

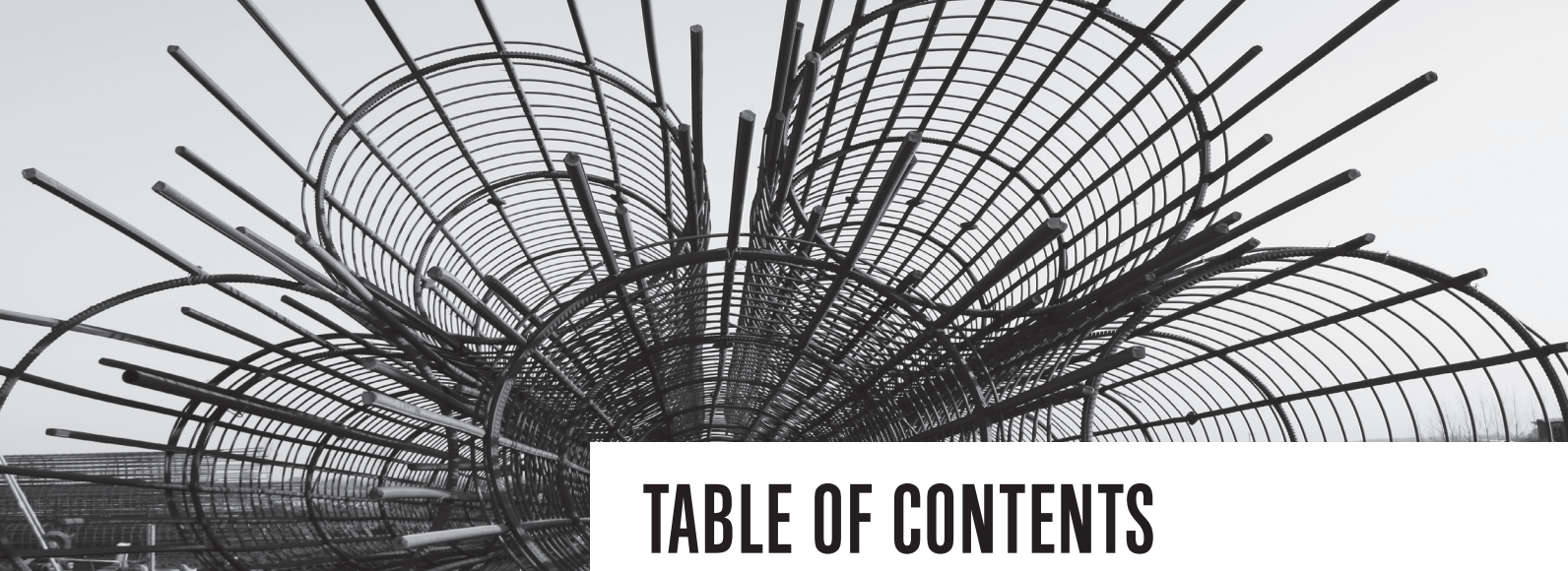


# PROFESSIONAL'S GUIDE TO MANAGING THE DESIGN PHASE

*of a Design-Build Project*



CHARLES PANKOW  
FOUNDATION



# TABLE OF CONTENTS

<b>INTRODUCTION: A Guide to this Guide</b> .....	4
What's New in Version 2.0 .....	5
Contributors to Version 2.0 .....	6
About the Charles Pankow Foundation .....	6
<b>Chapter 1: Design-Build, the Design-Phase Manager and Team</b> .....	7
1.1 The Design-Build Method of Project Delivery .....	7
1.2 How Design-Build Teams are Structured .....	8
1.3 Role of the Design-Phase Manager .....	8
1.3.1 What the Design-Phase Manager Does .....	9
1.3.2 Difference between the Design-Phase Manager and the Designer-of-Record .....	10
1.3.3 Design-Phase Manager Credentials .....	11
1.3.4 What the Design-Phase Manager Needs to Know .....	11
1.3.5 Alternative Ways to Staff a Design-Build Design Team .....	12
1.4 Business Drivers under the Design-Build Model — <i>and What They Mean for the Design-Phase Manager</i> .....	13
1.4.1 The Business of Designers .....	13
1.4.2 The Business of Builders .....	14
1.5 Cultural Differences under the Design-Build Model — <i>and Getting to Know The Team</i> .....	15
1.5.1 The Culture of Designers .....	15
1.5.2 The Culture of Builders .....	16
1.5.3 Putting Them All Together .....	17
1.5.4 The Ethical Imperative .....	17
<b>Chapter 2: Design-Builder Selection</b> .....	19
2.1 Common Design-Build Team Selection Methods .....	19
2.1.1 Cost-Based Selection .....	19
2.1.2 Qualifications-Based Selection .....	20
2.1.3 Best-Value Selection .....	21
2.2 Design-Phase Manager's Role during Selection .....	21
2.3 Phases of a Best-Value Design-Build Selection .....	22
2.3.1 Qualifications Package .....	22
2.3.2 Owner's Shortlist .....	23
2.3.3 Proposal Preparation .....	24
2.3.4 Interview .....	25
2.3.5 Award .....	25



<b>Chapter 3: Building and Sustaining a Functional and Successful Design Solution</b> .....	27
3.1 Assembling the Design Team Based on the Owner’s Needs .....	27
3.1.1 Primary Design Consultants.....	27
3.1.2 Specialty Design Consultants.....	28
3.2 Motivating the Design Team and Engendering Trust and Respect.....	29
3.3 Kick-Off Strategies to Begin the Job Right .....	31
3.3.1 Mission Statement and Team Chartering.....	31
3.3.2 Project Vision .....	31
3.3.3 Performance Expectations.....	31
3.3.4 Roles and Responsibilities.....	32
3.4 Achieving Collaboration .....	32
3.4.1 Team Collaboration .....	33
3.4.2 Importance of Communication.....	34
3.4.3 Information Management and Electronic Communication .....	34
3.4.4 Meetings during the Design Process.....	35
<b>Chapter 4: Contracts and Subcontracts</b> .....	37
4.1 Best Practices in Contracting for Design-Build Services.....	37
4.2 Teaming Agreements or Memoranda of Understanding during Selection Process.....	38
4.2.1 Exclusivity and Non-Disclosure .....	40
4.2.2 Inclusion of Subcontract as Part of the Teaming Agreement.....	40
4.2.3 Addressing Changes in Circumstances during the Design Selection Process.....	40
4.3 Standard Form Design-Build Subcontracts .....	41
4.4 Negotiating the Subcontract .....	41
4.5 Key Subcontract Terms and Issues to Consider in the Design Subcontract.....	42
4.5.1 Scope of Work Definition .....	43
4.5.2 Commercial Terms in the Design Subcontract .....	44
4.5.3 Risk-Sharing Provisions .....	44
4.5.4 Professional Liability Insurance and Errors and Omissions Contingencies .....	45
4.5.5 Indemnification Clauses and the Duty to Defend.....	46
4.5.6 Flow-Down Clauses.....	47
4.6 Other Legal Considerations in Contracting.....	47
4.6.1 Public-Private Partnerships.....	47
4.6.2 BIM Ownership .....	48
4.6.3 Electronic Communications, Project Documentation, and Copyrights .....	48
4.6.4 Performance-Based Criteria .....	49
4.6.5 Authority to Change the Design.....	49
4.6.6 Warranties and Post-Occupancy Issues.....	50
4.7 Resolving Conflict .....	50
4.7.1 Avoiding Disagreements.....	51
4.7.2 Dealing with Errors and Omissions .....	51
4.7.3 Addressing Changed Conditions .....	52
4.7.4 Techniques for Dispute Resolution.....	52

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<b>Chapter 5: Work Breakdown Structure and Schedule</b> .....	55
5.1 Project Phases and the Work Breakdown Structure .....	55
5.2 Developing the Design Schedule .....	57
5.2.1 Design Schedule Elements .....	57
5.2.2 How to Accommodate the Owner’s Decision-Making Process .....	58
5.2.3 Special Considerations for Developing a Fast-Tracked Project Schedule .....	59
5.3 Managing to the Project Schedule .....	60
<b>Chapter 6: Cost Estimating and Cost Control</b> .....	61
6.1 Developing the Cost Estimate .....	61
6.1.1 Developing the Design Cost Estimate .....	61
6.1.2 Developing the Construction Cost Estimate .....	64
6.1.3 Target-Based (Target-Value) Design and Designing within the Construction Cost Estimate .....	65
6.2 Managing Project Design Costs .....	67
6.2.1 Managing the Design Budget .....	67
6.2.2 Special Cost Tracking Considerations for a Fast-Tracked Project .....	68
<b>Chapter 7: Design</b> .....	69
7.1 Design Phases .....	69
7.1.1 Conceptual and Preliminary Design .....	70
7.1.2 Project Definition after Award .....	70
7.1.3 Detailed Design .....	70
7.2 Design-Phase Manager’s Role in Managing BIM .....	71
7.3 Design Considerations for a Design-Build Project .....	71
7.3.1 Best Practices for Overseeing the Development of Specifications .....	71
7.3.2 Level of Development Specification .....	72
7.3.3 Special Design Considerations for a Fast-Tracked Project .....	73
7.4 Sustainable Design Strategies .....	73
7.5 Building Quality into the Design Process .....	74
7.5.1 Informal Design Reviews .....	75
7.5.2 Criteria Compliance .....	75
7.5.3 Code Analysis and Compliance .....	76
7.5.4 Constructability Reviews .....	77
7.5.5 Peer Reviews .....	77
7.5.6 The Design-Builder’s Role during Design .....	78
7.6 Managing Change during the Design Process .....	78
<b>Chapter 8: Construction</b> .....	79
8.1 Design Support during Construction .....	79
8.1.1 Assisting with Equipment, Materials, and Supplies Procurement .....	79
8.1.2 Clarifying Design Issues that Arise during Construction .....	80
8.2 Project Closeout .....	81
8.2.1 Record Drawings, As-Built, and Turnover Documentation .....	82
8.2.2 BIM Turnover for Future Use .....	83
<b>Acronyms</b> .....	84



