.S. project delivery systems." *J. Const. Engrg. and Mgmt.*, ASCE, 124(6), 435–444.

and construction, construction speed, and overall delivery speed, with a high degree of confidence that the variation in the data and variables affecting performance are explained in the model. The remaining comparisons (cost growth and schedule growth) also showed a favorable result for DB but were considered secondary because there was a much lower certainty (24%) that the variations in the data could be explained in the model. The last category of analysis, quality, was measured in seven specific areas categorized in terms of turnover quality and system quality.

Turnover Quality

- Ease of start-up,
- Lack of callbacks,
- Low operation and maintenance costs.

System Quality

- Envelope, roof, structure, and foundation,
- Interior space and layout,
- Environment,
- Process equipment and layout.

Project owners/developers were asked to rank actual performance versus expected performance in terms of not meeting expectations, meeting expectations, or exceeding expectations. These measures of quality (owner satisfaction) were considered relative tests of quality and were the least objective of all performance measures used in the study. The results shown in Figure 1-11 indicate that DB projects achieved equal or slightly better quality results than CMR and DBB for both turnover quality parameters and system quality parameters.

Comparison of Reading and Construction Industry Institute Results

A controlled scientific study is difficult to conduct in the construction industry because projects are unique, durations are long, and accumulation of significant amounts of data is costly. Comparing the CII/Penn State and Reading research studies gives us a unique opportunity to achieve a somewhat controlled comparison. These studies were conducted independently in separate countries. Both of these studies were conducted with data populations in excess of 325 projects. Table 1-4 summarizes the results.

When viewed together, the results of the Reading and CII studies are even more significant. Both studies showed significant savings in unit costs, with the UK results displaying more savings than those of the United States. Schedule results were virtually identical. Construction speed for both studies was shown to be 12% faster for DB and delivery speed was shown to be at least 30% faster. While the choice of delivery method was not the only reason for these savings,

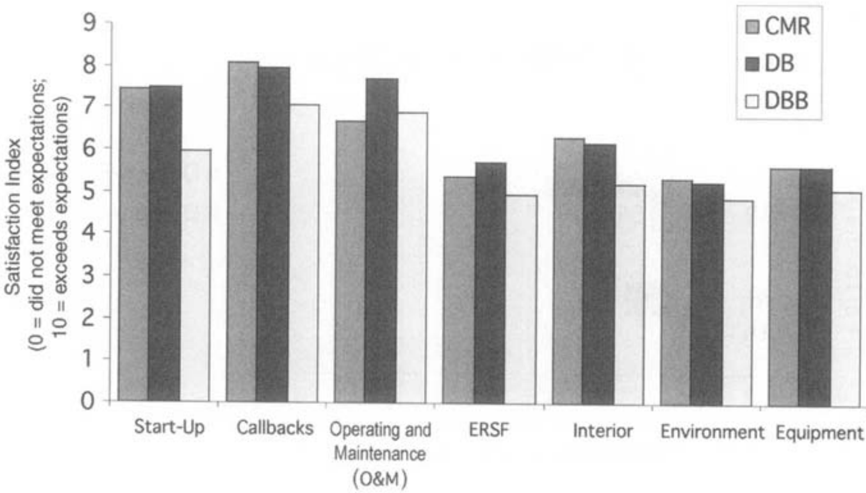

Figure 1-11 Delivery system quality performance results from the Construction Industry Institute project delivery methods study (*Konchar and Sanvido 1999*).

Table 1-4 Comparison of CII/Penn State and Reading Project Delivery Methods Research Results

	CII/Penn State (U.S.) DB vs. DBB	**Reading DB Forum (UK) DB vs. DBB**
Unit Cost	6% Less	13% Less
Construction Cost	12% More	12% More
Delivery Speed	33% Faster	30% Faster

Source: Konchar, M., and Sanvido, V. (1999). "Comparison of U.S. project delivery systems." *J. Const. Engrg. and Mgmt.*, ASCE, 124(6), 435–444.

one can argue that there is a significant correlation between project delivery method and project performance.

Naval Facilities Engineering Command, Southwest Division

The Naval Facilities Engineering Command (NAVFAC) has used DB since the late 1960s for military housing and has since employed DB on much more complex projects. The use of DB has grown significantly over the past 30 years but this growth has been based mainly on anecdotal evidence. At the 1998 National Government/Industry Forum on Design-Build Plus, Admiral D. J. Nash stated that the NAVFAC experience "... has been very good. The projects have completed on time and well ahead of schedule.... [I]t's cheaper because it costs less

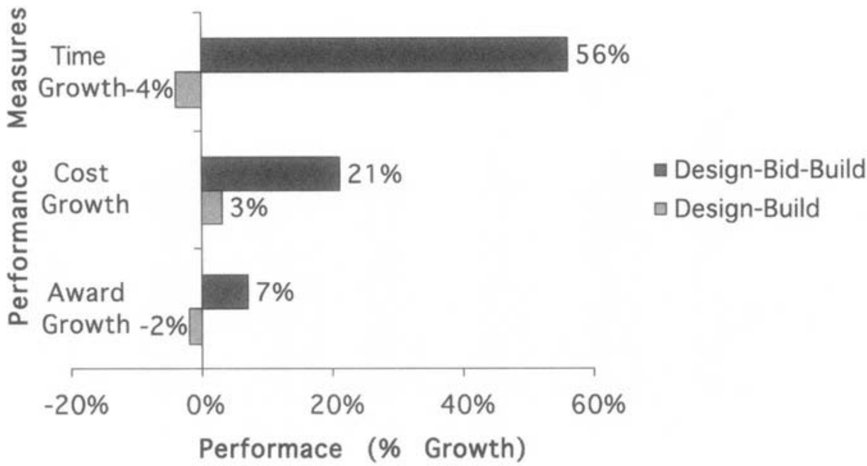

Figure 1-12 Results of the Naval Facilities Engineering Command design-build project performance study (*Allen 2002*).

to manage the construction and it costs less in litigations." (National Government/Industry Forum 1998) While compelling, these statements are the admiral's opinion and were not based on empirical data.

In an attempt to validate the belief that DB costs less and is faster for the Navy, NAVFAC's Southwest Division conducted a definitive and comprehensive investigation into the comparative performance of projects delivered using DBB and DB. The study was conducted as part of Linda Allen's Master's thesis at the Naval Postgraduate School (Allen 2001). A comparison of cost, schedule, and efficient use of funds characteristics of the two types of project delivery systems was completed using specific data from 33 military construction projects. The population includes 20 Bachelor Enlisted Quarters projects, 11 of which were DB and 9 were DBB. There were six Family Fitness Centers, four developed by DB and two developed by DBB. There are seven Child Care Centers, two developed by DB and five developed by DBB. The study included interviews to verify the financial information system data. These projects were similar in kind and had a uniform structure or composition. The results of the study are shown in Figure 1-12 and summarized in the following paragraphs.

Award Growth Award growth was the difference between the value of the programmed cost and the initial contract award amount. Award growth for Bachelor Enlisted Quarters, Family Fitness Centers, and Child Care Centers was found to be

- Design-bid-build: 7%,
- Design-build: -2%.

This metric provides an interesting view of the government's ability to forecast the cost of military construction. As a project proceeds from concept to completion, the owner's commitment to actual delivery becomes greater and greater. If the owner underestimates the project's cost in the early stages, that owner is liable to be more willing to pay an inflated price for the project as it draws closer to completion.

Cost Growth Cost growth measured the percentage increase of a construction contract amount from its award price to the total final price. The total final price is the original contract price plus any change orders (deductive or additive) that occur during the period of the contract. The cost growth calculation includes the architect/engineer design contract for DBB projects. In this manner a similar comparison is made. The cost growth for Bachelor Enlisted Quarters, Family Fitness Centers, and Child Care Centers was shown to be

- Design-bid-build: 21%,
- Design-build: 3%.

When cost growth is high, several inferences can be drawn. In a DBB project, the quality of the design could be poor, requiring numerous change orders to correct design errors and deficiencies. A high cost growth could also indicate a major unforeseen site condition that gravely affects the contractor's production. A negative cost growth indicates that the owner failed to scope the magnitude of the project properly, unnecessarily tying up working capital.

Time Growth Time growth measured the increase or decrease in the project delivery period. Contract time must change as the project scope changes and acts as another tool to measure project performance. Time growth for Bachelor Enlisted Quarters, Family Fitness Centers, and Child Care Centers was shown to be

- Design-bid-build: 56%,
- Design-build: -4%.

Typically, time growth and cost growth are directly proportional and the same inferences can be drawn as to the reasons for the growth.

Owners have driven the rapid growth of DB due to their belief that the delivery results in faster and less costly facilities. For the better part of the 1990s, this belief was primarily based on anecdotal evidence. The three studies described in this section present comprehensive empirical evidence that DB yields better performance than the traditional DBB method. Of course, the empirical results presented are, for the most part, based on averages and any one project may have different results. It is critical for the industry to look at its specific project and programmatic goals to determine whether DB makes sense on a given project or program.

Design-Build Success Factors

Some common themes for successful DB projects are presented throughout this book. The reader is encouraged to keep the following issues in mind while reading the text.

- Design-build requires a higher level of trust and partnering.
- Design-build requires the owner to develop definitive, functionally driven performance criteria.
- Design-build requires a cultural shift away from the DBB mentality.
- Remember who owns the details of the design.
- Get the team together early and keep it together.
- The DB contract is a construction contract that also covers design.
- Contractors have been doing design all along in the form of shop drawings and submittals.
- Design-build is a scope-driven endeavor.

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TWO

Developing Design-Build Project Scope

Developing the scope for any project involves understanding the requirements for the completed facility in both functional and performance terms. Proper scope definition has proven to be a primary determinant of project success in traditional delivery methods (Ashley et al. 1987; O'Connor and Vickroy 1985) and it is even more important in design-build (DB) (Songer and Molenaar 1997). Architects call this process developing the program. The first step in the scoping process should be a thorough analysis of the project's characteristics on a global basis, looking at more than just the technical requirements for design and construction. The project's owner must ensure that the entire context in which the project must be delivered is thoroughly understood and can be accounted for in plans for schedule, price, and quality. These plans must satisfy not only technical requirements but also those requirements established in law, in industry, and in the community where the project will be built.

Once the owner has determined all the external constraints that will impact the project, a project delivery method can be selected. The choice of delivery method drives much of the project's scope development because it establishes the level and nature of detail that must be achieved at the time the final contract to complete the project is awarded. Therefore, it can be argued that the choice of a project delivery method will ultimately define most of the important decisions that must be made before the contract for the project can be advertised. Picking a project delivery method should be done with great care and much critical thought. This delicate decision should not be arrived at arbitrarily. Each project has a delivery method that is best suited for its requirements and the owner should critically review the options available before selecting the delivery method.

Project delivery is a three-legged stool with the legs shown in Figure 2-1 being:

- Cost,
- Schedule,
- Quality as defined by the details of design.

In the traditional design-bid-build (DBB) delivery system, the quality is established by furnishing a completed design for the construction on which the contractors bid (Ellis et al. 1991). Thus, with the contract completion date usually being specified, the only leg of the stool left to ensure a level platform is the bid price. Therefore, DBB is by definition a system wherein the construction contractor tells the owner how much it will cost to deliver the quality defined in the design within the specified period of performance.

Design-build, on the other hand, can demand that the design-builder offer a firm, fixed price for a project whose scope is defined by a set of performance criteria within a specified period of time (Molenaar and Gransberg 2001). Therefore, the variable leg in the DB stool is the details of design. This puts the design-builder in a position where the details of design, and hence the resultant level of quality, are constrained by both the budget and the schedule. In other words, the design-builder must design to cost and schedule. As a result, it is extremely important to both the owner and the design-builder that the requirements for quality be clearly communicated in the Request for Proposal (RFP) so that the resultant proposals will be as responsive to the owner's needs as the cost, technical, and time constraints of the project allow.

When considering the use of DB, the owner must remember that this method entails turning over the details of design to the design-builder. This necessarily means that the owner is giving up some control over the fine points of the finished product. In this industry, when you give up something, you need to make sure that you get something in return. Using DB could mean that the owner gets to use the facility earlier than would be expected using the traditional delivery method. It could also entail being able to compete multiple design solutions for the same design problem and being able to take advantage of the design and construction industry's innovation and creativity. Regardless of why DB is selected, before the owner's team begins to assemble the necessary documentation to advertise the

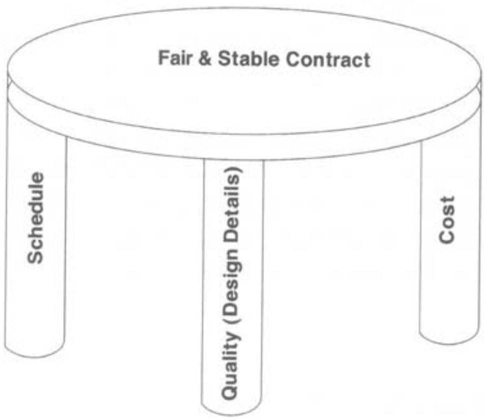

Figure 2-1 Project delivery concept.

project they should first designate the project delivery method and everyone on the team must understand the team's rationale for picking that method.

Design-Build Project Characteristics

There are a number of good reasons why an owner would select DB for a given project. The issue at this point in time is: can this project realistically accrue the desired benefit associated with selecting DB? Thus, the owner's team must rigorously analyze the characteristics of the project at hand and feel very positive that when the project is delivered with DB that the reason for using DB is indeed satisfied. A list of reasons for which an owner might decide that a given project is a good candidate for DB delivery follows:

- A compressed delivery schedule is required.
- A single point of responsibility is required.
- Constructability considerations drive the design concept or details.
- Unique factors require special knowledge or experience to produce the least-cost design.
- The owner/designer must rely on the builder to optimize technology with cost.
- The project will site-adapt a previous design.
- The project is a common commercial facility.
- The project is beyond the owner's technical capability.
- Risk can be shared to reduce cost.

Compressed Delivery Schedule

As discussed in Chapter 1, the major reason owners select DB is to compress the delivery schedule. This may happen for two reasons. First, a project that has a post-construction revenue stream associated with it (such as a toll bridge, a hotel, or a water treatment plant) will increase its profitability and, hence, its economic viability for every additional day of revenue that can be derived from the early opening of the project. From this perspective, it is easy to understand why gaming companies often select DB as the method for building new casinos. Even less-glamorous projects such as commercial parking garages or strip malls will incrementally enhance their long-term profitability if their owners are able to open their new facilities days or weeks earlier than would have happened using traditional project delivery. The concept that allows this to happen is permitting construction to begin before design is complete. In essence, the owner is consciously deciding to not wait until the color of the interior paint has been determined before starting to dig the foundations.

The second reason for wanting to compress the delivery period most often occurs in the public sector—the expiration of funding authority, perhaps at the end of a fiscal year. Owners in these types of projects select DB when they realize that taking the time to award a design contract and complete the project's final design, combined with allowing the requisite period to advertise, bid, and award the construction contract, takes the project's obligation of funds date past the established deadline for use of those funds. This can also happen in the private sector when the same set of circumstances places the construction finish date beyond the project's required delivery date. Thus, seeking to reduce the schedule by allowing concurrent design and construction activities allows the owner to complete the project in the time available. The best recent example was the Interstate 15 project in Utah where the Utah Department of Transportation needed to complete the project before the start of the 2000 Winter Olympics (Warne and Downs 1999). In another case, author Douglas Gransberg was involved in a commercial building project where the financing was predicated on awarding the construction contract by a particular date to lock in the financing discount rate. Expressed as a mathematical inequality, this reason for selecting DB rather than DBB would look like the following:

Time (DBB) > Required Delivery Date – Today
Where Time (DBB) = the time it will take to deliver the project using DBB.

In both of the above examples, the owner is getting an early delivery in exchange for giving up direct control of the details of design to the design-builder. Therefore, by moving control of both design and construction to a single entity, that entity is able to start construction at the earliest possible moment. The reader should note that this does not necessarily imply a fast-track project as was defined in Chapter 1. In the commercial building example above, the owner ultimately required that the design-builder complete the construction documents and pull all the permits before authorizing construction to begin. The reason for selecting DB was related to a financial deadline rather than the desire to open the facility as soon as possible. Thus, selecting DB does not mean that the owner must allow the design-builder to proceed as quickly as possible. By structuring the RFP to include both design and construction notices to proceed, the owner can complete a DB project in much the same manner as a traditional DBB one while obligating the construction funding as early as possible and saving the time it takes to advertise and award a construction contract after design is complete.

Single Point of Responsibility Required

The next reason for which an owner might determine that its project is a good candidate for DB project delivery is that a single point of responsibility for both design and construction is required to successfully complete the project. This reason could be selected for three major project conditions:

1. Long-term, post-construction considerations require a single point of responsibility.
2. The project must be built at a remote site.

3. Security considerations demand minimal access to project documentation.

In traditional DBB project delivery, the owner implicitly warrants the quality of the design to the construction contractor. Therefore, if the builder builds the project exactly as it was designed, then any long-term performance problems are the responsibility of the owner. Although it is theoretically possible to recover for damages caused by design errors and omissions, the owner's ability to prove that fact and the overall complexity of a construction project make it difficult and expensive to seek redress under that premise. In these cases the builder's position will be that the design was flawed, and the designer's position will be that the builder failed to properly execute the design as evidenced by the performance failure. Meanwhile, the owner will be caught in the middle with a project that does not perform as required and the prospect of a long, expensive legal battle to determine the liability for the performance failure. Thus, by selecting DB the owner greatly simplifies its position in this type of dispute. It does not matter whether the failure is due to a design error or a construction error. From the owner's perspective, that is clearly the responsibility of the design-builder who must then redress the problem and absorb the cost of doing so.

Another angle on the need to consolidate responsibility for long-term factors is the case of an infrastructure development project where the owner will turn over the operation and maintenance of a facility to the design-builder for a period after construction is complete. This is the design-build-operate-transfer (DBOT) model used by the World Bank to deliver infrastructure development projects in developing countries. Under this model, the design-builder not only delivers a completed project but also operates and maintains it for a fixed concession period. Once the concession has expired, the project is turned over to the host nation and it becomes a public utility. Typical examples are toll roads, irrigation projects, and electrical power projects. Often the developer must also finance these projects and amortize the capital costs of design, construction, operations, and maintenance from income derived by collecting tolls, selling irrigation water, or selling power. In these cases, the single point of responsibility principle allows the design-builder to design in a manner that minimizes life cycle costs rather than merely minimizing the initial costs of project delivery. It can be argued that DBOT operates as an ironclad warranty and probably delivers a project that is at a higher standard that a traditional project because the design-builder has a direct financial interest in the project's long-term quality.

The second major reason to select DB to achieve a single point of responsibility is for projects that must be built in geographically remote locations. There are a number of good reasons to use DB for these types of projects. First, by awarding both the design and construction contracts at the same time, both the design and the construction professionals can share in the initial site visits and ensure that the ultimate design is very buildable and conforms to the specific constraints of the remote site. An example of this is found in a project that the Naval Facilities Engineering Command delivered on an island off the coast of California.

Absolutely everything that was needed in that project, including potable water, had to be transported to the island and off-loaded at a small berthing facility. Thus, the designer had to constrain the design to use materials and equipment that could be transported on boats that were small enough to use the existing pier. Although this project could probably have been successfully completed using DBB, any mistake in the design with regard to construction materials and methods assumptions would have been the owner's responsibility. Therefore, DB was a good means to transfer the risk to the party who could best manage it across the life of the project.

Remote sites also have an inherent friction factor associated with actually getting onto the ground during the design phase. In DBB projects, designers often either choose to rely on owner-furnished, as-built documents and site maps or they have no choice but to use them. Constructors do not have this option; they must build the project on its site. Therefore, by awarding both design and construction to the same entity the owner removes this propensity to rely on documentation. The design-builder must eventually mobilize and, as construction often runs concurrently with design, the designer can use actual field measurements and rely on the builder's growing familiarity with actual field conditions to provide guidance with regard to construction means and methods.

The final reason for using DB project delivery to achieve a single point of responsibility became more important and more relevant due to the American tragedy of September 11, 2001. This reason is the maintenance of security on public and prominent private facilities. The use of DBB in public projects necessitates making detailed, project-related construction documents available to the public. Conceivably, these could be of use to terrorists in planning attacks against high-profile facilities. Using DB greatly reduces the public exposure to design details, as the RFP usually contains conceptual designs and performance requirements that would not be nearly as valuable to a terror attack planner. Also, by awarding both the design and the construction to the same entity, DB project delivery inherently restricts the knowledge of the detailed design information to only those who have a need to know to properly construct the facility. In the construction of critical defense installations where project personnel must be given government security clearances, awarding design and construction to one entity allows the military owner more time in which to properly clear the construction workforce; the owner can identify exactly who needs a clearance at the earliest possible time in the project life cycle.

Constructability Considerations

One advantage that clearly accrues to the owner in a DB project is the early involvement of the builder in the design development, as discussed in Chapter 1. By allowing the builder to be involved the owner also accrues the indirect benefit during proposal evaluation of being able to compare different solutions to the same problem, all of which have been analyzed and priced by the builder. DB project delivery allows the builder to propose a design that the builder is particularly experienced in building and for which it has competitive pricing data. This is constructability in its purest form. Public owners, such the U.S. Army Corps of Engineers (USACE), employ constructability reviews in their DBB processes, but typically these reviews come after final design is complete and therefore have little ability to truly influence the fundamental design itself.

Constructability is a term of art that has come to encompass a detailed review of design drawings, specifications, and construction processes by a highly experienced construction engineer before a project is put out for bids in DBB projects. It is defined as "the optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives." (CII 1986) The purpose of the constructability review is to identify the following five items:

- Design errors, both material selection and dimensional,
- Ambiguous specifications,
- Project features that will be difficult or exceedingly costly to construct as designed,
- Project features that exceed the capability of industry to properly build,
- Project features that are difficult to interpret and will be hard to accurately bid.

In the early 1980s USACE instituted a program of conducting formal constructability reviews on all DBB projects before they are released for bids (USACE 1994); the success of that program is important in understanding the potential value of constructability reviews for DB projects. Although no information that captures and quantifies the savings attributed to this USACE program is available in the literature, USACE's experience is that virtually every review catches some factor that, if left unchanged, would have necessitated a construction change order during that project (Gransberg et al. 1999).

This federal concept can easily be applied to DB projects. Essentially, it is a capability review of the builder to determine if it has the required level of tools, methods, techniques, and technology to build the project feature in question to the level of quality required by the RFP. The constructability review also entails an evaluation of the ability of construction subcontractors to understand the required level of quality and accurately estimate the cost of providing it. Thus, the level of risk due to misinterpretation that is inherent in a set of specifications or a project feature is reduced to the minimum level. When a formal constructability review is combined with a thorough cost engineering analysis, the final design is greatly enhanced and the project is therefore less susceptible to cost and time growth from change orders and claims. The benefits of a constructability reviews in DBB projects are listed below (Gibson et al. 1996).

- Reduced cost,
- Shorter schedules,
- Improved quality,

- Enhanced safety,
- Better control of risk,
- Fewer change orders,
- Fewer claims.

Although the use of formal constructability reviews has a reasonably long history in the building industry, application of constructability concepts to transportation projects is relatively new. A comprehensive study in the transportation field is presented in National Cooperative Highway Research Program (NCHRP) *Reports 390* and *391*(Anderson and Fisher 1997a; Anderson and Fisher 1997b). In this study constructability is considered an integral part of the project development process where a project is divided into three phases: planning, design, and construction. Figure 2-2 takes the NCHRP *Report 390* process for traditional design-bid-build projects and adapts it to show a generic framework for the constructability review process (CRP) for design-build projects.

Implementation of a constructability review cannot be conceived apart from experience in the field (Gransberg et al. 1999). Therefore, past experience and best-practice examples are invaluable inputs to the constructability process. With the application of the information learned during similar projects, possible areas of difficulty can be identified prior to construction. Analyses and constructability reviews during the planning, design, and construction phases only improve the quality of the final product. In doing the analyses and constructability reviews, the constructability team tries to establish some connections with similar past projects. The factors that created success in a past project can be replicated in the new project and the factors that led to the failure of a past project can be avoided in the future.

In DB project delivery the constructability reviews can be accomplished in conjunction with design development. Thus, they will be of much greater value because the findings of the constructability reviews can be used to directly influence the outcome of the design process in a manner where the loss of design effort is minimized. In this way a project whose successful completion depends on selecting a design solution that is perfectly matched with its required construction means and methods can be considered a strong candidate for DB project delivery.

Thus, integrating constructability into the project from its very beginning is of great value to all parties in the DB contract. With this in mind, if constructability issues will drive the design concept, then using DB project delivery is justified to ensure early and authoritative input to the design from the project's builder. For example, in a building project that has a very tight site, the issue of crane reach and pick can be used to decide whether to use a pre-engineered steel structure, a fabricated structural steel, a precast concrete frame, or a cast-in-place concrete frame. Each of these design technologies would furnish a suitable building frame but each has different requirements for the use of a crane to assemble the building. The pre-engineered steel structure has the advantage of being less expensive and will require the least preparation before it is fabricated, but it comes in standard dimensional sizes and must be assembled in a preconceived manner with little flexibility to alter the design to match field conditions. Thus, a tower crane might have to be

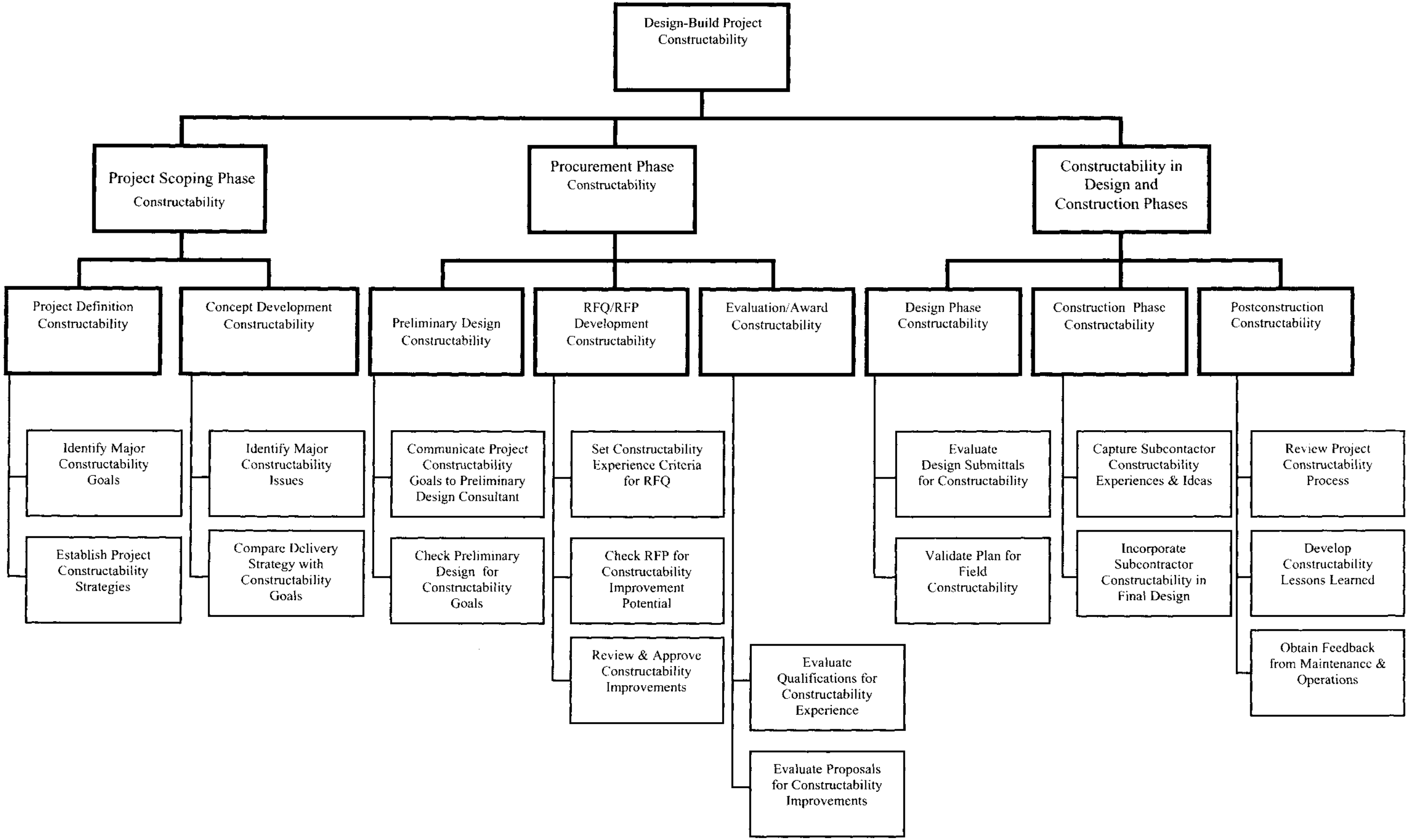

Figure 2-2 The design-build construction review process (*adapted from Anderson and Fisher 1997a and 1997b*).

installed if a mobile crane of sufficient capacity cannot be adequately fit onto the site. A custom-fabricated steel frame has infinite flexibility within the design constraints of the building; however, its heaviest piece will normally correspond with the requirement for clear span in the building. Again, if a mobile crane cannot be found that will both safely handle the construction loads and fit onto the site, a tower crane maybe be required. Precast concrete has many structural and construction advantages but it brings with it very heavy crane loads with the attendant issues of the previous two building frame technologies. Finally, cast-in-place concrete can be built in pieces that minimize the crane loads and ensure that a mobile crane can be used on-site, but it lengthens the schedule and multiplies the quality management issues.

These examples demonstrate how, by selecting DB, the owner is freed from needing to make this particular decision and can let the competitors for the project conduct their own analyses and propose the solution that best fits their requirements and experience. The successful competitor can then follow-up by designing around the constraints discussed above. In doing so, the design-builder will design the constructability into the project at its genesis rather than trying to modify the project to fit constructability issues after the design is complete. In the long run, this should produce a more satisfactory final product for the owner at a competitive price.

The above discussion is also true if constructability considerations will drive the details of the design. The above example of the Navy's remote site is a good illustration of this point. As everything used in that project had to fit on a boat that could dock at the island's pier, designing the project with pieces that would fit on the boat became the major design constraint. Not only did the pieces have fit on the boat, but the equipment, means, and methods used to incorporate those pieces into the project also had to fit. Thus, the designer and the builder had to work very closely together to ensure that the details of design were controlled such that everything that went into the final project could be handled by equipment that could be transported to the island. By selecting DB project delivery the owner of this project vested the design-builder with total responsibility for the whole project and thus assigned the risk for both design details and construction details to the party who could best manage it. In light of the above discussion, the owner should select DB project delivery for those projects where constructability issues will drive either the design concept itself or the details of design as related to execution of the construction.

Unique Factors

The owner should consider using DB project delivery when a project contains unique factors that require special knowledge or experience to produce the least-cost design. The most knowledgeable contractor will often be the one that is able to quote the most competitive price. Contractors must increase their margins to account for the level of contract risk. Thus, if one competitor has special knowledge with regard to a particular project, this usually gives that contractor a competitive price advantage because it will perceive the risk to be lower than its competitors will. The owner can use this principle to accrue those benefits to itself by using DB project delivery to take advantage of that special knowledge or experience.

A broad example of special knowledge has come in the post-9/11 requirement to enhance the security of those public utilities that are vulnerable to terrorist attack. For instance, after that catastrophe most major metropolitan water districts implemented security upgrade projects to protect the nation's potable water supply. Water districts are expert in the design and construction of water supply projects but their experience in the design and construction of remote sensing systems and security alarm systems is not nearly as deep. Therefore, because these types of projects require vast amounts of very specific technical expertise, selecting DB project delivery allowed the owners to leverage the technical expertise of those design-builders that specialize in security upgrade projects.

Unique knowledge and experience can also be applied beyond just technical expertise. The knowledge of local field conditions and business practices is also a reason to select DB. Private owners often use DB to deliver their first set of capital facilities in foreign countries because their first few projects can teach them how to practice design and construction in an area in which they have no experience. This situation was very true after the Iron Curtain fell and U.S. companies began setting up various businesses in the newly independent republics of the former Soviet Union. Few, if any, American companies had tried to design and build projects behind the Iron Curtain. Therefore, partnerships with foreign design and construction firms were forged to manage the risk of the initial projects. This factor in a project's environment could argue very strongly for the use of DB delivery. An example occurred closer to home in 2002 when the U.S. Forest Service needed to build a road through a national forest in Alaska. Because of the unique geotechnical, environmental, and climatological conditions challenging the project, the decision was made to select DB project delivery to ensure that both the project's designer and its builder had the requisite experience working in that locale and that they conducted the design process in a manner that maximized the local knowledge of field conditions that the builder would face during construction.

Optimizing Technology with Cost

Construction contractors must stay in constant touch with the current costs of various kinds of construction technology in order to stay competitive. Owners and designers might also feel that they are on top of the latest developments but, quite frankly, that is a misconception. Their livelihood does not depend on accurate cost estimates, so their knowledge of the cost of technological options is neither as current nor as accurate as the builders'. The builder in a DB contract will bring this type of knowledge to the project; when a project's budget is tight, the owner can use DB project delivery to leverage this type of knowledge to the project's benefit. This can be done in a number of ways, as listed below:

- Using a so-called design-to-cost contract where a fixed price is stipulated and the quality and quantity of project scope are competitively evaluated to identify the best value.

- Encouraging innovative design solutions by having the fundamental elements of design defined by performance criteria rather than prescriptive specifications in the RFP.
- Allowing the proposal of design alternatives for specific features of work.
- Awarding the DB contract with minimal design detail being required in the proposal, thus allowing the DB team to maximize its opportunity to change the design to take advantage of market fluctuations in construction materials and equipment.
- Publishing a desired rather than a required completion date, thus allowing the design-builder to develop a schedule that incorporates provisions for the logistics of delivering alternate technologies. This also prevents the unintentional elimination of some promising technical alternative that cannot be procured in the period allowed by the RFP.
- Allowing the design-builder to propose the project's schedule and offer alternative price proposals for schedules that miss the required completion date.

In essence, the above list enables the owner to recognize that DB project delivery furnishes a means for it to capitalize on the industry's special knowledge and experience. By doing so, the RFP writer does not unintentionally exclude innovative alternatives of which they are personally unaware. It also means that the owner must remember that the real technical experts on construction are the nation's construction contractors; that expertise can be effectively harnessed for the project's benefit by allowing the design-builder to optimize the project's technology with its cost.

Site-Adapt Previous Designs

Another opportunity to select DB as the project delivery method is a project in which the owner wants to copy a previous design onto a new site. Some will argue that this is a reason not to use DB, but they are forgetting that when an owner hands one project's set of construction documents to a design professional and asks that designer to site-adapt that design to a new location, the owner is certifying the quality of that design. However, depending on the owner's expertise and knowledge of both sites' technical peculiarities, a situation might be created where an unknown condition on the new site invalidates some assumption that was used in the design of the original project. By selecting DB, the owner can avoid this issue.

To transfer the professional liability risk to the design-builder on a site-adapt project, the owner should take the original design and clearly indicate those technical features that must not be changed. In most of these cases, owners do not care about the engineering that must be changed to make a specific design fit on a new site. What they usually care about are interior and exterior architectural features that enhance the way a building functions after construction. Thus, the approach is to allow the design-builder to redesign any of the technical features that cannot be preserved from the original design due to site-specific conditions, while preserving as much of the original design as possible. In doing so, the design-builder will redraw and certify the revised design, and assume the professional liability.

Using this approach with horizontal construction projects such as bridges and highways will be less appropriate in most cases. It might prove useful in the delivery of ancillary facilities such as rest areas, multimodal transportation terminals, small bridges, and box culverts. In these cases the owner would use the same approach as described above for architectural facilities.

Common Commercial Facility

This reason for choosing DB mainly applies to public owners. Often public owners need to build the same type of facility as a private commercial owner might build. An example of this would be a military commissary store that is fundamentally no different from a private grocery store. In taking the public project delivery system (which is mainly developed to deliver military- and defense-related projects) and applying it to a facility that has no specific military function, the public owner might induce unintentional technical and procurement constraints that are unnecessary for the given project and probably add cost without adding value to the project. Thus, by selecting DB for projects with comparable commercial facilities, the public owner can leverage private sector experience and expertise in the design and construction of those specific types of projects to the benefit of the public owner.

This benefit can also be accrued in the private sector when owners are looking at building a one-of-a-kind project for their use. For example, a manufacturing company that has decided to build a training center can use DB and thereby obtain DB teams with experience and expertise in designing and building educational facilities. By the same token, a hotel chain needing to build a bridge at a resort can turn to design-builders from the public market that normally work for state departments of transportation. Thus, it can be seen that the true reason to select DB on these types of projects is to capitalize on the experience of the DB industry to the benefit of both private and public owners who need that expertise to ensure a successful project.

Project Is beyond Owner's Technical Capability

The comparable commercial facility premise for selecting DB can also be extended to those projects that entail a scope of work that exceeds the owner's technical capability. This comment is not directed only at owners who do not have in-house design and/or construction forces; it also applies to very sophisticated owners that procure billions of dollars of construction projects annually. The idea here is for the owner to take a hard, objective look at its internal technical capability, experience, and expertise and determine if the project in question is sufficiently different from the routine type of project the owner's workforce normally manages.

A great example of this would be a project to build a new, major athletic arena on the campus of a large public university. Universities typically have an on-campus group of engineers and architects who manage the facility construction needs. However, the chances that any one of these people would have experience in managing the design and construction of such a highly specialized facility are low. By choosing to use DBB, the owner risks not being able to recognize flaws in the critical technical issues during the design phase and then being at risk for their correction during construction. However, by selecting DB the owner can compete the design as well as the construction, giving maximum weight to both personnel experience and successful past projects while shedding the technical performance risk by giving it to the party who can best manage it.

The other side of this issue deals not with specific technical experience, as in the above paragraph, but with the owner having adequate personnel resources to effectively manage a complex, multifaceted design and construction project. This issue becomes exacerbated when the required project delivery period is compressed, forcing a very aggressive schedule. Thus, if the owner's technical staff is limited by legislative fiat or personnel budget, DB project delivery furnishes an avenue to bring the requisite knowledge and experience to a project without having to deal with personnel management issues after the project is complete. It also simplifies contract administration issues by consolidating into a single DB contract all the contracts that would have to be managed in the traditional system.

Risk Can Be Shared to Reduce Cost

The traditional approach to risk management is for the owner to develop design and construction contracts that transfer as much risk as possible to the contractors. In doing so, the owner normally ends up paying for that risk transfer in higher bid prices. It would follow, then, that by also transferring the responsibility for the design to the contractor, the owner has successfully unloaded virtually all of the risk. However, by asking the design-builder to commit to a firm, fixed price before the design is complete, the owner is also putting the design-builder at risk for the changes in the design details as design development proceeds. Again, the owner will pay for this privilege. However, DB contracts do not have to be formed like traditional contracts and can provide a degree of risk flexibility that owners may not recognize. By allowing certain prices to be fixed after the design details are complete, the owner will generally accrue cost savings.

A common example of the above is the pricing of a foundation for a bridge or building before the geotechnical study has been completed and the actual subsurface conditions are known. This often happens in public projects where the reason for using DB is related to awarding the project's contract before the end of a given fiscal year to obligate the authorized funding. In this case there is no time to conduct the geotechnical survey before advertising the contract; it is usually included as part of the design scope. Unfortunately, if no geotechnical information is known at the time the contract is priced, the design-builder must allocate a large contingency to cover the cost of building the foundation under the worst-possible-case scenario. However, the owner can form the contract with the idea of sharing the risk regarding the final outcome of the geotechnical report. The design-builder can be allowed to furnish two separate prices, one for a deep foundation and one for a shallow foundation, or agree to pay for the actual foundation on a cost-plus, fixed-fee basis. This concept can be applied to a wide variety of risk management issues, and DB project delivery allows the owner sufficient flexibility to allocate the risk to the party who can best manage it.

Reasons Not to Select Design-Build

The greatest danger in selecting DB project delivery is applying it to a project that will not benefit from it. There are a number of reasons not to use DB, and early in the project scoping process the owner should look for these red flags and ensure that none apply to the project at hand. A list of reasons that might make an owner decide that a given project is **not** a good candidate for DB delivery is as follows:

- The design must be complete for accurate pricing.
- The design must be complete for permitting or third-party issues.
- The owner wants significant input into the design.
- The project is too small to attract competent competitors.

The first reason to select a project delivery system different from DB deals with those projects where the final design must be completed before an accurate estimate of costs can be made. If the owner cannot estimate the cost of design and construction with a reasonable degree of accuracy, it follows that the design-builder will have the same difficulties. If a project with these characteristics is awarded using DB, then there is a high probability that one of two unpleasant situations will occur. First, the design-builder will have to include a very large contingency to cover the potential cost of those items whose cost cannot be determined until a detailed design is completed. This is usually detected when none of the price proposals is found to be within the contract budget, a situation commonly called "being out of the money." The other possibility is that one of the competitors mistakenly underbids the project. This will be detected when only one of the proposals is under the project's estimated budget and the remaining proposals are far above it.

In both cases, the owner is now faced with a very difficult decision. In the first case, the owner will have invested a good deal of time and effort and will not be able to award the project because the necessary funding is not available. The second case is more insidious. As mentioned in the previous chapter, the main reason for selecting DB is schedule compression. The owner will be tempted to award the contract to achieve its schedule requirements, but awarding a contract to an offeror with a mistaken bid often causes the business relationship between the owner and its contractor to deteriorate (Ellicott 1994). Once the design-builder realizes its mistake it will attempt to mitigate its losses by ensuring that it delivers the absolute minimum in terms of scope and quality, and this will break down the necessary relationship of professional trust. In either case, the owner should have recognized the impossibility of adequately pricing the project before its design was completed and should have selected the traditional DBB project delivery process instead.

The next case that makes DB a poor project delivery choice is a project where the final design must be completed before the necessary permits or third-party interfaces can be obtained before the notice to proceed with construction can be issued. Regulatory enforcement and resource agencies have no incentive to facilitate a given project's delivery process. In fact, most have a charter that defines their major responsibility as identifying and stopping the construction of projects that do not comply with the regulations they enforce. Therefore, if an issue with the adequacy of the design with respect to a particular environmental or zoning restrictions arises, the entire project will be delayed until the issue is resolved.

The "meter" runs faster in DB projects than in DBB projects. Many so-called compensable construction delay costs can be incurred during the design phase in DB that would not occur in a traditional project. For instance, because both design and construction are awarded in DB contracts the design-builder will typically line up the major construction subcontractors and material suppliers based on the assumption that the award of the contract validates the proposed design approach and any details furnished in the successful proposal. Thus, commitments are being made and material prices are being locked-in to allow the design-builder to deliver the project as proposed. A long delay in receiving a specific permit could cause the schedule for major subcontractors to be severely impacted, and satisfying the permitting agency could potentially cause a significant change in the proposed design. This could possibly cause the cancellation of major materials orders and perhaps even a change in the types of subcontractors that will ultimately employed on the project. All of these possibilities may be compensable to the design-builder when negotiating the change order to cover the delay. Thus, if any question exists that permits will be difficult or impossible to obtain in a timely manner, then the owner will be better served to complete the design in the traditional manner and bid the construction as soon as the permitting issues are resolved.

The next reason to not select DB are projects where the owner wants heavy (significant) input to the design. To be successful, DB project delivery necessitates that the design-builder own the details of design until it is ready to commit to specific, detailed design decisions that have been both priced and scheduled. An owner that wants absolute control over the final design should not use DB project delivery. The main reason goes back to the idea that a higher level of professional trust between the parties to a DB contract is required to guarantee success. An owner that demands to control the design details will see any deviation from its mandate as an attempt to cut corners on quality. This issue will create an adversarial relationship and eliminate the ability of the two parties to effectively and honestly communicate during design reviews and subsequent construction meetings. Once the trust relationship is broken, the advantages of using DB are lost. Owners who find themselves in an environment where they cannot trust their design-builder should abandon DB project delivery and use DBB, where they can totally control the outcome.

The final reason not to use DB is on projects that are too small to attract competent design-builders. There is no absolute minimum value for this threshold. However, as the design-builder is taking most of the cost risk in DB project delivery, the project must be large enough to allow a commensurate reward in terms of profitability. A small project can exhibit all the characteristics of a great DB candidate but, because of its size, might only attract those competitors who demonstrate the marginality of their qualifications by proposing on the project. In the case of small projects, owners should always initiate the procurement process by requesting letters of interest from industry and also ask for some minimal qualification information in the letter. This will allow the owner to gauge the depth of the competitive talent pool. If it appears that those who respond are not the quality of design-builder that would be desired, then the owner should use the traditional DBB process to deliver the project.

Design-Build Selection Scope Issues

Once the owner has decided that the project in question might be a good candidate for DB delivery, the next step involves evaluating the project's characteristics and resolving the issues that are scope-related. The term "scope" in this step is used in the global context of the interrelationships between schedule, technical complexity, and price realism. The best approach for this final evaluation is to answer the following set of questions in a pragmatic and objective manner, guarding against overoptimistic sentiments and the political pressures of project customer needs. The first set of questions deal with the project's time horizon

- Can significant time savings be accrued through concurrent design and construction activities?
- Will owner's staff resource constraints impact project schedule?
- Must the work begin or end by a specific time?
- Are traffic, detour, and/or building closure periods limited?
- Can potential time savings be actually realized?

If the answers to these questions are satisfactory, then it would appear that the selection of DB project delivery will satisfy the project's schedule requirements. Next, the owner should look at the issues of technical complexity. The following list of questions concerns those issues:

- Does the project include a number of primary features such as
  - Road, bridge, and/or traffic control systems for transportation projects?
  - Building, parking garage, and/or access roads for architectural projects?
  - Treatment plant, wells, and/or distribution lines for engineered projects?
- Are the features tightly interrelated and/or closely located?
- Will construction staging be a major issue?
- Does the site present unique or unusual conditions?
- Are specialty skills needed for design or construction?
- Are specialists available in the area where the project will be built?

Finally, the owner needs to take a close look at the potential benefits that could be accrued from selecting DB project delivery to ensure that giving up total control of the details of design will be compensated by some other value-adding feature during project delivery. This can be done by asking the following questions:

- Will higher-quality products be realized from designs tailored to contractor capability?
- Will there be less impact on the public with the use of expedited construction processes?
- Are there traffic management issues that could benefit from contractor input during design?
- Is project size an issue for design and construction funding?

Influencing the Development of Design-Build Project Scope

Once the decision to select DB as the project's delivery method is made, the owner can now begin the detailed development of project scope knowing that contractual relationship will be defined by the project's RFP and the winning design-builder's proposal. Figure 2-3 is the well-known Construction Industry Institute project influence curve (CII 1986), covered in Chapter 1, adapted to design-build. The idea is that the ability to influence the final outcome of the project is greatest early in the project's life cycle. As times goes on, the owner's degree of influence falls off

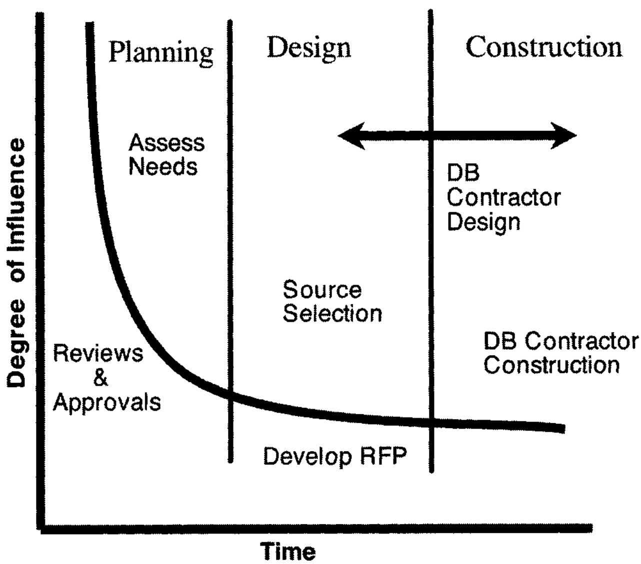

Figure 2-3 Influencing the design-build project curve (*adapted from CII 1986*).

dramatically and the cost of making changes increases. Thus, it is critical that the full scope of work be identified as early as possible in the process.

Scoping a DB project involves identifying all the various features of work and the management factors that will influence the design-builder's ability to satisfactorily deliver them. In essence, the RFP developer must strive to optimize the three major factors of the project: cost, schedule, and quality as portrayed by the details of design. One of these will be the most important for the success of the project, and it will probably be the reason that DB was selected in the first place. Thus, as the scoping process is started the owner's DB project team must agree on which of the three is the preeminent factor. The ideal would maximize all three but, pragmatically that is impossible because all projects at least have time and budget constraints that operate against each another. In other words, if the owner needs the project fast, it will have to be prepared to pay the price of accelerating the delivery period. The owner's DB project team must therefore

- Select one factor (i.e., either cost, schedule or quality).
- Buy into why that factor is the preeminent factor for this project.
- Base all future decisions on achieving that preeminent factor.

This becomes the default reason when two alternatives are being evaluated. For example, if schedule duration is the reason that DB was selected for delivering a given project, then when looking at alternatives the DB team will select an alternative that has the shortest schedule over one that is lower in cost or marginally higher in quality.

Figure 2-4 shows the conceptual framework upon which to develop project scope. Essentially, the scoping process consists of inventorying all the technical, management, schedule, and cost functions that must be brought together to deliver a successful project. The figure shows that at this stage the owner needs to stay at the general level, identifying only essential functional requirements without regard to specific design criteria. As RFP development proceeds, the scope for the required features of work will become more detailed and defined by a combination of performance criteria, performance specifications, or prescriptive specifications as appropriate. However, the owner's bias should be to try to stay as high as possible on the Figure 2-4 scale of detail. This figure applies not to just technical design factors but also to management, schedule, and cost factors as well. By adhering to this bias, the owner's DB team is both adding structure to their thought process and maximizing the potential for innovation and creation in the competing DB proposals. Doing so allows the owner to influence the detailed scope of work without directly specifying it.

Establishing Design-Build Project Essential Functions

Developing project scope boils down to a functional analysis of project requirements. Some of the requirements are truly essential functions, meaning that the project will not operate as planned without that requirement. Other so-called requirements

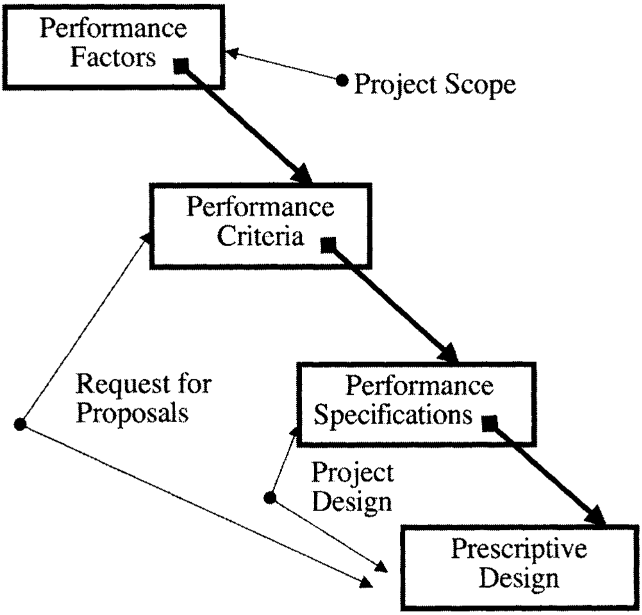

Figure 2-4 The design-build project development process.

are really preferences. Preferences are those features of work that could be removed or altered without harming the project's primary operating function. For instance, a building must have a roof to satisfy the essential requirement for weathertightness. However, that roof can come in many forms and still be weathertight. An owner preference for a clay tile, pitched roof may be articulated as a requirement but if the owner was shown convincing proof that this type of roofing system would cause the project's budget to be exceeded, then the owner would probably be willing to accept a different design solution as long as it was weathertight and within the budget. Thus, the essential function is weathertightness and selecting the specific type of roofing system that satisfies that function is a *design decision*. The owner can always articulate its preferences, but its DB RFP development team must ensure that contractually interjecting preferences into requirements will not adversely impact the overall viability of the project. Therefore, the team that is developing the DB scope of work should start with the inventory of essential functions and then move on to listing the preferences, while keeping those two lists separate.

Figure 2-5 is adapted from the Utah Department of Transportation's (UDOT) project analysis model developed by the Utah Technology Transfer Center (UTTC). Comparing it to Figure 2-4 shows that UDOT is using six categories of essential functions to organize its project scoping process. It can be seen that these categories cover the three major factors of project scope (cost, schedule, quality) plus one that deals with the design-builder's abilities to satisfy the project's scope requirements. Table 2-1 below organizes the UDOT approach into the generic approach that will be used in the remainder of the book.

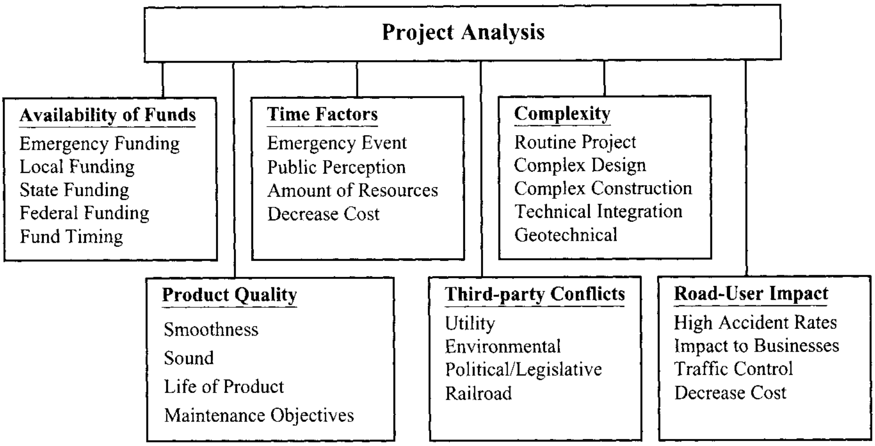

Figure 2-5 Utah DOT project analysis model (*adapted from UTTC 2001*).

Identifying Project Scope Requirements

Once the owner has determined the project's essential functions, the scope development process can move on to developing the specific performance requirements that will be needed to satisfy each of the project's essential functions. Using the generic categories shown in Table 2-1, the owner's DB team should begin to increase the level of detail in their thought process and determine the basic performance requirements that must be satisfied to adequately deliver each and every essential function. Figure 2-6 illustrates this concept and shows that each essential function will have one or more performance requirements that must be met to deliver the necessary functionality. Next, each performance requirement will need to be defined by one or more performance criteria to satisfy the requirement itself. Once the owner has identified all the functions, requirements, and performance criteria, then the project scope should be complete.

Thus, the UDOT project analysis approach can be generalized for any specific project in that it seeks to list the various factors that will influence project success and then group them into logical sets. These sets are related and ensure that the owner makes individual project delivery decisions in the context of the entire project. The owner's next step in project scope development is to break down the project and list the factors that will be vital to project success. In the generalized model, these factors will fall into the four categories shown in the aforementioned Table 2-1.

Technical Factors

Because technical concerns for the details of the design usually dominate the owner's thoughts at this stage of the project delivery process, technical factors are a good place to start developing the detailed scope of work. Additionally, the technical aspects of the project will ultimately drive the requirements established

Table 2-1 Comparison of the Utah Technology Transfer Center (UTTC) Design-Build Project Analysis Model with a Generic Design-Build Model for Developing Project Scope

Generic Project Scope Factor	UTTC Factor	UTTC Project Scope Requirement
Cost	Availability of Funds	Emergency Funding Local Funding State Funding Federal Funding Fund Timing
Schedule	Time Factors	Emergency Event Public Perception Amount of Resources Decrease Cost
Quality (Technical/Design)	Complexity	Routine Project Complex Design Complex Construction Technical Integration Geotechnical
	Product Quality	Smoothness Sound Life of Product Maintenance Objectives
Management (Qualifications/ Organization/Plans)	Third-party Conflicts	Utility Environmental Political/Legislative Railroad
	Impact to Road Users	High Accident Rates Impact to Businesses Traffic Control Decrease Cost

for the remaining three categories. It will therefore help to begin here, as well, from that aspect. First, the owner must determine those features of work that can be fully defined by performance criteria (both functionally and technically). Those aspects of the scope are the areas where the greatest potential for innovative and creative solutions lie; as a result, the owner will want to be particularly careful not to become overspecific in the final scope of work so as to accrue the maximum benefits from industry's solutions for the design problem posed in the RFP. Next, those features of work requiring a greater level of detail should be listed. Those features that can only be defined by owner-furnished detail design are listed last.

Once this is finished, the owner's DB team can continue the project analysis and determine the technical context in which each of these features of work must

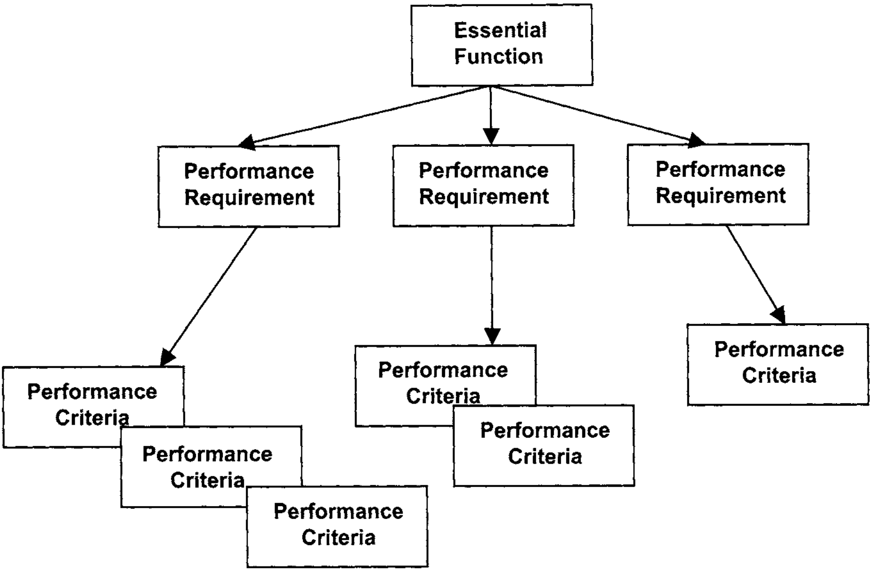

Figure 2-6 Hierarchy of design-build project scope elements.

be designed and built. That context consists of the following issues that must be analyzed for each feature of work:

- Site characteristics and impacts
- Special conditions that will affect
  - Final design solution
  - Construction means and methods
- Environmental, building, digging, and other permit requirements
- Special purpose functions
- Equipment considerations
- Aesthetic/architectural concerns.

The site will largely become the major constraint on the project's final form. It defines the boundaries within which work may be done. It dictates the level of effort that must be invested to make the facility relate to the natural ground on which it is built, and it provides the milieu of external relationships (existing environment) within which the project will have to be integrated. The site will also determine the constraints on solutions for many of the schedule and organizational factors. Thus, a thorough analysis of the unique characteristics of the project site must be made before moving forward in the scope development process.

Project special conditions can be physical, social, and/or legal. Physical conditions could run the gamut from unusual geotechnical issues to limited space upon which to conduct construction. Social conditions include all those issues that involve dealing with the public, both during design and during construction. They range from the requirement to evaluate congestion management plans on transportation projects to public affairs outreach tools to keep the general public informed about what to expect next as the project progresses. Finally, legal conditions must be thoroughly understood to define those regulatory constraints on the procurement process.

Schedule Factors

Schedule factors are the next stop in the project analysis process. Often, schedule factors will drive many of the possible solutions to the owner's project delivery problem. The first set of schedule factors consists of those that actually define the milestones in the project schedule itself. These factors are explicit constraints on the time function associated with this project. They are as follows:

- Required delivery date,
- Intermediate completion dates,
- Construction phasing requirements,
- Site availability date.

The next set consists of those factors that constrain the pace of the project itself. These factors are more subtle in nature and operation, and the owner's RFP development team must seek to clearly understand their impact on potential solutions proposed by the design-builders who will compete on this project. Examples of these are

- Permitting and external design/project review requirements,
- Cash flow considerations,
- Fast-tracking.

The owner must also make sure that these factors do not create a conflict with the factors identified in the first set of constraints. For example, a public owner who is using fiscal year funding to deliver a multiyear project cannot expect the DB industry to comply with a construction phasing plan that involves constructing more product than the owner has funding authority to reimburse. Additionally, a project that requires a significant environmental permitting process by an external agency with no incentive to facilitate progress may not be able to realistically achieve specific intermediate milestones through no fault of the project's owner or the design-builder.

The final thing that the project analysis team should do is to make sure that the schedule factors are in harmony with the technical factors and that no unintentional conflict has been created that would jeopardize timely project completion. An example of this is a project that includes a highly sophisticated item of equipment with a long lead time between order and shipping.

Cost Factors

The RFP scope development team can then move to cost factors. These will generally take the form of constraints that are applied either to the project's budget or to the permissible cost of various features of work. They may also determine the availability of financial resources to sustain an aggressive project delivery schedule. A list of typical cost factors is shown below

- Funds available for design and construction
- Statutory limits to funding on public projects
- Internal rate of return on investment for private projects
- Type of funding
  - Bonds
  - Legislative authorization limitations
  - Investment bank participation
  - Matching fund requirements and amounts
- Multiple fund sources required to achieve total budget
- Fiscal year funding issues on contract consummation and continuation
- Owner-furnished property
- Real estate/rights of way costs
- Time value of money:
  - Inflation
  - Financing
  - Escalation factors for labor and materials.

The above list is by no means exhaustive. Each project and each owner will have its own unique set of financial factors that must be understood to permit the project delivery process to move ahead smoothly. The point made here is that the owner cannot allow itself to begin the project with an unbridled sense of optimism that is not tempered by the financial realities within which the project must be delivered. If the cost factors conflict with either the technical or schedule factors, the cost factors will always dominate unless additional funding can be obtained. One object of using DB is to fix the project's actual cost as early as possible. Thus, before this can happen the scope of work must be developed in an atmosphere of financial pragmatism. This may be the most important step in the project scope development process.

Management Factors

Once the technical, schedule, and cost factors have been identified, the final step in project scope development can be undertaken. This step is the determination of those attributes of the ultimate design-builder that mark it as having a high probability of being able to complete the project successfully within the previously identified constraints. In doing this part of the analysis, the owner must remember that DB project delivery is a team sport and that the members of the owner's team will have an equally heavy impact on the success of the project. Therefore, the best place to start this analysis is with the owner's team itself.

First, the project scoping team should assess the owner's internal support for DB project execution. An owner such as a state DOT with a long history of adversarial DBB project delivery will need to make an enormous shift in its organizational culture to move to DB. This shift will involve great misgivings and fear of failure among that owner's project management/administration staff. It will involve changing the historical duties of the design personnel from technical design review to design criteria writing and interpretation. The owner's construction staff will find that it no longer has the technical crutches contained in a completed plans and specifications upon which it based its professional judgments; it must now become performance-oriented rather than compliance-based. The owner's contracting and legal staff will have to change the contract forms that they have become comfortable with and learn to seek ways to share with rather than shed risk upon the design-builder. These are but a few of the growing pains that an owner, public or private, embarking on its first DB project will experience. Understanding the magnitude of the organizational culture shift will help the RFP writers to determine the optimum level of technical specificity that will allow the owner's organization to maintain a feeling of control.

Next, the project scoping team should determine the level of comfort that the end user of the project has with the project delivery process. Knowing this will again allow the process to evolve in a manner that does not generate potential problems due to the end-user feeling a lack of control and potentially having to buy a product that is less than desired. One way to address these attitudinal aspects is to assess the level of past DB experience that is extant on both the owner's and customer's staff. Determining if that past experience was good or bad is key to understanding the potential reactions during project delivery. It is extremely important to determine whether the experience was based on anecdotal data or a solid base of actual events. The customer that has had one bad experience with DB will not be inclined to trust that the next project will not result in a similar, unsatisfactory result. When this issue is found, a concerted effort must be made to determine what the cause of the bad experience was and ensure that this circumstance does not reappear on the project at hand. Conversely, an owner who had an extremely good experience on one or two past DB projects may have unrealistic expectations for the project in question. More critically, an owner with no experience may decide to try DB based on reading about DB success in the professional literature and then be disappointed when the project does not generate the expected cost and time savings.

Once the owner's organizational issues are identified, the team can move on to listing the cogent factors that deal with the DB industry's ability to deliver this project. The first item of business is to determine if the industry indeed has the technical capability and sophistication to tackle a DB project of the given magnitude. To do this, the team should assess the logical pool of competitors' technical competence and past experience with DB. If the industry is also learning how to operate in this project delivery process, then the owner's team will need to proceed with double caution to ensure that they do not exceed the industry's ability to comprehend the total scope of work. If the industry is well experienced, then the owner must gauge current market conditions to determine if this project is likely to attract competent competitors and whether the market will permit one of those competitors to realistically be able to achieve the technical schedule and cost requirements inherent in the project and in the DB process.

When all the above is complete, the owner will now have a comprehensive inventory of project requirements that can be used to further develop the project's scope of work. If any of the above factors is in irresolvable conflict with another, then the owner's team must back up and reevaluate the decision to use DB project delivery. The project cannot be successfully delivered unless all of the above are in harmony with each other. If that is indeed the case, the scope development team can move to the next step and convert these factors, requirements, and constraints into project performance criteria. This process is described in detail in the next chapter of this book.

Design-Build Contract Model

Before the owner can begin the actual development of the RFP, the DB contract itself must be understood. In traditional DBB project delivery, the contract consists of the design as portrayed in the construction documents (i.e., plans and specifications) and the contract general and special provisions (sometimes termed boilerplate). This DBB contract model is shown in Figure 2-7. However, in DB delivery the design is not complete when the contract is awarded. Therefore, the details of design cannot be made part and parcel of the contract because they do not yet exist. Thus, the DB contract is composed of the RFP and the winning proposal. The plans and specifications are a deliverable under the contract

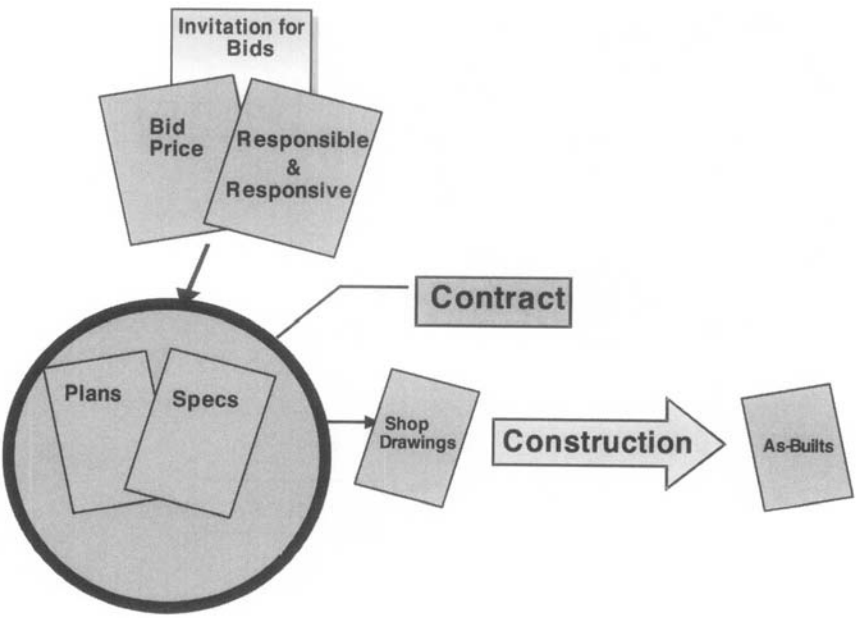

Figure 2-7 Design-bid-build contract model.

and, as such, their details belong to the design-builder throughout the course of the project. That means that the design-builder can change them to meet both budget and schedule constraints as long as the final product is fully compliant with the requirements set forth in the RFP. The DB contract becomes the RFP plus the winning proposal; plans and specs are no longer the contract—they are a deliverable under the contract. Figure 2-8 graphically shows this model. (See Appendix 3 for a listing of model DB contracts offered by the EJCDC.)

DB contracts have a hierarchy of documents in much the same fashion as DBB contracts. Just as specifications rule over plans in DBB, the RFP rules over the proposal in DB. In other words, if there is a conflict between the information contained in the winning proposal and a requirement published in the RFP, the conflict will be resolved in favor of the RFP. For example, if the contract is awarded to a proposal that clearly states that it will use a material that is excluded from use in the RFP, the fact that the owner overlooked this deficiency does not imply acceptance of the proposed material. The proposal is presumed to be fully responsive to the requirements of the RFP and, as a result, must comply with both the performance and prescriptive requirements contained in it. Thus, it can be seen that the owner must be prepared to invest the necessary resources and management effort to develop the RFP to the point where it can effectively describe the scope of work because, ultimately, it will be the document that governs the conduct of the entire project.

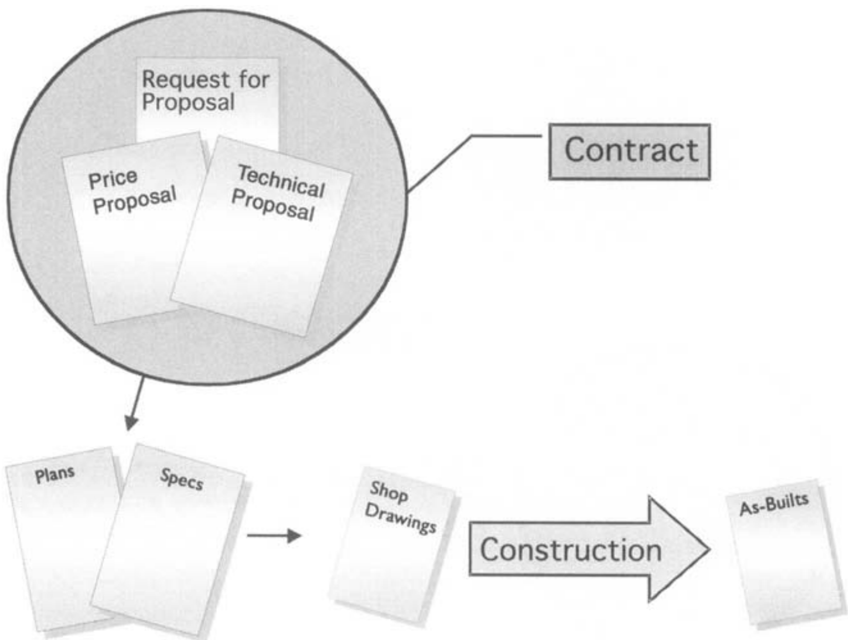

Figure 2-8 Design-build contract model.

Design-Builder Organizational Options

At this point in the process, the owner's DB RFP development team should determine what type of design-builder organizational structure might be best for executing the project in question. It is not uncommon for the owner to specify the desired organizational arrangement. However, by doing so the owner may be unnecessarily restricting competition. Many international development projects require that the design-builder be a joint venture between a local firm and a firm from a developed country. This is often necessary to secure the required financing and to distribute the U.S. firm's risk of working in a new environment. However, whenever possible the owner should leave the specifics of organizational structure to the competitors. Figure 2-9 shows the variations available to industry DB teams. From the owner's perspective, any of these could be used to successfully deliver a DB project. However, during Request for Qualifications/Request for Proposal (RFQ/RFP) preparation the owner should consider the various advantages and disadvantages of each possible organizational structure and use that analysis to guide the development of management criteria that will be used in the RFQ/RFP.

Figure 2-10 reports the results of research done by one of this book's authors on the actual distribution of DB organizational structure used in the United States.

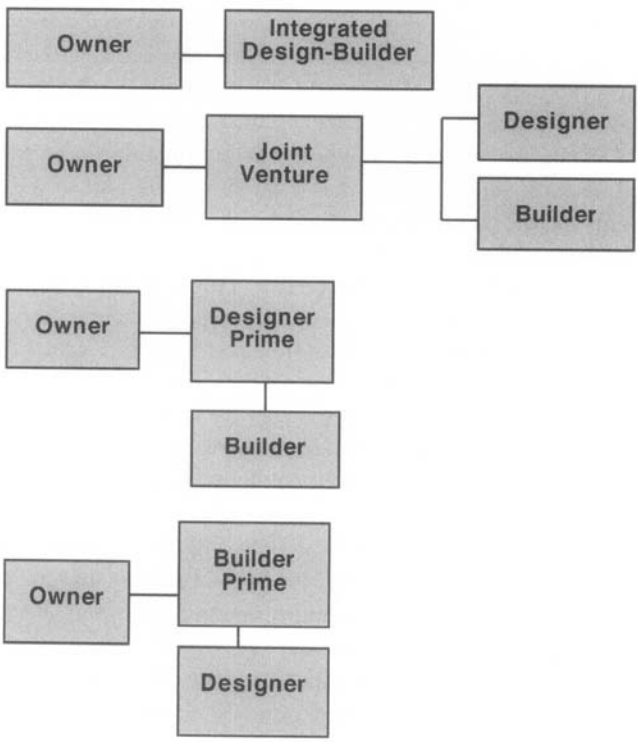

Figure 2-9 Design-builder organizational options.

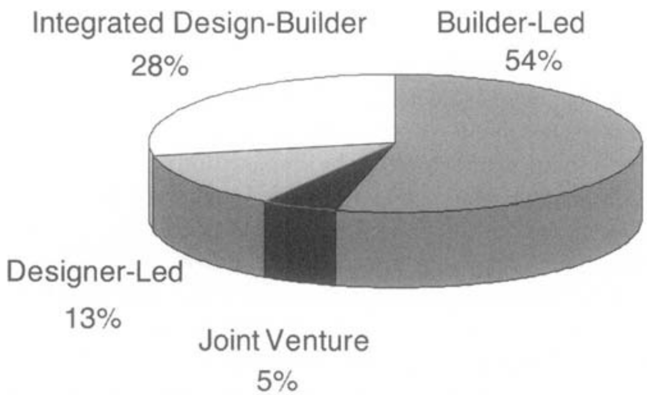

Figure 2-10 Breakdown of actual design-build organizational structure usage in the United States (*Molenaar and Songer 1998*).

The study looked at 1,683 public and private projects and found that builder-led DB teams were the most common (54%), followed by projects completed by integrated DB firms (28%) (Molenaar and Songer 1998). The reason that designer-led teams were fairly rare (13%) is tied to the requirement to be able to bond the DB project. Most architect/engineer design firms are not financially large enough to be able to obtain a performance bond on multimillion-dollar DB projects. That joint venture structures were the least used (5%) may come as a surprise to many readers. However, this is easily explained when one considers the risk to which parties to a DB contact are exposed when they are organized as a joint venture. In a nutshell, in joint ventures both the designer and the builder are exposed to both the design and the construction risk. Design firms are structured to deal with managing the risks of professional liability, just as construction companies are able to manage the construction performance risk. However, neither is experienced in handling the other's risk exposure. As most competent companies are loathe to assume risk that they do not personally control, forming a joint venture to compete for a DB project will probably only be done if the owner requires it in the RFP.

As stated above, each organizational structure brings its own advantages to the project. The integrated design-builder is the ideal structure in that both the designer and builder work for the same company. Thus, the type of firm will be organized to conduct total risk management as well as experienced with the process. In theory, coordination of design and construction issues could be conducted as routine, internal business and the project's profit margin would apply equally as well. The owner would literally have a single point of responsibility without the worry that the design-builder's internal contracts would not support the speedy resolution of performance issues in the final product. The one disadvantage lies in an integrated design-builder's desire to maximize the use of all internal resources, making it less open to bringing on specialists if a similar capability exists internally.

A DB team in which the builder is the prime contractor and the designer is a subconsultant (i.e., a builder-led team) also has certain advantages for the owner. First, there will be a focus on constructability. The builder will ensure that the designer is kept abreast of the issues that exist in making the construction proceed with minimal disruption. Key construction personnel (such as the general superintendent and the major trade subcontractors) will be available to review intermediate design products and furnish both value engineering and constructability input to the designer before the design submittals are handed in for owner review. This organization will bring state-of-the-art scheduling, material availability, and cost estimating to the project and, if the project demands an aggressive schedule, this type of organization will best understand the rigors and pitfalls of fast-tracking. Finally, the builder-led DB team will be able to better relate the need for design products to meet construction schedule requirements, allowing extra time to complete complex designs as required.

On the other hand, a designer-led DB team with the builder as a subcontractor ensures that the project will be completed by an entity that is capable of complex design and has a constructability cross-check available on demand. For projects that produce monumental architecture, aesthetics will be protected. This type of team will bring state-of-the-art architectural and/or engineering design to the project and, most importantly, the owner's design input goes directly to the designer, not through a cost-engineering filter that would be found in the builder-led organization. The major disadvantage with designer-led DB teams is that most design firms are not staffed to manage full-blown construction subcontracts and would probably have to add additional resources to do so. This may make their price proposal less competitive. Therefore, if an owner feels that a designer-led organization is required for a given DB project, then it must be prepared to award the contract on a best-value rather than low-bid basis in order to keep these types of organizations in the competition.

Formalizing Project Scope

Once the above-described analysis has been performed, the owner's DB team can finalize and formalize the project scope of work. Again, it is recommended that this be done in a fairly structured manner. This process will proceed in the following steps:

1. Agree on the preeminent factor for the project: cost, schedule, or quality.
2. List the reasons for selecting DB as the project delivery method.
3. List the potential benefits of using DB on this project as well as the owner action(s) necessary to accrue the benefit.
4. List the major features of work.
5. List the essential functions that are associated with each feature of work.

6. List the design constraints for each feature of work.
7. For each essential function, list the performance requirements that define that function.
8. For each performance requirement, list the performance criteria necessary to satisfy the requirement.