# INTRODUCTION

## A Guide to this Guide

Everyone wants a design and construction project to be successful. Owners want their projects to meet the intended objectives, within established budgets and schedules. Designers want their projects to be aesthetically appropriate, functionally efficient, and successful in meeting the owners' needs. Builders want their projects to be safe and run smoothly. All three want a reasonable return on investment.

This guide is intended to help owners, designers, and builders of design-build projects to achieve greater success via the unique—and relatively new—role of the “design-phase manager.” Many projects today are built under the design-build method of project delivery. The design-phase manager is the design-build team’s “master integrator.”

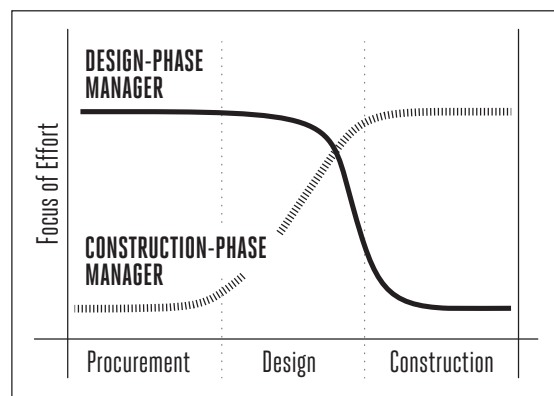
It would not be an overstatement to say that the design-phase manager is the most fundamental ingredient—the secret sauce, maybe—of a successful design-build project. A project without a competent design-phase manager is likely to turn into an exercise in futility, destined for frustration—or worse—amongst the project team.

By background or education, design-phase managers may be architects, engineers, or constructors, but regardless of background, the design-phase manager is the single most important project participant, connecting the design team to the construction team.

The design-phase manager in a design-build project serves in a pivotal position among the owner, designers, and builders. The design-phase manager organizes and manages the activities of all parties in the design process (owner, builders, architects, engineers, interior designers, landscape architects, and specialty consultants) to conceptualize and develop the design of a significant building project.

When the design is substantially complete, most design-builders will have the design-phase manager change hats and become the construction-phase manager as well. However, a good design-phase manager is not necessarily the best construction-phase manager, and vice versa.

Most design-build projects are led by design-builders, and many design-phase managers have substantial construction-phase skills. The project manager of a general contractor or other design-build entity is well-versed (and likely educated) in construction management issues and practices,



Every design-build project has a leader.  
The leader's role and focus of effort changes as  
the project progresses toward completion.

*The design-phase manager is the design-build team's "master integrator."*

but probably has fewer design-phase skills. The primary purpose of this guide is to act as a resource for those without a design background who have been assigned to oversee the design process for a design-build project, and assure that the design meets their firm's contractual obligations with the owner.

Professional or formal education and training in managing the design phase of a design-build project is rare. Therefore, this book includes details of the design process which the design-phase manager may or may not be specifically responsible, but are included to provide insights into how the design process takes place.

This does not imply that the design-phase manager should usurp the authority of the architects and engineers who are legally and professionally responsible for the content of the design. Rather, the design-phase manager, typically employed by the design-builder, will organize and manage the process of a design-build project from inception through completion.

This guide is a handbook for design-phase managers: practical suggestions—distilled from the experiences of facility owners, developers, and senior design and construction practitioners—and proven procedures that can be applied to the situation at hand. While the guide is intended for design-phase managers in design-build organizations, the principles in this guide may be broadly applied to other project delivery methods.

## **What's New in Version 2.0**

Version 1.0 of the Design Management Guide was published in 2011 and was received with enthusiasm. We are pleased to present Version 2.0, which includes feedback, comments, and input from many experts and practitioners in the design and construction industry. Version 2.0 greatly expands and offers new content for several concepts in Version 1.0, such as legal issues in contracting, fast tracking, target-based design, cost estimating and control, specification development, and Building Information Modeling (BIM).

The design-build method of project delivery is now being used for all types of horizontal and vertical projects. However, the recommendations in this guide are most applicable to the design-build of vertical structures: buildings such as multi-family residential units, office buildings, high-rises, municipal buildings, places of worship, medical facilities, and schools.

The typical design-build project follows a predictable trajectory through selection, design, and construction. This guide is structured to follow these three basic phases, with an emphasis on the design-phase manager's role—along with helpful information and tools—in each phase.

You are encouraged to skip directly to those subjects that address your current interests and concerns. Each chapter includes suggested procedures that can be used immediately. References for further information and study are also included.



**YOUR INPUT  
IS WELCOME**

The Charles Pankow Foundation considers the Design Management Guide to be an ongoing and living document—refreshed every few years with new ideas, more helpful tips, and best practices of the design-build industry.

We welcome your comments!

Please contact us at [info@pankowfoundation.org](mailto:info@pankowfoundation.org) with any thoughts and suggestions to make this manual more useful.



## Contributors to Version 2.0

The first version of the Design Management Guide was compiled from the thoughts and best practices of many people throughout the design-build industry. The Charles Pankow Foundation wishes to extend its most sincere thanks to the valued contributors and reviewers of Version 1.0 of the Design Management Guide, and now the contributors to Version 2.0 who include:

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## About the Charles Pankow Foundation

The Charles Pankow Foundation was established in 2002 by Charles Pankow, founder of Charles Pankow Builders, Ltd., a leading U.S. design-build constructor and a pioneer in the practice of design-build delivery. It was Charles Pankow's lifelong passion to promote and inspire new and better ways to build. He intended that the foundation foster and support innovations in the architecture, engineering, and construction (AEC) industry. The foundation continues to advance Mr. Pankow's legacy of innovation in the design and construction of buildings.

Since the foundation began its research-funding efforts in 2006, approximately 50 major research projects have been funded. The research findings and recommendations of many projects have already been put into practice.

The Charles Pankow Foundation is proud to bring together the efforts of numerous subject-matter experts to produce Version 2.0 of the Design Management Guide. The foundation wishes to express its thanks to those individuals who contributed to this publication, to advance the start-of-the-art for one of Charles Pankow's greatest passions: design-build.

For more information, visit us at [www.pankowfoundation.org](http://www.pankowfoundation.org)





# DESIGN-BUILD, THE DESIGN-PHASE MANAGER AND TEAM

## 1.1

### The Design-Build Method of Project Delivery

*One of the key benefits of the design-build delivery model is that there is just one team responsible for design and construction, so any gaps between the two contracts become the responsibility of the design-builder.*

Studies have shown that design-build reduces the overall duration of projects, reduces the total cost, and—at a minimum—maintains the same level of quality relative to the design-bid-build model. As defined by the Design-Build Institute of America (DBIA), design-build is a method of project delivery in which one entity—the design-builder—works under a single contract with the project owner to provide design and construction services.

Design-build is an alternative to the more traditional design-bid-build method. Under design-bid-build, design and construction are split: separate entities, separate contracts, and separate work. In traditional design-bid-build delivery, and even in integrated project delivery (IPD), gaps between the two contracts become the responsibility of the owner. These gaps may increase the construction cost, which becomes the responsibility of the owner. In design-bid-build delivery, the owner ultimately holds the risk.

Here's how design-build works. At the outset of a project, the owner develops a vision, program goals and requirements. The owner also secures the resources (money, land, and time, for example) for the project. The owner then issues a Request for Proposals (RFP). While there are a wide variety of team selection methods in competitive selections, usually several design-build teams are selected to study the project requirements and develop priced proposals with firm commitments on project size, function, performance, quality, and delivery schedule.

Based on its selection criteria, the owner evaluates the proposals and selects the one that offers the best value. Using the contract terms and conditions in the RFP, the owner enters into a design-build contract with the successful design-build team.

Once a design-build team has been hired, the architects and engineers develop the proposed design and, when approved, translate it into construction documents, whereupon the builders construct the project. The design-phase manager ensures that both design and build functions conform to the design-build contract and meet the financial requirements of the team budgets.