This can be called the project description process. When complete, the owner will have both a cogent scope of work and the framework upon which to begin the detailed RFQ/RFP development process. Figure 2-11 is a simplified model of this process. In essence, takes the user's functional requirements and creates a functional description for each requirement, which is then composed of either a performance criterion that the design-builder must meet to satisfy the requirement or, if there is only one technically acceptable solution to the requirement, the owner-furnished design. Once this process is complete, the owner has effectively inventoried the project's needs and created a path by which those needs can be met.

Functional Analysis Systems Technique (FAST)

The practice of formal value engineering studies is very similar to the development of DB RFQs/RFPs. Both seek to understand the basic functionality that is inherent in a successful project, and both are looking for ways to deliver that functionality in a manner that optimizes value. Thus, DB RFP writers can take a tool out of the value engineer's tool box to help in the project scoping process. This tool is called Functional Analysis Systems Technique (FAST). FAST diagramming adds structure to the engineer's thought process and helps keep the owner's team from assuming a design and then writing an RFP around it,

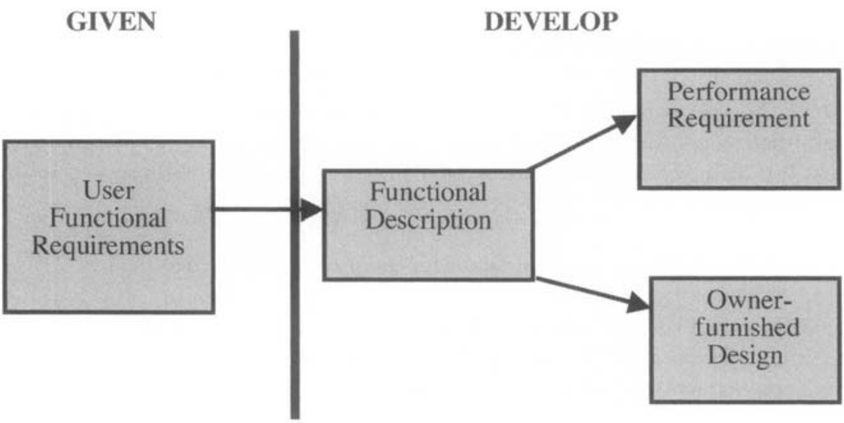

Figure 2-11 Project description process model.

which effectively stifles the opportunity for innovative and creative solutions to the owner's project. This technique will be discussed briefly here. Readers who would like a more in-depth treatment are referred to the book *Value Management for Construction* by Macedo, Dobrow, and O'Rourke (Macedo et al. 1978) for an excellent discussion of FAST diagramming theory and application.

Figure 2-12 shows the basis for FAST diagramming. The owner's DB team takes its list of essential functions for each major feature of work and then determines how it will be satisfied. This often requires that several performance requirements are necessary to furnish each essential function. In mathematical terms, the scope of work defined by the essential function is the sum of the performance requirements necessary to satisfy it. Next, the team moves one step to the right and determines *how* each performance requirement will be met. This may generate another list of subperformance requirements. This process is repeated until the only way a requirement can be met is by the final technical feature. Note that a single technical feature may satisfy a single performance requirement. It could take two or more technical features to satisfy a single performance requirement, or a single technical feature may satisfy more than one performance requirement.

Figure 2-13 is an example of the above discussion for a highway upgrade project. In this project an existing uncontrolled access road that passes through a town and is intersected by another highway (Highway 42) is being upgraded to a controlled access highway with an interchange at the intersection of the two highways. Thus, one of the essential functions that must be furnished in the new DB project is "Access." The owner's DB team begins the process by determining what requirements must be satisfied to furnish the essential function of "Access." In this case, there are three kinds of access that must be provided: routine, emergency, and

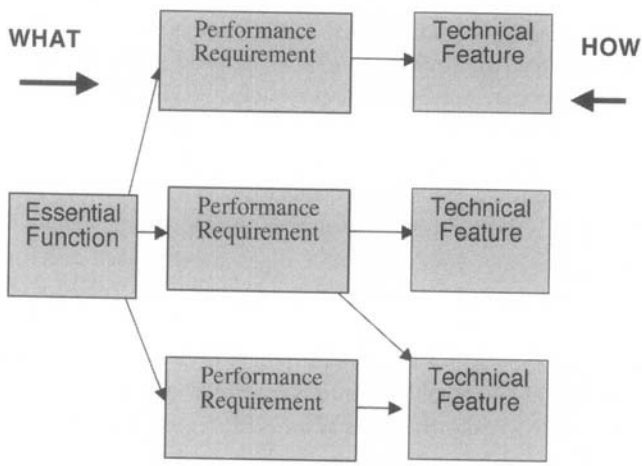

Figure 2-12 Functional analysis systems technique (FAST) diagram.

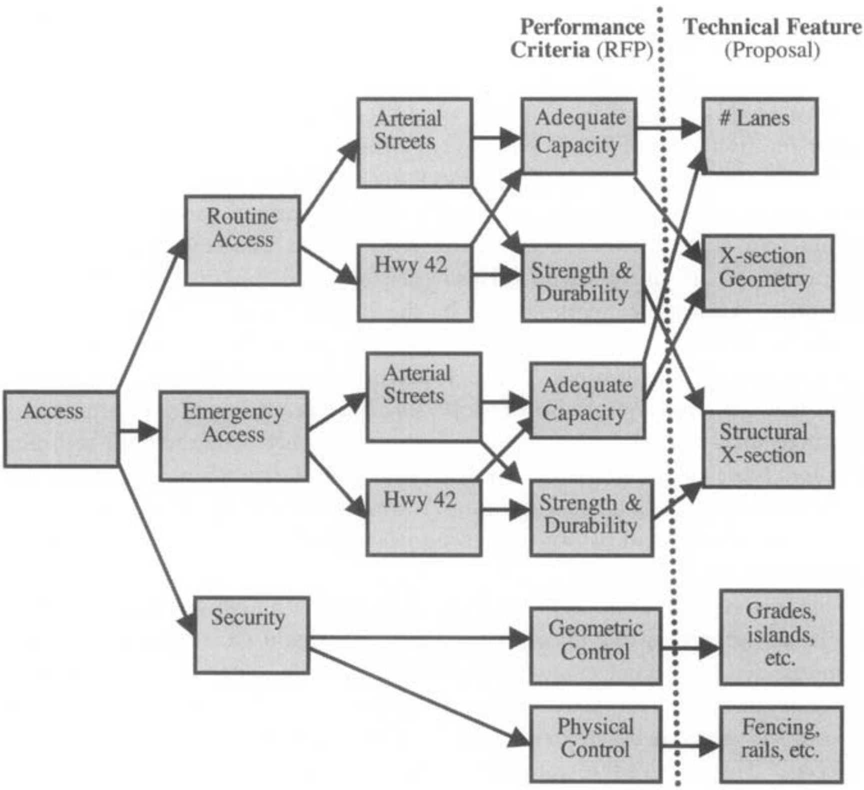

Figure 2-13 Example of a FAST diagram for a highway upgrade project.

security (i.e., lack of access). The process replicates itself for each of those. Looking at routine access, the project must furnish routine access for both the arterial streets that currently intersect the highway and the highway itself. Moving to the next step, the figure shows that delivering adequate access is a function of both geometric capacity to carry the requisite volume of traffic and structural capacity to support the design loads. Again moving to the right on the diagram, each of these is satisfied when a technical feature is designed. In this case, the number of lanes, the cross-sectional geometry, and the structural cross section of the pavement are the technical features. The process stops when the FAST diagrammers reach a technical feature. They can now back up and consolidate the performance requirements that fall just before the technical features. The project's RFQ/RFP will need performance criteria developed for each and every requirement in this list. Additionally, if there is only one technically acceptable technical feature, then the owner should design it and furnish it to the design-builders as an RFP requirement. In this case, if the owner wanted 12-foot lanes with 8-foot shoulders for the cross-sectional geometry technical feature, it would specify that and not allow the proposals to consider other options that might satisfy the capacity performance requirement.

Summary

Developing a design-build project scope can be a very structured process whose goal is to identify the prerequisites of the RFQ/RFP's contents. The owner must strike a delicate balance between the careful articulation of the project's performance requirements and inadequate description that leaves the DB industry proposals guessing what the owner's needs are. The major theme revolves around determining those aspects of a project's design that can be left open for interpretation by the design-builder and those that must be strictly specified to achieve hard owner requirements. As stated early in this chapter, one advantage that an owner gains from selecting DB delivery is the ability to compete different design solutions for the same design problem. Therefore, the DB project scope of work is actually a problem statement from which the design-builder crafts the proposal and against which the owner measures the adequacy of the final product.

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THREE

Writing Design-Build Performance Criteria

The crux of communicating the requirements of a design-build (DB) project is the owner's development of definitive performance criteria. These criteria serve to articulate the quality, cost, schedule, and qualifications requirements for a given project and become the foundation for the DB contract. Remembering from previous chapters that the design-build contract is composed of the Request for Qualifications (RFQs) and Request for Proposals (RFPs), performance requirements, and the winning proposal's solutions for those requirements makes the writing of performance criteria the most important step in a DB project's life cycle. This chapter will show the reader how to accomplish this vital step. It will also explain the difference between performance criteria and performance specifications and introduce the concept of design risk allocation that is inherent in the DB contracting process.

One must be very careful with the semantics of the DB performance definition methodology. A good place to start is a dictionary, to ensure that the definition used to develop these criteria is technically correct. *Webster's New World Dictionary of the American Language* (Guralnik 1986) defines the noun "performance" as "Operation or functioning, usually with regard to effectiveness." It goes on to define the verb "perform" as "To carry out; meet the requirements of; fulfill." It also defines "criterion" as "A standard, rule, or test by which something can be judged; measure of value." Therefore, using the dictionary's words, a "performance criterion" could be defined as

> A rule by which the effectiveness of operation or function is judged and its value measured.

So, keeping in mind that the operative terms in the definition are *effectiveness of operation or function, judged,* and *measure of value,* the RFP developer can move forward and create the performance criteria necessary to generate a set of responsive proposals from a group of competing design-builders that will result in a best-value award of the contract to design and build the owner's project. These criteria will set out the rules by which the evaluation panel and, after the award, the owner's project personnel will judge the effectiveness of design-builder's design and construction. These criteria will furnish the standard against which each proposed design solution will have its value measured. The net effect is to prescribe the standards for each of the project's various components. It can truly be said that clear, cogent performance criteria set the stage for a successful project.

As DB places the burden of developing the details of design on the design-builder, the owner must be quite careful to define all the constraints that may exist for a given feature of work without becoming overly prescriptive. The ownership of design liability will be allocated through the owner's RFP performance criteria. The unwritten rule of thumb is this case is

> Whoever designed it is responsible for its ultimate performance.

Therefore, the owner needs to carefully write the project performance requirements and the performance criteria that are responsive to those requirements. Figure 3-1 shows the hierarchy of performance/design elements. Many owners and members of the DB industry misuse the term "performance specification." The word "specification" implies that a design decision has been made based on the professional design process. When an owner formulates a design requirement that has more than one technically feasible solution, the proper term would be "performance criterion" rather than "performance specification" because the owner has conducted a project scoping process and determined the requirements that the design-builder contract (DBC) will have to meet to deliver a responsive project. The requirements of that project are then articulated in performance terms, but the owner has not completed the design process and therefore is not writing a "specification." It is important to be clear in the distinctions between the two. If a project performance issue develops during or after construction, the liability will rest with whichever party actually designed the feature of work in question. By calling the RFP "performance criteria" "performance specifications," the owner risks confusing the legal situation by inaccurate use of terminology.

Following the hierarchy of performance elements also prevents unintentional overspecificity. Although it is always within an owner's prerogative to prescriptively specify any feature of work deemed appropriate, too many prescriptive specifications in a DB RFP needlessly constrain the opportunity for creativity and innovation. *In every single case,* this can potentially bind the specification's author to the liability for its performance, regardless of the legal boilerplate that may be attached to the contract. The major benefit of selecting DB is the single point of responsibility for all design and construction issues. When an owner becomes overly prescriptive, a situation is created where the owner has assumed the liability for much of the design content before the proper design development process has been completed. Thus, much of the benefit of shifting responsibility for design

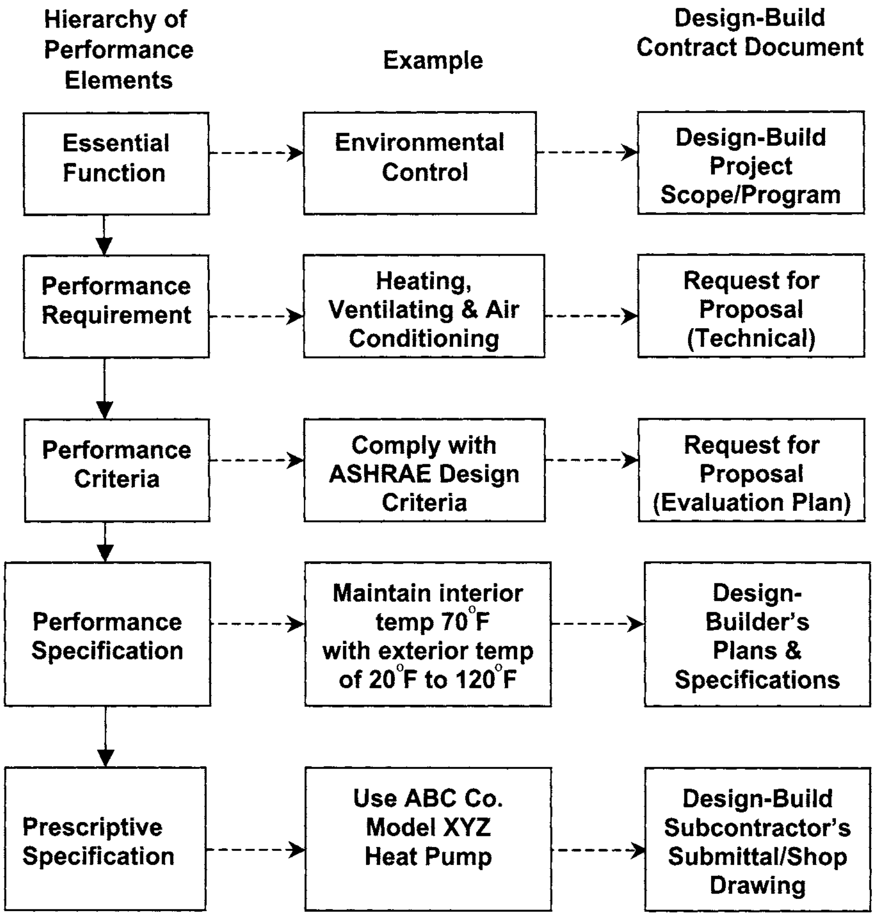

Figure 3-1 Hierarchy of performance elements in a design-build project.

and construction to the design-builder is lost. An owner must therefore be very careful in setting the objectives for developing the scope of a DB contract, and only constrain those elements of work that must be constrained.

Owner Objectives

The owner has four major objectives when establishing the performance scope of work in a DB project:

1. Develop a clear project description in functional terms.
2. Define operational/quality requirements in performance terms.
3. Define all of the project's requirements without relying on the post-award design process.

4. Outline the performance/acceptance tests required that will demonstrate the requisite level of quality for each item of work.

Accomplishing the first objective actually creates the technical scope of work for the DB contract. Accomplishing the second objective articulates the standards for quality that must be met in the final product and covered in the technical and price proposals. This also creates the mechanism whereby the project is accepted or rejected. In essence, it defines what will go on the project punchlist if those standards are not met in both design and construction. To achieve the third objective, the owner must complete the thought process regarding project requirements before the solicitation is issued and does not have the luxury of procrastinating on technical decision making until more information is known. It is absolutely essential that the owner bear this in mind during RFQ/RFP preparation. Because the owner is paying the design-builder to complete *both* the design and the construction, any owner-generated design change after the award will probably result in a compensable change order. The final objective reinforces the second one by specifying the technical evidence that the design-builder must produce to prove that the final product complies with the contractual requirements for quality and describing the means and methods that will be used to technically accept the final product.

In establishing these objectives, the owner must always keep the answer to the question "Why did we select design-build as the best delivery method for this project?" foremost in the solution. As stated in Chapter 2, the answer to this question is the project's preeminent condition and the default solution to a conflict between this condition and another condition. As previously stated, only one leg of the cost–schedule–quality triangle can be fully satisfied. Thus, the owner must be careful to not unintentionally create a conflict between the preeminent leg and either of the other two legs of that triangle through the performance requirements established in the RFP.

A hypothetical example of such a conflict is a case where an owner has decided to use DB to deliver a new water tower for the residents of a town because the existing water tower is very close to failing and leaving the town without water. The preeminent condition in this project is thus the schedule. That means that this owner must write its RFP in a manner that allows the design-builder to compress the delivery schedule as much as possible. The construction market is booming and, as a result, regional steel fabricators have a nine-month queue for new projects. The city engineer is leery of using reinforced concrete in the project because the town only has experience with steel water towers. If the city engineer requires that the tower be made of steel, the aforementioned conflict is created.

Obviously, the DB industry cannot compress the delivery of the new water tower faster than regional availability of materials allows. Therefore, this owner must recognize that the essential function that must be delivered is the capability to distribute water supply throughout the entire town; even though its technical expert is uncomfortable with a tower made of some material other than steel, the project's context demands that this personal preference be put aside to achieve the more important objective of guaranteeing the town's water supply. A compromise on this issue can be achieved to give the engineer more confidence in the decision to allow materials other than steel in the project. The following RFP statement can be made to address both issues:

> Any sound engineering solution for the tower is acceptable. However, preference will be given to those offerors proposing steel designs who can also guarantee project completion on or before the required delivery date.

Thus, if one offeror though its personal connections with a steel fabricator is able to negotiate a deal to allow it to get this tower project's steel to the head of the queue, both the engineer's professional preference and the preeminent condition of minimizing the schedule are met. If no one offers a steel tower, then the engineer knows that it was impossible to achieve both goals.

This example is easy to understand because it deals directly with the very reason for the project. However, more insidious ones deal with the myriad small details that go into a complex project. Author Douglas Gransberg was involved with an emergency replacement of a water treatment plant DB project. Obviously, schedule was once again the preeminent factor. The successful offeror indicated in their proposal that they would achieve a very aggressive schedule by designing the project around material that was immediately available in the local area. They proposed to begin the project with a joint shopping trip to local material suppliers to determine what was available that complied with the quality requirements of the RFP. One of the owner's mechanical engineers had a personal preference for a particular type of gasket system, which was not specifically required in the RFP design criteria. When it was determined that this gasket system was not locally available and that it would extend project completion approximately 60 days to procure it, a dispute arose over the acceptability of an alternative gasket system. The disagreement was quickly resolved in favor of the design-builder's alternative because the preferred system had not been mentioned in the RFP. The performance requirement merely required the gasket system to withstand a certain pressure without leaking, and the design-builder's designer-of-record felt that the alternative could satisfy that requirement. In fact, if it was installed and failed, the design-builder promised to replace it with the desired system. As it turned out, the system functioned properly and passed the final acceptance test.

This case provides a good example of how a minor technical preference could have destroyed the ultimate project goal of turning on the drinking water as soon as possible and using DB delivery to make that happen. Any owner's DB RFP writers should regularly step back and test the performance criteria they have written to ensure that by getting the fine points nailed down they have not destroyed the main reason that they selected DB project delivery in the first place.

Performance Criteria Development

Once the project's scope of work has been redefined as a set of performance requirements, the development of performance criteria can begin. The owner should take each performance requirement and analyze it separately to determine whether there is more than one technically acceptable solution for each requirement. If there is not, then this requirement is a strong candidate to be covered by a prescriptive specification rather than a performance criterion.

For example, a university might want to ensure that heating, ventilating, and air conditioning (HVAC) equipment being installed in a new dormitory is totally compatible with similar equipment in other buildings on campus so that the physical plant maintenance teams will not have to carry a separate set of spare parts or retrain their technicians on a new brand of equipment. Since there is only one technically acceptable solution for the manufacturer of the HVAC equipment, the RFP should prescriptively specify the required manufacturer's equipment rather than publishing an open-ended performance requirement in the RFP.

The owner should be totally honest with the industry and identify technical requirements as well as technical preferences. Failing to identify those items on which the owner will accept no deviation is a formula for post-award disputes and follow-on litigation. Many public owners will have difficulty being this explicit due to open-competition regulations. Many agencies have a tradition of adding the qualifier "or equal" to any name-brand item. There is nothing wrong with this approach as long as the owner will truly accept another brand as being equal. However, in the example given above, that public owner has a strong operational reason for restricting the brand and should use its administrative system to gain an exception to an "or equal" policy, prescriptively specifying the brand of HVAC equipment for its DB project.

Continuing with the university dormitory example, another, less clear side of this issue can be seen. Let us assume that the university has an architectural master plan that requires a specific shade of brick to be used on all new construction. Again, there is only one technically acceptable solution for the brick. However, the restriction is only on the brick's color, not on other technical aspects such as size, texture, bond, and other architectural features. In this case, the owner would develop a performance criterion for the aesthetic aspects of the architectural design and identify the requirement to use the special shade of brick as a specific *design constraint* related to the feature of work. This technique allows the design-builder to offer any number of innovative architectural solutions while agreeing to furnish and install brick of the required shade.

Many owners in this specific situation would tend to use a performance criterion such as

> The new building's design shall *match* the architecture of the surrounding buildings on campus.

Although there is nothing inherently wrong with this approach, it is subject to overinterpretation. Some competitors may interpret the word "match" literally (i.e., the most conservative interpretation of the clause) and offer designs that seek to exactly replicate all the features of the surrounding buildings. If all the offerors do this, the owner may have unintentionally lost another benefit to selecting DB project delivery—the ability to evaluate multiple design solutions to the same design problem. Thus, it can be seen that an owner must remain quite cognizant of the possible impact of seemingly trivial RFP writing decisions.

There are essentially four types of performance criteria that must be developed for every DB project

1. Management,
2. Schedule,
3. Technical,
4. Cost.

Engineers, contractors, and architects will tend to focus on the technical criteria (because, after all, that is what we are trained to do), but the RFP writers must not fail to pay close attention to the other three. Therefore, this section will address them in the order shown above. First, the salient features of each type of criteria will be identified and discussed. Next, the elements of a good performance criterion will be presented. Structure will be added to the performance criteria development process by introducing the idea of using abductive logic to write proper performance criteria, and finally, examples of typical criteria used in common civil engineering projects will be demonstrated to illustrate the entire process.

Management Criteria

A strong argument can be made that no matter how well the technical portion of the RFP is written, the success of the DB project really depends on the people and organizations that are selected to execute it. If an owner is pressed for time in getting a DB project's RFP advertised, it should probably be more careful about the development of the management criteria than anything else. This is because a really good designer teamed with a highly experienced builder can probably sort out the technical issues regardless of the quality of the RFP's technical requirements. This is somewhat counterintuitive to the traditional way of thinking, but the owner must remember that it is hiring a design-builder to *both* design and build the project. Therefore, it is incumbent upon the design-builder to ensure the ultimate performance of a properly scoped project.

Management criteria come in three general varieties:

1. Qualifications of the individual personnel,
2. Past performance of the organizations on the DB team,
3. Plans to execute the project.

Many public owners include schedule in the management planning portion of their RFPs but, as it is a unique and overarching feature of the project environment, it will be dealt with individually later in this section. In a two-step DB process the majority of the management criteria are published in the RFQ.

However, that does not preclude owners from adding additional management criteria in the Step 2 technical/price proposal. It often makes sense to ask for an initial set of management criteria in Step 1 and then ask for more specific management information (such as detailed environmental protection or safety plans that must flow out of the proposed design solution) in the Step 2 evaluation.

Looking first at individual qualifications, we find that these are generally defined in two broad categories. The first are professional credentials, which encompass personal credentials that qualify an individual or entity to perform a specific function on a DB team. The obvious credential is proper licensure for the designer-of-record in the state in which the project will be built. This and other qualifications (such as contractor licensing) are mandated by law and would have to be in place regardless of whether they were articulated in the RFP. However, to avoid potential misunderstandings it is good practice to write performance criteria that are at the very least minimally responsive to legal requirements; in certain cases performance requirements should be developed that exceed the minimum legal standards. In the latter situation, the owner must ensure that those criteria that exceed typical legal requirements are clearly and plainly spelled out. Design-builders should also be careful to look for these types of requirements and not assume that every project will only require the legal minimums.

The next category of qualifications is specific experience requirements. Most owners prefer that the members of the design-builder's team will come to this project with experience in designing and building similar projects. When developing performance criteria for personal experience, owners must not be arbitrary in setting the performance standard. By stating that the project's structural engineer must have "a minimum of 20 years of experience," that owner is saying that an engineer with 19 years and 364 days of experience is not good enough to design this project. By requiring an inordinate amount of seniority in its performance criteria, the owner is also driving up the personnel costs while reducing the competitive field of qualified candidates and perhaps unintentionally excluding some highly qualified offerors who miss the arbitrary mark set in the RFP. A better approach is to make the experience requirements project-specific, such as

> The structural engineer shall have been the lead design professional on at least three cable-stayed bridge projects with spans greater than XXX feet in the past ten years.

This technique satisfies the owner's desire for a highly qualified, experienced engineer without arbitrarily excluding someone based on age or specific career path. It also lays out a very clear and cogent standard that can easily be evaluated. If the standard is unrealistically high, interested offerors will probably question its validity during the proposal preparation process, thus allowing the owner to amend the performance requirement before qualified competitors drop out because no one can fill the bill.

The next major category of management criteria deals with the past performance of the organizations that comprise the proposed DB team. In writing performance criteria in this area, the owner is seeking to increase the probability of a successful project by demanding evidence of past success in similar pursuits. This category can be broken down into six major areas:

1. Applicable technical design experience,
2. Applicable technical construction experience,
3. DB experience,
4. Experience working together as a team,
5. Experience working for the owner,
6. Experience working in and around the project's geographic location

In its simplest form, an "applicable technical design experience" criterion would require that the design team have past experience designing exactly the same type of project. In a perfect world, this would always be the standard. However, the criterion writer should take a broader view and focus on those critical features of work that demand the greatest design effort and are most critical to the overall success of the project. For example, an owner of a new college dormitory project might be tempted to use the following performance criterion for design experience:

> The designer-of-record shall have been the lead design professional on at three university dormitory projects in this state in the past five years.

A more appropriate criterion would aim at those design skills that are particularly valuable for this type of project. Such skills would be the ability to efficiently lay out a high-density residential facility; knowledge of life safety code requirements for these types of facilities; and, perhaps, integrating the technological enhancements to the individual rooms and other parts of the building that would be inherent in a modern university dormitory. Therefore, a less restrictive performance criterion could be written as follows:

> The designer-of-record shall demonstrate appropriate past experience by providing a minimum of three examples of completed projects of similar size, type, and technical complexity.

This type of criterion would allow a design firm with experience in designing executive extended-stay residential facilities as well as regular hotels to compete and perhaps bring a new technical twist to the project that a firm specialized in educational facilities may not have. The owner always benefits when the potential size of the competitive pool is left as large as possible.

The same theory can be applied to "applicable technical construction experience." Being too restrictive can unnecessarily reduce competition. Again, the criterion writer should focus on the key elements of the construction that demand specialized experience in order to achieve a high-quality construction product. An example of how this was applied on a large, international project comes from the Republic of Turkey. The project, implemented in the late 1990s, was to design and construct a large, cross-country water supply line. Instead of specifically requiring water supply experience, the RFP stated:

> The contractor must have completed at least two projects that required the welded assembly of pipelines of at least 15 kilometers in length that were larger than three meters in diameter. (Resmi 1997)

The owner's rationale was based on a concern that the construction quality control requirements for welding large-diameter pipelines was substantially different from that required for smaller pipelines. A team made up of a company with extensive waterline construction experience and an oil pipeline services company that furnished the quality control engineers and lead welders for the construction group submitted the winning proposal. In this way the owner obtained the specialized experience it was concerned about from a source outside the normal market that would compete on this type of project. A less imaginative owner would have required experience in building 2-meter or larger waterlines and may have had difficulty finding an adequate number of qualified competitors.

Having previous DB experience is always desirable on a DB job, and in many cases is probably an unwaiverable requirement. The issue of how well a given partnership can work together as a team is also applicable in this consideration. The shift from the traditional DBB project delivery method is difficult for both the owner and the DB team. The research discussed in Chapter 1 showed that the probability of an owner hiring an integrated DB firm is small and gets smaller as the dollar size of the project decreases. Therefore, the RFQ/RFP should be written with the idea that the winning proposal will probably come from a partnership between a general construction contractor and a design firm. As previously stated, the probability is highest that a builder-led DB team can be found. As a result, the owner wants to be careful to ensure that the winning team has a track record of having successfully worked together on previous projects. If possible, those projects should have been DB projects because the owner does not want to have to pay for the DB team's learning curve. One way to verify whether the designer and the builder have previously worked together is to use the following performance criterion:

> The DB team shall submit evidence that they, the individual firms that comprise the proposed DB team, have successfully completed at least one previous DB project in the past five years while working together.

The above criterion may be overly restrictive for some types of projects, as it would effectively limit the competition to only those DB teams with previous DB experience. In the public sector, this might be interpreted as a catch-22 and correctly considered to unfairly restrict possible award of the project. In this case, a different criterion could be used that would accomplish much of the same intent without being totally restrictive:

> The DB team shall submit evidence that they, the individual firms that comprise the proposed DB team, have successfully worked together on at

> least one project in the past five years. Although previous DB experience is preferred, it is not mandatory. Teams are encouraged to submit evidence of past DBB projects on which the designer and the builder have jointly participated in any responsible role.

This criterion permits teams that have a long-standing relationship in the traditional project delivery market to leverage that experience and effectively compete for their first DB project together.

The final caution with regard to DB experience is to beware of the so-called shotgun marriage. This colorful descriptor refers to a partnership between two companies that not only have never worked together but also have only joined forces to specifically propose on the project in question. Although it is true that all good business relationships must start somewhere, it is also true that most owners cannot afford to risk the potential failure of the internal business relationship on their specific project. When owners write experience and qualifications criteria that are unduly restrictive, they put their project at risk to having all the qualified offerors engaged in a new, untried business arrangement. Also, if the owner itself is new to the DB world, it is particularly important that it insist on awarding the project to a team with previous DB experience, if for no other reason than to use the project as a means by which to train the owner's project personnel.

There is one exception to the above rule with regard to a preference for selecting a DB team with past DB experience: when an owner who is new to DB lives in a market where DB has never been used before and the project is either too small or located so remotely that it will not attract interest from outside firms with DB experience. In this case, both owner and industry will use this project as a training project to develop a new project delivery capability in the area. In this circumstance, both the owner and potential bidders would be well advised to retain an experienced DB consultant to assist them in preparing their respective documents and to facilitate the execution of the project. The cost of hiring a DB consultant will be trivial compared to the amount of project funding that is potentially at risk if the project goes sour due to lack of experience or an inability to shift business practices to accommodate the new delivery method.

Developing performance criteria to assess an offeror's potential to successfully team with the owner's organization is most easily accomplished by seeking to replicate success on the owner's past projects. Many owners, both public and private, have unique requirements that demand an intimate working knowledge of the owner's internal policies and procedures. For example, each state department of transportation (DOT) has its own set of design and construction standards that are unique to that state. The same can be said for each of the federal departments that routinely procure design and construction services. Many commercial construction contractors who have little experience with large, public owners underestimate the time and cost associated with contract administration on those projects. This results in, at best, a strained working relationship and, at worst, a contractor who is looking for ways to make up the loss by reducing the quality of the finished product. DB requires a much more trusting relationship between the owner and the design-builder, creating a selection bias in the performance criteria toward those with a proven record of working successfully inside the owner's system; this can pay dividends during project execution. Once again, this is not meant to recommend that only contractors with past experience on the owner's projects be given a chance to compete but, rather, that this knowledge of the owner's system and expectations is an asset that can be used as one component of the best-value award decision. A standard performance criterion for this type of experience would be:

> The DB team shall submit a list of all design, construction, or design-build projects that they, either individually or as a team, have completed for the owner in the past five years along with names for points of contact on each project.

Experience working in and around the project's geographic location is the final type of experience for which a performance criterion might be written. This is by no means a requirement for all projects, but it should be at least considered and used if it fits the performance profile that the owner is trying develop for the current project. This type of experience is extremely valuable if the project's location is remote or technically challenging. It would also be very important if there are features about the project that require special knowledge or experience to properly price.

A good example would be a project on an island off the coast of Alaska where the design-builder would not only have to be technically capable of doing the work but would also need an in-depth knowledge of the weather, the availability of personnel, equipment, and materials as well the magnitude of the logistical effort that will be required to support the construction. A second example would be a project that has a significant security aspect to it, such as a remodel of an airport terminal or a taxiway replacement project. In these cases, the design and the construction will have to take place in an environment where access and egress are highly restricted and where extraordinary security precautions, such as background investigations, may have to be taken to clear the workers who will need routine access to the construction site. These precautions will have a direct impact on cost, schedule, and design solutions, making a potential design-builder's past experience working in these areas a very desirable element of the best-value decision algorithm.

Another category of management criteria that is normally developed deals with the design-builder's management plans to execute the project. These plans can cover a multitude of issues that are important to the owner. The rule of thumb for deciding which plans to evaluate is to only ask for those that cover areas that are critical to project success and will assist the owner in making the best-value award decision. Stated in another way, the owner should *never* ask for plans in the proposal that are going to merely consist of regurgitating applicable owner policy or laws. If every competitor will be obliged to submit a plan that will say virtually the same thing (i.e., we promise to follow OSHA [Occupational Safety and Health Administration] safety procedures), then this is a plan that should be submitted after the award. Only those plans that help the owner discriminate between various proposals should be required at this stage of the procurement.

The owner should only write performance criteria for those aspects of the plan that impact the project award decision. Thus, an RFQ/RFP might only ask for a specific solution to a critical construction safety problem rather than an entire project safety plan. One more rule of thumb: if you are not going to evaluate it, do not ask for it as a part of the proposal. The owner wants the competing design-builders to focus their limited time for the proposal preparation effort on submitting highly responsive proposals that address the key issues of the given project, not word-processing masses of old DB plans.

The key plans that are normally addressed in most DB RFQs/RFPs are as follows:

- Design and construction quality management,
- Safety,
- Traffic control,
- Environmental protection,
- Logistics management.

Any number of other management plans can be included in this discussion. Of the ones listed above, the one that is the most important and therefore bears additional discussion is the quality management plan. Table 3-1 contains a list of commonly used management criteria.

Quality Management Plan Criteria

When the issue of DB project quality is evaluated, it must be reviewed within the context of the DB contract itself. As shown in Figure 2-1, project delivery is a three-legged stool with the legs being defined as cost, schedule, and quality (as defined by the details of design). In the traditional DBB delivery system, the quality is established by furnishing a completed design for the construction contractors to bid on (Ellis et al. 1991). With the contract completion date usually being specified, the only leg of the stool left to ensure a level platform is thus the bid price (Ellicott 1994). Therefore, DBB, by definition, is a system wherein the construction contractor tells the owner how much it will cost to deliver the quality defined in the design within the specified period of performance. DB, on the other hand, demands that the design-builder offer a firm, fixed price for a project whose scope is defined by a set of performance criteria within a specified period of time (Molenaar and Gransberg 2001). In this case the variable leg in the DB stool is the details of design. This puts the design-builder in a position where the details of design and, hence, the resultant level of quality are constrained by both the budget and the schedule. In other words, the design-builder must design to cost and schedule. As a result, it is extremely important to both the owner and the design-builder that the requirements for quality be clearly communicated in the RFP so that the resultant proposals will be as responsive to the owner's needs as the cost, technical, and time constraints of the project allow.

Table 3-1 Typical Management Criteria

Type	Examples	Source
Professional Credentials	"The lead architect shall have a professional license issued by the Virginia Architects and Professional Engineers Licensing Board and expertise in building design and construction."	VDOT, 2002
Personal Experience	"The lead design engineer shall have a minimum of five (5) years experience and expertise in the design of buildings and roadways."	VDOT, 2002
Applicable Technical Design Experience	"Submit past performance narratives on up to five (5) projects that demonstrate design experience in performing work similar in scope, size, and complexity to that described in the [reference paragraph citation] of the RFP."	NAVFAC-SouthDIV, 2001
Applicable Technical Construction Experience	"The construction superintendent shall have a minimum of five (5) years experience in supervising similar projects."	VDOT, 2002
DB Experience	"Complete the Design/Build Work History Form (Part D), list all previous design/build projects, with no project less than $10 million in value, worked on in the last five years. On a separate sheet give a brief description of not more than five; indicate which of the proposed team members were involved."	USAID, 2001
Experience Working Together as a Team	"The Selection Committee will also evaluate how the members of the Design/Build Team will work together to achieve project objectives. This will include any experience the team members have in working together."	State of Utah, 2002
Experience Working for the Owner	"For all DFCM projects completed in the last 5 years identify the project by name, number and DFCM project manager. Each prime contractor and each prime design firm wishing to compete for this project that has not completed at least three DFCM projects in the last 5 years, will be required to provide one copy of a list of references on additional similar projects for a total of 3 projects."	State of Utah, 2002
Experience Working in and Around the Project's Geographic Location	"The degree to which the design-build team can demonstrate that they understand local conditions, including but not limited to, soils, weather, working with city officials, quality and availability of the area's subcontractors, etc.; and the degree to which the design-build team can effectively and realistically demonstrate its ability to work in a remote location while maintaining quality assurance and quality control construction practices."	State of Utah, 2002

Continued

Table 3-1 Typical Management Criteria (continued)

Type	Examples	Source
Organizational Structure for DB	"Submit organizational structure for design and construction teams demonstrating contractual arrangements and clear lines of authority among key personnel including a well-structured, strongly focused design/build team."	NAVFAC-SouthDIV, 2001
Integration of Design and Construction	"Provide offeror's proposed processes for handling field problems and assuring Designer of Record involvement."	USAED-Savannah, 2001
Safety Management Plan	"The degree to which the design-build team can demonstrate: a) successful safety management on past higher/public education projects (including OCIP projects and current emod rate) and for this project, especially as it pertains to student safety; and b) that they will allow for continued and proper functioning of the existing adjacent student housing."	State of Utah, 2002

Sources: Virginia Department of Transportation (VDOT). (2002). "Request for qualifications: demolition and construction of a safety rest and state welcome center, eastbound I-64 in New Kent county, Virginia." Richmond, Va.

Southern Division, Naval Facilities Engineering Command (NAVFC-SouthDiv). (2001). "Request for proposal 160 family housing units, Pascagoula, Mississippi." *Solicitation No. N62467-01-R-0398*, North Charleston, S.C.

U.S. Agency for International Development (USAID). (2001). "Requests for qualifications (RFQ) No. 294-2001-004 Jenin-Nablus highway design-build project." Section H-8, USAID Mission to the West Bank and Gaza, Tel Aviv, Israel.

State of Utah, Department of Administrative Services. (2002). "Request for proposals for design/build services, stage 1, Eccles Living Learning Center at Southern Utah University, Cedar City, Utah." *Division of Facilities Construction and Management DFCM Project No. 01312730*, Salt Lake City, Utah.

U. S. Army Engineer District, Savannah (USAED-Savannah). (2002). "Phase one of two-phase design/build submittal procedure for basic combat training complex with central energy plant 4, phase 1 and 2 at Fort Jackson, South Carolina." *Solicitation No. DACA21-02-R-0018*, Savannah, Ga.

Generic Quality Evaluation Criteria

The American Society for Quality (ASQ) defines quality as:

> The totality of features and characteristics of a product or service that bears on its ability to satisfy given needs. (ASQ 2002)

That definition is quite broad but the focus on "satisfy given needs" is cogent to this section. The owner must clearly articulate the given needs for design and construction quality in the DB project RFP. One way to do this is by requesting specific, quality-related submittals as a part of the DB proposal. The other way is to include the requirements for design and construction quality management as submittals required after the contract award. ASQ goes on to define five varying types of quality as follows (ASQ 2002):

- *Relative Quality:* Loose comparison of product features and characteristics.
- *Product-Based:* Quality is a precise and measurable variable and differences in quality reflect differences in quantity of some product attribute.
- *User-Based:* Fitness for intended use.
- *Manufacturing-Based:* Conformance to specifications.
- *Value-Based:* Conformance at an acceptable cost.

Thus, it can be seen that the concept of quality has many facets. As a result, an owner who is attempting to articulate the requirements for both design and construction quality needs to be very precise in the working definition of quality for each feature of work.

A recent study of 78 public DB RFQs/RFPs (Gransberg et al. 2003) showed that their authors treated quality in two distinct areas. The first is in the pre-award requirements for the various facets of quality that must included in the DB proposal. These included asking for quality-related qualifications of key personnel; requiring a quality systems manager on the DB team; and asking for a design and/or construction quality management (QM) plans in the DB proposal. The second area covers post-award quality issues that must be resolved during actual project execution. These typically took the form of specifying a requirement to submit design and/or construction QM plans for owner review and approval as well as the standard set of design and construction submittals that one would find in a DBB project manual. Ensuring quality during project execution is certainly vital, but the contractual requirements should be established before the award is made. As a result, the RFQ/RFP quality definitions will set the stage for the project and any commitments made by the design-builder through the contents of its proposal as amended by pre-award negotiation become a part of the contract and are just as enforceable as post-award QM submittals.

The study indicated that there appear to be six general approaches to articulating the owner's DB quality requirements in the RFQ/RFP. These are listed below with their definitions:

- *Quality by Qualifications:* The RFQ/RFP was either vague or silent on specific requirements for a DB quality management program. However, it contained language in the requirements for past performance and/or personnel qualifications that indicated that the owner was concerned about the qualifications of the DB team. As it is incomprehensible that any owner would award a multimillion-dollar project without a concern for its quality, it was assumed that the owner believed that awarding to a highly qualified and experienced team would ensure the project's quality requirements.

- *Quality by Evaluated Program:* The RFQ/RFP required the design-builder to submit its proposed QM)program in the proposal and the owner would then evaluate and rate it. The submitted QM program was not restricted in any way.
- *Quality by Specified Program:* The RFQ/RFP required the design-builder to submit a proposed QM program in the proposal that complied with an owner-specified program. The owner would then check the proposed QM program and determine if it was responsive to the specified program.
- *Quality by Performance Criteria:* The RFQ/RFP required the design-builder to submit proposed technical solutions that were responsive to owner-furnished technical performance criteria. The owner would then evaluate each proposed solution and rate it. The performance criteria were open-ended and permitted more than one possible alternative to satisfy a given criterion.
- *Quality by Specification:* The RFQ/RFP required the design-builder to submit proposed technical solutions that were responsive to the owner's prescriptive technical specifications. The owner would then check the proposed solutions and determine if they were responsive to the specifications. The specifications were generally closed and permitted only one possible alternative to satisfy a given specification.
- *Quality by Warranty:* This category was for those RFQs/RFPs in which the issue of quality was not specifically addressed but that had a requirement for some type of performance warranty or maintenance bond. One of these projects required the design-builder to operate and maintain the facility for a specified period after construction was complete.

Table 3-2 relates the above approaches to articulating the owner's DB quality requirements to the different types of quality defined by the American Society for Quality (ASQ 2002). This allows the data related to each DB RFP to be put into the context established ASQ and allows for a more uniform interpretation of the output.

The information given above can be used in the development of performance criteria for quality management plans. In essence, the owner must decide which approach to quality it is most comfortable with and which approach best matches the given project's quality requirements. With that decision made, specific performance criteria can be developed to be used in the RFP evaluation plan.

It is advisable to write criteria for both the design quality management and the construction quality management. Even if the owner has decided to use the Quality by Qualifications approach, certain aspects of the design will be of particular importance to either the technical success of the project or the specific concerns of the owner's project personnel. Remembering that the overall quality of the project is defined by the details of the design, establishing a performance criterion for the design quality management plan becomes nearly essential. The Minnesota

Table 3-2 Comparison of American Society for Quality Definitions with the Study's Definitions for Owner Design-Build Quality Approaches

ASQ Quality Type	ASQ Definition	Owner DB Quality Approach
Relative	"Loose comparison of product features and characteristics."	Quality by Specified Program
Product-Based	"Precise and measurable variable . . . reflect differences in quantity of some product attribute."	Quality by Performance Criteria
User-Based	"Fitness for intended use."	Quality by Evaluated Program
Manufacturing-Based	"Conformance to specifications."	Quality by Specification
Value-Based	"Conformance at an acceptable cost."	Quality by Qualifications; Quality by Warranty

Source: American Society for Quality (ASQ 2002) "Quality glossary." <www.asq.org/info/glossary>.

Department of Transportation helped to put the classifications derived from the above analysis in perspective when it laid out the objectives of a design quality management plan and construction quality management plan as follows:

- The Design Quality Management Plan is intended to:
  - Place the primary responsibility for design quality on the design-builder and its designer(s).
  - Facilitate early construction by the design-builder.
  - Allow the Department to fulfill its responsibilities of exercising due diligence in overseeing the design process and design products while not relieving the design-builder from its obligation to comply with the contract.
- Quality in the construction phase is the program of policies, procedures, and responsibilities required to provide confidence that the desired characteristics have been obtained to help ensure the project will perform its intended function over its design life. (Gonderinger 2001)

Using the Minnesota DOT's definitions as a framework, the following performance criterion could be written for a design quality management plan:

> The proposal shall contain the design-builder's design quality management plan in sufficient detail to show how the designer-of-record will control the quality of the design process and ensure that the final design

> is fully responsive to both the prescriptive and performance requirements of the RFP. Specific attention should be paid to the following elements of the design: [list the elements of particular concern].

Most owners have a fully developed, technically mature system to manage construction quality. By the same token, most designers and construction contractors have their own parallel construction quality systems. Therefore, it probably makes sense to use the Quality by Specified Program approach to the issue of construction quality management; this would establish a criterion that asks for a DB construction quality management plan that is responsive to the owner's established construction quality management program. The one new wrinkle added by DB delivery is that the designer-of-record (DOR) now assumes what in DBB had been much of the owner's quality assurance (QA) responsibilities. Therefore, the owner must decide in the RFP how much of the QA it wants to retain and how much best belongs to the DB team. This decision should be made after a careful analysis of the design risk allocation for the project (see Design Risk Allocation through Performance Criteria, below). If the owner has been very prescriptive in the development of its performance criteria and includes many prescriptive specifications in the RFP, then it would make sense for the owner to retain much of the construction QA responsibility. On the other hand, if the RFP is on the other end of the performance spectrum shown in Figure 3-2, then the majority of the QA responsibility should be shifted to the DOR because the latter will be making the majority of the detailed design decisions. One can see in Figure 3-2 that qualitative considerations are preeminent as one moves away from sealed bidding. Assignment of QA responsibility should move the same direction in tandem with the selection methodology.

If the owner publishes an open-ended, performance-oriented RFP but retains the traditional construction QA responsibilities, it runs the risk of seizing much of the design responsibility through the routine efforts of the QA program. For example, if the owner's personnel disapprove a construction product or process that was submitted as the project QA and dictate corrective action by specifying another product or process, they have made a design decision and probably have

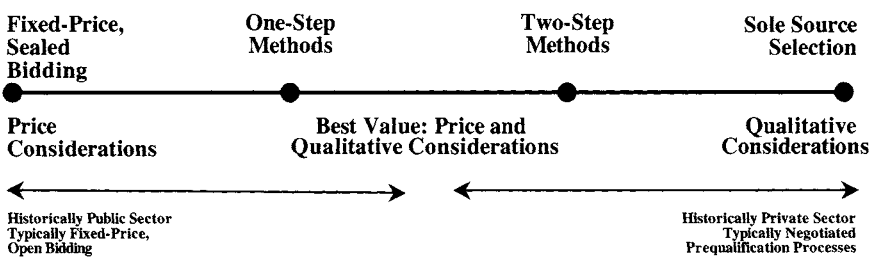

Figure 3-2 Selection methodology performance continuum.

assumed the performance liability for that item of work regardless of the verbiage in the contract. Conversely, if the owner is advertising a draw-build DB project and has prescriptively made most of the salient design decisions, it should want to control the construction QA process to ensure that submittals are consistent with the fundamental design intent for the project. Moving that responsibility to the DOR merely risks inadvertent errors and omissions during the submittal review process. The owner can control this process and establish a performance criterion by detailing the DOR's responsibilities for QM in a contract clause such as the following, which is drawn from an actual U.S. Agency for International Development (USAID) RFQ:

> **Roles and Responsibilities of the Designer-of-Record**
>
> The Designer-of-Record (DOR) is the single point of responsibility for all design decisions and design products for the Design-Build Contractor and shall supply the required professional liability insurance. The DOR shall review, coordinate, deconflict and approve for construction all design and extensions of design produced by all members of the DB contractor's team regardless of who produces it and/or internal contractual arrangements between members of the DB contractor's team including design subconsultants, construction subcontractors, material suppliers and other entities as required. The DOR shall indicate review and approval on all record drawings, specifications, and other design product by fixing a stamp indicating approval for construction or the DOR's seal as appropriate.
>
> The DOR shall conduct and document regular jobsite quality assurance inspections and verify that the contractor's quality control system and construction quality conforms to the record drawings and specifications. The DOR shall verify in writing that all partially completed design and construction is in good order before partial payment is claimed by the DB contractor for those items of work. The DOR shall conduct a prefinal inspection, prepare a punchlist, and then conduct a subsequent inspection to ensure that all items on the punchlist have been corrected *prior* to the DB contractor scheduling the owner's pre-final inspection. (USAID 2001)

In light of all the above discussion, several rules can be formulated with regard to developing performance criteria for management plans:

- If every competitor will furnish the same response to the given criterion, move the requirement to submit the plan from the proposal to a post-award submittal.
- Only ask for the plans that will directly assist the evaluation panel in making the best-value award decision.
- Only ask for sufficient detail to allow the evaluators to properly evaluate each plan.

- Quality management is the key to successful DB projects. The owner should ask for and evaluate *both* design and construction QM plans.
- The performance criteria for QM plans should be directly related to the level of owner specificity in the technical criteria of the RFP.

Schedule Criteria

Developing schedule performance criteria for a DB project is more than just setting a contract completion date. These criteria are particularly important because owners typically select DB as a means to compress the project delivery period (Molenaar and Songer 1998). Anything that would affect the schedule must be disclosed in the RFP and, if the schedule is an item of competition (i.e., the owner allows the offerors to propose the schedule), definitive performance criteria must be established against which the proposal evaluation panel can rate the various proposals. Schedule criteria come in four general forms:

1. Completion criteria
2. Intermediate milestone criteria
3. Restrictive criteria
4. Descriptive criteria.

Developing completion criteria is quite straightforward. It can be as simple as merely stating:

> The project shall be competed no later than [date].

However, if the owner desires competition on the completion date, the schedule-related performance criterion needs to be more explicit. It needs to portray a sense of urgency and the evaluation plan and rating system must give schedule an appropriate weight among all the other rated categories. One way to write such a criterion is as follows:

> Offerors shall submit their proposed completion date and a critical path schedule that supports a completion no later than [date]. Completion before that date is highly desirable, and proposals with an early completion will be given preference.

Intermediate milestone criteria are called for if the owner needs to control the pace of the project. These criteria can often be applied to those aspects of the project's progress that are not completely controlled by either the owner or the design-builder. An example of this is the permits that must be pulled from outside agencies that have no incentive to facilitate the project's progress. Another example would be a requirement to complete a portion of the project before starting the remainder of the project, a process commonly called phased construction. An example of this type of performance criterion is:

> The critical path schedule shall show completion of all Phase 1 design and construction, including receipt of all environmental and building permits by [date]. No Phase 2 work will proceed until Phase 1 work and permits have been inspected and accepted by the owner.

Restrictive criteria would include issues that must be included in the schedule that would prevent the design-builder from being able to complete the project as fast as possible. Actions such as restricting work hours, forbidding certain types of work during specified periods of time, mandating holidays, and implementing security precautions must all be addressed and, if appropriate, performance criteria need to be written to permit scoring of each proposal. An example is:

> The design-builder shall minimize the use of construction means and methods that require the production of loud noise levels. The critical path schedule shall highlight in green those activities that routinely produce noise levels in excess of XX decibels. Those activities may not take place during normal business hours of 8:00 AM to 5:00 PM, Monday through Friday, or late at night on any day of the week between the hours of 10:00 PM and 6:00 AM. Additionally, the proposal will contain a calendar that shows those periods in which loud activities will be planned. Those proposals that show the fewest number of days that exceed the prescribed noise limit will be preferred.

Descriptive schedule criteria are used to establish a uniform format for the proposal's schedule-related submittals. Its purpose is to put all proposals on a level playing field and thus facilitate equitable evaluation. In developing these criteria, the owner should seek to minimize the "bells and whistles" on the schedule submittals, reducing the submittal requirement to a stark, easy-to-analyze document. One way to do this is:

> The critical path schedule shall be displayed as a bar chart with no more than 50 activities. The following major milestones shall be shown on the chart along with their associated completion date: [list of milestones such as design submittal completions, construction phase completions, final acceptance, etc.]. Both design and construction tasks shall be shown on the chart.

The owner can also use these criteria to influence the approach the design-builder takes to scheduling the project. This is somewhat along the lines of restrictive criteria, but these criteria would be suggestive rather than directive in nature. For instance, if the owner wanted to encourage the integration of design and construction, the following performance criterion could be used:

> Design and construction activities shall not be separated on the schedule submittal. Each design package should be shown to directly coordinate

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with its subsequent logistics and construction activities. Those proposals that show a high level of integration between design and construction tasks are preferred.

Table 3-3 contains a listing of commonly used schedule criteria.

Table 3-3 Typical Schedule Criteria

Type	Examples	Source
Completion Criteria	"The schedule will be evaluated as to how well it meets the objectives of the project. Unless other objectives are stated the shorter the design and construction duration that is evaluated to be feasible while maintaining safety and quality in conformance with the RFP is preferred. The overall completion date shown on the schedule will be used in the contract as the contract completion date."	State of Utah, 2002
Intermediate Milestone Criteria	"Provide a Gantt chart to indicate proposed milestones for completing design and construction based on an estimated Notice to Proceed (NTP) of NLT 30 days after contract award."	USAF, 2002
Restrictive Criteria	"The schedule will not include work on legal holidays. This base observes the following legal holidays: New Year's Day, Martin Luther King's Birthday, President's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, and Christmas Day. Any of the above holidays falling on a Saturday will be observed on the preceding Friday. Holidays falling on a Sunday will be observed on the following Monday."	USAF, 2002
Descriptive Criteria	"The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period."	USAED-Omaha, 2002

Sources: State of Utah, Department of Administrative Services. (2002). "Request for proposals for design/build services, stage 1, Eccles Living Learning Center at Southern Utah University, Cedar City, Utah." *Division of Facilities Construction and Management DFCM Project No. 01312730*, Salt Lake City, Utah.

U.S. Air Force (USAF). (2002). "Request for proposals, indefinite delivery-indefinite quantity contract for design-build services." *Solicitation No. F41622-01-R-0011*, Wright-Patterson Air Force Base, Ohio.

U. S. Army Engineer District, Omaha (USAED-Omaha). (2002). "Request for proposals, medical/dental clinic, PDC# Glen 023001 at Schriever Air Force Base, Colorado." *Solicitation No. DACA45-02-R-0040*, Omaha, Neb.

FOUR

Preparing Design-Build Requests for Qualifications or Requests for Proposals

Preparing design-build (DB) Requests for Qualifications (RFQs) and Requests for Proposals (RFPs) is the heart and soul of DB contracting. As shown in the previous chapters, the DB contract is composed of the RFQ/RFP and the winning price and technical proposal. Thus, this step in the procurement process will ultimately define the quality and quantity of the final project. Because this step is so critical, the owner and its RFQ/RFP development team should approach it with a clear idea of the project's definition of success. Having conducted the development of a detailed scope of work as described in Chapter 2, and understanding the process for writing definitive performance criteria as outlined in Chapter 3, the team can press forward to the final level of detail—writing and publishing the project's RFQ and RFP.

To successfully form a DB contract, the owner must have a clear set of objectives for the solicitation documentation. These objectives should support the owner's reason for selecting DB project delivery and should accomplish the following:

- Clearly describe the project's scope of work.
- Define salient operational and quality requirements.
- Explain the methodology for evaluating proposed design solutions for the operational and quality requirements.

The first objective is to develop a clear project description. This flows directly out of the project scoping process and creates a foundation on which the remainder of the RFQ/RFP can be based. The project description includes:

- Performance requirements for the project itself.
- Major constraints that must be considered when designing and building the project.

The project description should be able to stand alone and be read and understood without the need to reference other documents or informational resources.

In effect, the project description takes the place of the plans and specifications in the contract. The Washington State Department of Transportation (WSDOT) defines the project description as follows:

> The Project Description should define the purpose of the project, its limits, unique conditions, design elements, physical components, schedule issues, and other items as necessary to fully describe the project. Describe third party issues such as right-of-way acquisition, utility relocations, environmental mitigation, railroad facilities, and public information to provide the proposers with a complete view of the Department's expectations. Information contained in the Project Description is repeated in various places in the contract documents and other portions of the solicitation package. *Because of this, be sure to check the information regularly throughout the development of the solicitation documents to ensure continued accuracy and consistency.* Continuously updating the information contained in the Project Description during project development serves as a quality assurance mechanism for the Project Team. It also functions as a stand-alone administrative aid for communicating the progress of the project with the Project Team, Department administration, stakeholders and other interested parties. (WSDOT 2000)

The next objective is to clearly define the operational and quality requirements for every major feature of work. Because the RFQ/RFP comprises the technical portion of the DB contract, the owner's team must make its design decisions based on the information at hand, just as the design-builder must do when it is preparing its proposal. This aspect of making decisions in conditions of uncertainty is part of the culture shift that hits an organization trying to implement DB contracting for the first time. In traditional design-bid-build (DBB) project delivery the owner's team could procrastinate and postpone certain decisions until the design development process had proceeded to a point where uncertainty was minimized. However, in DB projects that same team can no longer rely on design process involvement to further define requirements because the majority of the design process will occur after the contract has been awarded. Therefore, the RFP must clearly portray those decisions and the mechanisms used to manage the risks inherent in the early decision making required in a DB project.

A classic example of this issue involves the risk associated with subsurface conditions at the project site. In DBB, the owner could wait until a geotechnical study had been completed to determine the type of foundation that would be required on the project and then direct the design that best fit the owner's budget and time constraints. As schedule most often drives the decision to use DB project delivery, the owner often must include the geotechnical study as a part of the DB contract design phase and thus cannot determine whether a less-expensive, shallow foundation will be sufficient. Thus, the owner's team must include provisions in the RFP itself to allow the design-builder to make that decision and find ways to possibly share the risk of final foundation costs as a vehicle to reduce overall projects costs.

The final objective should be to articulate to the industry exactly how the owner will evaluate the proposal and accept the completed project. This information is necessary to permit an accurate pricing structure to be developed during price proposal preparation and to allow the design-builder to gauge the amount and types of risk it is assuming by signing the DB contract. The simplest way to do this is to require specific performance and acceptance testing to determine if major systems and features of work are achieving the performance criteria set forth in the RFP. For those features of work that cannot be tested, such as the major structural elements or the aesthetic aspects of the project, the owner should then promulgate both criteria for their design and a standard against which the subsequent design and construction can be compared to determine the definition of "satisfactory" for each item.

Ultimately, the RFQ/RFP forms the detailed guts of the DB contract. Its level of technical detail will range from the specific to the inherently abstract. Accordingly, it will furnish the base of design and administrative detail against which the design-builder will measure the project's distribution of risk. The allocation of risk in the contract subsequently decides the margins that the design-builder must earn to compensate it for assuming its portion of the project's total risk. A project's profit potential basically drives the level of industry interest and, hence, the competition that will be experienced during the proposal phase. As a result, the owner must be careful to strike a delicate balance between the need to shed risk and the need to share risk in order to make the project attractive to potential design-builders and to ensure that those organizations that are interested in winning the project are both competent and capable of achieving the definition of success that is communicated in the pages of the RFQ/RFP.

Design-Build Risk Types

Contracts in the design and construction industry are used to distribute risk among the parties to the contract. Thus, as the RFQ/RFP becomes part of the contract it is essential that those who are developing this document both understand and consider how it is allocating the project's risks. In any project delivery method there are essentially three types of risk that must be distributed in the contract

1. Scope,
2. Cost,
3. Schedule.

It should be noted at this point that when the term "risk management" is used, it is not meant only to refer to the insurance package associated with the project's parties. Risk management will be used in the more global sense of identifying the various risks that must be faced in project execution and consciously allocating those risks to the various parties to the DB contract. The guiding rule will be to determine which party can best manage a given risk and then form the contract to distribute that risk to that party.

Scope Risk

Scope risk denotes all those areas that define the technical scope of the project and the ability to confidently quantify the level of effort required to satisfy the required level of technical functionality in the finished project. The DB industry uses the term "scope creep" to express this type of risk. Scope creep occurs during design development when the owner demands that work be incorporated into the final design which was not contemplated during the preparation of the project's price proposal. Hence, scope creep is synonymous with reduced profitability because the design-builder will eventually use the contingencies built into the price proposal to account for the cost of unknown work and, when the contingencies are gone, the costs will eat into the project's profit margin. Therefore, a DB project with a solidly defined scope of work will be less susceptible to scope creep than one whose scope of work is vague. The design-builders proposing on a well-defined project will be able to minimize the amount of contingencies and propose a competitive profit margin. This will give the owner a lower price for the work. If the scope of work is vague, the design-builders will have to increase not only the contingencies associated with it but also their profit margins to try to ensure that the project will be profitable despite the scope risk. Predictably, this will drive the proposed prices to potentially unreasonably higher levels.

This is where enlightened risk management plays a strong role. As discussed in Chapter 2, the owner can choose to share the risk as a means of reducing the project's cost. Following the risk management principle stated above, the owner should assume those risks that it can best manage. For example, a project whose subsurface geotechnical conditions will be unknown at the time of DB contract award leaves the owner with two options by which to distribute the scope risk associated with the design and construction of the foundation

1. The owner could place the risk on the design-builder by directing it to conduct a geotechnical survey and produce a foundation that is designed and constructed in accordance with the requirements of the final geotechnical report. The design-builder would include the cost of the foundation in the lump-sum price proposal.
2. The owner could share the foundation's scope risk with the design-builder by offering to pay for the foundation on a unit-price or cost-plus basis and the remainder of the project on a lump-sum basis.

In the first case, the owner is shedding all the scope risk with regard to the ultimate cost of the foundation, forcing the design-builder to account for it in some fashion within the price proposal. If the actual conditions mirror the worst possible geotechnical case, then the owner may actually benefit from having a foundation that probably cost a bit more than the design-builder estimated. However, if the opposite is true the discrete cost of the foundation will be considerably higher than what the owner would have had to pay in a DBB contract. In the second case, the owner forms the contract regarding the scope of foundation work in a manner that permits the design-builder to get paid exactly for the foundation that is required by the actual geotechnical conditions. Because these conditions cannot be accurately estimated until after the contract award, this payment mechanism is designed to allow the owner to accept the scope risk for the foundation while the design-builder carries the scope risk for the rest of the project. In this case, the design-builder will only need to select an appropriate markup for profit and overhead; as a result, it will probably declare a number that is lower than the one that would have been used in the first case because the owner has accepted this specific piece of the project's scope risk.

Thus, it can be seen that shedding the all scope risk is not free; an owner can break with tradition and accept those risks that it can best manage and accrue real benefits for doing so. Table 4-1 details the comparison between DB and DBB for the most common types of scope risk.

From Table 4-1, one can see that the scope risk for design errors and omissions and latent defects attributed to design move from the owner in DBB projects to the design-builder in DB projects. This tracks with the single point of responsibility doctrine discussed in detail in Chapters 1 and 2. The contractor retains the risk that competent personnel will be available who can satisfactorily translate the design requirements into construction product. Responsibility for latent defects due to workmanship is also retained on the contractor's side.

The contractor's risk associated with warranties and guarantees actually grows in DB. This is because the design-builder will be warranting the quality of the design. If the final constructed product does not satisfy the performance requirements contained in the contract, then the design-builder will have to not only reconstruct but also redesign those systems that fail acceptance testing.

For example, consider a DB contract for a medical facility that contains performance requirements regarding the HVAC system. One criterion specifies the minimum number of air changes that must be present in the surgery suites

Table 4-1 Comparison of Scope Risk in Design-Build versus Design-Bid-Build Contracts

Project Delivery Method	Contractor's Risk[a]	Owner's Risk
Design-Build	Design errors and omissions Warranties and guarantees Latent defects • Design • Workmanship Competent personnel available	Clear project definition Unknown site conditions Direct and tacit approval Design comments and directives Technical capability
Design-Bid-Build	Warranties and guarantees Latent defects • Workmanship Competent personnel available	Design errors and omissions Unknown site conditions Latent defects • Design Direct and tacit approval

[a] The term "Contractor's Risk" is used to denote the entity that has the prime contract with the owner for construction in a DBB project and for design and construction in a DB project.

and another limits the noise level at the diffusers associated with the air flow throughout the entire hospital. However, during final acceptance testing the noise at the diffusers in the surgery suites exceeds the allowable maximum performance criterion when the threshold numbers of air changes are being made. If the number of air changes in the surgery suites is reduced, then the noise criterion can be met. The noise criterion at the required number of air changes can be met in all other locations throughout the hospital. In order to satisfy the terms of this contract, the design-builder will need to redesign and reconstruct the HVAC system that serves the surgery suites. It should be noted that this is not a latent design defect because it can be easily found during routine quality control inspections.

Table 4-1 shows that the owner's major scope risks lie mainly in the project approval process. In DB, the owner must also bear the risk that its personnel are going to be technically competent enough to make informed technical decisions as they arise. This is not to say that an owner's approval or acceptance of the design-builder's final design in any way relieves the design-builder from the total design liability. The issue is more subtle and goes back to the "Whoever designed it is liable for it" principle discussed in Chapter 3. When the owner becomes directive in its design review comments, it flirts with assuming the liability for those design directives.

For example, an owner's engineer who reviews a specification for rustproofing and does not like the designer-of record's (DOR's) method might make the following comment: "Change rustproofing specification to require galvanizing in accordance with ASTM standards." By articulating the concern in this manner, the owner is usurping the DOR's responsibility and making the design decision on this feature of work. Thus, if the design-builder complies and the coating later fails to work as desired, the owner will be found to have transferred the risk for rustproofing performance to itself. However, if the owner's engineer expresses the same concern by saying: "The specified rustproofing method does not have a good record of performance in this application. Reconsider the use of this method and explore other options such as galvanizing per ASTM standards." The owner has left the design decision squarely on the design-builder's back and furnished a clear indication of owner preference in this area. If the design-builder decides to use galvanizing and it subsequently fails, the scope risk will remain with the design-builder. This is because the design review comment was advisory rather than directive in nature.

In DB, tacit approval is even more abstract in its application. The issue of tacit approval often arises when the owner does not know how to respond to a contractor-initiated request for approval and, as a result, does not respond at all. There is plenty of case law regarding this subject and all of it indicates that the "do nothing" option will always be construed against the owner. In DB, the implications of tacit approval become even more confused, especially during the design phase of the project. The authors can offer no single method to protect an owner against tacit approval problems except to say that the owner's personnel must always respond to the design-builder's requests for approval in a timely manner.

That response could be as simple as to state that the matter is being taken under advisement and that this response should not be construed as approval.

In the past decade a controversy has developed regarding the owner's role in approving the design-builder's design product. One side of the issue argues that to formally approve the final design is to return to the risk distribution inherent in the DBB process, and that approving the design is tantamount to warranting that it complies with the contract, thereby relieving the design-builder of responsibility to correct design errors and omissions at its own expense. Those who adhere to this school of thought prefer to use "accept" in place of the word "approve" to indicate that the owner is satisfied with the design product but will not take responsibility for its quality.

The counterargument avers that when the owner reviews the design product and gives the design-builder authority to proceed with construction, this action constitutes an approval of that product and carries no more import with regard to transfer of design liability than does approving a construction contractor's shop drawings in a DBB contract. The authors have no opinion with regard to which school of thought on owner design approval is correct. However, the discussion is offered here to alert owners about the issue and to stimulate discussion within each owner's organization to ensure that worries about inadvertent transfer of design liability do not lead to inaction and potential transfer via tacit approval.

It can also be seen in Table 4-1 that the owner does not transfer the scope risk for previously unknown site conditions by selecting DB project delivery. This is also an issue of some controversy. Various clauses have been written to attempt to do this, but they have been found to be unenforceable using the same legal doctrine as was developed for similar attempts in DBB project delivery. Essentially, the owner is presumed to have superior knowledge of the project and its conditions by virtue of the fact that the owner has procured the real estate and created the technical definition of success in writing the project scope of work. Thus, if the owner has no knowledge of an adverse site condition that will necessitate a change in the total scope of work, the design-builder cannot in any way be magically empowered to somehow know that the site condition exists and be able to account for it in the proposal merely by being assigned the responsibility to complete the final project design. This is plain common sense and fairness. Managing this type of risk requires both the owner and the design-builder to include contingencies in their financing plans to account for the unknown conditions and unforeseen situations that reasonably may arise during project execution.

Cost Risk

Cost risk in DB is more than just the risk associated with the change in project scope discussed above. It encompasses the entire issue of being able to accurately determine the total cost of the project before either awarding or being awarded the DB contract. In many aspects, it deals with the dramatic shift in the project's time line that occurs when the design-builder is awarded the contract before many of the fundamental design decisions with respect to the final technical

Table 4-2 Comparison of Cost Risk in Design-Build versus Design-Bid-Build Contracts

Project Delivery Method	Contractor's Risk[a]	Owner's Risk
Design-Build	Rework due to poor workmanship Redesign due to design errors and associated construction rework Subcontractor default Market fluctuation during design and construction	DB contract amount Prompt payment Prime default
Design-Bid-Build	Rework due to poor workmanship Subcontractor default Market fluctuation during construction.	Redesign due to design errors and associated construction rework Construction contract amount Prompt payment Market fluctuation during design

[a] The term "Contractor's Risk" is used to denote the entity that has the prime contract with the owner for construction in a DBB project and for design and construction in a DB project.

solution are made. Table 4-2 compares the distribution of cost risk between DBB and DB projects.

One can see from the table that the major shift in cost risk is associated with exposure to market fluctuations after the award of the contract. In DBB, the construction contractor is only exposed to unforeseen changes in the price of labor and materials that are experienced after award of the construction contract. Presumably, these will only be those that are unexpected and have not been passed to major material suppliers and subcontractors by requiring them to lock-in their respective quotes. An example would be a subcontractor unexpectedly going out of business and the prime contractor having to hire a new sub at a higher price than the one used in the bid price. Another example might involve a short-term shortage of critical construction materials that forces the general contractor to pay a premium above the bid amount to obtain those materials as required by the schedule.

An inaccurate estimate of the impact of inflation on the price of critical commodities and/or labor in the out-years of a multiyear project is another example of this type of risk in a DBB contract. In DBB, the owner bears the lion's share of this type of risk during the design phase of the project. The longer it takes to complete the design and award the construction contract, the greater the risk to the owner that the contract's bid prices will fall outside the available funding for the project. Thus, by shifting to DB the owner effectively transfers this risk of market fluctuation during design to the design-builder.

The other shift of cost risk to the design-builder lies in the issue of having to pay for rework that results from design errors or omissions. In DBB, the owner clearly carries that risk, but in DB the design-builder must be very careful to ensure that the project's design and construction teams coordinate their efforts carefully to avoid the expenditure of construction effort on features of work whose final design has not been approved for construction by the DOR and/or the owner. This risk becomes especially critical in fast-track DB projects having extremely aggressive project delivery periods.

In DB, the owner increases its cost risk with respect to the contract amount in that it is contracting for both design and construction rather than being at risk for the design contract alone followed by the construction contract alone. If the design-builder were to default, the owner may not have any partial design product that can be transferred to a new design-builder and, thus, the possible cost of default risk may be a totally new DB contract with the new design-builder refusing to accept liability for any of the defaulted design-builder's design product. Taken to the extreme, this could also include the demolition of any partially constructed features of work.

The owner's other major cost risk is the availability of funding to support the cash flow requirements of the design-builder. Owners often assume that DB projects will proceed to 100% design completion before any construction work will begin. Unless the owner specifically requires this process by noting in the RFP that the construction notice to proceed will not be issued until the design is complete, the design-builder has every right to proceed at its own risk and begin construction activities as soon as possible. One of those activities can be ordering materials and items of equipment with long order-ship times to ensure that the availability of these critical items does not delay the project's early completion. Thus, the design-builder's actual rate of earned value often exceeds the owner's estimate of that rate and puts the owner in the position of having to make early progress payments that are larger than expected. Although this is not a problem in most public projects where the entire project amount is obligated and available upon award of a DB contract, the owner of a privately funded commercial project that depends on capital improvement financing must fully understand the cash flow consequences of selecting DB project delivery and account for them in the project's financing scheme. Failing to do so could, at the very least, put the design-builder in a cash flow-constrained position and possibly force a slowdown in project progress. This may result in a compensable delay claim due to the owner's breach of contract with respect to progress payments. This leads to the discussion of DB schedule risk.

Schedule Risk

Schedule risk is often quantified from the owner's perspective in the daily amount of liquidated damages. By definition, liquidated damages are the cost to the owner due to the project's late completion. One must be careful not think of them in reverse fashion (as the benefit of finishing early). This not true; the owner's benefit of early completion is related to the project's ability to generate revenue

Table 4-3 Comparison of Schedule Risk in Design-Build versus Design-Bid-Build Contracts

Project Delivery Method	Contractor's Risk[a]	Owner's Risk
Design-Build	Contract completion date Time impact of design errors and omissions Liquidated damages Competent personnel available	Unrealistic schedule Timely approvals on fast-track projects Timely delivery of owner-furnished property
Design-Bid-Build	Contract completion date Liquidated damages	Timely design completion Timely delivery of owner-furnished property

[a] The term "Contractor's Risk" is used to denote the entity that has the prime contract with the owner for construction in a DBB project and for design and construction in a DB project.

or intangible benefits associated with its capacity to satisfy owner operational requirements. It is not in any way related to the liquidated damage amount. Liquidated damages are merely a portion of the design-builder's quantified schedule risk. The rest of the schedule risk is associated with the design-builder's inability to commit resources and available capital to other potential projects and could rightly be classified in engineering economic terms as the "cost of lost opportunity." Table 4-3 shows the change in schedule risk distribution as an owner shifts from DBB to DB project delivery.

One can see from the table that the design-builder's schedule risk is greatly increased compared to the traditional construction contractor's schedule risk. This is inherently due to the shift in design responsibility and the associated issues of making design errors and omissions during project execution. The risk is magnified by the fact stated in Chapter 1 that the most frequent reason for DB project delivery selection is an owner's desire to compress the delivery period and accelerate project completion. Thus, all the scope and cost risks discussed in the previous paragraphs have some influence on the schedule itself for the design-builder. As a result, design-builders must carefully analyze the schedule requirements of an RFP and ensure that they are achievable within the design-builder's capability to bring resources to the project.

Conversely, the owner's greatest schedule risk is the potential for being overly optimistic in the industry's ability to satisfy specified schedule requirements. A project solicitation that generates very little industry interest may be deemed to be too risky because of unrealistic schedule expectations. This unattractiveness is usually magnified by the imposition of onerous liquidated damages if the design-builder fails to achieve the desired completion date. Thus, while the circumstances of the project might demand an extremely aggressive project delivery schedule, the owner must guard against making the schedule risk so great that no competent design-builders are willing to compete for the project. Also, if the owner demands an aggressive schedule it must be prepared to support the execution of that project at those points in time where the owner's actions may be on the critical path. These are the other owner-related schedule risks.

First and foremost, the owner must adjust its own internal policy for design review to recognize the demands of a schedule-driven project. For example, one of the authors reviewed a DB RFP for a public owner who needed a 12-month project delivery period to meet an important deadline with respect to the project's availability. In this RFP, the owner required three design submissions and instructed the design-builder to allow the owner 30 days to review and approve each design submittal, and then compounded the schedule risk by stating that construction could not proceed until the design was 100% complete and approved. The owner was shocked when it received no responses to its RFP. By framing the contract schedule requirements as they did, the owner in this project effectively reduced the allowable period for construction to less than half the 12-month contract period. Liquidated damages were not enormous but they were substantial enough to make the schedule risk so high that no one was interested in pursuing this project. This is a great example of an owner trying to execute a DB project with a DBB mentality. The owner must also be prepared to both minimize the number of times that its review and approval processes will be on the critical path and commit to expediting those reviews, if possible, to support the fast-track completion of schedule-driven DB projects.

The final owner-related schedule risk that needs to be addressed is the inclusion of owner-furnished property in a DB project with an aggressive schedule. Most owners use this type of property as a cost control measure, preferring to take the schedule risk for the timely delivery of that property rather than pay multiple sets of markups on the property's purchase price if the contractor were allowed to both furnish and install the item. This is a valid concern, but owners who select DB on schedule-driven projects must carefully analyze their ability to meet the design-builder's production requirements for the availability of that equipment or property and ensure that it can indeed be ordered and delivered in a manner that does not delay the project.

This is particularly critical in DB projects with an early completion bonus. By assuming responsibility for the timely delivery of a critical piece of equipment, the owner may not be able to expedite its delivery if the design-builder gets ahead of schedule, making the design-builder eligible for a bonus. Thus, if the equipment shows up after it is needed (but perhaps on time per the original order) and the design-builder is unable to finish early because of this occurrence, the owner may find itself paying the bonus for a project that did not actually finish early. Thus, before the owner decides to save a little money by furnishing high-value items of critical equipment, it should compare the potential incremental cost savings to the potential losses that would be incurred if the owner-furnished property does not arrive in sync with the design-builder's schedule. A rule of thumb would be to never furnish property to a fast-track DB project; this would manage the owner's schedule risk by giving the design-builder complete control of all time-related aspects of the project's execution.