One of the key benefits of the design-build delivery model is that there is just one team responsible for design and construction, so any gaps between the subcontracts become the responsibility of the design-builder. In many ways, the design-phase manager's role is similar to the role the owner traditionally fulfilled in design-bid-build delivery. Through the design-build contract, the owner has transferred the risk and responsibility of managing the design to the design-builder.

## 1.2 How Design-Build Teams are Structured

The design-build team can take many forms. While the design-build relationship can be embodied in a joint-venture agreement or LLC operating agreement, the most common approach is where the builder serves as the design-builder, and subcontracts with the architects, engineers, and other designers.

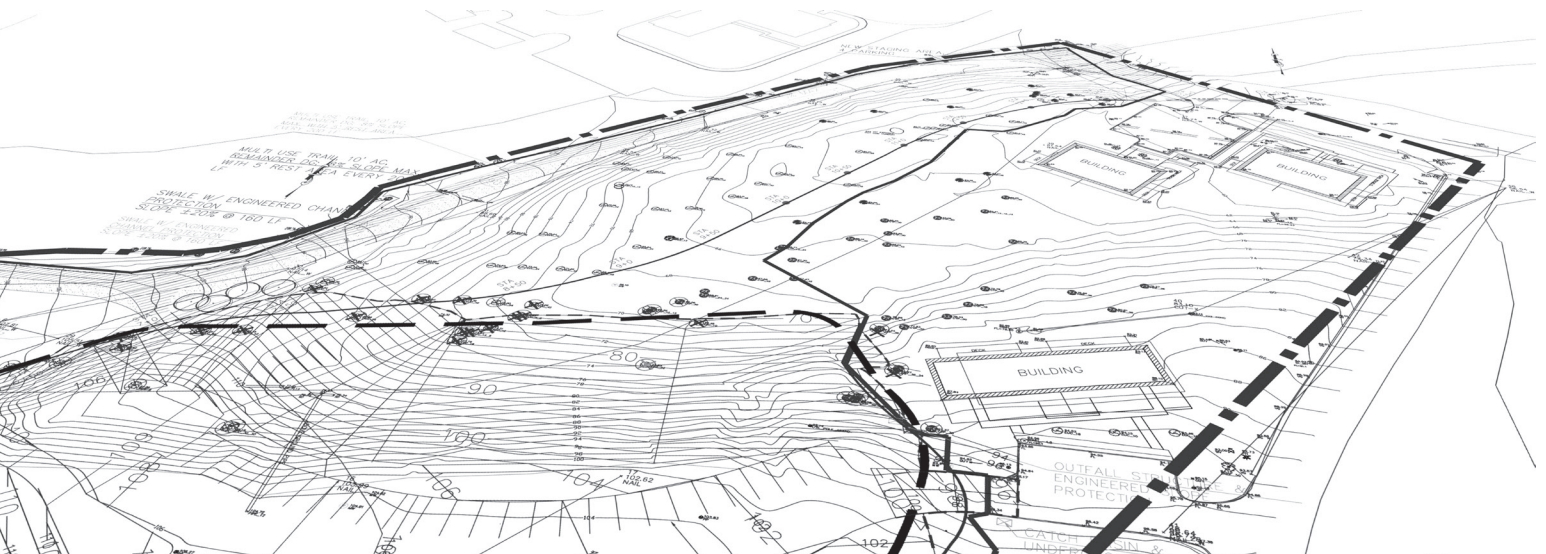
A second model is where a designer serves as the team lead, and subcontracts with the builder and other team members.

A third model is the integrated design-builder, in which the design-builder has both design and construction management in-house. These integrated firms are usually specialists who focus on specific market segments, but they often face many of the same challenges as a design-build team comprised of individual firms to collaborating on a specific project.

Design-build teams actually encompass the collective involvement of the entire construction industry. This involvement includes the builder's and designer's staff members, cost estimators, procurement specialists, vendors, suppliers, material-handling experts, manufacturers, and artisan craftspeople. The design-phase manager is expected to orchestrate the degree and timing of every member's contributions, as the need for their particular contribution evolves with the project development.

## 1.3 Role of the Design-Phase Manager

For purposes of moving the discussion forward, in this guide, we've assumed that the structure of the design-build team involves a design-builder who subcontracts the design responsibilities to design firms. Within this structure, the design-phase manager is typically an employee or representative of the builder, who is responsible for coordinating and integrating the design process.



The design-builder typically provides this service because it is the party at greater risk. The design-phase manager is the manager of this risk: the risk that the design is on time, on budget, is constructible, and satisfies the contractual obligations and the expected commercial outcome for his or her employer.

The design-phase manager does not assume the role of designer or builder. Rather, the design-phase manager coordinates the interface between the owner, the builder, and the design team.

The design-phase manager actually wears many hats and holds a number of unofficial titles as the project moves from early solicitation all the way through close-out. Each project phase demands unique management skills and experience. The proposal-phase manager, the design-phase manager, and the construction manager may be embodied in the same individual, but each role demands different competencies.

The design-phase manager ensures that the owner's objectives are realized, the design-builder's goals are met, and the design is integrated with the construction. Design management means shepherding the process of creating something out of nothing—through the exercise of one's intellect. This contrasts with construction management, which can be considered the science of creating something from something else.

These responsibilities are no different than what an owner would do if it was managing a design-bid-build project itself. The responsibilities are also what an architect or engineer would do in an integrated design-build firm or what a design firm that outsources the construction of the project would do.

What is different now, which inspired the need for this book, is that the design-phase manager role is still relatively new, since design-build delivery has not been around as long as design-bid-build. We are asking more and more individuals without design backgrounds, primarily in construction firms offering design-build services, to oversee some aspects of the design process.

### 1.3.1

*The design-phase manager conducts highly skilled, level-headed exercises of extraordinary organization every day.*

#### What the Design-Phase Manager Does

In the design of modern, complex structures, the two parts of a building's solution—design and construction—must be considered simultaneously. The design-phase manager takes responsibility for ensuring that both aspects are developed in unison.

Think of the design manager as an air traffic controller, constantly communicating with various aircraft and scheduling the exact moments for take-offs and landings. So it is with the design-phase manager. The design-phase manager communicates with the project's design professionals to schedule their design services to arrive exactly when needed to support construction. The design-phase manager conducts highly skilled, level-headed exercises of extraordinary organization every day.

The design-phase manager is really the design integrator, communication facilitator, and diplomat. As the project progresses, different participants will take the lead. The design-phase manager recognizes and empowers the most appropriate person to lead the process at any given point in the project's development.

Design-phase managers are leaders who comfortably and effectively communicate with both senior business executives and construction superintendents. Design-phase managers have a high degree of emotional intelligence and must instantly understand the subtle cues and adapt to the psychological, social, and cultural differences among project participants. The requisite skills are teachable but not necessarily intuitive.



A design-phase manager manages a project's design process—and helps guide it so the owner's objectives are satisfied. The design-phase manager delivers the design to meet the design-builder's overall schedule. The design-phase manager also guides the process so that the design will satisfy the design-builder's construction budget, and is executed within the constraints of codes, public safety/welfare, and "standard of care." This is done within the contractual obligations of the agreement between the design-builder and the owner.

Diplomacy is a prerequisite for the effective design-phase manager. An effective design-phase manager is able to simultaneously communicate with the left-brained creative design professional while translating those concepts to the right-brained, practical, problem solvers on the construction team. The design-phase manager finds commonality among the stakeholders' diverse positions. Positions that may at first appear irreconcilable can often be brought into agreement. Facilitating that agreement by identifying common points is a critical strategy for success.

The design-phase manager acts as the hub of the information wheel, managing the flow of project information in and out of the development of the design and construction. He or she makes sure that the architects, engineers, and builders have programmatic information, design direction, and owner buy-in, while providing the schedule and cost information to the team and to the owner, as required to keep the project on track.

### 1.3.2

#### **Difference between the Design-Phase Manager and the Designer-of-Record**

Design firms typically assign one person who is ultimately responsible for the content of the design, typically called the designer-of-record. The design-phase manager does not assume the role of designer-of-record.

Depending on the project or the design firm, the designer-of-record may be an architect or engineer. In addition to managing aesthetic and programmatic criteria, this person has professional responsibilities to assure the design meets codes, maintains public safety and welfare, and conforms to the standard of care of the industry.

The designer-of-record is the person on the design team who is officially responsible for the design. The designer-of-record must be assigned clear accountability for the work and the work product.

##### **The designer-of-record:**

- Produces and certifies plans and specifications.
- Makes sure the design is compliant with requirements of the RFP.
- Reviews shop drawings and submittals from subcontractors.
- Corrects errors and omissions.
- Incorporates select vendor documents to supplement their drawings and specifications.
- Coordinates owner design reviews and approvals.
- Coordinates sub-consultant designs and removes any conflicts.

The designer-of-record also assumes financial responsibilities to keep design costs within the limits of the contract and deliver the design within a specified time period. Some designers may even take on limited responsibility for the design to ensure construction costs meet a certain budget, with provisions for redesigning the project as necessary to stay within that budget.

The design-phase manager does not direct the design, but rather, supports the designers and the design process. The design-phase manager communicates overall project budget and schedule information to the design team to ensure that the design reflects budget and constructibility considerations.