Applied Risk Management in Design-Build

There are many good books and articles on the subject of risk management in engineering and construction projects. This book will not try to replicate their theoretical approaches. Instead, the next section will delineate the practical process used to identify the types of risks that may need to be addressed in a DB RFP and point out possible ways to handle them in the RFP itself. It will be easier to illustrate this process by example. To do so, we will use a general example from the transportation industry, since these types of projects typically are larger, more wide-ranging, and have more uncontrollable risks than building projects.

The first step in this process is to review the DB project's scope of work and determine those aspects that are easily controlled and those that are not. In a transportation project, the following might be a list of risks that are generally found in all projects that are linear in nature, cover relatively large pieces of ground, and must be constructed in manner where daily contact with the public cannot be avoided:

- Environmental studies and permits,
- Public endorsement,
- Interagency and third-party agreements,
- Railroad agreements (if not avoidable),
- Utility agreements.

Selecting DB project delivery does not change the environmental study and permitting process. The required involvement, timing, and supportive design detail is dependent on project type and location rather than the process. Thus, this is an aspect of schedule risk that must be allocated and managed to secure timely project completion. Most environmental permitting agencies have no incentive to facilitate the progress of any given project. To the contrary, their charter requires them to ensure that projects are *not* built that do not precisely comply with current environmental legislation and regulation. Therefore, they act as an element of schedule risk that cannot be controlled by either the owner or the design-builder.

Permitting agencies' procurement paradigm was developed for DBB project delivery and, as a result, they have been structured to review completed construction documents, identify those areas that do not comply with their regulations, and only issue construction permits once the design has been corrected in accordance with their comments and directives. Thus, bringing to them a fast-track DB project where construction must begin before the design is totally complete demands a plan to manage the risk that the design will be delayed due to a need to make corrections; the construction will be delayed indefinitely while waiting for the required permits. There are also elements of cost risk in this process when the design-builder chooses to proceed with those activities that seemingly are not impacted by the environmental permit, but later finds that directed design corrections trickle back into a change of completed work.

The owner must therefore address this issue in the RFP. Doing so demands answers to at least the following two questions:

- Can the agencies issue the necessary permits from less-than-100% plans?
- Can any elements be appropriately shifted to the design-builder's control?

The first question deals with the permitting agencies' routine manner of doing business. Because they were created in an era where DBB was virtually the only allowable mode of doing business in the public sector, their internal process was designed to be inserted between design completion and advertising for construction bids. This was a safeguard against designs that were not compliant with the latest environmental requirements and policies. Thus, these agencies are structured to look at the design concept as portrayed in a complete set of signed and sealed construction documents. They would look at an intermediate design product as a work-in-progress that may change and, therefore, they would be understandably reluctant to issue a permit because the design is not actually finished. Thus, the owner has two choices in this situation:

1. Structure the project in a manner where the construction notice to proceed is not issued until the design is complete and all permits are in hand.
2. Negotiate with the permitting agencies to obtain permits with less-than-100%-completed design.

The first option is usually the easiest to implement because it makes the DB project fit its progress into the permitting agencies' routine method of doing business. If time is not the driving factor in the project, it will always be the least risky way to manage the schedule risk associated with obtaining environmental permits. However, in a time-driven project this will probably not allow a completion schedule that meets the required delivery date.

Therefore, the owner should meet with the specific agencies and attempt to reach an agreement to obtain the necessary permits before the design is totally complete. The owner's approach must seek to determine the specific types of technical design information and products that are truly essential to allow the permitting agency to properly issue a permit. This approach can be simply explained by asking the agency questions such as: Does the agency *really* need to technically review the color of the paint on the inside of the transit stations to be able to issue the environmental permits associated with the construction of the light rail system's trackbed? Obviously, the answer to this type of question is probably "No," and the owner can pursue this line of reasoning until the answers to the questions become "Yes."

At this point the owner develops a list of technical design decisions and their related design products that must be developed as soon as is technically possible to support a cogent application for the necessary permits. This is called progressive permitting. In this process, the owner and the permitting agencies agree that intermediate permits will be issued that apply to corresponding intermediate stages of design completion. The owner then structures the DB RFP to require the DOR to schedule the design progress in a manner that complies with the progressive permitting process, and the design-builder is required to schedule the construction in a manner such that it never exceeds the authority furnished in the intermediate permit. When the design is totally complete and found to be in compliance with the permitting agencies' requirements, the agencies then issue final permits that release the builder to build the project that has permitting constraints. Thus, the owner has shared the schedule risk associated with the permitting process with the design-builder.

The second question speaks to the DBB mentality that attempts to place as much risk on the contractor as possible. Agencies that issue environmental permits are notoriously fickle because the rules that govern the issuance of these types of permits are broad and subject to local interpretation. If the owner is unable to strike a deal to allow progressive permitting on a DB project, then the owner has no choice but to separate the design and construction phases of the project in the RFP, with a permitting phase of indeterminate length. Attempting to shed this schedule risk by inserting a clause in the RFP that makes the design-builder responsible for obtaining all the necessary permits will probably not effectively transfer that risk because the design-builder can no more control the timeliness of the permitting process than can the owner. This type of clause will merely force the competitors to insert additional time in their schedules and additional money in their price proposals to cover the impacts of the unknown aspects of this process.

Public endorsement becomes the next risk management issue in the RFP preparation process. There are really only two ways that this can be handled in a typical transportation project. First, the same routine, required process can be followed to satisfy environmental and statutory issues as could be followed in a traditional project. This approach leaves the end result in question and probably serves to needlessly extend the time period before which construction can begin. The other method would be allow the process to be conducted by the design-builder during contract execution. Bear in mind that the public endorsement process often entails the risk of political consequences that might delay the start of construction. Certain specific risk-sharing mechanisms can be incorporated into the DB RFP that would equitably distribute that risk. One such method would be to ask that a specific amount of money be included in the price proposal as a contingency to fund unforeseen scope and schedule changes that arise from the public endorsement process.

Interagency and third-party agreements are important considerations in managing the project risk during RFP preparation. The owner can best manage this risk *before* advertising the project. To do so, the owner must coordinate with all outside parties and formally define in the RFP all anticipated interagency and third-party involvement with the design-builder. Next, the RFP should define the decision-making process, authority, and responsibilities of each of the parties. Ideally, design-builder interfacing with third parties during DB project execution of the design-build contract should be minimized to coordination efforts only, and the RFP should be clear as to what responsibilities the design-builder has with regard to these types of coordination efforts.

Railroad and utility agreements are probably the major hurdles that must be cleared in a large transportation project. Managing these types of risks in the DB process demands that the owner invest a great amount of effort to nail down the constraints that will be imposed on the project by these third-party participants. In some cases the owner will have the ability to negotiate better terms than those normally imposed by railroad and utility companies. Therefore, before publishing the RFP the owner must ensure that these terms are explicit in the solicitation and that the constraints imposed on both the design and the construction are clearly articulated so that the design-builders can account for them in their price proposals and schedules.

The above discussion of risk management in DB was focused on transportation projects. The same approach can be applied to building projects and engineered projects such as water treatment plants. The idea shown above boils down into looking carefully at the given project and all its components and identifying those areas in which control over the component of work passes from the hands of the owner and the design-builder into the hands of another party that is outside the contract. When the impact of that loss of total control is assessed, responsibility for the risk associated with the possible loss of control is assigned to the party who can best manage it, and that responsibility is articulated in the RFP. This leads the discussion of RFQ/RFP development to the topic of the contracting strategy that will be employed to deliver the project.

Contracting Strategy

The contract is the vehicle that actually distributes the risk among the parties in a DB project. Developing a comprehensive strategy for the contracting portion of the project's life cycle is essential to the success of the project. The contracting strategy consists of the following six elements:

1. Contract vehicle itself,
2. Best-value award method,
3. Advertisement and award process,
4. RFQ/RFP content,
5. Evaluation plan and process,
6. DB team composition.

Each of the above elements is essential to creating a strong and fair contractual framework within which to complete the project. They are all interrelated and are not listed in any particular chronological order. They form a checklist to ensure that the contractual process has been completely analyzed and its various parts synchronized with each other to form a strong foundation of reference for all parties during project execution.

Contract Vehicle

The contract itself can take many forms, from standard contracts sold by professional societies and trade groups, such as the list of standard contracts offered by the EJCDC in Appendix 3, to contracts customized for specific projects. Public agencies often have their own contract formats, and the federal government uses contracts based on the Federal Acquisition Regulation (FAR). Regardless of the contract's format and boilerplate, the owner must visit each project individually and ensure that the standard form and boilerplate actually fit the given project to avoid the creation of ambiguities between the general and special provisions of each contract.

The next step is to select the contract vehicle itself. The contract vehicle basically defines how the contractor will be paid by the owner for accomplishing the specified scope of work. Knowing how payments will be calculated influences the way the price proposal is formed. Owners, designers, and construction contractors in the architectural and engineered project areas will be familiar with lump-sum contracts, whereas those in the transportation industry will be more familiar with unit-price contracts. Private owners and those in the process industries will have experience with cost-plus contracts.

Regardless of the owner's past policy for contract vehicle selection, the needs and characteristics of the project at hand should drive the selection of the contract vehicle. Each contract vehicle inherently distributes cost risk by its very nature. A firm-fixed-price contract puts all the cost risk for the scope described in the contract upon the design-builder. Thus, the design-builder must be able to price the project to a reasonable degree of accuracy without a final design. If this is not possible, the owner must anticipate that the price proposals will be higher than expected for those design-builders that are truly competent and able to fully understand the prescribed scope of work. The danger for the owner comes when one price proposal comes in significantly lower than the rest and it is the only one that falls inside the project's budget. The owner must then determine if that offeror indeed understood the total scope of work and, if so, did not make a mistake in preparing the price proposal.

It is important for the owner to satisfy itself that the level of design development that will take place in the RFP will be sufficient to allow the proposers to accurately develop a price that does not contain excessive contingencies to cover the potential cost of design decisions that must be made after DB contract award. Unit-price contracts are typically used to share the scope risk between the owner and the contractor. In transportation projects, this is done because it is impossible to prepare a precise quantity survey before the project is bid due to the inherent variation in soil characteristics, actual lengths of friction-bearing piles, and other difficult-to-quantify pay items. Thus, the owner commits to paying for actual quantities to avoid creating a situation where the construction contractor would have no choice but to bid the worst-possible case in each pay item if a lump-sum bid was required.

Delivering these types of projects using DB in no way alters both parties' ability to quantify actual quantities before the contract is awarded. In fact, it probably makes it more difficult because final construction documents are not available upon which to base a price. Thus, projects that would have used a unit-price contract in DBB will also probably find that the unit-price contract is still applicable in DB, although the methodology for determining allowable over- and underrun percentages becomes much more abstract because the design-builder, not the owner, will develop the engineer's estimated quantities along with the design documents. As of this writing, the industry is still grappling with the resolution of this issue. There seem to be three possible solutions emerging:

1. Do not allow overrun or underrun percentages. The design-builder gets paid for actual quantities and the owner is protected by a guaranteed maximum price established at either award or design completion.
2. Split the contract between lump-sum for the scope of work that is reasonably well-defined with regard to quantities of work, and unit-price for only those quantities that are impossible to quantify.
3. Use statistical models in unit-price contracts to determine quantity variations that exceed some specified normal variation.

Cost-plus contracts place the scope risk squarely on the owner and reduce the price proposal to merely competing the design-builders' fees and costs of general conditions (also called overhead or indirect costs). These types of contracts are often used when it is impossible to quantify the scope of work after the design is complete. For example, an emergency DB contract might be required to remediate petroleum-contaminated soil because it is difficult, if not impossible, to accurately determine the extent of the subsurface contamination and, hence, the amounts of contaminated soil that must be removed, the amounts of backfill that will be required to replace it, as well as the amount of time that must be allowed to complete the project. In such a case an owner that advertised a lump-sum or unit-price contract would find itself paying a huge premium to distribute the scope risk to the design-builder. Therefore, it is better to retain this risk and merely compete the design-builders' percentage markups or lump-sum fees.

Best-Value Award Method

Once the contract vehicle is selected, the remainder of the selection and award process must be determined to ensure that the requirements outlined in the RFQ/RFP actually support the owner's decision-making process. Seven generic categories for public project source selection procedures are available and are proposed here. Adhering as much as possible to Design-Build Institute of America (DBIA) terminology, they can be termed

1. Low Bid DB
2. Adjusted Bid DB
3. Adjusted Score DB
4. Weighted Criteria DB

5. Quantitative Cost–Technical Trade-off
6. Qualitative Cost–Technical Trade-off
7. Fixed Cost–Best Proposal (Gransberg and Molenaar 2003).

The details of the award algorithms that support each of these award methods are contained in Chapter 6 of this book, and the reader is referred there to gain further information on them. However, it must be stressed that the owner should have determined which award method is going to be used *before* the RFQ/RFP is written because the award method will establish the level of detail that must be articulated in the solicitation documents. This will permit the owner's evaluation panel to fairly rate each proposal and develop the output necessary to identify the proposal that represents the best overall value to the owner.

Advertisement and Award Process

Given the award method, the owner can now establish the process by which it will advertise the contract and reach a point where the award decision can be made. Often this process is driven by the schedule requirements of the project itself. A project that must be awarded or completed by an unmovable deadline will require a more abbreviated process than one that has no hard milestones. Generically, there are really only four options for the owner to select a procurement process:

- Fixed-price, sealed bidding
- Sole source, negotiated
- One-phase, competitively negotiated
- Two-phase, competitively negotiated

Figure 4-1 illustrates the continuum from the sealed bid on one end to sole source procurement on the other. The sole source method merely involves contacting a design-builder who appears to have the requisite capability and experience and attempting to hammer out an agreement that is acceptable to both parties to complete the project. It really has no formal structure that can be described in general terms; it will rely mostly on the owner's internal policies and procedures for capital project delivery. Obviously, this method will be found more often in private, commercial projects than in public works. However, most public agencies have the ability to utilize sole source procurement when certain sets of circumstances apply.

The difference between one-phase and two-phase selection processes is as follows. One-phase selection requires the design-builders to submit qualifications, technical approach, schedule, and price simultaneously. Two-phase selection consists of a Phase 1 RFQ where only qualifications are submitted and evaluated. A shortlist of the best-qualified offerors is then issued the Phase 2 RFP that details the technical approach, schedule, and price in its response. The decision whether to use one or the other is critical for most projects. The advantage to

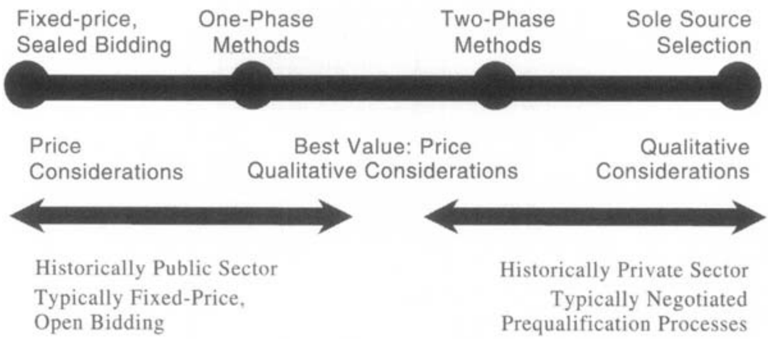

Figure 4-1 Design-build selection process continuum.

industry in the two-phase process is that only those offerors who are truly qualified and therefore competitive are required to undergo the expense of preparing the much more detailed and expensive technical and price proposal. The advantage to the owner lies in the relatively low cost to industry of preparing a statement of qualifications that increases the level of competition. Short-listing also makes those firms on the list feel as though their chances of winning are higher when they are competing with only two or three others. Many highly qualified design-builders pass on one-phase DB projects because they are unable to accurately gauge their chances of winning in a larger field.

The other risk from industry's perspective of the one-phase method is that a less competent competitor will submit an extremely low price proposal, either through ignorance or incompetence, and make it extremely difficult for the owner to award to a higher-priced, more competent competitor. Research has shown that the two-phase selection process is preferred by both owners and design-builders (Molenaar and Gransberg 2001) and that it provides the following benefits:

- Ensures quality of design-builders' credentials.
- Enhances innovation.
- Keeps proposal preparation costs to a minimum.
- Increases competition.

One-phase DB procurement should be reserved for those projects that are either very simple and require very little design development in the proposal, or where the owner does not have sufficient time to invoke the two-phase process due to a hard deadline, such as the end of a fiscal year. Figures 4-2 and 4-3 illustrate process charts of each process from two typical state departments of transportation.

Proposal evaluation is the next step in the selection process and must be outlined before the RFQ/RFP can be written. In fact, the evaluation plan itself is so important to the process that it should probably be completed before either the RFQ or the RFP is released. This is because the RFQ/RFP must support the evaluation

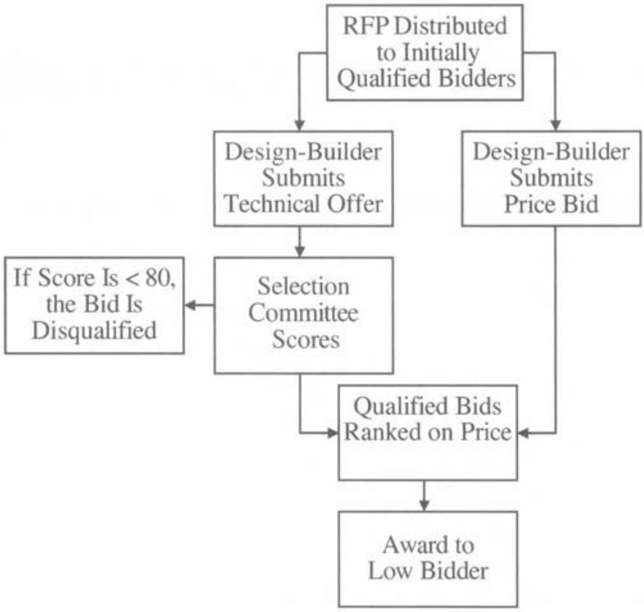

Figure 4-2 Indiana Department of Transportation's one-step selection process (*Molenaar and Gransberg 2001*).

plan. Everything that will be evaluated must directly correlate with a published RFQ/RFP requirement that tells the design-builders exactly what products to submit for evaluation. Additionally, the act of drawing up the evaluation plan forces the owner's DB team to establish standards and performance criteria against which the proposals will be rated. Publishing these in the RFQ/RFP makes the selection process transparent and actually helps the offerors to make their proposals as responsive as possible to the owner's requirements. This is because the owner's requirements are clearly stated, their relative importance is known, and the formula that will be used to select the winning proposal can be evaluated in a manner that causes the proposal to emphasize those aspects that are most important to the owner. A paper by written by a construction industry attorney emphasized this issue when it recommended:

> Clearly state the evaluation criteria and the weight given each item and ensure the [evaluation] team uses them. Clearly state the requirements of the RFP including what will be considered to be a non-responsive proposal. (Parvin 2000)

Chapter 6 of this book provides a detailed explanation of DB evaluation planning. Once the evaluation is complete, the owner must decide if it will use a procurement technique referred to in the federal sector as discussions. Discussions

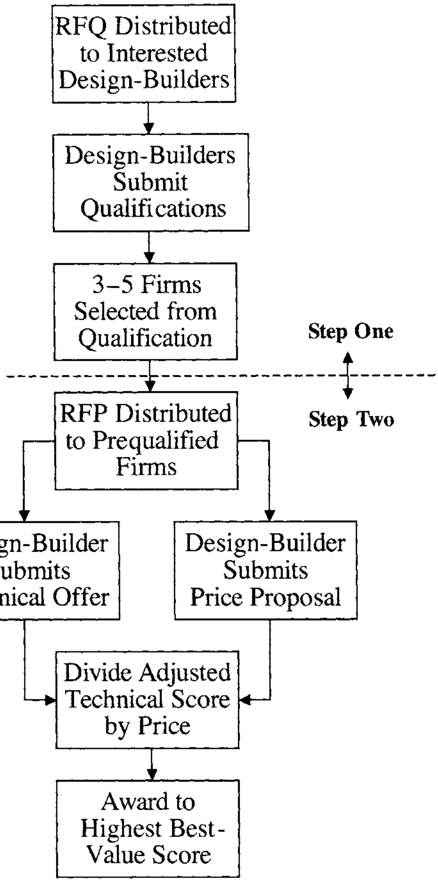

Figure 4-3 Washington State Department of Transportation's two-step selection process (*Molenaar and Gransberg* 2001).

are a key part of a competitively negotiated procurement process. Their use springs from the assumption that most proposals will have at least some minor deficiencies that will need to be corrected. Because both the RFQ/RFP and the winning proposal form the technical basis for the contract, it is prudent and in the best interest of the owner to allow all competitors a period in which to make corrections and submit a revised proposal. Thus, the discussion period consists of the following elements:

- Telling each offeror which deficiencies exist in its initial proposal.
- Asking each offeror to clarify those portions that may have been unclear or confusing to the evaluation panel.
- Defining, if necessary, those portions of the proposal that may not be changed.

- Allowing a reasonable period of time to make corrections and changes.
- Establishing a deadline for the submission of the corrected proposal.

The owner can always reserve the right to award the contract without discussions if it finds one proposal that is totally responsive and in need of no corrections. Discussions also allow the owner an opportunity to correct mistakes and ambiguities contained in the RFQ/RFP and ask the offerors to revise their final proposals accordingly. The corrected proposals are often called the Best and Final Offer (BAFO) or the Final Proposal. An owner can then determine if it will allow a second iteration of corrections to be made if the first set of corrected proposals does not yield a fully responsive proposal. Once this decision is made, the owner can then determine the steps by which it will make a best-value award decision and the procedures with which it will award the DB contract.

Request for Qualifications/Request for Proposal Content

The first question that must be answered with regard to what goes into the RFQ/RFP deals with the level of design that will be portrayed in the solicitation documents. In essence, the RFP constitutes a design problem that the owner describes and the DB proposals comprise individual, differing solutions for the same problem. By selecting DB project delivery, the owner is reaping the benefit of being able to evaluate different solutions for the same problem and selecting the solution that promises, though its innovation and creativity, to offer the owner the best value for this given project. Thus, from the owner's perspective, the level of RFP design content is a function of three things

1. Design constraints for which there is only one technically acceptable solution,
2. The owner's ability to adequately describe the scope of work in performance terms,
3. The time available to award the contract.

As previously discussed, design constraints are inherent in every project and must be clearly articulated in the RFP. They form a portion of the RFP's design content when there is only one technically acceptable solution. For instance, a large university may have selected a single supplier of HVAC equipment for every building on its campus to minimize the requirements for repair parts stockage and training for its in-house technicians. Thus, a DB RFP for a project to construct a new building should contain a design constraint that requires the design-builder's mechanical engineer to design the new system using this specific brand of equipment. By narrowing the field of design options to a single supplier, the owner then assumes a modicum of risk that the final system will not be as efficient or as cost-effective as one designed using another supplier's equipment.

In order to receive reasonable and realistic price proposals, the owner must define the DB project's scope of work as clearly as possible while attempting to stay in the performance realm as much as possible. This is a difficult balancing act. At times it will be impossible, and in those instances the owner must design a given feature of work to a level where its technical scope can be adequately understood by those preparing the DB proposal. Therefore, a useful rule of thumb for RFP preparation can be stated as follows:

> If the only way you can satisfactorily describe the technical requirements for a feature of work is to design it yourself, then do so knowing that you will be assuming the risk for its ultimate performance.

Finally, the time available to the owner to advertise, evaluate, and award the DB contract often puts a functional cap on the amount of design the owner furnishes in the RFP. As the available time period grows shorter, the owner's physical ability to conduct pre-award design decreases. A very common example of this principle deals with the timing of the geotechnical study within a DB project that is sited on land on which there has been no previous construction. The only reasonably reliable way that an owner can characterize a project's subsurface conditions in a manner that permits the design-builder to price the cost of the foundation without a large contingency is to conduct a preliminary subsurface investigation and include its results in the RFP. In DBB, this is normally done during the design phase. However, in DB this can occur either before or after award of the contract. If the owner has the time to complete such a study, it will reap the benefits of more competitive price proposals, while assuming the risk that the preliminary study was not representative of the actual conditions found on the site. However, if the time to do the study is not adequate, the owner will have no choice but to shift that risk to the design-builder and accept that the actual cost of the foundation to the design-builder may be less than the amount that was quoted in the price proposal.

Figure 4-4 shows the conceptual relationship between the amount of owner-furnished design that is contained the RFP and its impact on risk distribution between parties to the DB contract. One can easily see that as the level of owner's RFP design content increases, the owner's risk also increases, and the opposite is true for the design-builder. Now, the figure is merely a conceptual graphic and was not developed using any calculation. What it shows is that for every project there will be a point where the design content and the risk are equitably distributed, and that point is the place where to the two curves cross. This break-even point is where the owner has adequately described all the salient performance aspects of the project while leaving as much room as possible for design-builders to exercise design and construction innovation and creativity through generating their own solutions to the owner-described design problem.

Figure 4-5 relates the level of RFP design content to commonly used terms-of-art for various types of DB contracts. The first type, called Direct Design-Build, occurs when the owner is able to award the contract with very little self-performed design. In commercial development the owner may actually hire the design-builder

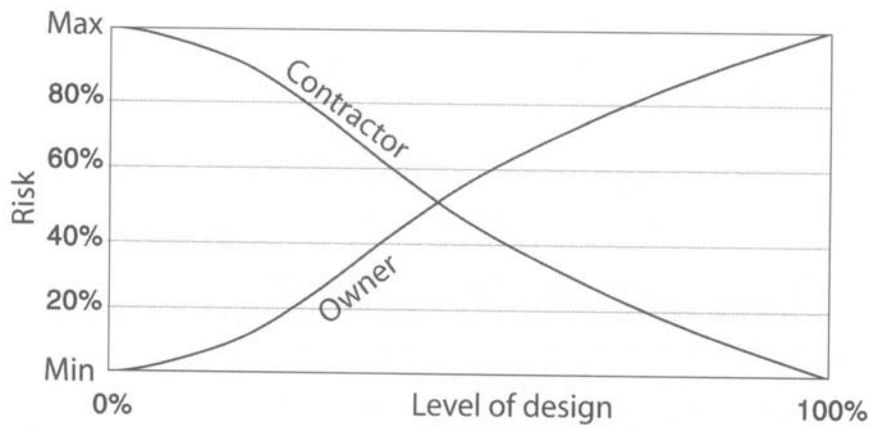

Figure 4-4 Request for Proposal (RFP) level of design versus contract risk distribution between the design-builder and the owner.

to assist the owner in developing possible alternatives for the use of a given piece of real estate. This would correspond the negative level of design content shown in Figure 4-5. An example would be a commercial developer with a fixed amount of capital to invest who is trying to determine the best alternative between several pieces of undeveloped real estate. This owner could award a DB contract that asks the design-builder to develop conceptual designs and cost estimates for each location and then uses that information to make the investment decision, with the design-builder eventually completing the design and construction for the selected alternative.

Design-Criteria Design-Build signifies a DB solicitation with minimal design content, where the design-builder will have great latitude within the published design constraints to generate design solutions that satisfy the owner's performance requirements. Preliminary Design Design-Build indicates that the owner has completed an initial design and probably made the major design decisions. Thus, the design-builders' proposals will differ only in terms of the design details. Consider an example where a state department of transportation advertises a Preliminary Design Design-Build project to rehabilitate a section of deteriorating highway. The owner will have fixed all the horizontal and vertical geometry in the original project. The owner will describe the design traffic loads that the given section is expected to receive and will probably require the use of the state's standard set of specifications in the design and construction. Thus, design-builders' proposals will probably only differ in the proposed structural pavement cross section and the various aspects of construction management planning, such as traffic control and specific means and methods.

Design Draw-Build indicates that the only design task left to the design-builder is to draw the details of the design. The owner has made essentially all the design decisions and assumed the lion's share of the performance risk. "Bridging" is a term

FIVE

Design-Build Requests for Proposal Case Studies

This is the first of two case study chapters in this book. The case studies illustrate the application of important themes from previous chapters. Specifically, this chapter discusses case studies involving design-build (DB) Requests for Proposals (RFPs). Of primary concern in this chapter is the importance of decisions made in RFP development. As stated many times throughout this book, the RFP is the most important document in the DB contract hierarchy. Other issues include the owner's ability to move into a DB culture (or away from a design-bid-build [DBB] culture); partnering relationships between the owner and the design-builders; and defining appropriate and measurable performance criteria. The case studies describe disputes or difficulties during project execution that stem from the details of the RFP. These cases are drawn from real projects and have been sanitized to prevent identification of the actual participants. Some of the facts have been excluded or changed slightly to illustrate the points and fit the format of this text, but they are for the most part true. The format for each case covers: first, the facts and situation; second, a discussion of the positions and issues; third, the outcome; and fourth, lessons learned.

Case 5-1: To Spec or Not to Spec—Is That the Question?

Situation and Facts. A university purchased a decommissioned military base for expansion of their campus. Some of the main structures were utilized in their existing state while other, obsolete buildings were demolished to make room for new buildings. Because the existing power infrastructure was inadequate, the university determined the need for a new power generating station to complete the master plan. In order to achieve the quickest possible delivery, the owner decided to construct a power generating station for the entire campus before the detailed plans of the individual buildings were completed. The owner chose the DB delivery method to facilitate the fast-track delivery needs of the project. The owner issued a performance-based RFP, specifying little more than the location of the power station and the required loads of the future buildings. The owner received numerous proposals within a close price range.

During the negotiation with the design-builder that submitted the low-cost proposal, the owner began to question the proposed completed product. The owner was not convinced that the proposal details were sufficient to ensure that there would not be substantial change orders. The main concern revolved around the location of the power distribution lines. The owner could not determine from the proposal if the DB team was proposing exact locations for the power lines or if it was submitting a "ladder or one-line" diagram. The owner pressed the design-builder to commit to exact locations for the power lines, but the design-builder would not commit at the proposed price because he did not feel there was adequate detail in the master plan. However, the design-builder was comfortable that its proposal would meet the owner's desired outcomes.

Issues and Discussion. The owner had a very difficult time becoming comfortable with the design-builder's proposal. Thus, the issue became:

- Should the owner accept the proposal with the possibility of change orders, or should the owner issue another RFP with more prescriptive requirements for the location of the power lines?

The university's facilities management department had been using DBB delivery for over 100 years but were very new to DB delivery. Due to the need for an expedited project, they recognized the benefits of DB for this campus renovation. They employed an owner's representative to help them develop the RFP and new DB-related documents. Although they took time to develop the new documents, their culture and attitude were deeply entrenched in the DBB delivery method. They were having a very difficult time giving up control of the design details at this early stage in the process.

Outcome. The owner's representative recommended that they accept the design-builder's proposal with the possibility of changes in the layout of the power lines. The owner chose not to take that risk, canceled the solicitation, and prepared a more prescriptive specification for the new RFP. When the owner received the second round of proposals, the cost was more than 15% higher than the original proposal. The owner's representative conducted discussions with a number of the DB proposers. They concluded that the original proposals allowed for more innovation and the solutions were more cost-efficient. The owner had lost substantial time and money by delaying the procurement.

Lessons Learned. The owner needs to determine how much risk it will accept and how much faith it has in the DB process. One of the benefits of DB is that the owner contracts with an integrated team where the designer and the builder can develop truly cost-effective solutions, using the strengths of the team members.

In this case, the owner was unwilling to place that faith in the design-builder at the proposal stage and, as a result, the owner went back and revised the documents to reflect their risk tolerance; it paid a higher price for this decreased risk. One could argue that this issue should have surfaced during the RFP preparation and the level of detail required for contract award should have been established before the RFP was issued.

Case 5-2: Keep Looking Until You Find the Right Answer

Situation and Facts. An owner wishes to construct a new building on its campus using DB delivery. They issue an RFP which states that all buildings over a certain height at this campus "shall be founded on caissons." A six-year-old geotechnical report for an area two miles away from the project site is provided to "furnish a representative condition on which to base preliminary foundation designs." The RFP also requires the design-builder to execute soil borings and provide a geotechnical report "on which it will base its final foundation design." The design-builder's price proposal indicates that the use of caissons is contemplated for the foundation.

When the preliminary geotechnical report is submitted to the owner, it contains three reports from three different subconsultants:

- Report 1 states, "Building A must be founded on caissons."
- Report 2 states, "This report was prepared to determine if Building A really must be founded on caissons. Report 1 used soil tests that are normally used on loam soil, and the soil in question is clay. Nevertheless, if the results were used to determine the requirement for a deep foundation, they would indicate caissons, but as the soil type is different, Report 1 may be incorrect in its application of test data to foundation design."
- Report 3 (prepared by the structural designer and his in-house geotechnical engineer) states, "Having reviewed the information contained in Reports 1 and 2, we disagree with their conclusions. We agree with Report 2's assertion that the tests results were not properly evaluated with respect to clay soils. After additional testing and an analytical study of all the results, we find that Building A should be founded on spread footings."

Exercising its prerogative to "proceed at its own risk," the design-builder began preparation to put Building A on spread footings before the final geotechnical report was submitted. The owner's experience in this area indicates that certain areas of the campus require deep foundations and others do not. This project is literally on the geologic boundary between the two areas. Also, the owner awarded this project at a price that virtually eliminated any contingency funds to pay for changes after award.

Issues and Discussion. The main issue here is controlling the risk and the project approach. In this case, that involves two questions:

1. Does the owner have the authority to require the contractor to suspend foundation work until the final geotechnical report is submitted?
2. If the owner believes that a shallow foundation brings an unacceptable risk of performance with respect to settling, can the design-builder be required to build caissons without a compensable change order?

The secondary issues are: first, what does the way this preliminary report was prepared say about the quality of the design-builder's design process; and second, what should the design-builder have done to eliminate the controversy spawned by the preliminary report?

Outcome. In spite of the owner's RFP language and the DB contractor's price proposal, the requirement to conduct detailed geotechnical investigation and base the design on the final geotechnical report leaves open the final design and allows the design-builder to accrue the benefit of a less-expensive foundation if the technical facts support that design decision.

The owner had to decide whether the risk of settlement and its attendant headaches associated with trying to recover damages was worth less than negotiating an adjustment to require caissons. In this case, the owner commissioned an outside geotechnical expert to prepare a report based on the contractor's soil test data. The report showed that both methods would appear to be adequate but that spread footings had a low factor of safety (1.25). As a result, the outside expert recommended that caissons be used. An agreement was reached where caissons were designed and installed in exchange for a reduction in scope in a later feature of work. Thus, both the budget and the technical requirements were maintained. However, a time extension for the preparatory rework was granted.

Lessons Learned. The owner needed to specify a specific factor of safety if it wanted to open up the solution options for the DB contractor. If the owner was only comfortable with caissons, then this should also have been unequivocally stated in the RFP. On the other hand, the DB team needed to understand its potential clients. If they were only comfortable with one approach and the proposal offered a different approach, then an attempt to sell this idea to the owner should have been made before proceeding with the work. If the owner was uncomfortable with that different approach, then the design-builder should have offered additional information detailing the salient aspects of the approach that would provide the confidence factor the owner desired. Finally, the design-builder should have made it clear in its proposal that the final geotechnical report would govern its solution for the foundation, even though its initial thought, as provided in the proposal, was that caissons were the contemplated solution.

Case 5-3: All the Right Moves

Situation and Facts. A city is building a new bridge to replace one that has met its useful life. The RFP states that "the alignment of the new bridge shall not change from the existing alignment." A 60-year-old geotechnical report for the project site is provided to "furnish a representative condition on which to base preliminary foundation designs." The RFP also requires the design-builder to execute soil borings and provide a final geotechnical report "on which he will base its final design." The design-builder's price proposal indicates that the use of piles is contemplated for the foundations of both abutments.

During the owner's review of the foundation design, the owner receives a working drawing indicating a shift in the alignment for the south end of the bridge to the edge of the existing right-of-way within the designated project limits, a distance of about 35 feet. Upon questioning the geotechnical engineer, the owner is shown the required final geotechnical report that shows a shelf of bedrock located on the side of the project that apparently was not found on the original survey for the old bridge. This condition permits the design-builder to install one abutment on a shallow foundation system.

Issues and Discussion. A three-part question identifies the issues

- Does the owner have the authority to require the contractor to build the foundation on the original alignment?
- If the owner does have that authority, can the design-builder be required to build the changed alignment without a compensable change order?
- If not, should the owner receive some consideration for the cost savings inherent in the new location?

The design-builder maintained that the RFP required him to redo the geotechnical survey. He furnished an exhaustive geotechnical survey (from his perspective, one more extensive than contemplated by the authors of the RFP). The design-builder believed he was entitled to reap the benefit of the cost savings allowed by this discovery. Furthermore, he chose to interpret the clause regarding alignment to mean that the bridge must be built on the available property described in the site plan. In order to effect the increased capacity requirement for the new bridge, he was forced by project geometry to slightly alter (by about 5 feet), with the owner's approval, the alignment of the north side of the bridge to accommodate new access ramps within the existing project limits. Therefore, if it was acceptable to move one end of the bridge within the project limits to make it work, it should follow that the shift from the existing alignment on the other end would also be acceptable.

Finally the design-builder pointed out that moving the south end of the new structure allowed him to maintain a full and unimpeded flow of traffic during construction for an additional six weeks. The schedule depicted that closure would have occurred at the beginning of the tourist season. Since this bridge is on a main route to a major tourist attraction in the area, the owner would receive value due to decreased user inconvenience (opportunity costs) during the construction phase of the project.

After intense internal discussions, the owner recognized the advantages of the new alignment. However, the owner contended that the design-builder should provide a credit due to a cost savings from the original price proposal because the owner was furnishing relief from the "shall not change from the existing alignment" RFP performance requirement. The design-builder refused to entertain the idea of sharing the savings. He believed he had exceeded the RFP performance criteria for the geotechnical survey and, as a result, should receive the windfall associated with conducting a thorough geotechnical study. He also argued that the shift in the north end of the bridge to accommodate the access ramps actually exceeded the price for that feature that was contained in the price proposal.

Outcome. The inability to punctually resolve the two diverging views essentially created schedule delays. In order to bring this to resolution, the two parties engaged a mediator. After a short meeting, the parties agreed that in spite of the owner's RFP language and the DB contractor's price proposal, the requirement to conduct a detailed geotechnical investigation and base the design on the final geotechnical report left open the final design. It also allowed the design-builder to accrue the benefit of a less-expensive foundation if the report's conclusions supported that design decision. The owner conceded that the previous approval of a change from the original alignment on the north end of the bridge probably constituted a waiver of that RFP requirement. The design-builder agreed to forgo a claim for the time delay caused by this dispute and to accelerate the work to make up the schedule.

Lessons Learned. The primary lesson learned pertains to which requirement takes precedence in the contract. In this case there were conflicts generated by not consistently applying the contract document hierarchy. Unless specified otherwise, a hierarchy needs to be established between the RFP, the proposal, and the required documents emanating from the RFP (e.g., deliverables). In this case, the hierarchy was not evident and therefore was inconsistently applied. These issues, if not addressed in the RFP, should have been resolved at one of the initial project meetings. The primary lesson here involves communication; both sides were operating from different assumptions and they proceeded accordingly. DB projects require a great degree of trust between the owner and the design-builder. The only way to guarantee this trust is to communicate.

Case 5-4: Trust Me. I Know This Will Work

Situation and Facts. A government agency had designed and built many buildings using DBB in the local area. Its design and construction personnel had developed a standard design package that was considered to be totally adequate for the area and had a proven record of success. This agency usually required that all buildings have basements to enhance their storage capacity as well as furnish an area where special, secure storage requirements could be met in each structure. Because the local water table is generally high, experience with past DBB projects demonstrated that a mud slab system with a waterproof membrane beneath the slab and on the basement walls would adequately waterproof the basement. The RFP's level of design detail was minimal, containing only a few schematic drawings and detailed performance criteria. The RFP stated:

> The basement shall be designed and constructed to be waterproof for typical conditions in this area. (Gransberg and Molenaar 2001)

The RFP did not specifically ask the design-builders to identify their proposed basement waterproofing systems in their proposals. When the performance criterion for basement waterproofing was written, the owner expected that the competing design-builders would investigate the previous buildings constructed by the owner in the area and discover that a mud slab system was the typical solution for this design problem. Finally, the project contained only the normal one-year construction warranty.

The project was a fast-track project and had been awarded to the proposal that offered the most aggressive schedule. The contract contained provisions for incremental approval of design features, permitting the design-builder to begin construction as the earliest possible moment. When this particular issue arose, the design-builder had completed the final foundation design and the owner had approved reviewed and accepted it. The waterproofing design had not yet been submitted.

Issues and Discussion. The design-builder began construction of the foundation. Before the footing excavation began, the design-builder placed a gravel base in the basement area that the owner's construction personnel assumed was preparation for the installation a mud slab. Later, the owner discovered that it was only a temporary working surface. When the owner's construction personnel surveyed the excavation they found that the elevation for the top of the first and only constructed footing did not allow sufficient space for the installation of a mud slab, leading the owner's personnel to assume that an error had been made in construction of the first footing.

When asked about the waterproofing design, the design-builder verbally described a system that they had priced in the proposal based on the RFP's waterproofing performance criterion; it did not include a mud slab. Drawings and specifications for the waterproofing design were being developed precisely at the time the question about the system was raised. Based on past experience with waterproofing basements in this area, the owner's representative recommended that footing construction be stopped to mitigate cost. The design-builder assured the owner that the planned system was responsive to the performance criterion published in the RFP and would work properly, based on the contractor's past experience. After several days of haggling over the intent of the performance criterion, they reached an impasse. The design-builder stated that if the owner wanted a mud slab system, that would constitute a change in scope and the designer-builder would request a change order and a time extension if it was directed to change to the mud slab technology.

Outcome. With this impasse on a fast-track project, the parties agreed to take the issue to alternative dispute resolution. The decision was made quickly; the essentials are as follows:

- The owner failed to identify its preferred basement waterproofing design in the RFP.
- The DB contractor was assumed to be competent in designing and installing an adequate system for this facility, as evidenced by the award of this contract.
- Therefore, the owner must pay for a directed change to the scope of work if the owner insists on the mud slab design solution, and the owner will assume liability for its ultimate performance if it is designed and installed properly.
- Additionally, the owner must grant a time extension and pay for redesign and any rework.

This owner decided that because the schedule was the preeminent factor in selecting DB on this project the DB contractor would be allowed to proceed as originally planned. To mollify the owner's concerns, the DB contractor offered to flood the area over a three-day weekend to prove that the contractor's waterproofing system was adequate.

This case is an example of an owner who wrote an open-ended performance criterion and assumed that the design-builder would interpret it in the way that the writer had intended. There was nothing in the criterion that indicated that the owner had a preference for the mud slab waterproofing system. The owner clearly had superior knowledge of the conditions at the project site but failed to share it. The crux of the issue was not the technology itself but, rather, the long-term impact on operations and maintenance as well as the potential cost if the installed system failed, making the basement potentially unusable as intended. Thus, the stakes for the owner were quite high.

When these conditions exist for a given feature of work, one would expect to see a relatively prescriptive performance criterion. On the other hand, if the owner wants to allow for alternative solutions, a requirement to submit details of the system in question as a part of the proposal would be contained in the RFP. Either way, the final, approved system would have become part of the contract before award and this type of dispute would have been avoided. Because the owner in this case assumed that the phrase "typical conditions in this area" would cause the offerors to investigate previous projects and find out that mud slab systems had been successfully used in the past shows that the owner had unrealistic expectations about the level of detail that the competitors would undertake in proposal preparation. The owner had superior knowledge about the project site and failed to share it with the competitors in the RFP. The owner also failed to indicate that it had a special concern about the waterproofing and had a preferred solution to this design problem.

The entire issue could have been avoided if the owner had used the following performance criterion instead of the original one:

> The basement shall be designed and constructed to be waterproof for typical conditions in this area. A mud slab system has been successfully used in the past and is the preferred system.

If the owner wanted to ensure that it got the preferred system, then the following criterion could have been used in the RFP:

> The basement shall be designed and constructed to be waterproof using a mud slab system similar to the one used in [name of previous project].

The difference between the two criteria is the level of design liability that the owner assumes. In the prescriptive criterion, the owner has essentially assumed the performance liability for the waterproofing system. If the design-builder properly designs and installs the mud slab system and it fails, it would be able to successfully argue that it was not permitted to make the fundamental design decision associated with this feature of work and that it had followed the owner's instructions per the contract. Therefore, the owner would be liable for the damages. However, if the design-builder operating under the first criterion designs and installs a mud slab system, the outcome would probably be different because the named system is merely identified as the preferred design solution. This leaves the fundamental design decision up to the design-builder and leaves the performance risk of this feature on the design-builder's side of the contract.

Lessons Learned. Lessons learned from this case are as follows:

- If the owner is concerned about the design of a particular feature of work, it should state its concerns in the RFP and require that those concerns be addressed in the proposal.
- Criteria writers should never assume that design-builders will interpret their performance criteria in any other way other than literally.
- The owner will always have superior knowledge of project conditions and should share it in the RFP.

In summation, this chapter has shown the reader how to develop good DB performance criteria.

Summary

The four cases presented in this chapter illustrate a few common themes that occur throughout the design-build process, regardless of the facility type or industry sector. The most obvious theme is the importance of the RFP in the hierarchy of DB contract documents. Owners must invest the time and resources to carefully prepare this document. They must strike a balance between clearly expressing those items for which there is only one acceptable technical alternative, and not allowing for more efficient alternatives when that technical alternative is really just a design preference. The owner must leave open those areas where an innovative solution might arise to reap the true benefit of design-build. This is sometimes difficult to do when the DBB culture is entrenched in the owner and industry management structures. These cases are intended to demonstrate that a true cultural shift can take time but the rewards can be substantial. The lessons learned will help to level the learning curve of DB RFP development.

SIX

Selection Process Request for Qualifications/Request for Proposals Evaluation Planning

The advent of widespread use of design-build (DB) as a primary project delivery system for both private and public works projects has proliferated a number of methodologies for making a best-value evaluation of DB proposals. As a result, the application of competitively negotiated contracts requires a fair and equitable system that gives an owner a logical method by which to determine which proposal has the highest probability of successfully completing the project at the lowest overall cost. Inherent in the success of this system is a highly developed, well-defined evaluation plan that can quantify many of the qualitative aspects of each proposal. This chapter will therefore delineate the component elements of a comprehensive evaluation plan and demonstrate the various methods that can be used to develop a quantitative scoring system that leads to a fair and equitable award recommendation to the source selection board.

The most common problem caused by a poor evaluation plan does not involve contractor default; rather, it generally involves a minimally qualified contractor attempting to provide the lowest possible project quality to avoid losing money on the project (Ellicott 1994). This situation usually finds the owner coping with an inordinate amount of change order requests, time extension requests, and quality disputes as the contractor uses every contract clause to attempt to minimize potential losses. It is virtually impossible to write a perfect set of plans and specifications (Ellicott 1994). Therefore, the contractor can use every ambiguity to reduce the overall quality of the completed project. The ultimate end is a dissatisfied owner, a financially bruised design-builder, and more work for the court system that must settle the disputes generated by a problem project after construction completion. In addition, a check of the final cost of the project (including claims and legal fees) will probably show that it ultimately cost more than the prices quoted by unsuccessful offerors on the same project prior to award (Tenah and Guevara 1985).

Thus, it is imperative for all the parties involved in a DB project that the evaluation plan be fair, equitable, and transparent. An insightful article written by Cordell Parvin in 2000 articulated the importance of clearly communicating the

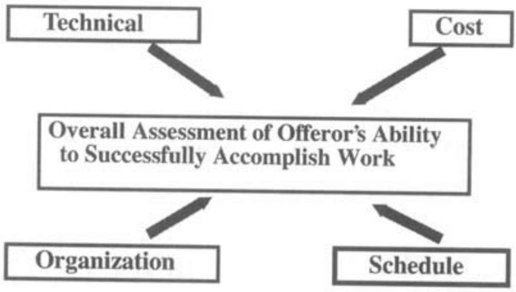

Figure 6-1 Evaluation planning model.

method for selecting the winning proposal. Parvin indicates that is mandatory that the owner "clearly state the evaluation criteria and weight given for each item and ensure that the evaluation team uses them. Clearly state the requirements of the RFP including what will be considered a non-responsive proposal" (Parvin 2000). Parvin's article describes several cases where the award was successfully protested because the evaluation plan was unclear and subjective. Award protests and their subsequent project delays are completely avoidable by the owner investing the up-front resources necessary to develop a fair and equitable system with which to select the best value among several competing proposals.

Figure 6-1 is a graphical model for what must be accomplished in a good evaluation plan. Essentially, the owner must develop a series of evaluation criteria that match the salient performance criteria in the Request for Qualifications/Request for Proposal (RFQ/RFP). The evaluation criteria will fall into four categories: technical, organization, schedule, and cost. Each criterion must have a standard associated with it that can be used to measure the proposed item of work. Each category must have a weight relative to all other categories and, finally, there must a formula or methodology to roll up the scores received by each category into a *rubric* with which to make a best-value decision.

To successfully do so, the project team must bear in mind, while designing the evaluation system, the reason why DB was selected and which of the factors is most important for this project. For instance, if schedule is the preeminent factor, then those evaluation criteria that directly impact the ultimate schedule must be given a greater weight than all other factors. Public owners must be careful here. Some enabling legislation has unintentionally dictated the evaluation plan weighting. A good example is the DB legislation in a southern state where the law requires that price be given 60% of the weight in the best-value decision. Thus, this state's public owners cannot give schedule or technical a higher weight than price. Federal agencies will often indicate in their RFPs that "Price is equal to all other factors combined." This is done to preserve flexibility in the Cost–Technical Trade-off best-value decision mandated by the Federal Acquisition Regulation (FAR 2001). However, when this statement is made, it indicates the price is weighted at 50% and the sum of all other categories is 50%. Therefore, a low price is more valuable than technical excellence or an aggressive schedule, regardless of what the owner may have intended when the RFP was written.

Award Methods

The first decision that must be made regarding the structure of the evaluation plan is the method by which the award will be made. This decision will drive the composition of all other facets of the evaluation plan. In fact, the owner must be careful that the evaluation plan supports the award method, or confusion will reign during the proposal preparation process. Two studies of the means used by various public agencies to award DB projects have been completed in the past decade (Gransberg and Senadheera 1998; Molenaar and Gransberg 2001). Both studies attempted to identify best practices used by public agencies and the major project characteristics associated with each best-practice subject.

Public Agency Award Methods

The previously cited studies surveyed all state departments of transportation (DOTs) and federal agencies that routinely procure design and construction services using DB, to identify the best practice in use throughout the nation. Thirty-three out of 50 states, four federal agencies, and two municipal entities responded to the study questionnaires. Of the 33 state respondents, 13 indicated that they had used DB and furnished details of their evaluation and award process. These states were Alabama, Alaska, Arizona, Colorado, Connecticut, Florida, Indiana, Iowa, New Jersey, North Carolina, Pennsylvania, South Carolina, and Washington. The Federal Highway Administration (FHWA) has approved DB projects in the following 24 states and the District of Columbia under the Special Experimental Project (SEP) 14 Program (AASHTO 2001): Alabama, Alaska, Arizona, California, Colorado, Delaware, Florida, Georgia, Hawaii, Indiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Utah, Virginia, and Washington. In addition to those states, many other states, including Texas and Oklahoma, have authorized the use of DB for public building projects only.

The geographic dispersion of the states that have adopted DB covers virtually the entire country. No specific region seems to either espouse or reject DB. The experience of the federal government is also cogent to this discussion. All the military departments, the General Services Administration, the U.S. Forest Service, and the U.S. Department of Energy have successfully used DB on a wide variety of projects.

An evaluation of the documentation that was obtained on the state- and federal-level DB programs showed that the programs in use by Arizona (Arizona 1996), Colorado (Colorado 1996), Florida (Florida 1997), Pennsylvania (Pennsylvania 1995) and the U.S. Army Corps of Engineers (USACE 1994; FAR 1997) were the most mature. Florida, in particular, has been using DB since 1983 and, as a result, has the most well-developed set of guidelines and procedures for implementing

Table 6-1 Summary of Best-Value Selection Methodologies

State/Agency	Agency Terminology	Remarks	Generic Award Method
Alaska	Criterion Score	Divide technical score by price	Adjusted Score
Arizona	Quality Adjusted Price Ranking	Percentage system used to adjust bid price for technical score	Adjusted Bid
Colorado[a]	Low Bid, Time Adjusted	Multiparameter bid with qualifications	Low Bid
Florida	Adjusted Score	May also include time adjustment	Adjusted Score
Indiana	Low Bid, Fully Qualified	Minimum technical score to be found qualified	Low Bid
Maine	Overall Value Rating	Divide price by technical score	Adjusted Bid
Michigan	Low Composite Score	Divide price by technical score	Adjusted Bid
Minnesota	Low Bid, Fully Qualified	Shortlist by qualifications	Low Bid
Missouri	Low Bid + Additional Cost	Additional costs include life cycle cost calculation	Low Bid
New Jersey	Modified Low Bid	Included design costs	Low Bid
North Carolina	Quality Adjusted Price Ranking	Percentage system used to adjust bid price for technical score	Adjusted Bid
Ohio	Low Bid	Includes design costs	Low Bid
Oregon	Best-Value	Combine technical with cost by weights	Weighted Criteria
South Carolina	Low Composite Score	Divide price by technical score	Adjusted Bid
South Dakota	Best-Value	Divide price by technical score	Adjusted Bid

Continued

Table 6-1 Summary of Best-Value Selection Methodologies (continued)

State/Agency	Agency Terminology	Remarks	Generic Award Method
Utah	Best-Value	Combine technical with cost by weights	Weighted Criteria
Washington	High Best-Value Score	Divide technical score by price	Adjusted Score
Federal Highway Administration	Best-Value	Adds owner contract administration costs to price	Adjusted Score
General Services Administration	Best-Value	Uses Weighted Criteria approach to arrive at technical score	Cost–Technical Trade-off
Naval Facilities Engineering Command	Best-Value	Uses Weighted Criteria approach to arrive at technical score	Cost–Technical Trade-off
U.S. Army Corps of Engineers	Best-Value	Uses Weighted Criteria approach to arrive at technical score	Cost–Technical Trade-off
U.S. Forest Service	Best-Value	Uses Cost–Technical Trade-off formula to differentiate between bids	Adjusted Bid
U.S. Postal Service	Best-Value	Uses Weighted Criteria approach to arrive at technical score	Cost–Technical Trade-off

[a] In 1999, the Colorado Legislature passed HB1324 allowing for a true best-value selection. Other states may be actively changing their procurement legislation during the time of this writing, as well.

DB on transportation projects. The U.S. Army Corps of Engineers (USACE) and the Naval Facilities Engineering Command (NAVFAC) also have more than a decade of DB experience on a wide variety of military building and industrial projects. Table 6-1 is a summary of this process and clearly illustrates the value of standardizing the technical vocabulary in this emerging area of infrastructure project delivery.

It is not surprising to find two agencies that use the same term for a specific DB award method in actuality use very different algorithms to arrive at the source selection decision. This is particularly true with the term "best value." This term's official meaning ranges from the relatively subjective comparison of price and proposal technical score in the Federal Acquisition Regulation (FAR 2000) to the objective, mathematical combination of the two used by several state DOTs (Carter and Burgess 1998; Colorado 1998; Washington 2000). Thus, the proliferation of various methodologies has created a situation where a design-builder must ask the agency which authored the best-value selection methodology about the details of the evaluation and award decision-making process in order to properly assess the odds of winning a given project.

Tables 6-2, 6-3, 6-4, and 6-5 illustrate this point with a hypothetical project and five typical agencies which each use a different method to make the best-value decision.

Table 6-2 Example of Best-Value Selection with Four Typical Agencies

Agency (1)	Formula with Agency Name for Method (2)	General Award Type (3)
Arizona DOT	Adjusted Price = Price Proposal − Quality Value	Adjusted Bid
Federal Highway Administration	$\text{Adjusted Score} = \dfrac{\text{Technical Score} \times 10{,}000}{\text{Price Proposal} + \text{Contract Admin Cost}}$	Adjusted Score
South Carolina DOT	$\text{Composite Score} = \dfrac{\text{Price Proposal}}{\text{Technical Score}}$	Adjusted Bid
Washington DOT	$\text{Best Value Score} = \dfrac{\text{Technical Score} \times 10{,}000{,}000}{\text{Lump-Sum Price}}$	Adjusted Score

Table 6-3 Quality Percentage for Technical Proposals (Arizona)

Technical Score (1)	Quality Credit (%) (2)
100	15
90	10
80	5
70	0

Table 6-4 Best-Value Selection with Five Typical Agencies (*Wide Spread in Scores and Prices*)

Firm (1)	Technical Score (2)	Time (3)	Price Proposal (4)	INDOT Low Bid, Fully Qualified[a] (5)	ADOT Best Value with Quality Credit[b] (6)	SCDOT Low Composite Score[c] (7)	WSDOT High Best Value Score[c] (8)	FHWA Best Value[c] (9)
A	92	450	$11,880,000	$11,880,000	$10,573,200	129,130	77.44	[d]63.10
B	86	460	10,950,000	10,950,000	10,074,000	[d]127,326	[d]78.54	62.73
C	76	500	9,850,000	9,850,000	[d]9,554,500	129,605	77.16	59.14
D	74	500	9,760,000	[d]9,760,000	9,564,800	NR	75.82	57.99
E	68	500	9,700,000	NR	9,700,000	NR	70.10	53.54

[a]Fully qualified: Technical Score ≥ 70; [b]See Table 6-2 for Arizona DOT Quality Credit; [c]See Table 6-2; NR: Technical Score ≤ 75; [d]Winning Proposal.

Table 6-5 Best-Value Selection with Five Typical Agencies (*Narrow Spread in Scores and Prices*)

Firm (1)	Technical Score (2)	Time (3)	Price Proposal (4)	INDOT Low Bid, Fully Qualified[a] (5)	ADOT Best Value with Quality Credit[b] (6)	SCDOT Low Composite Score[c] (7)	WSDOT High Best Value Score[c] (8)	FHWA Best Value[c] (9)
A	92	480	$10,200,000	$10,200,000	$9,843,200	132,468	75.49	58.87
B	86	480	10,000,000	10,000,000	9,700,000	131,579	76.00	[d]59.01
C	76	500	9,850,000	9,850,000	9,603,750	[d]131,333	[d]76.14	58.37
D	74	500	9,760,000	[d]9,760,000	[d]9,564,800	NR	75.82	57.99
E	68	500	9,700,000	NR	9,700,000	NR	70.10	53.54

[a]Fully qualified: Technical Score ≥ 70; [b]See Table 6-2 for Arizona DOT Quality Credit; [c]See Table 6-2; NR: Technical Score ≤ 75; [d]Winning Proposal.

It can be seen that, when given the same set of inputs, the effect of the various selection methods is pronounced. Every responsive offeror can thus be selected as the winning proposer depending on how the best-value metric is calculated. This can lead to confusion and the temptation to manipulate the numbers to enhance one's chance of winning, which in turn can reduce competition and generate erroneous proposal input (Parvin 2000). It is therefore in the best interests of the industry for each owner to standardize its technical vocabulary and publish the definitions, thereby eliminating these kinds of misunderstandings.

Selection and Award Processes

As was introduced in Chapter 4, seven generic categories for public project source selection procedures are available and are proposed here. These are somewhat different from those presented in the DBIA's *Design-Build Manual of Practice* (DBIA 1996) but, adhering as much as possible to DBIA terminology they can be termed

1. Low Bid DB
2. Adjusted Bid DB
3. Adjusted Score DB
4. Weighted Criteria DB
5. Quantitative Cost–Technical Trade-off
6. Qualitative Cost–Technical Trade-off
7. Fixed Cost–Best Proposal (Gransberg and Molenaar 2003).

Low Bid DB is defined as any selection process where the eventual award will be made to the lowest-priced, fully qualified offeror. This category includes the DBIA processes labeled Equivalent Design/Low Bid and Meets Criteria/Low Bid and the FAR method labeled Fully Responsive–Lowest Price (also called Lowest Price–Technically Acceptable), as well as other variations on this theme.

As a general rule, the low-bid approach is preferred on projects where the scope is very tight and clearly defined and where innovation or alternatives are not being sought. This might include highway projects with a specified type of pavement, geometric design, and minimal ancillary works. It also is used on building projects where the owner has completed most of the design development and the design-builder only needs to complete the final construction documents. The Indiana method described in Table 6-1 is an example of Low Bid DB.

Adjusted Bid DB means the price has been divided by some factor related to the technical evaluation. Its thrust is to logically modify the price in a manner that reflects the value of the underlying, proposed qualitative factors. Its selection as an award methodology indicates that price is an important consideration but there is some other aspect of the project that must be included in the algorithm to determine best value. This is, in effect, a unit price of quality (Gransberg et al. 2000). The Arizona and South Carolina DOT methods shown in Table 6-1 are examples of this generic type of DB award method.

Adjusted Score DB is the mathematical reciprocal of Adjusted Bid DB. In this case, some function of the technical score is divided by the proposed price to give an index in units of technical points per dollar. It would follow that adopting this approach would signal that the owner is less concerned about cost than quality. The Adjusted Score approach seems to work well when overall outcomes can be clearly defined and a number of alternatives exist that could provide the desired outcomes. This could include public buildings where the owner has some design constraints but is open to innovative solutions within those constraints. It has also been used in highway projects where alternative geometric designs and material types are acceptable, and in water treatment plants where the owner wants to evaluate alternative treatment processes.

The definition of Weighted Criteria DB used here is broader than the DBIA definition. The Weighted Criteria method should be selected when innovation and new technology are to be encouraged or the requirement for specific types of experience is required to obtain the desired outcome. This approach may also be used when a fast-track schedule is required or when constructability is inherent in the successful execution of the project. The Weighted Criteria method has the advantage of distinctly communicating the owner's perceived requirements for a successful proposal through the weights themselves. For example, if a project's owner is very concerned about the architectural appearance of a final project, a disproportionate weight can be given to the sum of those evaluation criteria that directly define the ultimate aesthetic appeal. On the other hand, if an owner is worried that the project's program might exceed the available budget, price can be given a weight of greater than 50% of the total and, thus, DB proposal authors will propose design solutions that will conservatively meet the proposed price.

Cost–Technical Trade-off DB is a method that includes the federally mandated variations of best-value award and those jurisdictions where technical and price must be evaluated separately (USACE 1996; NAVFAC-SouthDiv 1999). This can be done by either quantitatively comparing the mathematical functions of price and technical score or by qualitatively comparing the value inherent in higher-priced proposals against the value of the lowest-priced proposal. In the latter form, this can be the most subjective of all the award methodologies. In essence, the owner compares the value of the various features of the technical, schedule, and organization against the proposed price; it determines whether the aspects of a given proposal justify its price and whether the additional positive attributes are worth more than the attributes proposed by the lowest-priced proposal.

Finally, Fixed Cost–Best Proposal is a relatively recent addition to the DB award scene. Sometimes called Design-to-Cost, this method stipulates a maximum price and competes project scope instead of cost. This method has the advantage of immediately allowing the owner to determine if the required scope is realistically achievable within the limits of a tight budget. It also reduces the best-value decision to a fairly straightforward analysis of the proposed design. This method truly is responsive to the efficient use of capital by committing available funding up-front and using the quantity and quality of project scope to determine the most attractive offer.

Given the above discussion, it is now possible to classify each of the existing DB source selection methodologies into these proposed seven general categories. It is believed that by doing so, much confusion about the details of the various selection methods can be eliminated.

Low Bid Design-Build

Low Bid Design-Build (LBDB) encompasses the two selection processes called Equivalent Design/Low Bid and Meets Criteria/Low Bid and other variations where the final award decision is based on price. One example is the Modified Design-Build method implemented in New Jersey to comply with state statutes requiring low-bid selection (Molenaar and Gransberg 2001). New Jersey employed the fixed-price, sealed bidding method of selection. Each design-build team submitted proposals to the New Jersey Department of Transportation (NJDOT) based on an advertised project that was 50% designed. The bidders specified their design price as well as the construction price, which were then added together to determine the DB bid price. The lowest bidder was selected to complete the design and construction of the project (New Jersey 1996; New Jersey 1999).

Another LBDB process is used in Indiana, where each design-build firm submits separate technical and sealed cost proposals to the Indiana Department of Transportation (INDOT) selection committee. As a minimum requirement, each design-build firm or team consisted of at least one INDOT prequalified construction contractor and one prequalified designer. All technical proposals were scored before any cost proposal was reviewed. The selection committee produced a technical score based on preliminary plans, schedule and project completion time, quality control plan, and traffic control plan. Schedules exceeding INDOT's designated completion date, as well as those scoring below 80, were deemed nonresponsive and were not further considered. The winning firm was then selected based on low cost (Indiana 1998).

In the Colorado LBDB model, each design-builder submits a technical proposal and a cost proposal to the Colorado Department of Transportation (CDOT) Technical Review Committee (TRC). The TRC initially reviews only the apparent low bidder's technical proposal. If the technical proposal is considered nonresponsive, the TRC then moves on to review the technical proposal of the next apparent low bidder until they find a responsive technical proposal (Colorado 1997a; Colorado 1997b). The 1997 version of CDOT's *Design-Build Manual* also allows adjusting the project price based on a "road user delay value" (Colorado 1997a). This procedure is an extension of time plus cost bidding (commonly called A+B bidding) that is being considered by many states for design-builder selection because the desire for an accelerated project delivery schedule is typically a primary factor for choosing design-build as a project delivery method (Songer 1996). This value is based on an owner-determined daily delay cost to the users. The time value (in dollars) is multiplied by the contract length (in days) and that value is added to the price proposal to produce an adjusted price (not to be confused with an Adjusted Bid as discussed in the previous section).

Adjusted Bid Design-Build

In the Adjusted Bid Design-Build (ABDB) process, the owner sends the technical proposals to the TRC and holds the sealed price proposals until after the technical proposal scores are provided by the TRC. Each contractor's technical proposal is evaluated based on the rating criteria provided in the scope of services. The TRC then submits a final technical proposal score for each contractor to the owner, who schedules the public opening of the sealed price proposals. The owner then opens the sealed price proposals and divides each contractor's price by some function of the technical score, as shown in Equation 6-1, to obtain an adjusted bid. The contractor selected will be the one whose adjusted bid is lowest.

$$\text{Adjusted Bid} = \frac{\text{Price Proposal}}{\text{Function of Technical Score}} \tag{6-1}$$

South Carolina's methodology is one example of how the ABDB formula would work. After the technical proposals are scored, the cost proposals are opened only if the technical proposal score was above 75. If the technical score was below 75, the proposal is deemed nonresponsive and the price proposal is not considered. The South Carolina Department of Transportation reserves the right to adjust the proposals based on any contingencies or qualifications deemed necessary. A composite score (which is, in fact, an adjusted bid by this definition) is then calculated by dividing the total proposed price by the technical score, as shown in Equation 6-2. (South Carolina 1997). The composite score is really an adjusted bid similar to the formula previously shown in Equation 6-1.

$$\text{Composite Score} = \frac{\text{Price Proposal}}{\text{Technical Score}} \tag{6-2}$$

Adjusted Score Design-Build

Adjusted Score Design-Build (ASDB) procedures are virtually identical to ABDB. The major difference is that instead of operating on the price with some function of the technical score, ASDB operates on the technical score with some function of the price, as shown in Equation 6-3.

$$\text{Adjusted Score} = \frac{\text{Technical Score}}{\text{Function of Price Proposal}} \tag{6-3}$$

The state of Washington uses an ASDB selection process that starts by advertising an RFQ that leads to a shortlist of three to five design-builders who prepare a Best and Final Offer (BAFO). The BAFO includes two separate submittals—a technical proposal describing the design solution, and a price proposal. Upon receipt, the technical and price proposals are separated. The technical proposal is assigned a technical score based on selection criteria detailed in the RFP. After the technical scores are assigned, the price proposal is opened, an adjusted score is determined using Equation 6-4, and a base-value score is computed using Equation 6-5. The winning proposal is the one with the highest best-value score. This constitutes an adjusted score, as in Equation 6-4 (Washington 1999a; Washington 1999b). It can be seen that this method can be properly classified as ASDB. In the formula below, the 10,000,000 figure is used to produce a best-value score between 1 and 100 on a $10,000,000 project. This figure could be higher or lower, depending on the estimated size of the project.

$$\text{Best Value Score} = \frac{\text{Technical Score} \times 10{,}000{,}000}{\text{Lump-Sum Price}} \tag{6-4}$$

The FHWA's Eastern Federal Lands Highway Division also utilizes a version of ASDB. This agency adds to the price proposal a contract administration cost that equals the agency's daily contract cost times the design-builder's estimated schedule (in days) and calculates an adjusted score, as shown in Equation 6-5. In the formula below, the 10,000 figure is used to produce an adjusted score between 1 and 1,000 on a $10,000,000 project.

$$\text{Adjusted Score} = \frac{\text{Technical Score} \times 10{,}000}{\text{Price Proposal} + \text{Contract Admin. Cost}} \tag{6-5}$$

Weighted Criteria Design-Build

Weighted Criteria Design-Build (WCDB) is different from ASDB in that the technical proposal and the price proposal are evaluated individually, with the project price being one category in the evaluation. Each evaluation category is assigned a weight consistent with the objectives of the project, and the score for each evaluation category is multiplied by its weight. The sum of the weighted scores in each category is the final score for each proposal. The product of the category weight and its relative value becomes the category value, and the sum of the weighted criteria values becomes the overall value (total score [TS] in Equation 6-6) for a given proposal for factors other than bid price. This relationship can be expressed as:

$$TS = W_iS_i + W_2S_2 + \ldots + W_iS_i + W_{(i+1)}PS \tag{6-6}$$

Award TS_{max}

TS = Total Score
W_i = Weight of Factor $_I$
S_i = Score of Factor $_I$
PS = Price Score

Table 6-6 illustrates a hypothetical example of a WCDB evaluation result. This project contains a typical DB RFP evaluation plan statement that price is weighted roughly equal to all other categories. Proposal 3 has minimally fulfilled all the requirements of RFP and proposed the lowest price. If this were an LBDB award, Proposal 3 would have been awarded the contract. Proposal 1 is the strongest proposal, having been rated as meeting or exceeding the requirement in every category. However, Proposal 2 is determined to be the best value because it has the highest number of points. Based on the relative weighting between the price and the other evaluated categories, Proposal 2 would be awarded the DB contract for this project.

Further analysis shows that Proposal 2 proposed the best design of the three. This was the most heavily weighted category, after price. It met the minimum requirements in the Quality Management Plan and Design-Build Experience categories and exceeded the minimum in the other areas. Thus, it was able to propose a price that was 7.5% higher than the low bid and wind up with the highest point total.

It should be obvious that assigning the weights in the WCDB method is key to making a successful best-value decision. In the previous example, if the price had been given a total weight of 75%, then Proposal 3 would have won. If technical score had been given a total weight of 75%, then Proposal 1 would have been awarded the contract. In practice, design-builders heavily scrutinize the relative weightings between various evaluation categories to determine where to offer betterments over the minimum. The previous example shows that although Proposal 2's betterments increased the proposed price by 7.5%, this offer was rewarded by the owner's evaluation plan determining it to be the best value, even though one competitor had a lower price and the other offered more betterments.

Cost–Technical Trade-off Design-Build

Cost–technical trade-off design-build (CTDB) is a method that can be as subjective (qualitative CTDB) or objective (quantitative CTDB) as the owner feels it can afford to be. Thus, it probably offers the greatest degree of flexibility over the other DB award methodologies. The owner must bear in mind that as the level of subjectivity in the award decision increases, so does the possibility of favoritism and/or corruption.

Quantitative Cost–Technical Trade-Off Design-Build

When the final scores are determined, they are arranged from lowest price to highest price and the TRC must conduct a cost–technical trade-off analysis. This can be conducted in a manner approved by the FAR for federal projects. In essence, the TRC must justify the selection of a proposal whose price is higher than the lowest proposed price by determining that the added increment of cost is offset by an added increment in value, as measured by the evaluation plan. For example, taking the Table 6-6 results and placing them into Table 6-7, the difference between the lowest and the second-lowest price proposals is 8%; the

Table 6-6 Example of Weighted Criteria Method with Price Equal to Technical Score

Evaluation Category (1)	Weight (2)	Proposal 1 Score (3)	Weighted Score (4)	Proposal 2 Score (5)	Weighted Score (6)	Proposal 3 Score (7)	Weighted Score (8)
Proposed Design	30	4	120	5	150	3	90
Quality Management Plan	5	4	20	3	15	3	15
Traffic Control	5	5	25	4	20	3	15
Key Personnel	10	4	40	5	50	3	30
Design-Build Experience	15	4	60	3	45	3	45
Past Project Performance	15	4	60	4	60	3	45
Schedule	20	4	80	3	60	3	60
Total Technical Score	100		405		400		300
Price		$4.4 million	450	$4.3 million	462.5	$4.0 million	500
Total Score			**855**		**862.5**		**800**

Note: **Technical Rating System (500 points possible):** 5 = Excellent; 4 = Exceeds Requirement; 3 = Meets Requirement; 2 = Below Requirement but Correctable; 0 = Nonresponsive.

Price Rating System (500 points possible): Low Price = 500; subtract 5 points per each 1% above low price.

Table 6-7 Quantitative Cost–Technical Trade-off Example

Proposal Number (1)	Price (2)	Total Technical Score (3)	Price Increment (%) (4)	Score Increment (%) (5)
3	$4.0 M	300	—	—
2	$4.3 M	400	+ 8	+ 33
1	$4.4 M	405	+ 3	+ 1

difference in the weighted scores should be greater than 8% to justify expending the additional increment of cost. In this case, it is 33%. Therefore, an increase of 8% in price is warranted by the 33% increase in proposal weighted score, indicating that Proposal 2 is a better value than Proposal 3. This is not the case when comparing Proposal 2 to Proposal 1, where the 3% increase in cost is not justified by the 1% increase in weighted score. Thus, the best value in this example would be Proposal 2, as shown in Table 6-7.

Qualitative Cost–Technical Trade-Off

The qualitative CTDB tradeoff is used by many federal agencies under the FAR. This method relies primarily on the judgment of the selection officials and not on the evaluation ratings and scores (Army 2001). The final decision consists of an evaluation, comparative analysis, and trade-off process that often require subjectivity and judgment on the part of the selecting officials. The flow chart in Figure 6-2 depicts the qualitative cost–technical trade-off algorithm as described in the *Army Source Selection Guide* (Army 2001).

The trade-off analysis is not conducted solely with the ratings and scores alone. The selection officials must analyze the differences between the competing proposals and make a rational decision based on the facts and circumstances of the specific acquisition. Two selection officials may not necessarily come to the same conclusion but both must satisfy the following criteria:

- The decision must represent the selection officials' rational and independent judgment.
- The decision must be based on a comparative analysis of the proposal.
- The decision must be consistent with the solicitation evaluation factors and subfactors.

Fixed Cost–Best Proposal Design-Build

Fixed Cost–Best Proposal Design-Build (FCBP) is used when an owner has a well-defined set of project scope requirements and a tight budget. This method is different from the others in that it makes no attempt to compete project price.

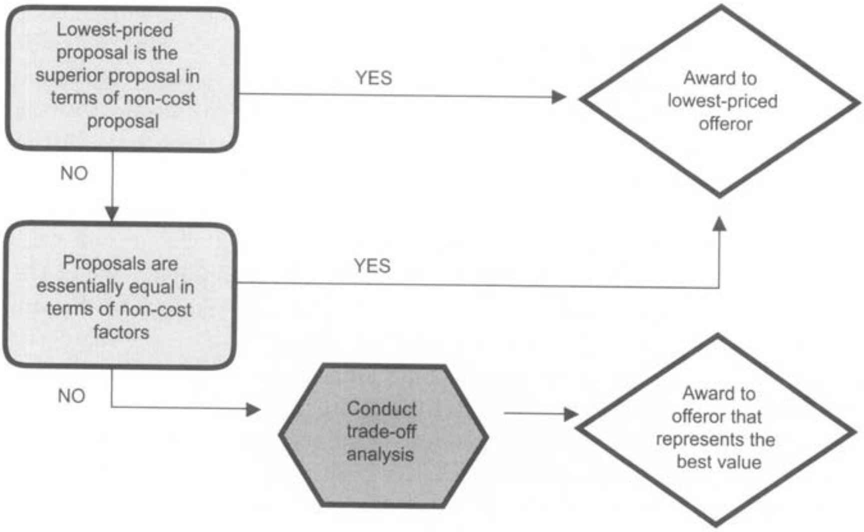

Figure 6-2 Decision model of determining the successful offeror (*Army 2001*).

The owner declares the maximum acceptable price and then lists the project requirements as well as the features of work that are desired if the budget permits. Award is essentially made to the offeror that proposes a design that satisfies all the requirements and offers to deliver the greatest number of desired options. FCBP is the purest form of best-value award. Offerors compete on the basis of scope and other non-price items such as schedule, qualifications, and betterments above minimum design criteria.

Fixed Cost–Best Proposal Design-Build will be impossible to implement in public agencies whose legislative restrictions require an award after some form of price competing. Also, it will generally be hard to convince technically unsophisticated politicians and citizens that a public owner using FCBP will still attempt to obtain the best possible price and will not spend its entire authorized budget. In the face of this type of uninformed opposition, an owner that wants to use FCBP will need to use the argument that utilizing the entire construction budget reduces the future financial requirements for operations and maintenance by building a higher-quality, more cost-effective facility. One way to do this is to include life cycle design criteria in an FCBP RFP and utilize life cycle cost analysis (LCCA) in the evaluation plan. This allows not only the owner but also the design-builder to visibly demonstrate the strength of the winning proposal.