## What Makes a Good Design-Phase Manager

- Trustworthiness, above all other attributes
- Integrity, ethics, and a reputation for fairness in the design and construction community
- Empathy with and enthusiasm for the project's goals and objectives
- Decisiveness (when necessary)
- Skilled at conflict management
- Goal-driven and open to challenges
- Level temperament and patience in working with others
- Willingness to give due credit to co-workers
- Familiarity with most methods of project delivery, such as design-bid-build, design-build-operate, engineer-and-procure, design-assist, construction manager at-risk, design-build, integrated project delivery
- Familiarity with the building type
- Training and broad experience in design and construction management
- Being a recognized professional in his or her chosen field
- Having a natural ability to direct creative professionals (both designers and builders) toward the project's objectives
- Ability to optimize and manage the motivations of many different entities (for example, able to simultaneously meet the owner's goals and produce a financially acceptable outcome for the design-builder)

### 1.3.3

## Design-Phase Manager Credentials

DBIA's professional education curriculum trains individuals in the best practices of design-build. Its professional certification programs have two levels of accreditation: Associate Design-Build Professional™ for the emerging professional, and Design-Build Professional™ for the design-builder with hands-on experience in pre- and post-award design-build.

In addition to having the proper training, the successful design-phase manager must have the leadership and management skills necessary to facilitate a successful process. The design-phase manager should be educated in design-build best practices, and should have multi-disciplinary fluency in architectural design, engineering, pre-construction processes, and construction processes.

The design-phase manager must also understand conceptual estimating and project scheduling. Managing a design-build project is different than a hard bid project, and the design-phase manager must clearly understand the contractual differences and risks undertaken by the design-builder.

### 1.3.4

## What the Design-Phase Manager Needs to Know

Each entity involved in a design-build project—owner, architects, engineers, builders, and others—has a business model that is structured differently, along with inherent cultural biases and ways of approaching the work. These differences are real. For a smooth-flowing, profitable project, the design-phase manager needs to know how to take these differences into account.

The main business drivers that must be considered are time, cost, quality, design value, dispute resolution, scope creep, and risk and reward. Each of these elements, if out of balance, can have a detrimental impact on the project if it affects the business performance of the other team members or the entity as a whole.

The design-phase manager needs to know how a design firm operates and produces its products. For example, designers typically bill hourly against the fee. If solutions are not realized in a timely manner or there are significant changes to the design, fees may be consumed before the work is complete, jeopardizing the quality of the design documents and the designer's profit expectations.

The design-phase manager also needs to know how to influence the process positively and help mitigate risks. The design-phase manager should understand and convey to the design team the requirements for each deliverable, along with the level of detail necessary to price, permit, review, and build the work.

*A successful design firm on a design-build team understands the processes and the motivators of the builder, and works cooperatively with them to minimize risks.*

Communication and collaboration are key factors in the success of the design-build project, and the design-phase manager needs to know how to foster close collaboration. More and more firms are using building information modeling (BIM) to produce the design. The design-phase manager should understand the various BIM software platforms and the needs of the design team.

The design-phase manager should also understand which software the specialty trades prefer to produce their work, and the formats required to record documents at time of project close out.

Design-phase managers also need to understand the relationships among the owner and the third-party owner's representatives (like independent construction managers, cost/audit specialists, estimators hired to review change order requests, and so forth), including responsibilities, fee structures, and personalities of key individuals. Knowing how these representatives influence the owner or how they will interpret the decision process is very important. A clear definition of responsibility should be established at the project inception to ensure that the third-party representatives are appropriately integrated into the team, with the same goals and objectives as the design-builder and owner.

The design-phase manager should be fluent with the terms of the prime contract and the obligations of the design-builder. They should have an intimate knowledge of the RFP and any deviations or exceptions that were identified at the time of the agreement. The design-phase manager should be able to distinguish between design development and scope creep and assure that no design has been presented to the owner before it has been vetted and approved by the design-build team. The design-builder should be able to recognize what constitutes deviation from the stipulated agreement and be prepared to present the change impacts to the owner when appropriate.

If the project is based on an owner-prepared conceptual design, the design-phase manager should understand where the risks are, what is sacred, and what is appropriate for an alternate or innovative solution. If there are deviations or exceptions, the design-phase manager should be able to resolve the design issue, get approval from the owner, and document the outcome in the contract.

The design-phase manager needs to get to know and understand the members of the design teams individually. Section 1.5 delves more deeply into the personality- and culture-related drivers of design-build team organizations.

### 1.3.5

#### **Alternative Ways to Staff a Design-Build Design Team**

A design-build team can be organized in a number of different configurations. In the pre-proposal phase, the design-phase manager should assess the needs of the owner, the capabilities of the design team, and the market conditions before selecting the best structure for the design-build team. Ideally, all major members of the team (including major specialty trades) are in place at the commencement of the process; however workloads, competition, or other market factors may preclude this arrangement.

In addition to architects and structural engineers, the design team may include specialty consulting engineers for the major system designs like mechanical, electrical, and plumbing. Specialty consulting engineers are on the team to provide schematic or design development documents, peer review functions, or complete coordinated design documents ready for bid. The level of development of the documents they produce must be identified at project inception. For example, are they to deliver bid-quality documents or will a specialty subcontractor be brought in to assist with design?



Quite often, independent consultants are used to create design development documents which are used to solicit a design-build specialty firm to complete the design and the shop drawings. The consulting engineer is then retained as a peer reviewer for the final system design.

Specialty firms are added to the team either through a true design-build relationship, design assist, or bidding. When a specialty firm is brought onto the builder's team, the design-phase manager must integrate the specialty firm's efforts with those of the designer's team of consultants and the owner to assure that the objectives are consistent and the efforts are coordinated. The development of documents for bidding, fabrication or construction should be delineated, so the architect and its team know which areas of the design may be developed by design-build subcontractors.

The level of detail that the architect provides can also vary with the project delivery strategy. Typically the architect produces design documents to a level of detail that allows the presiding authority to approve them for compliance with code and life safety concerns. The requirements for the review and approval of submittals should be discussed and documented with the owner and the design team, so that the proper entities review and approve the work, and avoiding miscommunication.

## 1.4 **Business Drivers under the Design-Build Model— and What They Mean for the Design-Phase Manager**

Under design-build, the business models and the roles played by the designer and builder have shifted, relative to design-bid-build and other traditional structures. Consider, for example, how risk and reward influences the design-build team's decision-making processes. The design-build team typically assumes additional risk that may occur from the design process. Scope creep, constructibility issues, and failure to meet design schedule deadlines can place the design-builder at risk and can negatively affect profit. A successful design firm on a design-build team understands the processes and the motivators of the builder, and works cooperatively with them to minimize risks.

### 1.4.1 **The Business of Designers**

The size and structure of design firms varies tremendously. Design firms can be small or large, private or public, sole proprietorships, partnerships, or corporations. Many of the larger design firms have active design-build programs with more than 100 design professionals. However, most design firms are small, privately held professional entities (with a dozen or fewer employees).

The design profession has undergone a significant change over the past two decades, with large and publically held architecture and engineering firms becoming larger and more prevalent. As this trend continues, the design-phase manager should understand that the risk model may change. Primary motivators may shift toward more profit and shareholder value, rather than design merit alone.

Architectural and engineering firms, regardless of size, do not have the same capitalization requirements as builders. There is usually not much equity at risk, unlike a contractor that must maintain a considerable asset base to guarantee a contract.

Architects and engineers offer their skills, talents, and intellect by the hour, typically at a 2.0 to 3.5 multiplier on direct personnel expenses—to account for overhead, marketing, training, and other non-billable time, as well as profit.

Profit is not a design firm's only motivator, of course. Other major motivators include peer recognition, developing a reputation for excellent work, and the intellectual satisfaction of creating a successful project. In fact, these other motivators, which may inform the desire to "tweak" (or enhance and improve) a design throughout the design and construction process, can compromise the project's and firm's profitability. Failure to achieve productivity goals is sometimes justified on the basis of design merit.

A design firm's insurance requirements differ from a builder's. A design firm's professional liability insurance is not insurance for minor errors (which occur), but for negligent errors and omissions of significant magnitude.

In design-build delivery, the design-builder assumes the majority of the risk for performance. In a builder-led design-build contract, the design firm's primary risk is to its fee at the outset of the project, and to its professional reputation. In a designer-led design-build contract, there is usually a capitalization requirement. In this case, the designer's business model may change from one of maintaining low equity to one with higher equity and capitalization. The designer must have adequate capital to meet the guarantee requirements of the contract.

Design firms do face risks: profitability (the ability to keep the lights on), and professionalism (the ability of its design professionals to maintain their licenses and practice their profession). Failure to perform can lead to an inability to obtain future commissions. Professional negligence, or failure to meet the industry's standard of care, can lead to censure or loss of license. If designers lose their professional licenses, they are out of business.

## 1.4.2

### **The Business of Builders**

Builders have a totally different business model than designers. Builders require substantial capital and credit at initial start-up. Construction companies are profit-oriented businesses, frequently evaluated and measured by their surety and their banker.

To achieve a reasonable return-on-investment, builders are forced to take higher risks. Higher risks can mean higher profits and, occasionally, considerable losses. Factors that affect profit and loss are sometimes unpredictable and subject to economic forces beyond the builder's control.

Generally, the more responsibility the builder has for the end results (quality, schedule, and cost), the more control it must exert over the design-build team. Generally, whoever can best manage the risk should also be in charge of mitigating risk.

Builders are naturally vigilant about unpredictable costs, which, by definition, include those inherent in unique and innovative design solutions. Too much caution in risk and cost control in the early stages of conceptual design may suppress good ideas before they can be fleshed out and demonstrate their ultimate value.

Construction firms can be small, medium, or exceptionally large. They can be employee-owned, privately or family held, or publically traded. Each builder's approach to risk may be different, depending on its business model. An employee-owned company, for example, may manage risk at every level in the company. A publically held corporation's upper management may emphasize risk management much more than its lower-level (non-owner) personnel, who have less incentive.

## A Design-Phase Manager's Guide to Becoming Familiar with Design Team Members

### From the Design Profession:

- Spend a significant amount of time on an active construction site to observe superintendents, field engineers, and inspectors.
- Become familiar with the professional and trade journals of the team's various disciplines.
- Sit in on a project risk adjudication conference in a contractor's office.
- Review planning with the project schedulers to understand the critical path through the project.
- Meet with the construction superintendents to understand job site logistics, site constraints, and system installation challenges.
- Talk with the trade subcontractors' foremen to understand how they maintain productivity and control quality.

### From the Construction Profession:

- Attend the architect's design presentation rehearsals and ask questions.
- Spend time in the studio observing and interacting with the design team to better understand the design process of iteration and exploration (i.e., how they produce the work).
- Sit in on a designer's marketing presentation and compare it to a builder's qualifications interview with an owner.
- Study the results of local and regional design award programs.
- Study profit and loss statements of design firms and construction firms.

## 1.5

### Cultural Differences under the Design-Build Model—*and Getting to Know the Team*

You don't have to be in the design and construction industry very long to know that the architectural designer and the construction superintendent are two very different people. The architect has to imagine a solution to a set of programmatic challenges. The builder has to create solid mass from a set of limited instructions, quickly and with an economy of means.

Somewhere between these two are the practical and solution-focused engineers. The engineers translate the imaginative architectural scheme into engineered design solutions. Then, the builders translate the design and engineering documents into detailed fabrication documents, fabricate the assemblies, and construct the building. Design involves iterative cycles, whereas construction is a largely linear process.

The team members of the architectural and engineering professions are culturally different from builders and are trained to approach problems differently. The successful design-phase manager must recognize these differences, understand the motivators that drive each member of the design-build team, and bring a commonality to the process, blending the disparate cultures into one high-performance team.

The design-build team members' individual job responsibilities, their training, their experiences, and their psyches are all well suited to their individual tasks. It is essential that the design-phase manager understand and appreciate these differences.

### 1.5.1

#### The Culture of Designers

Architects are planners, technologists, and aestheticians versed in the theory of built spaces, beauty, and artistic expression. They understand the role of symbolism in architecture and know how to express ideas in form, function, scale, decoration, and materials. Architects typically arrive at solutions through iterations, evolution, and refinement rather than by solving problems directly and immediately.

Self-performing builders may manage their business model differently from a general contractor (GC) that brokers some or all of the work. Self-performing GCs and subcontractors know that their bottom line is directly affected by their ability to manage the general conditions and labor elements of the project.

## Using Insights about Team Members to the Project's Best Advantage

- Understand the requirements, skills, and knowledge necessary to manage the design process.
- Understand how architects and engineers think, and how that affects design delivery.
- Recognize that participants have different objectives, motivations, and work culture perspectives.
- Understand how to help designers manage their fees and reimbursable expenses.
- Understand professional liability insurance for design professionals, and what it costs a firm or a project.
- Understand how other projects in the design firm affect its professional liability insurance policy, and how this impacts the project.
- Determine the necessary team culture for a design-build project, taking into account the different personalities of team members.
- Recognize team members' common traits, along with their areas of potential conflict.
- Learn how to communicate to drive behavior toward project objectives.

### 1.5.2

For instance, interpreting and integrating applicable code and other regulatory requirements into the design may take several iterations, as may integrating into the design the many building systems, assemblies, and components developed by manufacturers.

Engineers are trained to solve problems. They apply these techniques, as well as analytical skills and logic, to select and develop systems. Engineers are the critical link between project goals and reality.

Architects and engineers are licensed professionals. The public's safety, health, and welfare is the licensed design professional's paramount charge. Designers' professional responsibilities to the public can sometimes conflict with their obligations to satisfy the owner's criteria and the design-builder's business objectives. This can present a challenge.

Regardless of whom the design professionals work for, or who pays their fees, ultimately, a designer's first duty is to public welfare—and compliance with codes and standards of care. Licenses are granted to individuals, not to the companies that employ them. Design firms must operate in full compliance with these mandates.

The "Architect-of-Record" and/or "Engineer-of-Record" is the individual who signs and stamps each drawing and who is ultimately professionally responsible for each drawing's content. Generally, the stamp signifies that the drawing was prepared under their direct supervision.

### The Culture of Builders

Builders are often trained as engineers or construction managers, so they too are oriented toward action and tangible results. They tend to be factual and see things in the light of experience and probability of outcome. They are cost- and schedule-driven, and are typically more concerned with results than process, although the results are often driven by process. The best builders are highly organized and capable of orchestrating complex combinations of people, materials, and machinery to achieve a physical product.

Specialty contractors are often brought into a project to build parts of the project that require a higher degree of expertise (such as foundation construction, lighting, and mechanical systems). Specialty contractors are schedule-driven and solution-driven. For specialty contractors, important considerations include the availability of craft labor, prefabrication options, schedule, and cost. The specialty contractor may draw from in-house engineering capacity or may work with independent design consultants.

## Creating a Culture of Ethics

**How can the design-phase manager create a professional environment that meets an appropriate level of ethical decision-making?**

- Above all else, act ethically.
- Collect and publish the relevant professional ethics statements in the team members' handbook.
- Develop and publish specific rules on communications, confidentiality, favoritism, travel expenses, gifts, and workplace behavior.
- When ethical situations arise, candidly discuss the problem and the resolution with the team (without violating employee confidentiality).
- Address ethical violations by team members promptly and decisively.

### 1.5.3

## Putting Them All Together

Sooner or later in a design-build process, architects and engineers must understand the builder's means and methods. They must also understand the project's schedule and budget. Concurrently, the builder must understand the design process and the project's programmatic requirements.

Team members need to understand the work flow of their fellow team members. To do so effectively, the architect must learn what's involved in building, the builder must learn what's involved in design, and the engineer must learn about both. This oversimplifies the task, but the concept is clear: understanding these differences is a necessary foundation to developing and implementing efficient and effective design-management practices.

The architect's design concept will often challenge engineers to find a pragmatic resolution, and may test the builder's resolve to arrive at a cost-effective and on-schedule solution. With an integrated and collaborative approach to design and construction, these challenges can be addressed collectively and creatively, and resolved more quickly.

When confronted with strongly held but conflicting opinions from qualified team members, the design-phase manager must resolve issues quickly or the design effort will suffer. If not resolved in a timely manner, conflicts can have significant impact on cost and schedule.

Chapter 3 provides more in-depth suggestions on how to build and sustain a highly functional design-build team.

### 1.5.4

## The Ethical Imperative

Ethics are the guideposts that an individual follows to decide between right or wrong in everyday life. Ethics are personal. Ethics are unenforceable by anyone except the individual. They are useful when an individual meets the philosophical "fork in the road" and must choose a direction. Ethics provide the roadmap.

Professionals carry additional ethical responsibilities not demanded of the general public. Because professionals are qualified to make informed decisions based on their relevant training and experience, they are held to a higher standard. In their professional capacity, professionals are expected to act first in the best interest of those they serve.

In the practice of building design, differences between the interests of occupants and those of owners or the design-builders may be critically important, and should be examined carefully. Although the underlying responsibility to protect the health and



welfare of facility users is addressed in most states' professional licensing regulations, the ethical designer will look further than only the immediate requirements of the state.

The design-phase manager's responsibilities require that he or she be generally familiar with the ethical standards of the design disciplines within the industry. Early in the team's organization and mobilization, the design-phase manager should discuss standards of ethical behavior—and the consequences to the project, to the team, and to the individual for failing to adhere to these standards.

The design-phase manager and design leaders are expected to know and act in accordance with the ethical standards of their own professional disciplines. By fostering an environment where ethical behavior is demanded, the design-phase manager and team leaders will create a project that is most likely to embody the owner's needs, the design-builder's needs, and the building occupants' needs. These criteria serve at the very core of a successful project.