Comparison of Methods

Each DB selection method brings strengths and weaknesses to the DB contract award process. LBDB is by far the simplest and is technically the closest to existing

DBB/low-bid award processes. As such, it is probably the easiest to implement by an agency that has no previous DB experience. It is also the method that will probably face the least political opposition, for two reasons. First, the concept of short-listing design firms on a qualifications basis is well-accepted; and second, awarding to the lowest-priced proposal from the prequalified firms is not very different from the typical public agency low-bid paradigm. In fact, it seems to straddle the fence for those states (e.g., Texas) that require both qualifications-based selection of designers and low-bid award for construction (Wright 1997). The greatest weakness of LBDB is its focus on price alone. By doing this, it eliminates one of DB's greatest benefits—the ability to compete different design solutions to the same problem. Therefore, it can be concluded that LBDB is probably more appropriate for projects where no great degree of technical innovation is expected.

Adjusted Score Design-Build and ABDB, on the other hand, allow competition between varying design solutions if appropriate for the project. This increases the potential benefit from industry's innovative approaches while preserving the ability to rate the qualifications of both designers and builders. However, by mathematically combining the technical score and the proposed contract price, ASDB and ABDB have the potential to create an environment where design-builders may be tempted to play games with the numbers to increase their adjusted bids or scores. Nevertheless, the adjusted bid system also appears to be useful on projects where funding is constrained but where some qualitative feature of the project (such as a fast-track schedule or external factors such as traffic disruption or innovative environmental protection) is also very important to the owner. ABDB seems to be most appropriate for projects where innovation is encouraged but where a high degree of price competition is desired; ASDB is more appropriate where the technical content is more important than the price.

Weighted Criteria Design-Build is the most flexible of the seven DB selection methods. It preserves the benefit of being able to tailor the evaluation plan to the specific needs of each project and rate the qualifications of both the designer and the builder. It provides a method for including price as only one of several evaluation areas and permits the agency to adjust the weights of each rated category, as required, to meet the needs of the particular project. Its greatest drawback is the complexity of the evaluation planning itself. To properly implement WCDB, a great deal of up-front investment in time and human resources must be made during the development of the RFP and its evaluation plan. Because WCDB can be somewhat subjective, it is also probably exposed to the risk of bid protest by unsuccessful offerors.

Qualitative CTDB preserves the owner's option to award based on a subjective comparison of the value of higher-priced proposals or, using quantitative CTDB, to make the cost–technical trade-off decision objectively, as shown in Table 6-7. It also furnishes the most robust method with which to make the best-value decision. Using CTDB forces the owner to relate the price and the value of the other evaluated factors in a way that highlights the best features of best-value award methods. Also, CTDB is mandated for federal projects (FAR 1997). It is probably best used when the owner anticipates a very competitive set of proposals submitted by a sophisticated, well-qualified group of competitors. It provides a way to step back after the evaluation and contemplate the relative desirability of the various combinations of qualifications, design approach, and price. Finally, it should be noted that the above discussion assumes that the technical evaluation is conducted using some method similar to WCDB.

The selection of a method boils down to determining which of the seven possibilities is the most appropriate for the project in question. The goal of DB contract award is to devise a system that maximizes the probability of selecting a design-builder who will successfully complete the project. One must remember that every project is different and that each of the above-described methods is merely an individual tool in the private owner's or public agency's procurement toolbox. It must also be remembered that the tried and true DBB method will, in many cases, be the most appropriate method. Therefore, a careful analysis of the project must be made before deciding on a project delivery methodology, and all possible methods should be considered before deciding to select one the DB systems.

Conclusions about Award Methods

Several conclusions can be reached from the foregoing discussion of award methods. First, DB is proliferating throughout the United States in building and infrastructure projects. Its current use in a diverse group of private organizations and public agencies indicates that it is both effective and efficient. To sustain industry and government acceptance of DB project delivery, both parties to a DB contract need to understand and trust the integrity of the source selection system. As there are a number of methods that can be utilized to award DB projects, some level of uniformity in technical vocabulary is necessary to eliminate misunderstandings about source selection procedures. In addition, owners must make all aspects of the selection process transparent to the DB industry (Parvin 2000). In the case of technical evaluations of design solutions, there must be some degree of professional judgment exercised by the selection officials. Owners must clearly and completely inform the offerors that these judgments are being made by competent professionals in a fair and unbiased manner. Full disclosure of the method being used before the selection and complete debriefings of the professional judgments after the selection will ensure the integrity of the system.

The various award methods can be logically organized into the seven general categories previously outlined. Adoption of this proposed terminology imposes a technical discipline on this subject that will enhance understanding and consistency of DB selection and award processes. It must be remembered that each project is unique and each project will need to be carefully analyzed to determine which method is the most appropriate for its requirements. Finally, DB permits a means of steering away from the classic award-to-the-low-bidder approach. An evaluation of the qualifications of not only the designer but also the builder will potentially enhance the probability that the project will be completely successful by eliminating the chance that the project will be awarded to an unqualified contractor based only on the submission of a low bid.

Evaluation Criteria

Once an award method has been selected, the owner can move on to the next step of the DB procurement—developing the evaluation plan. The evaluation plan consists of the following major components:

- Qualifications criteria
- Technical criteria
- Project management criteria
- Cost criteria
- Rating/scoring system
- Weighting
- Ranking
- Debriefing procedures (public)
- Feedback procedures (private)

The actual development and writing of qualifications and technical and project management criteria has already been covered in Chapter 3 of this book. Developing and evaluating cost criteria has its own unique challenges. In most award systems, cost is rated separately from all other criteria or is not rated at all. Therefore, it will be covered in detail at the end of this chapter. The evaluation system must be comprehensive for qualifications as well as all other rated areas. In a two-phase DB procurement, the owner will use separate pieces of the overall evaluation plan to select the shortlisted offerors and then subsequently evaluate the price and technical proposals of those companies on the shortlist. In these types of DB awards, the owner must be careful not to unintentionally create a bias toward proposing minimally qualified (and, hence, lower-priced) project personnel. This happens when the evaluation plan fails to include any element of relative standing between the firms that made the shortlist. In other words, the owner must ensure that there is some mechanism for rewarding an offeror who has proposed an especially well-qualified and highly experienced DB team; its qualifications edge must not be lost during the remaining evaluation. The reason for this is quite simple and straightforward: no matter how sophisticated the owner's evaluation system is for qualifications, technical score, and price, the ultimate success of the project depends on the people and organizations that actually do the work. *By failing to carry forward a factor from the Phase 1 selection into the Phase 2 evaluation, the owner has literally leveled the field with regard to qualifications.* Thus, in the price evaluation a DB team that includes a designer who is at the top of his or her field (and therefore commands a higher salary) teamed with a builder who has successfully delivered this exact type of project many times (and therefore probably has a more senior and highly paid project staff) will lose that qualitative edge to a DB team that minimally met the owner's Phase 1 criteria and barely made it onto the shortlist. In fact, this literally turns the offer of a highly qualified team into a liability for every single DB award method except a subjective CTDB award.

Table 6-8 Example of Two-Phase Weighted Criteria Method with Price Equal to Technical Score

Evaluation Category (1)	Weight (2)	Proposal 1 Score (3)	Weighted Score (4)	Proposal 2 Score (5)	Weighted Score (6)	Proposal 3 Score (7)	Weighted Score (8)
Key Personnel	20	4	80	5	100	3	60
Design-Build Experience	40	4	160	3	120	3	120
Past Project Performance	40	4	160	4	160	3	120
Phase 1 Score	*100*		*400*		*380*		*300*
Proposed Design	50	4	200	5	250	3	150
Quality Management Plan	10	4	40	3	30	3	30
Traffic Control	10	5	50	4	40	3	30
Schedule	30	4	120	3	90	3	90
Phase 2 Technical Score	*100*		*410*		*410*		*300*
Price		$4.4 million	450	$4.3 million	462.5	$4.0 million	500
Phase 2 Total Score			**860**		**872.5**		**800**

Note: **Technical Rating System (500 points possible):** 5 = Excellent; 4 = Exceeds Requirement; 3 = Meets Requirement; 2 = Below Requirement but Correctable; 0 = Nonresponsive.

Price Rating System (500 points possible): Low Price = 500; subtract 5 points per each 1% above low price.

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Table 6-9 Example of Results of Not Bringing a Phase 1 Score into Phase 2

Proposal Number (1)	Price (2)	Phase 1 Wt Score (3)	Phase 1 Rank (4)	Phase 2 Wt Score (5)	LBDB Rank without Phase 1 (6)	ABDB Rank without Phase 1 (7)	ASDB Rank without Phase 1 (8)	WCDB Rank without Phase 1 (9)	CTDB Subjective Rank (10)	CTDB Objective Rank (11)
1	$4.4 M	160	1	245	3	2	2	2	1	2
2	$4.3 M	155	2	245	2	1	1	1	2	1
3	$4.0 M	120	3	180	1	3	3	3	3	3

SEVEN

Design-Build Proposal Evaluation Case Studies

This chapter synthesizes some of the fundamental issues from previous chapters through the presentation, analysis, and discussion of five case studies. These studies illustrate various aspects of evaluation planning and execution and the potential consequences of failing to properly consider all the various aspects of performance criteria, potential design solutions, and retaining sufficient flexibility in the evaluation plan. The cases are drawn from real projects and have been sanitized to prevent identification of the actual participants. The format for each case covers first, the facts and situation; second, a discussion of the issues and positions; third, the outcome; and fourth, lessons learned.

Case 7-1: Let Me Really Strut My Stuff

Situation and Facts. A public owner has issued an RFP for a small building on its campus. Procurement of the design-builder involves a one-step proposal evaluation process in which significant value has been assigned to the aesthetics of the project. The proposal evaluation process is employing a jury to score the aesthetics of the proposal as part of the best-value selection.

The RFP states:

> The architectural approach section of the technical proposal shall include the following: a narrative, not to exceed two pages, demonstrating the architect's understanding of the owner's aesthetic requirements for the project; photos of not more than three previous projects designed by the architect of similar scope and aesthetic quality; and three renderings demonstrating the fundamental architectural design approach for the project. The first rendering shall consist of a plan view clearly showing the building's relationship to the landscape, the local transportation network, and its relationship to the two other major buildings in the block. The second rendering shall be

an elevation viewed from X Street, and the third shall be a rendering of the building's elevation as viewed from northwest corner of the lot.

The proposal evaluation plan published in the RFP allocates 400 out of 1,000 technical points for the architectural and landscape aesthetics. Within that category, the design approach as shown in the renderings can receive a total of 300 points. The RFP goes on to state:

> This building will become the most important building on the campus. The building's aesthetic design should portray a corporate image and it should serve as the architectural focal point for that portion of the campus. The design-builder should endeavor to preserve as much of the existing landscape as possible and clearly show the effect in the renderings to be submitted as a part of the technical proposal.

There were seven proposals received from an unusually well-qualified group of DB teams. All of the proposals were fully responsive to the RFP. When the technical evaluation panel received the technical proposals, one DB team had exceeded the requirement for architectural renderings. That team furnished seven renderings and a model of their proposed design. The renderings included two plan views (one as specified in the RFP and one that showed their plan to "preserve as much of the existing landscape as possible"); one rendering for each of the four sides of the structure; and a rendering of the view from the northwest corner of the lot. The model included the two existing buildings and the architect's narrative referenced the model in a manner that would make it unintelligible if the evaluator could not look at the model while reading the narrative.

The evaluation plan was designed to specifically rate each of the three specified renderings and the architect's narrative. During the preparation for the evaluation, a senior member of the evaluation panel passed through the area where the proposals were being processed prior to the evaluation, saw the model, and absolutely fell in love with it.

Issues and Discussion. The issues in this case focus on the clarity of the evaluation criteria and the potential for possible technical leveling. Specifically in this case, the initial questions concern the evaluation panel:

- Can the panel look at the extra renderings? Can they use the model in their decision?
- If the answer is "Yes" to either of the above, how would you integrate those items into the existing evaluation plan and how would you ensure equity to the other DB teams who followed the RFP requirements explicitly?

Outcome. The procurement official ruled that the additional renderings and the model were not to be used in the evaluation. The DB team was contacted and asked to designate which three renderings were to be used by the technical evaluation panel. The senior panel member remained on the technical evaluation panel and was instructed to not let his opinion of the model influence his evaluation. During the initial evaluation, the architect's narrative was rated as deficient but correctable. This DB team was kept in the competitive range and was asked to resubmit their narrative with their Best and Final Offer (BAFO). All seven proposals remained in the competitive range and went to BAFO. The DB team in question did not win the contract and indicated during debriefing that they were considering a protest. However, the protest did not materialize.

Lessons Learned. First, the owner must produce an RFP that is not subject to interpretation in terms of required submittals with the proposal. There should be no room for interpretation in terms of what will be allowed in the proposal. Second, every DB team needs to read the RFP and ensure they "answer the mail" in the allotted amount of pages with the allotted amount of submittals. Third, the evaluation team must take careful steps to ensure it does not place itself in a position where it performs technical leveling. The owner in this case considered offering the other competitors the opportunity to submit a model if they so chose. However, business decisions on whether to pursue projects that require costly proposals are made based on factors such as returns on investment and available resources. Adding a requirement that drives proposal preparation costs up after all DB teams have submitted the initial proposals serves to reset the competitive equilibrium; this creates an ethical dilemma for the owner and a business dilemma for the DB teams who have submitted proposals. The way to avoid this is to ensure the RFP is clear, precise, and concise in terms of the requirements, formats, and submittals for the proposal.

Finally, the owner had developed an evaluation plan that had no flexibility to reward a proposal such as the one in question, which offered more than the minimum in terms of design development. Obviously, a DB team that was willing to invest the resources to prepare and submit the additional architectural products is clearly demonstrating a desire to be responsive to the owner's most important evaluation factor, the architectural aesthetics. That the senior member on the evaluation panel loved the design is indicative of the proposal's potential to become a successful project. Thus, the owner could have allowed the additional products to be evaluated if the published evaluation plan had included an additional evaluation area for "creativity or innovation." This is often done when owners are unsure of exactly how the DB industry will respond to a given RFP. If this had been the case, this owner could have rated the model and the additional renderings in that area and been able to reward the proposal for offering to go beyond the minimum requirements for design development. However, as this was not the case, the owner in this instance believed it had awarded the project to the second-best proposal in spite of the outcome of the evaluation plan.

Case 7-2: Making a Passing Grade

Situation and Facts. A highway agency is expanding an existing highway from two 11-foot lanes with 2-foot shoulders to two 12-foot lanes with 6-foot shoulders because the original stretch of highway has a high percentage of accidents during vehicle passing. The RFP states:

> Passing lanes will be provided on grades exceeding X% where passing sight distance is less than Y feet.

There are three sections on the project where it appears that this performance requirement will apply. Each of those sections is in relatively rocky terrain. Part of the project entails flattening out some vertical curves and increasing the radius on several horizontal curves to increase the total amount of passing sight distance along the project's alignment.

The evaluation plan contains a section for "proposed conceptual highway geometry." The DB teams were asked to "furnish a preliminary alignment with stationing and indicate with a red line those areas where passing sight distance is less than Y feet." One of the performance criteria is "maximize passing sight distance through the project's length." A *passing site distance ratio* (a ratio of the sum of the distances where passing sight distance is met divided by the total length of the project) is used to measure and evaluate this performance criterion. Roughly 15% of the total score for the proposal can be earned by maximizing this ratio.

During the owner's evaluation of the design-builder's technical proposals, one proposal is found to have made passing lane provisions for only two of the steep grade sections. This proposal has the highest passing sight distance ratio among the offerors, and also contains the lowest price. A check of the price proposal shows that the costs of cut and fill significantly exceed those in the independent estimate. However, this proposal's proposed costs of hot-mix asphaltic concrete pavement are less, which compensates for the cut and fill numbers. In virtually every other category, this proposal appears to be the top alternative.

Issues and Discussion. The dominant issue centers the unexpected technical proposal from the design builder. The issues lead to the following questions:

- Should the owner disqualify this particular proposal?
- If not, what should the owner's next step be?

The evaluation plan rates the steep grade passing lanes on a go/no go basis and, as a result, this proposal is rated as deficient in this category. No discussions were contemplated in this procurement and the agency's design-bid-build (DBB) culture leads it to feel that any deficiency equals a nonresponsive proposal, although nothing in the RFP or the state's new DB law explicitly articulates that sentiment or requires it. The owner obviously assumed that three passing lanes were required because the rocky terrain would make excavation uneconomical. However, this particular proposal appears to have found a means to trade off the extra excavation costs by not having to furnish and install as much pavement on one steep grade. This is an alternative that was not contemplated when the evaluation plan was developed. Now the owner is in a position of not being able to award the project to the best proposal that has offered an innovative solution to a critical design and construction problem.

Outcome. The owner rejected the proposal as nonresponsive. The design-builder filed a bid protest, stating that the reason only two steep grade passing lanes were provided was that one of the steep grades was to be flattened to meet the passing sight distance requirements specified in the RFP, thereby eliminating the requirement to install the extra lane. The increased costs of earthwork in the price proposal reflected the extra cut and fill associated with that option. This also eliminated a need to borrow fill material for other vertical alignment improvements near that particular grade. The decreased costs of hot-mix asphaltic concrete were the result of not needing to build the extra lane, as well as other efficiencies in their conceptual geometry. The motivation for selecting these alternatives was to maximize the performance measurement criteria ratio. The RFP did not ask offerors to furnish conceptual profiles. Therefore, there was no place in the prescribed proposal format where the information regarding that grade could be displayed, other than in the conceptual quantities shown in the price proposal. The design-builder's fear of being declared nonresponsive by deviating from the prescribed format prevented it from adding an explanatory note. The protest is not sustained.

Lessons Learned. When the design-builder submits a proposal, it is imperative that all sections of the proposal are integrated and explained. This is especially critical when the DB team is proposing something unique or will provide an enhancement to the owner. The price proposal format might lock the proposer into a certain format, but the narratives in the technical proposal can explain the approach and where this will impact the price proposal. The approach should be easy for the owner to understand and the proposal must be very clear and easy to evaluate. This requires a consistent approach regarding themes and solutions. Furthermore, there is always a hesitation to ask questions, particularly if the question might give the competition insight to one's approach. A business decision must be made as to whether or not to ask the question. In this case, it might have been beneficial to question the owner about formatting concerns.

The owner in this case also learned a hard lesson. It had assumed a design and then wrote its RFP and evaluation plan around it. Because it assumed there would be no economical way to flatten all three steep grades, it therefore created an evaluation system that penalized the offer that achieved the owner's main design goal of maximizing the passing sight distance throughout the length of the project. Because of this shortsightedness, the owner forced itself to disqualify the best proposal and ended up paying more for a technically less-satisfying solution. The developers of DB RFPs and evaluation plans should allow some method to reward innovation and creativity in the technical proposals.

Case 7-3: A Bracing Thought

Situation and Facts. A branch of the military is using DB to deliver a new masonry building. The government has designed and built many reinforced masonry buildings on this military base. It usually requires that walls over four feet high be braced from both sides for at least seven calendar days, due to the potential for high wind gusts in the area and past experience that unbraced walls have had a greater tendency to crack within two years of completion. However, the RFP is silent with respect to this specific construction procedure. The *Masonry Designer's Guide* published by the North American Masonry Institute contains a Wind-Bracing graph that indicates that an eight-inch reinforced block wall should have wind bracing at roughly the four-foot height. The RFP states:

> Structural design shall conform to applicable codes and standards. Construction shall proceed in accordance with accepted standards of the industry and shall specifically comply with all federally mandated safety requirements.

During construction of the wall, the contractor indicates that bracing will begin at the eight-foot level in accordance with Occupational Safety and Health Administration (OSHA) requirements. The DB contractor's structural engineer indicates that the *Masonry Designer's Guide* is just that—a design *guide*, not an "applicable code or standard." Reinforced masonry walls under construction off the military base are braced at the OSHA eight-foot height and above. The owner's structural engineer feels strongly that the design-builder should be required to install wind bracing. The design-builder responds that the bracing will interfere with the working space required in other scheduled construction activities and will therefore increase cost and require rescheduling.

Issues and Discussion. The owner is contemplating a stop work order. This issue leads to the following questions:

- Does the owner have the authority to require the wind bracing without a change order?
- If a change order is required, for what items should the contractor be compensated?

Outcome. The use of the *Masonry Designer's Guide* as an "applicable standard" is determined to be tenuous, at best. Bracing at eight feet does comply with "federally mandated safety requirements," and the fact that commercial construction bracing starts at the eight-foot level indicates that the "accepted standard of the industry" is eight feet. The owner had to decide if it would accept the risk of cracking after two years or pay for the additional bracing today. An agreement was reached to pay the contractor to furnish a named-peril insurance policy to cover the potential for cracking for a specified period after the one-year warranty had expired. This provided the owner with protection against potential damage at a cost less than issuing a change order to require wind bracing at the four-foot level.

Lessons Learned. Unless specifications are presented in the RFP or incorporated by reference, the design-builder provides them as part of the contract. The safety and quality control plans will specify applicable standards. The owner is not in a position to arbitrarily select which standard it will use without a bilateral agreement. If the owner has superior knowledge regarding the technical conditions inherent in the project site, it should express that knowledge in the RFP. Assuming that the design-builder would automatically furnish and install the desired wind bracing as a matter of good engineering practice is unreasonable. Therefore, if wind bracing was desired, it should have been specified in the RFP. Also, the owner could have required the design-builder to identify in the quality assurance/quality control plan the standard for bracing masonry walls it intended to use. This would have brought the discussion of the bracing standards to the forefront before construction began.

Case 7-4: Bait and Switch?

Situation and Facts. A branch of the military is using DB delivery to construct a 350,000-square-foot data processing center in a single structure. The primary driver for employing DB is the need for a fast delivery—the owner is expecting a fast-track process. The design-builder was selected through a best-value process using the Best and Final Offers (BAFOs) submitted from the shortlist of three DB teams. Emphasis was given to the completion date and specification requirements.

The level of design in the RFP contained minimal drawings and few detailed performance specifications. The RFP specified a building location on the site and performance specifications for the minimum thermal conductivity (insulation value) and loading (wind and roof) of the exterior envelope. When the performance specifications were written, the owner was expecting a metal-clad steel structure.

At the time of the BAFO, the exterior envelope design was approximately 10% complete and the winning design-builder did not specify the type of material in its proposal. As the design progressed, the design-builder showed the owner's technical representatives a split-face concrete masonry unit (CMU, jumbo block) exterior envelope at the 50% design development submittal milestone. Construction of earthwork and foundations progressed as the design was being completed. The fast-track nature of the project resulted in costs that were higher than expected during the initial construction process. In order to stay within the lump-sum contract price, the design-builder decided to change back to a metal-clad steel structure for the 100% construction milestone documents because this exterior system met the performance requirements contained in the RFP.

Issues and Discussion. The main issue stems from the RFP solicitation and evaluation but focuses on design commitment. The following questions can be asked:

- Does the design-builder have the authority to unilaterally change the envelope or structure to a metal-clad steel structure in lieu of the CMU block before submitting 100% construction milestone documents, or does the design-builder need to submit a change order?
- If a change order is required, should the owner approve the change order?

Outcome. The error in the budget was actually found after another company acquired the design-builder. After realizing the problem, the new owners of the design-build company wanted to substitute the metal-clad steel structure because it met the original performance specification of the RFP. They maintained that the design submitted at the 50% design milestone was a "work in progress" and that they had the right to alter any design details to meet both schedule and budget constraints that might arise until they had submitted the final construction documents at the 100% milestone. The owner asserted that the use of the CMU drove many other design details, and that the design-builder's failure to note that the exterior envelope design shown in the 50% submittal was not a final design and essentially invalidated the owner's design review and approval of that submittal. Therefore, the design-builder had committed to the use of CMU and could not change from it to metal cladding without a bilateral agreement.

In the ensuing dispute resolution process, it was determined that since the owner formally reviewed and approved the 50% design documents, the design-builder was bound to those drawings and was require to furnish a CMU structure regardless of the cost implications.

Lessons Learned. Needless to say, this was an expensive lesson for the design-builder due to its errors in estimating a fast-track project. In this specific case, this project situation may also preclude this design-builder from working on future DB projects with this owner. The DB team did not understand the importance of design commitment or comprehend when the design was truly locked-in. Once the owner agreed to the design, which it had done in this case at the 50% milestone, then it could only be changed with a bilateral agreement. The DB team should also have developed and used project control systems (starting during the proposal preparation stage) that would integrate cost and schedule. These systems should have been established so that the DB team could have designed and constructed to budget.

Case 7-5: Defending the System

Situation and Facts. The request for qualifications (RFQ) for a major highway DB project states:

> The selection team shall evaluate the design-build qualifications of responding firms and shall compile a short list of no more than five *most highly qualified* firms in accordance with qualifications criteria described in the request for qualifications (RFQ).

The evaluation plan and its attendant evaluation criteria are published in the RFQ. Thus, competitors would be able to score themselves just as the evaluators will score them. The evaluation plan assigns 15 and 30 points, respectively, (out of a total 100) to Submitter Organization and Experience and Key Personnel. Thus, past experiences at both the corporate and personnel level could accrue 45% of the possible total points. The published evaluation criteria are as follows:

Submitter Organization and Experience (15 Points):

- Effective project management authority and structure
- Design and construction management structure
- Effective utilization of personnel
- Owner/client references
- Experience on projects of similar scope and complexity
- Experience with timely completion of comparable projects
- Experience with on-budget completion of comparable projects
- Experience with integrating design and construction activities
- Experience of design-build team members working together.

Key Personnel (30 Points):

- Team members with experience and qualifications that cover project scope
- Key management/staff experience, capabilities and functions on similar projects.

After completing the statement of qualifications (SOQ) evaluation of five firms, the technical review committee (TRC) scores the five as follows:

Firm A: 85.7
Firm B: 83.0
Firm C: 82.7
Firm D: 71.9
Firm E: 69.4

There is a 10-point gap between the third-place and fourth-place firms and the top three firms score within 3 points of each other; the TRC decides that these facts delineate the "qualified" from the "most highly qualified." Thus, the shortlist consists of three firms which are then invited to submit technical and price proposals from the RFP.

Issues and Discussion. The primary issue in this case is the transparency and scoring of evaluation criteria. The owner's goal in the RFQ process is to have only the most highly qualified firms compete in the DB proposal competition. DB proposals are costly to prepare and to evaluate, so it is reasonable to create a pool of only those firms that are most likely to be competitive or, conversely, to eliminate those firms that have no chance of winning based on their qualifications alone. Therefore, the owner has asked for what it considers the most critical management factors for completing the process. Compiling and evaluating these items can be done at a relatively low cost. However, evaluation of items such as organization, experience, and key personnel is somewhat subjective and not completely transparent.

Firm D filed a protest on the basis that the shortlisting method was "arbitrary and capricious" because the owner used "unpublished requirements" (i.e., past DB experience) to arrive at a shortlist. According to the protest, this had the effect of "limiting competition to only those with design-build experience and favored out-of-state contractors," as few, if any, local contractors had this experience (this was one of the first DB projects in this state). Is the basis of Firm D's protest factual? From reading the published evaluation criteria, could the owner consider previous design-build experience and use it as a discriminator to identify the "most highly qualified" competitors?

In this state, to prove that a decision was "arbitrary and capricious" the defendant must show one of the following:

- ... exercise of the agency's will, rather than its judgment ...
- ... decision is based on whim or is devoid of articulated reasons.
- Where there is room for two opinions on the matter, [an agency's choice of one course of] action is not arbitrary or capricious.
- ... relied on factors that were never intended ...
- ... entirely failed to consider an important aspect ...
- ... explanation ... runs counter to the evidence ...
- ... decision is so implausible that it could not be ascribed to a difference in view of the result of agency expertise.

This state's case law also shows that the "... court will only intervene where there is a 'combination of danger signals' [that] suggest the agency has not taken a 'hard look' at the salient problems and 'has not genuinely engaged.' "

Outcome. The protest was overturned. The judge's memorandum justified the decision to find for the owner. Concerning allegations of unpublished requirements, the judge found that "all submitters were put on notice ... that design-build experience would be considered." From the evaluation plan, the term "similar" can be construed to include DB experience in the following evaluation criteria:

- Experience on projects of similar scope and complexity.
- Key management/staff experience, capabilities and functions on similar projects.

The judge's memorandum went on to say, "Such consideration was not unreasonable given the project's level of complexity[,] ... did not unduly restrict competition" and, in fact, "all three of the submitters on the short-list have a local firm as a major component of their teams." Furthermore, the judge stated that "[the owner] must choose the most highly qualified contactors to perform high quality work ..." and is "prohibited from ... requirements that favor local firms."

The judge commented on the subjective nature of the management evaluation criteria in his ruling on the arbitrary and capricious allegation. He stated that the members of the TRC were qualified and any errors in scoring " ... would not have changed the outcome." The judge found that " ... it was ultimately the responsibility of the submitters to provide the necessary information and to convince the committee that it was the most qualified Submitter for the [DB] Project" and although the TRC " ... drew conclusions that, while not perfect, were reasonable ... their decision does not reflect an error of law, arbitrary and capricious fact-finding or conclusions unsubstantiated by the evidence ... did not exceed its statutory authority or abuse its discretion." However, the judge did state that the evaluation process could be improved. "It would be impossible to use people in the process and filter out subjective evaluations ... the fact that the process could be improved does not make the process used in this case arbitrary or capricious."

Lessons Learned. The case contains three primary lessons. First, publishing the evaluation plan protects the owner from allegations that it was arbitrary and capricious *if* the owner rigorously follows the letter of the plan. Given a reasonable and transparent process, an owner is unlikely to sustain a successful protest if it follows its published plan. Conversely, deviating from a published (or even an internally unpublished) evaluation plan render an owner vulnerable to a successful protest and litigation.

The second lesson is that even the best engineers or evaluators must use some level of subjectivity when evaluating professional submittals. It can be expected that there will be subjectivity in the evaluation and it is up to the owner to make sure it is reasonable and directly relates to the published evaluation criteria. Owners must choose experienced design and construction professionals to evaluate proposals and then provide a documented evaluation plan for them to follow. The judgment of these professionals is an acceptable method by which to choose a DB team, given that they follow the evaluation plan and can document the reasoning behind their judgments.

Finally, if the owner is going to evaluate a specific factor such as past DB experience, it should state this explicitly in the published evaluation criteria.

Although the judge in the above example did find that "experience on projects of similar scope and complexity" did equate to DB experience, the owner and the industry would have been better served if the RFP directly stated DB experience in the description of the evaluation criteria. The best practice is for owners to make evaluation criteria as transparent as possible at the time of evaluation and then not deviate from those criteria during evaluation.

Summary

The cases illustrated above all address similar themes that run through the DB process. First, the use of the DB RFP as a means to communicate the owner's requirements and desires is tantamount to DB success. Owners must invest the time and resources to carefully prepare this document and place particular emphasis on the evaluation plan. Owners can benefit from competitive architectural and/or engineering design proposals, but they must be absolutely clear in how they will be evaluated. They also must be clear about what is valuable to them. Owners should not assume a design and then write the RFP around that assumption. The case of the missing highway passing lane showed that there was indeed an innovative, economical solution for the design problem of which the owner was unaware at the time of RFP preparation. The result of assuming a design with three passing lanes caused the best-value proposal to be eliminated for being nonresponsive. Thus, taxpayers ended up paying more for a design that was not as safe. The owner must leave open those areas where an innovative solution might arise. The evaluation plan should have a means to reward an unexpected, innovative offer and not be so prescribed that there is no way to allow a proposal offering a pleasant surprise to continue in the competition.

Design-builders must clearly convey winning ideas in their proposal while staying within the guidelines of the RFP evaluation plan. Design-builders often feel they are in a difficult position. They do not want to ask questions for fear of giving away a competitive advantage. In the authors' opinion, it is typically better to truth-test ideas with the owner before the proposal is submitted and risk losing a slight competitive advantage. The risk of submitting a proposal that the owner deems nonresponsive, or simply does not like, is often greater than giving up that small advantage over the competition.

Finally, owners must strive to make their evaluation plans completely transparent. Transparency in this context means that the competitors can evaluate themselves and their potential for success from reading the published evaluation plan. Such techniques as establishing numerical weights or rank orders of importance among the factors to be evaluated greatly assist in making the owner's needs and desires for the project completely transparent. This also allows the members of the DB industry to gauge their opportunity for success on a given project and concentrate their resources on projects where they are most competitive. This generates a side benefit for the owner in that it greatly reduces the risk that an unqualified or incompetent design-builder will propose and, through some unfortunate trick of fate, win.

EIGHT

Preparing Design-Build Proposals

The book to this point has focused on the owner's development of the design-build (DB) Request for Proposal (RFP) and its supporting documents. This major technical and administrative undertaking would be wasted if no proposal was received for the DB project. Therefore, it is logical that we now turn to the other side of the coin and discuss the design-builder's development of a proposal based on the contents of the DB RFP. This chapter will detail both the sequence of proposal preparation and the detailed development of the proposal's contents. It will present the idea that a fresh set of eyes (in the form of a Red Team) be used to check the proposal against the RFP. Finally, it will espouse the philosophy that winning proposals are not only totally responsive but also must offer something that sets such proposals apart from their competition in terms of technical betterments, innovative approaches to solving design and construction problems, or having especially well-qualified DB team members.

Design-Build Proposal Preparation Sequence

The fundamental issue in the proposal preparation sequence is really fairly simple: is participation in this specific project justifiable based on our firm's business environment? It undoubtedly seems to the novice that the design-builder's decision to examine a Request for Qualifications (RFQ) or Request for Proposal (RFP) is primarily based on exceeding a minimum rate-of-return threshold or on the whim of a corporate officer; however, the true decision drivers are often based on other business conditions and factors. The design-builder's decision drivers should define what is justifiable and what constitutes its key interests in the current business environment. These drivers will evolve from the strengths, weaknesses, opportunities, and threats (SWOT) assessment process. It is critical to understand which business decision drivers are influencing the design-builder's response decision about an RFQ/RFP, and to cross-check the decision drivers with the owner's selection criteria and evaluation system to ensure this project fits the design-builder's current needs.

Once you have decided to request the RFQ/RFP documents from the owner, you must decide how you want to start the initial review. This review is applicable to either an RFQ or an RFP. As you start this planning, a litany of questions will ensue. Firms that are serious about pursuing projects in the DB arena will either have standard operating procedures that detail the process of question resolution, or they will create a systematic approach to resolve these questions shortly after receiving the RFQ/RFP.

Some of the questions requiring answers include the following:

- Who within the organization will read the document and make the initial recommendation concerning whether you want to spend more resources and energy on the project?
- Who within the organization will be the champion or pursuit manager for the initial decision on this project?
- Will you use a team of people within your firm to review the document?
- Which other firms will be involved with your firm in the initial review?
- How soon will the decision be made to commit additional resources and create a pursuit strategy?
- Which firms will be willing to participate with you on this project?

The initial analysis should be conducted by reading the project scope, then reading the evaluation criteria. If you are addressing a standalone RFQ, then you will want to determine whether you can assemble a team that can satisfy the owner's desires in terms of skills, economic viability, social goals (disadvantaged business enterprise participation, environmental consciousness, etc.), and so forth. If you can satisfy the owner's qualification requirements, and if the project meets the business decision drivers for the various entities, then the decision is generally to initiate the RFQ preparation. This leads to creation of the team.

If you are addressing an RFP, once the reviewer has an understanding of the scope and criteria the remainder of the RFP should be read. This will assist the reviewer in making a recommendation concerning whether more effort should be spent evaluating this RFP. If the decision is made to expend more effort on the RFP, then it needs to be examined at the micro level. Design and construction professionals from various disciplinary perspectives need to read the document verbatim. They should follow the same approach the initial reviewer used. The project scope and evaluation criteria should be read first and the evaluation criteria should be kept close for constant cross-referencing while the entire document is reviewed. The reviewers need to examine any plans, references, diagrams, and so forth that were included or referenced in the documents.

It is imperative that the document be read and reread carefully. Unfortunately, some owners produce documents wherein important details only appear in a note, yet significantly impact the total project. These notes are generally "last-minute" or "better address that risk" comments that resulted from some previous situation, and often produce internal discrepancies within the owner's package. It is critical that the design-builder notes all of these comments and determines their impact on the total project.

This micro-level analysis will give the team an understanding of the project and enable the members to brainstorm viable solutions for successful project completion. It will create a better baseline for developing a recommendation pertaining to the bid/no-bid decision. Finally, it will provide the documentation that can be used to develop the proposal and/or improve the databases pertaining to that particular owner and the type of project. The micro-level analysis must address whether the design-build team can create a viable proposal that will enable it to meet both the business needs of the design-build entity and satisfy the owner's requirements. If both of these conditions can be met, then the decision will be to initiate the formal proposal preparation process.

Once the decision is made to pursue the project, the DB team must be created. This team is generally developed after an initial SWOT assessment is conducted. The team is assembled by including entities that will bring the appropriate skill sets (including planning, design, public involvement, and construction) to the DB team. Entities will be added to reinforce the team's strengths, overcome weaknesses, take advantage of opportunities, and neutralize or mitigate threats. The team is also formed with strategic business decisions in mind. As each new entity is added to the team, there must be a corresponding increase in the value of the equation that defines the team. When responding to the RFQ, it is not likely that the entire DB team roster will be filled; however, at least the marquee players will be identified. Additional members will be brought in to completely fill the roster during the proposal preparation process and after the contract is awarded.

Building a team is seldom a simple process. Due to the business practices prevalent in the DB industry, there must be legal documents drafted to solidify the teaming arrangement. The documents are typically in the form of letters of intent, joint venture agreements, contracts, or some similar legal instruments. Their purpose is to create some type of binding agreement that will address issues related to cost sharing, risk allocation, decision making, scopes of work, and so forth. The documents should address the salient business issues pertaining to both the project pursuit and the subsequent project award. Once the team is formed, the qualifications will be submitted if this was requested. The qualifications will convey to the owner's statement of qualifications (SOQ) evaluators and selection authority that the DB team has the economic and technical wherewithal to complete the project per the owner's requirements.

Though it might seem like simple advice and a restatement of the obvious, there is a safe way to respond to the RFQ. First, read the document again before preparing a response. Second, "answer the mail"—make comments on every item where the owner has asked for information. Third, write answers in a straightforward manner, using a writing style that is succinct yet informative. Fourth, use one person to make sure the document flows and that the writing style is consistent (this will make it easier to read). Fifth, have someone proofread the document to provide constructive criticism. This process will help you ensure you have "answered the mail," emphasized the major messages you want to convey, and created a document that is correct in terms of spelling and grammar. Finally, provide it in the requested format, submit the correct number of copies, and deliver it to the owner on time.

Once the RFQ has been submitted and the team (now known as the design-builder) has received the RFP, the preparation of the proposal begins in earnest. Depending on what role you serve on the team, your participation and input will be defined. The first step is to develop a proposal strategy. The areas of highest potential success for the team are those where the team's strengths match a significant number of the owner's highest-weighted RFP requirements and simultaneously correspond to the competitors' known weaknesses.

One strategy is to emphasize those areas within the RFP where your team has strengths that address the owner's needs and desires but the competitors do not have strengths in the same areas. Simultaneously, you de-emphasize those areas where the competition has strengths that address the owner's needs but your team is weak with respect to satisfying those needs. Mitigation of the competitors' strengths is best accomplished by emphasizing how your solution or approach is solid and how, along with your other approaches, it will have a synergistic effect on the entire project.