# DESIGN-BUILDER SELECTION

## 2.1

### Common Design-Build Team Selection Methods

*The design-phase manager has a vested stake in helping the team win the project.*

The selection process—by which an owner chooses its design-build team—is where it all begins. At this phase, the design-build team is typically formed, teaming agreements are put into place, and a preliminary design (with associated price) is created.

Generally speaking, a building owner may select a design-builder using any one of three criteria: cost alone, qualifications alone, or a combination of these two criteria in a process referred to as “best-value selection.” These three selection methods have many variations—for example, best design, fixed price, or others. The design-phase manager’s role will vary slightly depending on the selection criteria.

The design-phase manager has a vested stake in helping the team win the project. The design-phase manager will likely help assemble a team of design consultants and design-build subcontractors. In order to assemble a competitive team, the design-phase manager should understand the nuances of the various selection methods. Team composition should be optimized to the selection criteria the specific owner will use to evaluate the design-builder’s qualification statement and proposal.

### 2.1.1

#### Cost-Based Selection

As the name implies, the owner’s selection decision for a cost-based selection is heavily weighted toward the design-builder’s proposed cost of the project. In a cost-based selection, the owner will likely have several “threshold” or “pass/fail” criteria the design-build team must meet. For example, these criteria may include a minimum bonding capacity, specific professional and contractor licenses, location of proposer’s business, or areas of operation in a defined geographical area. Owners may also elect to limit the number of cost proposals they consider.

**For a cost-based selection, the owner’s Request-for-Proposals (RFP) may include:**

- Quantified facility requirements
- Performance and/or prescriptive specifications
- Schedule requirements
- Warranty conditions
- Form of design-build contract
- Maximum contract award amount (*total or unit cost*)

In addition to these fundamental criteria, many owners will include evaluation criteria that relate to quality, quantity, the building's functional efficiency, site logistics, security, and safety.

The owner may also elect to develop a "bridging design" prior to issuing the RFP. The bridging design consists of a detailed architectural design concept for the project. If used, the bridging design allows the owner some participation in design development. If not used, the design-build team assumes full responsibility for the project's conceptual and final design.

If the design-phase manager expects the owner to use the cost-based selection criteria, he or she should build a team that can meet the owner's objectives and RFP criteria **at a competitive price**. Upon award, the design-phase manager facilitates the process of motivating this competitively priced team to develop the project scope, schedule, and costs.

Once the owner and the design-builder agree on the scope, a guaranteed maximum price is developed that will guide the team forward. Often the work is broken down into distinct packages that trend the cost of the design as it develops and the impact on the schedule. At this point the design-phase manager assumes the responsibility of assuring that the final design documents reflect the agreed-upon scope definition, and that the project stays on budget and on schedule.

## 2.1.2

### Qualifications-Based Selection

The owner's decision for a qualifications-based selection is heavily weighted toward the qualifications of the design-build team to execute the project. A qualifications-based selection is similar to selections conducted in accordance with the Brooks Act. The Brooks Act is a United States federal law passed in 1972 requiring that the U.S. Federal Government select engineering and architecture firms based upon their competency, qualifications, and experience, rather than by price alone.

The cost may not even be considered when making the initial qualifications-based selection of the best design-build team. However, the fees for services will be negotiated following selection and before contracting.

**In a qualifications-based selection, the owner's decision is typically based on one or more of the following criteria:**

- Demonstrated overall competence of the design-build team in design and construction management. The team's reputation needs to be supported by relevant references.
- Qualifications (business and professional) of the design-build team, including, for example, the experience of team member firms with similar projects or building types; the experience of individuals proposed for specific project design and construction roles; previous positive experience with the owner; professional awards for design or construction excellence; and financial capacity.

In a qualifications-based selection, the owner typically looks to the design-builder to develop a conceptual design and then develop cost scenarios. Owners may elect to increase or reduce the scope of the project, based on how the cost scenarios fit within their budget constraints.

If the owner is expected to use the qualifications-based selection criteria, the design-phase manager should identify the best, most qualified team to propose on the project during the procurement phase. Upon award, the design-phase manager facilitates the process of motivating this high performance team to develop the project scope, schedule, and guaranteed maximum price.

### 2.1.3

#### Best-Value Selection

Under best-value selection, the owner considers both qualifications and cost when selecting the design-build team. Best value can be thought of as the measure (value points) of the quantity and quality that the owner may receive on a “cost per value point” basis. The relative value is clearly expressed and understood for technical innovation, design excellence, management capability, past performance record, and overall proposal value, including cost.

Best-value selection (and its variations) is the most prevalent means by which owners select their design-builders. The design-phase manager must understand the particularities of this selection method and how they will influence the project.

Subsequent sections and chapters within this guide are generally predicated on the assumption that a contract has been executed under a best-value scenario.

## 2.2

### Design-Phase Manager's Role during Selection

Major portions of the project design are often conducted during a best-value design-build selection process. Therefore, the design-phase manager has a very active role in the project's selection phase.

During the selection process, the owner defines its needs and resources (i.e., the program, site, budget, and schedule). In response, the design-builder, with significant input from the design-phase manager, organizes and coordinates a comprehensive team of designers, builders, specialty consultants, contractors, specialty contractors, vendors, material suppliers, and equipment manufacturers to develop a proposal that responds to these resource constraints for the owner's consideration.

The owner may or may not have already developed a preliminary design concept for the project. Regardless, the design development conducted during the selection phase is quite involved, starting from the announcement of the project by the owner and continuing throughout the life cycle of the selection process.

The design-phase manager should take the lead in learning as much as possible about the project, the owner, the consultants and staff, and the competition. The design-phase manager convenes design team leaders and other stakeholders to develop a strategy for pursuing the project based on the project information included in the announcement.

The design-phase manager develops a winning proposal strategy after considering the strengths and weaknesses of the competition and the design-build team. If shortlisted, the design-phase manager then prepares for the interview and determines how to add value to the conceptual plans so as to be ahead of the competition.

The design-phase manager is in charge of developing a proposal schedule and budget, as well as mobilizing the team that is involved in creating the proposal. It is the design-phase manager's imperative to stay ahead of the competition. He or she also needs to keep abreast of (and successfully meet) all of the current and changing guidelines and regulations that govern various parts of the project.

*The design-phase manager is in charge of developing a proposal schedule and budget, mobilizing the team that is involved in creating the proposal.*



## 2.3

### Phases of a Best-Value Design-Build Selection

In a competitive design-build selection based on best-value, the selection process goes through several phases. This section describes a typical competitive best-value selection process, but this scenario is only one of many courses the selection may take.

#### 2.3.1

##### Qualifications Package

The project owner issues a Request for Qualifications (RFQ) describing the project. The RFQ will likely include information on the building type, size, location, budget, schedule, and selected project delivery method.

The RFQ will also outline the owner's minimum requirements for the design-build team and list the criteria for selection. It prescribes the information necessary for a complete qualifications statement, as well as the submittal contents, format, and deadline.

The design-phase manager should analyze the owner's evaluation criteria and translate them into specific standards determining the choice of potential design team members. More about assembling a winning team is presented in Section 3.1.

To the greatest extent possible, the design-phase manager should guide the team to offer something extra beyond the minimum requirements set by the owner in the RFP. Some examples of desirable bonus features include: higher energy efficiency or higher LEED certification than required; additional functional spaces that would make the project more useful and efficient; and/or other amenities that the owner and building users will appreciate. The better the design-phase manager understands the owner's unspoken objectives, the more successful he or she will be in this effort.

Upon award of the project, the design-phase manager communicates the award announcement to the organization and executes a contract and notice to proceed with the owner.

During this selection process, the design-build team members will incur costs. The owner may pay an honorarium (or stipend) to cover at least a part of the design and proposal-preparation costs. Regardless, the design-phase manager should specify in the teaming agreement (see Section 4.2) how costs are to be borne and how the stipend will be distributed among the team members.



The design-phase manager then helps the design-build team put together the qualifications package and prepares the design team leadership for qualification interviews or interviews-with-concepts, as necessary.

**Typically, the owner’s criteria (not all related to the design team) will include such things as:**

- Design-builder’s experience in the design and construction of like facilities
- Number and type of past design-build projects that used the same team
- Designers’ design awards (for both aesthetics and sustainable design)
- Designers’ familiarity with local history, building regulations, and regional environmental conditions—especially important for architects, landscape architects, and civil engineers
- Design-builder’s bonding capacity, permanent staff, and principal office location(s)
- Team’s change order record and experience meeting initial budget and schedule objectives
- Qualifications of key personnel assigned to project (as indicated by certifications like AIA, PE, LEED, DBIA, or CMAA)
- Builder’s safety record
- Previous client satisfaction

The design-phase manager evaluates whether the remainder of the selection process will be based primarily on aesthetic, functional, cost, or schedule considerations, or variations thereof. With this evaluation, the design-phase manager leads the design team in initial conceptual design development and tentative system selections in anticipation of receiving the RFP.

## 2.3.2

### Owner's Shortlist

The owner—or a selection panel appointed for their knowledge of the owner’s project—evaluates the qualifications packages. This evaluation may include in-person qualification interviews with the design team leadership. It may even require a submittal or presentation of initial design concepts (often called “interviews-with-concepts”).

Based on these evaluations, the owner or selection panel typically selects three to five firms for its shortlist. For larger projects for which honoraria are offered, this shortlist will likely be limited to three finalists. Shortlisted firms are asked to prepare proposals, as described in the next section.

A word to the wise: the design-phase manager should start the design process early, even if information about basic project parameters is only preliminary or even just rumored. Do not wait until the RFP is issued, or the competition will have the advantage. An early start will also help the team identify the design challenges and refine its strategy.

If shortlisted, the design-phase manager asks the owner which competing design-build teams made the shortlist. After analyzing the competing teams with input from the design team, the design-phase manager reexamines the proposal strategy in light of the competitions’ strengths and weaknesses. If the team needs to be strengthened with additional members, members from the unsuccessful RFQ proposers may serve as potential candidates.

## 2.3.3

### Proposal Preparation

**The owner distributes the RFP, which will likely include, among other things:**

- Stipulations about honoraria to be paid for developing a proposal (as applicable)
- Facility requirements and performance criteria
- Project budget and delivery schedule
- Form of the contract, including insurance requirements and warranty conditions
- Proposal submittal requirements, including format, schedule, and deadlines
- Request-for-clarification procedures
- Information on pre-proposal meetings (as applicable)

The design-phase manager compares the project definitions and parameters in the RFQ with those in the RFP. If there are any scope ambiguities and/or a lack of technical specificity in the RFP, the design-phase manager needs to clarify these issues with the owner.

Typically, the owner holds one or more general information meetings (called “pre-proposal meetings”) for the proposers, at which the owner explains competition rules, conducts site tours, and answers questions. The owner may also offer one-on-one meetings with proposing firms.

If the owner offers private or proprietary pre-proposal meetings (which could be attended by the owner, the building’s users, and/or the selection panel), the design-phase manager organizes the design team to prepare a number of conceptual design sketches. These sketches are used during the meetings to elicit opinions of various design alternatives and expose any possible design preferences. The design-phase manager should debrief the team immediately after the meeting(s).

The design-phase manager then guides the team in evaluating and preparing conceptual designs to include in the team’s proposal. The design process is described in more detail in Chapter 7.

The proposal preparation process includes pricing the conceptual designs to determine if the team can add value to the design-build proposal; evaluating the balance of risk and reward of the conceptual designs compared to the respective order-of-magnitude cost estimate and the potential fees for the project; and identifying the resources necessary to complete the proposal, including additional team members.

The RFP dictates the deliverables that will be evaluated. Generally, it is wise not to exceed the specified level of detail to maintain design flexibility if selected.

While the RFP will likely require only the submittal of schematic design documents, the reality of lump-sum design-build proposals is that additional design documentation may be needed to allow the design-builder to price the project with a reasonable level of risk.

During proposal preparation, the design-phase manager tracks the design development and proposal production schedule. He or she regularly reviews the proposal strategy in light of the design progress and any information gathered about the owner, selection panel, and competing design-build teams. The design-phase manager also periodically validates that the design-in-progress meets the owner’s requirements.

The design-phase manager should consider the use of modeling software for construction phasing, along with general and detailed renderings. In this case, he or she devises a building information modeling (BIM) strategy, as discussed in Section 7.2, and communicates it to the design team. This strategy may include energy modeling.

*Often, communication skills and personal chemistry between team members is essential.*

### 2.3.4

#### **Interview**

Most owners require the design-build team to make one or more in-person presentations of its design proposal to the selection panel. This presentation is typically called an interview.

There are several important reasons why an owner conducts interviews. Interviews give the proposer an opportunity to expand on information in the proposal. Interviews also allow the owner to meet the people who will potentially be involved in the project. Often, communication skills and personal chemistry between team members is essential. Many owners base their final selection decision on a combination of the proposal and the presentations.

### 2.3.5

#### **Award**

The owner evaluates and scores the design-build proposals and interviews, and selects the preferred design-build team. The owner then issues a “Notice of Intent to Award Contract.”

Regardless of whether the team is selected or not, the design-phase manager should personally thank team members for their efforts. For a winning effort, the design-phase manager schedules a kick-off meeting with all team members, including the owner, to validate the design and scope, and to explore any alternatives or preferences. And don’t forget to celebrate!

If sustainable designs are applicable to the project, the design-phase manager must understand the Leadership in Energy & Environmental Design (LEED) certification requirements and sustainability goals. He or she then develops a standard checklist on how the design team can achieve the required standards. More about creating a sustainable design is presented in Section 7.4.

Ideally, the proposal identifies and addresses any issues that the owner may encounter after the project is complete and ready for occupancy. The design-phase manager helps the design team imagine these potential problems so they can include solutions in the proposal.

Before finalizing the proposal, the design-phase manager reviews the risks, fees, contingencies, and costs with senior management in order to finalize the proposal cost estimate.

If practical, key representatives of the entire design team co-locate for the duration of the proposal-preparation process. Co-location helps to maintain design progress, privacy, and confidentiality among the team members, staff, subcontractors, and vendors. If co-location is not practical, the design-phase manager evaluates how the team can approximate a co-located working environment.





# BUILDING AND SUSTAINING A FUNCTIONAL AND SUCCESSFUL DESIGN SOLUTION

## 3.1

### Assembling the Design Team Based on the Owner's Needs

*The design-phase manager assembles a design and construction team that has exceptional talent, skill, and capacity for the project.*

The design-phase manager assembles, and then manages, a highly collaborative team that is laser-focused on a single target and unified by a “failure is not an option” attitude.

#### The design team is assembled to:

- Maximize the likelihood of making the owner’s shortlist in a competitive selection process.
- Be professionally compatible with the design-builder’s organization and other team member firms.
- Have ethical business practices and sufficient production capacity.
- Be committed to a common teaming agreement, contracts, and fee levels within the normal competitive range.

If the selection is competitive—meaning that multiple design-build entities are vying for the project—the design-phase manager will be guided by criteria in the owner’s RFQ and RFP. If the project is being awarded sole-source—meaning that there is no competition—the design-phase manager may use his or her own judgment, with guidance from senior managers and trusted advisors. The design-phase manager may be able to solicit input from the owner on which designers should be considered for the design team.

Regardless, the design-phase manager assembles a design and construction team that has exceptional talent, skill, and capacity for the project. It’s best to assume that the competition will also have excellent design credentials. Subject to budget considerations, try to offer more and better design talent in every discipline, more than the owner ever imagined it could attract to the project. Setting the qualifications or talent bar high in the owner’s mind—and then meeting or exceeding expectations—will give a favorable advantage during proposal evaluations.

### 3.1.1

#### Primary Design Consultants

For a building project, the primary designer is usually the architect, or perhaps the architect-structural engineering team. The design-phase manager may use a formal selection process to evaluate the suitability of prospective design members and select the most appropriate team. Alternately, the design-phase manager may assemble a team based on previous working relationships or other less formal means.



## Typical Specialty Design Consultants

- Civil and structural engineering
- Mechanical and plumbing engineering
- Electrical engineering
- Landscape architecture
- Interior design
- Geotechnical engineering
- Food service
- Sustainability (green) design
- Audio-visual, information technology (IT), and communications
- Cost estimating and value engineering
- Traffic engineering
- LEED certification
- Facility operations
- Building safety and security
- Building information modeling (BIM)
- Theater and lighting design
- Parking
- Envelope (roofing and moisture protection)
- Vertical transportation and conveyance
- Fountain and swimming pool design
- Cultural advisors
- Graphic and signage design
- Permit application specialists
- Design-build competition advisors
- Anti-terrorism force protection
- Acoustic and vibration
- Electro-magnetic interference

### 3.1.2

In a formal selection process, the design-phase manager develops and distributes a request for expressions of interest (REI) to targeted design firms.

**The REI will likely consist of a request for the design firms to outline their qualifications, including such criteria as:**

- Years of experience in the building type and experience on design-build projects
- Compatibility of team members to collaborate in the design-build environment
- Direct experience on past projects with the owner or other design team members, including past awards/recognitions or disputes/claims between parties
- Minimum value or size of previous projects
- Fee structure
- Cultural diversity, community involvement, and location of the firm's principal office
- Current workload commitments, staff size, and availability of key staff for the project

The design-phase manager evaluates the expressions of interest based on factors that reflect the selection criteria, weighted to reflect the owner's project objectives. The design-phase manager then reviews these evaluations with the senior managers who are responsible for selecting key design team partners.

### Specialty Design Consultants

Specialty design consultants are experts that deal with narrowly-focused but crucial elements of the facility's design. Specialty consultants may be selected in the owner's RFQ or identified by principal architects and engineers on the design team.

Similar to how the primary design team is assembled (as discussed in Section 3.1.1, above), the design-phase manager can use a formal or informal selection process to evaluate the suitability of specialty consultants. Specialty consultants should always be selected in consultation with principal design team members.