A second strategy is to recognize those projects in which no competing team has an edge. In this situation, price will be the discriminator for the owner's selection. Therefore, it is essential that the design-builder sharpen its pencils and ensure that its pricing is competitive.

The final proposal strategy is one that must be considered even though it is rather unpalatable. In this situation, the competition clearly has the edge. Before you make the decision to not bid (which is usually the final decision in this situation), you need to consider the secondary effects a no-bid decision could have concerning future work with this client. Also, you must judge whether the competition could have a fatal flaw in its proposal that could result in it being not considered by the owner.

These various proposal strategies could shift during the time the proposal is being prepared. Again, although you might start with one strategy, the SWOT assessment and how you address the findings in that analysis could change your initial strategy significantly.

Once the strategy has been set, it is time to establish the working conditions for the proposal preparation. Now you are getting into the tactical phase of the proposal process; this phase should commence with determining who will be working on the project and the proposal. It is highly recommended that the people who will work on the project should either be intimately involved in the preparation of the proposal or they should have the opportunity to provide their input. These are the project leaders and participants who will need to manage the in-house resources for the team's lead member while shepherding, coaxing, and coordinating the efforts of other team members to produce quality products in a punctual manner. While developing the proposal plan, it is important that one consider whether the owner's time line for proposal submittal is reasonable. Because there will be time, cost, and quality trade-offs during the proposal preparation, it is best if some of those trade-offs can be identified early in the process.

Establishing a budget for the proposal is also critical. Usually there is a conceptual budget that is used to make the initial decision to submit the qualifications and the subsequent proposal. However, once you actually decide to submit a proposal, the budget must be further developed and refined. Items that will generate costs in the proposal process (e.g., special exhibits and drawings) need to be identified very early. Most proposal teams operate with a certain proposal preparation budget, and staying within that budget is key because the decision to pursue the project is usually influenced by the proposal costs and efforts. How the costs are going to be borne or shared is another consideration. This decision must be made and documented when the teaming arrangements are legally formalized.

Once these items have been addressed, the second step is creation of the administrative structure that will pull together the proposal from its multitude of disparate sources. This structure will establish communication channels, address lists, document formats, access to information, lines of authority, and will define who is the interface with the owner. This set of procedures should also include how reviews of questions will be conducted before they are released to the owner for answers. Due to the nature of these proposals, one must be careful not to ask the owner a question that will give the competition an advantage or a window into your strategy. Proposal teams often overlook this simple yet necessary step, and it comes back to haunt them when the proposal deadline nears. It is much easier to establish the ground rules early and build upon this foundation, instead of recreating documents over and over.

A schedule should be developed for team meetings, deliverables, production times, and client meetings (when allowed). A proposal leader needs to be appointed and given the authority and responsibility to successfully and punctually complete the proposal. Individual team members will receive their assignments from the proposal leader. Once the assignments are given, the RFP is distributed to all team members and the schedule is set; then the real work begins. A depository or library should be established so team members can send their documents to one collection point when completed. One person should serve as the document controller or head librarian.

Many organizations operate under the premise that the proposal must be crafted to "get your foot in the door" and that the presentation is the tool that enables you to "close the deal." This approach is contingent upon the owner's evaluation process and the tactics used to win the project must take this into account. As was the case with submitting qualifications, the key to preparing the best possible proposal is ensure that you at least address every single aspect of the RFP. More specifics pertaining to proposal preparation will be provided in the following sections.

If there is to be a presentation, the team must decide what they want to emphasize and what technology they intend to use in the presentation (e.g., models, simulations, high-speed graphics). It is also critical that the team not lose sight of those items the owner wants covered in the presentation. The owner will often place restrictions on the presentation in terms of time, number of people involved, and use of technology. It is imperative that you understand these constraints and also know how to address the audience to most effectively reach them with your message. These issues are centered on knowing and understanding your client.

At some point there is usually a discussion stage with the owner, where you can learn about items that need clarification from your proposal or from the RFP. The key to the discussion is to listen to what you are being told or asked, then go back and make the adjustments per the guidance provided. Once this is done, the best and final offer (BAFO)is submitted. If all works as planned, you will have the winning proposal.

Prior to the BAFO, the design-builder generally has the opportunity to terminate the proposal process. Many reasons could suggest such a move. It could be something as simple (yet detrimental) as realizing that a significant internal problem has surfaced, or one of the members pulled out of the team, or another project was awarded that will take away the resources you had intended to use for this project. The financial situation could have changed, making this project too risky for your team, or a number of other issues could have emerged. An effective business leader will constantly analyze the situation throughout the proposal development cycle to ensure that the situation remains able to satisfy the firm's business decision drivers.

Proposal Preparation by the General Contractor

Although the breakout of work elements and the proposal management should be tailored to each individual project, the majority of projects tend to be led by the construction contractor or the integrated design-builder. If a construction management firm is performing this project on an at-risk basis, then its approach will be closely related to the approach the general contractor would take if such a firm were leading the team.

In most cases, the design-builder will undoubtedly develop the bulk of the plans. Since the design-builder will have the majority of the work force, it will usually take the lead and develop large parts of the management plan, the quality assurance/quality control (QA/QC) plan, the safety plan, and most other plans that pertain to the total project. The trade subcontractors and the architect/engineer (A/E) firm will need to provide significant input to the management plan and the QA/QC plan. In terms of the safety plans, the A/E will typically provide comments related to how they will incorporate safety into the design.

Although this has already been stated several times, it bears repeating: the first step in the actual analysis of the RFP is for each team member to familiarize themselves with the entire RFP. This is accomplished by reading the document (preferably verbatim, multiple times), which will increase each team member's understanding of the scope of work, the owner's intent, the evaluation criteria, and the project requirements. Everyone involved in the proposal preparation, not just the team members who will put the final proposal together, must carefully read each document.

After the document is read for the first time, it should be reread with a more critical eye; this is where the analysis starts. During the second and subsequent readings, the owner's evaluation criteria should be compared with each section of the RFP. Such a comparison enables the proposal team members to understand how the written requirements align with the scoring criteria. During these readings, the owner's needs (minimum requirements) should be highlighted in one manner and its desires (upper thresholds) highlighted in a different manner. It is imperative that the design-builder provides a response which, at minimum, satisfies the owner's needs, but the team should also strive to satisfy the owner's desires while still maintaining a competitive pricing proposal.

During this process, the reviewers are conducting a more comprehensive SWOT assessment than was prepared in the qualification stage. Once they have identified the owner's needs and desires, they conduct a gap analysis. As they address each owner requirement, they are drafting a response as to how they can satisfy the requirement. This is accomplished by determining if they have the capability or solution to satisfy each need and then each desire. They determine if the team has the necessary and available technical capability. Where that capability or solution does not exist, they determine the gap (where they are versus where they want or need to be) that exists and then figure out what it would take to eliminate or reduce that gap. They are developing courses of action and recommendations; when this is not possible, they bring this gap to the team as an item requiring attention or action.

In this analysis, there will be many team members who identify gaps. However, these gaps might easily be eliminated when a more knowledgeable team member addresses the solution, reveals a capability that another reviewer did not know the team possessed, or demonstrates that this has been mitigated by something else. This is generally discovered when the various reviews are consolidated by the team document control or proposal preparation specialist. Within each area of expertise, the respective team members will document how their organization will bring its strengths and knowledge to bear to satisfy, and preferably exceed, the owner's requirements.

There will be times when the gap cannot be eliminated by one individual or design-build team member firm. Where a gap is identified for team action, the approach is to eliminate this gap by directing the collective wisdom and experience of the entire team toward the gap. When the team does not have the expertise to eliminate the gap, then the team must find the expertise that can provide the solution. It will also conduct a benefit-cost analysis to determine if the benefit of adding this additional resource to the team is worth the cost. Eventually, the team will decide on a course of action concerning how to reduce or eliminate the gap. The team will refine the course of action during the discussion periods and progress meetings.

Once the gap analysis has been done of the team's capabilities, the next step is to examine areas where there might be opportunities to showcase the team's talents, demonstrate the team's unique approach, or to develop or expand some particular business approach. Whenever and wherever the team can identify a feasible opportunity, the team should take advantage of it.

The SWOT analysis then examines the threats from potential competitors or a threat that is inherent in the RFP itself. This could be in the form of liquidated damages, restrictive clauses, strengths other teams possess (greater or a special expertise your team does not possess), and so forth. As these threats are identified, courses of action that would negate the effects of the threats should be developed. In a perfect world, the courses of action would turn these threats into a competitive advantage for your team.

A SWOT assessment is an iterative process that is superimposed on the entire proposal preparation process. The end result is to eliminate known gaps or ensure that everything possible has been done to mitigate every known gap's negative impact on the proposal. This SWOT process within the proposal process also enables the proposal to be strengthened with each successive revision—new items are added, the message is clarified, and the document is honed to perfection. It also ensures that the technical capabilities essential for successful project completion are identified. Whether those capabilities are incorporated into the team, or whether the team decides to take a risk in that area, is a business decision.

During the proposal preparation process, it is critical that the team members identify the risks associated with the project. Although many of these risks will be identified through the SWOT analysis, others must be derived by a careful analysis of the project's total environment. This environment includes the physical area of the project, the politics, personalities, and dollars that impact the project, and the situation with the public and the various governmental entities that can influence the project. Once the risks are identified, the team needs to determine who can best control, mitigate, or eliminate them and how the project can be developed to prevent the development of additional risks.

One of the more complex issues surrounding a DB proposal is the interrelationship between the cost and design decisions. The design team needs to work closely with the design-builder's estimator and scheduler to examine the various design options. These examinations will focus on the impacts the various alternatives have with respect to schedule, cost, and quality. One of these elements will be the owner's preeminent condition. The schedule–cost–quality relationship requires a constant focus to keep these elements as closely balanced as possible. Saying that one of the elements is the preeminent condition means that, given a situation requiring a trade-off between or among schedule–cost–quality considerations, then the decision should be made in favor of the element identified as the preeminent condition. These issues need to be brought to the attention of the individuals who are making the final decisions for the design-build team on the proposal, and ultimately, the project.

The owner's evaluation plan and the associated evaluation criteria will influence the decisions made relative to the schedule–cost–quality trade-offs. The bottom line is that the technical factors presented in the technical proposal will be eventually matched in some manner with the price proposal. It is important that the relationship between the technical and price proposals are understood when the trade-offs are made, because of the potential multiplier effect of the decision. For example, a price decrease, even though it might produce an increase in quality, could result in an increase in schedule. If the schedule is a major decision criterion (preeminent condition) for the owner, this increase in time could outweigh the positive impacts of the reduced cost and better quality. Use of simulations (such as a Monte Carlo) will help the team understand the impacts of some of these trade-offs.

The key for the design-builder is good proposal management, which requires a whole gamut of actions. The design-builder must have a strong leader, and a steadfast commitment in terms of making the right resources available, when they are needed, is absolutely essential. Continuous and open communication with all the team members (including subcontractors and suppliers) must be the modus operandi, not the exception. Smart business practices must also be the rule of law in this situation, and the development of and adherence to agreements codified by a legal instrument will go a long way in building the right working relationships.

Proposal Preparation by the Designer-of-Record

The designer-of-record (DOR) has the daunting task of accomplishing a critical portion of the design in a very short time frame. This requires the same attention to detail and systematic approach that have been previously mentioned. The DOR must understand the owner's intent and how the DOR's potential design decisions will impact the sundry plans that will be created to address management, safety, and quality issues. Unless the owner has negated the impact of the design within the RFP, the DOR has the pivotal role in the proposal preparation.

After the initial reviews are conducted, the DOR must carefully analyze the performance criteria and determine if a design team that brings the appropriate skill sets to the proposal can be pulled together. Next, the myriad business issues internal to the DOR's own organization must be sorted out. Questions similar to the following must be answered:

- Are the in-house resources available to perform the work?
- Is there enough time, based on all other projects, to perform the work?
- Is the budget realistic?
- Is the owner providing sufficient time within the RFP submittal schedule to accomplish the task of producing the winning proposal?
- Can the DOR find the appropriate design consultants to provide expertise in areas not on hand in-house?
- What is the normal working relationship with this client and is the client prepared to manage this as a DB project instead of a design-bid-build (DBB) project? (This has serious repercussions in terms of design budgets.)
- Does the DOR have the corporate support to accomplish the proposal?
- Will the DOR be able to have the access it needs to the design-builder's personnel and the trade subcontractors so the design can be integrated with the design-builder's capabilities and take advantage of its strengths?

Once these issues have been resolved, the DOR will know how to proceed. As the DOR and its team of designers start working through the RFP, they will identify the implicit performance requirements that are derivatives of the stated requirements. They will need to identify those requirements where various codes and laws mandate various design approaches, and determine what additional studies or investigations will be needed to reduce risk or provide the information necessary to complete the design. A design schedule with taskings must be developed to control the process; this schedule will need to be integrated with the schedule for the entire proposal to ensure that the various team members have the time they need to work with information provided by others.

Risk considerations will be the intertwined with all design decisions and alternatives. Financial, safety, public relations, economic, and schedule issues will be examined during the design process. Although many will argue that this is no different from the DBB project delivery method, there is a significant difference in the risk management process. In DB, the designer has the bonus of working with the design-builder to eliminate or mitigate those risks. The DOR will work closely with the entire project team to determine the best way for the collective team to address the risks. They can examine who will control and manage the various risks. Many assumptions will be eliminated and the resulting plan will replace beliefs and hopes.

During this process, the DOR will identify what information is needed to respond to the RFP. If there is additional design required to prepare the proposal or presentation, the DOR will need to provide it. It will have to determine which design questions and requests for information (RFIs) will need to be brought to the owner's intention. The hard part is deciding what questions to ask without sacrificing its team's competitive advantage. The DOR will also need to catalog which submittals will be required with the proposal and which submittals will be required during the complete design. Catalog cuts, various drawings, samples, renderings, color boards, and specifications must be determined for proposal submittal, as well as other items identified as future, post-award submittals.

Last but not least, the DOR must balance the workload and business risk. It must determine how the various sureties will work with the design firm to ensure the proper insurance coverage is in place. This will include both the in-house design and the design that is provided by others. The insurance issues will have a major impact on the project and they will also have to be coordinated with the general contractor and the various subcontractors who provide design work through the shop drawing process.

Preparing the Price Proposal

The strength of the design-builder's parametric database will have a major impact on how quickly and accurately a price proposal can be developed. With a solid database in place, pricing the project can begin very soon after the site plan is completed. The design-builder should be able to provide conceptual estimates based on the site plan and any major end-items. As the design progresses, its designers will be to continually refine the estimates and, for some features of work, they might even be able to provide detailed estimates. The estimators will continue to hone the estimates and provide estimates for various design solutions. These estimates will enable the team to better examine various alternatives, check possible enhancements, and conduct "what if" analyses. The estimators and designers must decide early on which items can be priced immediately and which items require significant design effort before any type of estimate can be completed. They must also determine if there are any special requirements in the RFP that mandate a detailed estimate for a particular feature of work. The designers and estimators must be in constant communication during this process.

Starting the price proposal involves three main considerations. First, identify features that can be priced before proposal design decisions are made. The details of the proposed design for these features need to be confirmed by the DOR. Once that is done, the estimates should start immediately. Second, the team must identify those features that can be priced after proposal design decisions are made. These should result in a schedule of high-priority design decisions for the DOR. Finally, the team should identify those features that must be priced in order to make proposal design decisions. For these items, priced alternatives are developed for the team. Many of these items will focus on betterments or be required for cost–design trade-off decisions.

Information needs to be shared freely. Wherever possible, the designers need to be provided with pricing and the estimators need to be provided with the design details. The give-and-take will produce a design that has a realistic cost associated with it. During these discussions between the designers and the estimators, the scheduler should also be involved so that the project schedule (both for the design preparation and the construction schedule) can be integrated with the design and the construction costs.

The designers need to be cautious when they are working on the designs. First, there must be an understanding that cost considerations will have a major influence on the design. In most cases, the DOR must design to a budget. Comments in the RFP that request a technologically superior or first-class design would lead a designer to think this could be a signature project. However, this notion should not be taken to the extreme by the DOR as most design-build projects are typically not candidates that will lead to award of the Pritzker Architecture Prize for the A/E.

The estimators must also be extremely cautious. The estimators must document their assumptions and check them with the designers; they do not want to create a situation where risk coverage must be increased because the team has more assumptions than facts. Elimination of assumptions is important to the risk management process, but when the designers and estimators make a design decision they cannot totally eliminate the original assumption. It needs to be highlighted, explained, and then priced appropriately. The estimators must also document the source of their estimates so that those sources can be checked. Rules of thumb for estimates are wonderful tools but they need to be challenged during the refinement of the estimates. Working closely with the designers, the estimators need to determine the cost to produce the studies the designers will need to complete the designs (e.g., geotechnical reports, traffic studies, and environmental studies).

Finally, the estimators need to separate costs from the overhead, profits, and pricing for risk. They want to ensure that their respective activities are priced appropriately, that the risk for each item is quantified in financial terms, and that the overhead and profits can be verified in the internal project accounting systems.

As the design and estimating teams refine the estimates and designs, there are a few rules that will help prepare the final price proposal. First, the design costs must be able to be accurately estimated. Using a percentage of construction for design, or just using a multiplier for man-hours (and treating the design as cost-plus), will not work in DB. Second, at the earliest opportunity subcontractor and supplier quotes need to be locked-in; the designs must be developed to the point where this can be done. The design-builder also must be very careful of what is included in the quotes and what is excluded. Third, the cost and pricing data should be collected and configured to fit the owner's RFP price proposal format. The scheduler can also help in this area. Developing a work breakdown structure that uses the owner's price proposal format will make it easier to roll up the numbers and keep them associated with discrete parts of the design. Fourth, one must recognize the time value of money and determine how to handle inflation and account for escalation and issues such as upcoming labor contracts, seasonal increases, and the availability of skilled labor.

Closure of the Proposal Preparation Process

Closure starts the minute the DB team decides to submit the proposal. The deadline, scope, and tasks with an understanding of the quality level are all being developed within a budget. To bring a proposal to successful closure, it is imperative that the design-builder employs procedures that will support that goal. Of the gamut of management practices that almost every A/E and builder will employ to some degree, two procedures, in particular, will be extremely useful in the closure effort. First, as an outgrowth of the SWOT analysis, completion of a proposal comparison chart will enable you to bring various approaches and decisions to the forefront. The second is the use of a Red Team to analyze the proposal.

Creation of a proposal preparation chart will serve as a cross-check and guide for proposal items. This chart translates the items identified in the SWOT analysis and superimposes them on the owner's evaluation criteria. The result is an easy-to-understand graphic that shows the areas of evaluation, the owner's weights, an applicable objective metric, suggested comparative scores, and actions to raise the potential scores for your team's proposal. The difficulty with this tool is that the team needs to be very objective when performing the self-evaluation and their evaluation of the competition. Unless this is objectively performed, the team may be lulled into a false sense of security and the result will be the development of actions that might not be the most appropriate response.

Using a Red Team proposal review is a tried and true method of turning a collection of wonderful thoughts into a cohesive and coherent document. Like the owner's Blue Team review, which focuses on ensuring the DB RFP is clear and unambiguous, the Red Team review is used to ensure that the design-builder's proposal is equally clear, unambiguous, and conveys the team's approach to solving the design/construction problem posed in the RFP in the most direct terms. The primary goal of the Red Team is to check for full responsiveness to the RFP. The proposal is compared to the RFP line-by-line and section-by-section. Generally, the Red Team will force the document drafters to write the proposal in the same format, in the same order, and using the same descriptors as the RFP. This assists the owner by making the proposal easier to evaluate. Using checklists and grading sheets, the Red Team members will conduct a comprehensive review and make sure the document is easy to read. This makes it easier to verify that the proposal team has indeed "answered the mail."

Red Team members must be people who can apply constructive criticism, analyze documents, understand the type of project and the owner, have solid writing skills, and are truly committed to making the document totally responsive. They must be willing to ask the tough questions and be brutally honest in their assessment (this does not require an uncivil approach, just a candid approach). The more thorough and tough the Red Team members are, the more useful the review will be for the proposal team.

The Red Team will look for ways to strengthen the verbiage. It will examine the numbers to ensure they make sense and are consistent, and will critically question whether the approach is consistent and responsive to the owner's needs (and possibly the owner's desires). Verification of the risk allocation will be a major focus of the Red Team; they will determine whether the risk is being properly allocated between the proposal and the RFP.

The Red Team will make recommendations as to how to raise the competitiveness (potential score) in each area. The final decision makers (who will receive the Red Team review) will be given the Red Team's recommendations on any design, price, technology, or business decisions that are still pending within the proposal. The team's design versus cost trade-off recommendations will reinforce the need for the decision makers to generate timely decisions so the proposal team can complete its work. Finally, the Red Team will inventory the document for total responsiveness, identify conflicts between partial products, identify ambiguities, and check pricing. Once the Red Team is through, the proposal team will then take the Red Team's comments and produce the necessary changes in the RFP.

If possible, the Red Team reviews should be conducted twice during the proposal process. The first Red Team review (explained in the preceding paragraphs) should be conducted when the proposal is at the 50% completion stage. The second review is performed when the document is substantially complete. During this review, any ambiguities or discrepancies are identified and corrected on the spot. The proposal writing team is available to make these corrections. This final review makes sure there are proposed solutions for the owner's technical needs and desires, ensuring that the document emphasizes the enhancements that this design-builder is offering to the owner and how these features provide benefit to the owner. The final Red Team review has the goal of making sure the document is complete, that the proposal clearly "answers the mail," and, finally, that the proposal provides the equivalent of a winning lottery ticket to the owner by providing a product that will truly exceed the owner's demands, yet meet its requirements.

Summary

Much has been presented in this chapter. Those readers who have worked on proposals and hard bids will see many similarities between the DB approach and their own experiences on proposals and hard bids. This type of proposal encompasses all the difficult aspects of either answering a normal RFP or responding to an invitation for bid (IFB): there is never enough time; there are too many people to coordinate with in a short period of time; the preparation costs are significant; and entities will wait until the last minute to provide pricing. Successful participation in the DB proposal process requires a well-organized team with the requisite technical skills and managerial skills to achieve a goal. A successful team will make continuous and open communication a fact of life. Quality work must be provided punctually and proactively. Necessity dictates that a good team will develop a clear understanding of all project risks and determine ways to manage that risk. This is all achievable, just as it is possible to deliver a winning proposal or a winning bid.

This process can also provide the owner the best of both worlds by getting the A/E and the design-builder focused on delivering a project wherein both entities can influence schedule, quality, and cost, starting at the planning stage, working through design and construction, and continuing through the warranty period. This is the situation that each entity claims they want on most projects. When the process is implemented correctly, the owner and the design-builder will not be thinking "if only we could have"; instead, they will have the satisfaction of knowing that they were able to satisfy that wish.

In conclusion, a winning design-builder will provide the following type of proposal:

- It is fully responsive to the RFP.
- It is full of critical information and facts.
- It is clear and easy to evaluate.
- It focuses on the heavily weighted categories.
- It demonstrates a full understanding of the scope of work.
- It is biased toward quality, cost control, and timely completion.
- It offers enhancements over the minimum requirements.
- It emphasizes team strengths and mitigates competitors' advantages.

NINE

Summary of Design-Build Contracting

Design-Build Basic Concepts

This book has taken the fundamental concepts of the design-build (DB) contracting pre-award process and disaggregated them. It has defined and quantified each component in the process and presented them in an integrated fashion that allows the reader to follow the DB Request for Proposals (RFP) development process in an orderly fashion. The proposal development process has been discussed from the perspective of maximizing its responsiveness and attractiveness to what the owner articulated in the DB RFP. This effort can be summarized in the following principles:

- Single point of responsibility,
- Ownership of the details of design,
- Well-written performance criteria,
- Transparent evaluation plans,
- Responsive DB proposals with a competitive edge,
- Establishing trust for contract execution.

Single Point of Responsibility

Two major benefits that an owner derives from selecting DB project delivery are the transfer of design liability to the design-builder and the institution of a single point of responsibility for both design and construction. The single point of responsibility concept is viable only in an environment where the design-builder is allowed the latitude to expand on the level of design development contained in the RFP, with a free hand to furnish adequate solutions that not only meet the published performance criteria but also meet the constraints of the design-builder's budget and schedule. Once the project has been awarded, the design-builder must finish the design within the contract price and develop a final design that can be constructed within the project's schedule. If the owner imposes itself into the design process in a manner that impedes the design-builder's freedom to design a project that meets both budget and schedule constraints, the owner risks losing the benefit of being able to hold the design-builder responsible for the ultimate performance of the completed project. To be successful, a DB contract must preserve the concept of single point of responsibility.

Ownership of the Details of Design

Design-build gives the owner the benefit of the single point of design and construction liability but, in doing so, the owner gives up control of the details of the final design. The design-builder must own the details of design during project execution. In the traditional design-bid-build (DBB) system, the details of design are fixed before the price. However, by definition in DB, the price is fixed before the design is complete. Therefore, to be successful, the design-builder must have the freedom in its proposal to design to the price and schedule constraints. If the owner imposes itself into this process by attempting to require its own technical solutions to design problems, it has in fact breached the contract by constructively imposing changes to the technical scope of work. Although the design-builder's design details must be responsive to the owner's RFP performance criteria and to any other specific detail contained in either the RFP or the winning proposal, the design-builder must have the ability make changes to working drawings that allow it achieve both its target budget and its schedule. Thus, the owner must focus its RFP preparation efforts on the development of well-written performance criteria that free it from the concern that the ultimate details of design will not be satisfactory.

Well-Written Performance Criteria

Definitive performance criteria are the heart and soul of successful DB contracts. They should be address technical, schedule, cost, and qualifications and management factors. They define the constraints within the project for design and construction execution and detail the desired results for tasks both large and small. An owner that remains mired in the old DBB attitude that it must be prescriptive in its RFP is unnecessarily tying the hands of the DB industry's ability to creatively propose innovative solutions to the owner's DB problem. Although it might be necessary to be prescriptive in some areas to achieve the desired goal, owners should strive to leave as many doors open as possible for design and construction management options. A well-written performance criterion lists both the rule and the result, using the abductive logic approach detailed in Chapter 3 of this book. The RFP will contain not only the performance criteria that define the project's ultimate form but also the criteria against which proposals will be evaluated. Thus, these criteria must be clear, unambiguous, and definitive.

Transparent Evaluation Plans

The DB selection and award decision will always contain some element of subjectivity. As a result, the fear that an award decision will be made on a basis of favoritism rather than merit must be directly addressed to ensure that an owner always has the most highly qualified and competent pool of competitors willing to propose on its DB projects. This is accomplished by making the methodology used to make the award decision totally transparent to the competitors who will vie for the project. Transparency means publishing unambiguous evaluation criteria, describing the relative importance of the various factors that will be evaluated, and detailing the process that the evaluation panel will use to make its decision. Once this is done, the owner must follow those procedures to the letter every time it awards a DB contract. Public owners often have to debrief the unsuccessful proposers after award and let them know what their deficiencies were.

From a design-builder's perspective, the most important aspect of the evaluation plan is the clarity with which the requirements and preferences are articulated. It goes without saying that a clear set of requirements is necessary for the DB industry to furnish a responsive set of proposals, but it is also important that the owner clearly express its desire for betterments above the minimums. To win a best-value procurement, the design-builder must offer something more than just the published minimums; it must offer a betterment that will make its proposal the literal best value. If the evaluation plan is structured in a manner where there is no incentive to exceed minimum requirements, the owner is unintentionally creating a low-bid award because the only discriminator between proposals will become price. Thus, evaluation planning can be summarized as a method for the owner to communicate its requirements and desires to potential offerors in a manner that provides an incentive to exceed the owner's expectations.

Responsive Design-Build Proposals with a Competitive Edge

Design-builders must read the owner's RFP carefully and develop an inventory of all the elements that comprise a totally responsive proposal for this particular project. Owners can help support this process by specifically listing everything that will be evaluated in the RFP. Even so, a design-builder cannot afford to have its proposal eliminated from the competitive range merely because some bit of administrivia was missing. Thus, the responsiveness to the minimum requirements of the RFP must be checked and rechecked as the proposal is developed. If there is doubt as to the details, the design-builder should send a request for information (RFI) to the owner to gain clarification.

Once the standards described in the RFP are met, the design-builder must then decide where it will offer betterments to make its proposal the best value. If the owner has written a clear evaluation plan, as described in the previous section, this becomes an "open-book test." The design-builder's competitive edge should be developed in those areas where its proposal stands to gain the most advantage during the rating process—in the categories most heavily weighted in the evaluation plan. If the evaluation plan is ambiguous or inherently foggy, the design-builder must make a judgment call based on past experience with the owner, the outcome of the pre-proposal meeting, or the apparent emphasis on specific areas in the body of the RFP. If no area can be determined to be more important to the owner than any other, then the design-builder should fall back on furnishing the lowest possible price. To win a DB project, the proposal must be both fully responsive and contain a competitive edge.

Establishing Trust for Contract Execution

The final dimension of DB contracting deals with the ability of the parties in the contract to execute it in an environment of trust. This is the ultimate culture shift that must be made by owners, designers, and builders. The foundation for this environment is the way the RFP is written, the proposals are evaluated, and the award decision is made. Owners can foster a positive environment by being explicit about their needs and desires, transparent in the documentation they produce, and open and honest during the proposal preparation phase by being helpful and responsive to design-builders' RFIs. They can also promote trust by being frank and open in debriefings of unsuccessful offerors, helping them to understand their deficiencies and shortcomings in a manner that helps them strengthen and enhance their future efforts to obtain work.

Finally, all the contractual parties must remember that DB shifts the risk distribution among the parties in a manner that is quite different from the traditional DBB system. The members of the entities involved must be sensitized to this shift and be given training to help them understand their new roles.

The owner gets to make a qualifications-based selection of both the designer and the builder and should make every effort to select a design-builder it can trust. Design-builders must reciprocate by engaging in business practices that engender trust. DB contracting brings a number of benefits to both the owner and the design-builder. To actually accrue these benefits requires that both parties enter into the agreement with an element of trust.

The Future of Design-Build

Alternative project delivery is gaining popularity throughout the United States and overseas. DB has proven to be a means of successfully delivering needed facilities in an expeditious manner without sacrificing quality or economy. Private and public owners are continually experimenting with variations on the DB theme. Design-build-operate-transfer (DBOT) is being used by development banks to deliver infrastructure projects in developing countries, and the United States is beginning to follow western Europe's lead in forming public–private partnerships to deliver infrastructure projects in design-build-operate-maintain (DBOM) or design-build-operate-own (DBOO) modes. DB furnishes a method whereby a facility can be delivered in the shortest possible time and is, therefore, very attractive to owners of projects producing strong post-construction revenue streams, such as retail stores and toll roads. It allows such owners to turn on the positive cash flow as early as is technically possible. As a result, the DB delivery method is no longer an innovation; it is now a standard means to deliver projects.

The word architect is derived from "master builder" in Latin, not "master designer." The idea that the designer should have a direct financial responsibility in the success of a construction project is not counterintuitive; forcing the designer and the builder to team up on a given project accrues many advantages to both the owner and the DB team. As a result, the authors can authoritatively report that DB contracting is not merely a passing fad. It is here to stay. Although it will never supplant the traditional DBB process, it will never disappear. All the major professional design, engineering, and construction societies have recognized the DB method and many have rushed to develop their own set of standard contract documents. The Engineer Joint Contract Documents Committee (EJCDC) (National 2005) is but one source of tried and tested contract documentation for DB contracting. (See Appendix 3 for a listing of EJCDC contracts.) Each owner must find the appropriate legal means to contract for DB services that fits its organizational constraints and its market sector. Engineers, architects, and construction professionals must all learn how to operate efficiently and effectively within the DB paradigm. This book was written to facilitate that transition, and the authors hope that it will indeed serve that purpose.

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APPENDIX 1

A Design-Builder's Perspective on the Design-Build Request for Proposal Process in the Transportation Industry

Larry Hurley, Sr. Vice President, CH2M-Hill Constructors, Inc.

A design-build (DB) project's Request for Proposal (RFP) sets the stage for all the other events that happen during the DB project's life. A design-builder must rely on the RFP to articulate the owner's intents for project scope, quality, schedule, and ultimately price. The RFP identifies the distribution of risks between the parties to the DB contract and, as such, it is important for owners and those who write DB RFPs to understand the design-builder's perspective on what is most important in the RFP and the contract award process. As a result, I'd like to offer my thoughts on the following topics: selection criteria, evaluations, proposal preparation costs, stipends, innovations, best and final offers (BAFOs), and the design-builder's project selection process.

Selection Criteria

The industry, in general, seems to have adopted a two-phase selection process that allows for both a price- and qualifications-based selection. This allows the owner to not only choose the best price but also the best-qualified design-builder, resulting in an overall best-value selection. The owner then should be capable of selecting the best DB firm to perform the work. Open requests for Letters of Interest (LOIs) are a way for owners to test the market interest in their projects. Requests for LOIs should be issued as soon as the owner determines that it will use the DB project delivery method and a general scope of the work can be identified. The responses the owner receives to these will indicate the level of industry interest in the project and, hence, the level of competition that the owner can expect. Next, the owner should issue a Request for Qualifications (RFQ). Interested design-builders will then submit a formal DB team Statement of Qualifications (SOQ). Evaluation of the SOQ will allow the owner the opportunity to short-list to a select group of best-qualified competitors, who will then be asked to submit a full technical and price proposal for the project.

Owners should take note that just because a team makes the shortlist does not guarantee a submitted proposal. As the proposal is developed, the terms and conditions of the project are firmed up, and funding issues are clarified, teams may or may not follow through with a formal proposal. Therefore, owners should acknowledge that possibility and short-list three to five teams if they want to ensure that they have at least three competing proposals to evaluate. This happened on the Foothills Corridor and Alameda Light Rail projects in California, the West-East Light Rail project in Salt Lake City, and the I-25 project in Denver.

Evaluation Plans

The evaluation criteria must be clearly established and followed by all parties (both owners and design-builders). The time and expense of working through this type of procurement method is very significant. Design-builders understand the risks involved and deserve that a fair and honest evaluation process be established and followed. Subjective analysis is neither very well-accepted nor desired by the DB industry. Evaluation plans should be published in as much detail as possible and be transparent to all interested parties. Scoring and weighted percentages are favored. The RFP is the design-builder's roadmap from the owner. Knowing exactly what the owner expects will increase the proposal's responsiveness, allowing the design-builder to specifically address the salient concerns of the owner. A transparent evaluation plan will result in a better set of highly responsive proposals for the owner's evaluation panel to rate.

Proposal Preparation Costs

The time and cost of preparing an SOQ and a DB proposal can be onerous, depending on the owner's requirements. Owners must understand that design-builders want to present a quality product, and the quality of the submitted proposal can be an indication of the quality of design-builder with which they will be dealing. In many cases DB transportation projects (e.g., highway, bridge, and marine) are large and may require joint venture teaming, due to overall construction risk and the nature of today's surety markets. Using a $100 million project as an example, the joint venture costs for such a project could run as high as $100,000 for the SOQ and approach $1 million for the technical and price proposal. This is a significant investment and the probability of success will be closely evaluated by the design-builder prior to submitting the SOQ.

Stipends

Because of the high costs associated with DB proposal preparation, stipends to partially reimburse unsuccessful offerors are strongly suggested. The owner wants to attract a quality group of design-builders and receive the best design and construction packages possible for the project. Stipends allow the unsuccessful bidders of recoup a portion of their preliminary design costs and allow the owner to take ownership of any ideas and innovations submitted in the proposals. These innovations or options can then be used by the owner and incorporated into the ultimate design of the project.

Stipends also allow the design-builder to secure the services of smaller design subconsultant firms which, without compensation, are unable to provide the investment required to participate in the up-front proposal preparation activities associated with design-build projects. The bottom line on stipends is that they increase both the level and the quality of the competition for DB projects, and that is definitely in the owners' best interests.

Innovations

The idea behind DB is to allow a team of designers and contractors to bring their expertise to the project. New, innovative design and engineering concepts teamed with creative construction means and methods can positively impact the cost and schedule of the project. DB allows for constructability reviews to proceed hand-in-hand with the design of the project to ensure that value engineering is designed into the project and built into the project from the date of award, and the owner receives the benefits of this activity. As a result, owners should be careful not to overly restrict the desired design details, thereby unintentionally constraining the design-builders' ability to propose creative and innovative solutions to the project's design problems.

Best and Final Offers

In general, the use of BAFOs by owners in their DB project delivery process is frowned on by design-builders in the industry. A BAFO requested because of a change in scope is understandable and, of course, acceptable. However, the industry often perceives the use of BAFOs as nothing more that a chance for the owner to shop the project among competitors. Therefore, owners should establish the scope of the project, set the evaluation criteria, and then select the best-qualified proposer in terms of experience, resources, technical approach, and cost.

Design-Builder Project Selection Process

The use of DB is growing within the transportation industry. The number of DB opportunities being offered to the construction industry continues to grow as the Federal Highway Administration enacts its recently passed DB regulations, and more state departments of transportation are becoming legislatively authorized to utilize this procurement method. As design-builders, we utilize various screening processes to evaluate all potential projects. In general, the criteria fall in the following areas:

- Funding: is the project funded or fundable?
- Political: is there political support for the project, including environmental issues?
- Public Need: is there a public need for the project, or is it a developer's dream?
- Will there be a short-listing of competitors?
- Are the owner's contractual terms acceptable in terms of risk sharing?
- Will there be a stipend offered by the owner?
- Is there a structured evaluation process defined by the owner?

If we can answer "Yes" to each of these, we usually will take a close look at the project and then analyze the possible competition, the complexity of the project, and the potential delivery schedule. Next, from a close analysis of the RFP we will estimate the cost to prepare the SOQ and the proposal and compare that to the value of any stipend to determine if we are interested in competing for this project. Finally, we will look at the technical performance criteria and the time frame to determine whether we can identify what is important about this project from the owner's perspective. Within our technical submittal, we try to focus on these owner-identified issues.

As we become more informed about the project during the proposal stage, the issues of contractual terms and conditions become more important. Risks are identified and many times discussions are held with the owner to examine these issues and determine who best is capable of managing these risks. These contractual risks must be addressed prior to submittal of the technical and pricing proposals. At any point in this RFP process, the design-builder may elect to no-bid the project based on its understanding of the terms and conditions related to the contract, the owner's unwillingness to negotiate realistic limits of liability, or other issues that make going forward impossible for the design-builder.

Summary

For an owner to have to a successful DB project, a successful design-builder is necessary. To ensure that the owner will select a design-builder who will be successful, the owner must attract the industry's best and brightest designers and constructors to its specific project. A carefully thought out, well-written RFP with a transparent evaluation plan that clearly conveys the requirements of the project without undue ambiguity is the first and most important step of the DB project delivery process. An owner that is able to attract a strong field of highly qualified design-builders to its project will garner not only the cost-saving benefits of increased competition but also the enhanced quality benefits of being able to select the best-value solution from among several innovative DB proposals.

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