The design-phase manager develops a short list of qualified consultants early and determines their availability and willingness to be exclusive to the design team for the project. If the specialty consultant involves the owner's core business (such as kitchen consultants for a restaurant owner, or a hospital consultant for a healthcare organization), the design-phase manager should involve the owner in the selection.

Based on the nature of the project and contract, the design-phase manager determines which specialty consultants will be included on the architect's team and which will be contracted directly by the design-builder. In traditional design-bid-build contracts for buildings,

the architectural firm serves as the lead designer, and all specialty design consultants are subcontracted to the architect. The design-builder may elect, however, to subcontract directly with the structural engineer, or the mechanical/electrical engineers, or with a design-build specialty subcontractor.

Specialty consultants' fees are not normally included in the cost of architects' or engineers' basic services. Therefore, the design-phase manager should investigate these costs early in the planning and budgeting process. If they are included in the designer's fee, the scope and value of the work should be clearly delineated.

If there is to be a specialty consultant and a related specialty design-build subcontractor (for example, a geotechnical engineer and a foundations contractor), the design-phase manager should clearly delineate the scope of work of each, to ensure all scope is covered and there is no redundancy of effort.



#### FOR MORE INFORMATION:

The DBIA's Manual of Practice #308, *Design-Build Teaming Agreement Guide*, provides good information on the selection of team members, possible organizational structures of the design-build agreement, team roles and responsibilities during the proposal phase, and termination of the teaming agreement. The design-phase manager should consider using the DBIA Teaming Checklist (included in the Manual of Practice #308) to develop a teaming agreement that addresses the unique factors of the particular project at hand, and the design-builder's own policies on design consultants and subcontractors.

## 3.2

### Motivating the Design Team and Engineering Trust and Respect

Design is a complex intellectual and creative process, and motivating creative people is challenging. To achieve results in a design team environment, design-phase managers need to understand the nature of creativity, the effects of rewards on creative performance, the individual personalities of team members, and the way individuals interact with each other as a creative organization.

**Designers (collectively, architects, engineers, and specialty consultants) are motivated in four basic ways:**

- Intrinsic: The nature of the work itself, the chance to express creativity, and individual interests and passions
- Extrinsic: Money, professional recognition, awards, praise, and appreciation
- Personal: An individual's own personal values and self-discipline
- Interpersonal: Creative collaboration with and recognition by other individuals

The design-phase manager uses these fundamental aspects to gain insight into a designer's motivations and to propel the design forward in a manner that rewards them personally and professionally while continuing to align with project goals and objectives. When design professionals are motivated, the product is likely to be superior.

Even when the design team is comprised of professionals with the same basic goal, there's no guarantee that each person—or each organization—will automatically work well together.

*When design professionals are motivated, the product is likely to be superior.*

Because of work cultural differences, for example, architects and engineers may have some difficulty working together. Similarly, design firms may be team members on one project and adversaries on another. “Bad blood” from previous competitions may spill over into the current project.

The design-phase manager needs to establish trust and respect among people who may be misaligned—or worse. One effective technique is to establish a physical location where the team works together, and encourage all project-related work to be done at that site. If a single workspace is not practical, designate a project workroom or conference room where meetings can take place and where all current plans, reports, reference documents, and other information are available to team members.

Establishing a culture of accountability is important in helping team members gain mutual respect. In a successful project, each person is held accountable for tasks and schedules, with the understanding that failure to perform on an individual basis is failure for the entire team. Praise accomplishments, privately and in the presence of the design team. Reward accomplishment of objectives such as meeting a milestone schedule event or delivering a successful client presentation. Deal quickly and directly with problems, and be prepared to go as far as replacing team members, if necessary, to ensure harmony and productivity.

Another essential strategy is getting to know individual team members, regardless of rank or responsibility, and helping them get to know each other more personally. For complex projects, consider engaging an outside expert (such as a professional facilitator or corporate team coach) to help create a team culture before design-phase activities begin.

If needed, have the expert facilitator continue to interact with the design team throughout the design phase. The use of a professional facilitator may help the design-phase manager avoid the perception that he or she is manipulating the team to his or her (or his/her respective firm’s) advantage. A professional facilitator can also conduct team-building exercises and serve as an impartial guide for the process.

Consider using a personality profile exercise to encourage people from different disciplines to understand each other. Understanding another person’s tendencies and motivators can dispel adversarial “good-guy/bad-guy” attitudes. A well-balanced and healthy team is almost always more successful.

Establish regular social get-togethers and events (group sporting events, happy hours, etc.) during the project, so team members can have fun and enjoy each other in a non-work environment. Trust and friendship among peers are essential for a healthy and productive work environment.

*In a successful project, each person is held accountable for tasks and schedules, with the understanding that failure to perform on an individual basis is failure for the entire team.*

## 3.3 Kick-Off Strategies to Begin the Job Right

A successful design-phase manager knows the importance of planning and implementing several key preparatory steps at the project's outset. These actions will pay many dividends later in the smooth and efficient functioning of the design team and in the quality of the design itself.

### 3.3.1 Mission Statement and Team Chartering

A team charter, by definition, is a document developed in a group setting that clarifies team direction while establishing boundaries. The charter encourages understanding and buy-in, and should be developed early, during the formation of the team.

The purpose of a team charter is two-fold. First, the team charter serves as a source for the team members to define the mission, vision, focus, and direction of the team, and to clearly identify the members of the team and their roles and responsibilities for efficient execution of projects. It also outlines operating guidelines for the entire team, which include communications, participation, and outside party involvement. Second, it educates others (non-team members) on the mission, structure, and operation of the team.

In a design-build environment, the design-phase manager is the individual responsible for facilitating the development of the team charter and ensuring that it stays up-to-date.

### 3.3.2 Project Vision

All building projects start with a vision—grand, modest, practical, or somewhere in between. The vision presents a conceptual image of the future as the project's stakeholders might imagine it. This is where a design starts, and, in the end, the criteria by which it will be judged.

The design-phase manager, with support from key design team members, takes a lead role in documenting the owner's vision. Therefore, it will be essential for the design-phase manager to obtain a vision statement from the owner, either through the RFP, discussions with the owner, and/or other preliminary communications. The design-phase manager then works with key design team members to translate the vision statement into design-appropriate project goals and objectives. These goals and objectives are confirmed with the owner, and then communicated back to the design team. The design-phase manager should later communicate to the team the resulting project deliverables and requirements, including review sets, bid sets, permit sets, and construction documents.

Throughout the design, the design-phase manager and key design team members will conceptually evaluate the project's design against the vision. The design-phase manager might consider developing a project poster with relevant graphics to provide a constant reminder of the team vision. Remember—the end result and satisfaction derived will relate directly to meeting the common vision.

### 3.3.3 Performance Expectations

Performance expectations are the articulation of the project vision into specific roles and responsibilities for each of the design team members. Performance expectations, along with the project vision, help define a successful project.

To arrive at a workable set of performance expectations, consider having each project stakeholder express to the team how he or she would define project success. Stakeholders might include, for example, the owner, architects, engineers, the builder, major subcontractors, specialty consultants, end users, and maintenance staff. Similarly, consider having project stakeholders identify their top three risks and/or concerns related to the project's success.

A professional facilitator may help the vision-setting and performance expectation-setting processes more efficiently than the design-phase manager, because, if the design-phase manager serves as facilitator, it may be difficult for him or her to participate effectively as an individual.

The design-phase manager should consider implementing a process for periodic evaluation of team member performance against performance expectations, a process to correct performance deficiencies is a must. Periodic management meetings focused solely on performance, along with periodic team performance surveys can inform performance evaluation discussions. An ongoing performance recognition program can be beneficial and motivating.

### 3.3.4

#### **Roles and Responsibilities**

Roles and responsibilities within the design-build team need to be clearly defined when the design process starts. The design-phase manager takes the lead in developing a customized organizational chart that will inform the project's design process.

**Design firms can have a variety of job titles for the same function. Design-phase managers should confirm that they understand:**

- Exactly what each title and role on the organizational chart means
- Who is responsible for what tasks
- The layers of authority in each of the member firms
- Each person's individual level of authority
- Who can make both design and business decisions

**Some pertinent questions to explore with each firm:**

- How is the company organized? How might this affect the design-build team's organization?
- Who has decision-making authority?
- What are the team's and individual staffs' talent sets?

The design-phase manager should also consider if a conceptual contract briefing and risk allocation discussion would be beneficial at this stage of the project. This discussion would inform all project participants of the risks and responsibilities assumed by each of the other participants.

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## 3.4

### **Achieving Collaboration**

Design is essentially a collaborative process among equals. Unlike analytical thinking, design collaboration is a creative process based around the "building up" of ideas. There are no judgments early in the process. This eliminates the fear of failure and encourages maximum participation in the initial concept phase of design.



*A successful design firm on a design-build team understands the processes and the motivators of the builder, and works cooperatively with the builder to minimize risks.*

### 3.4.1

#### **The design collaborative process is continuous and occurs in several phases:**

- Program definition and refinement
- Research into appropriate building prototypes and systems
- Conceptualization of multiple design schemes incorporating constructability considerations
- Refinement of several promising concepts
- Selection of a single concept with owner, user, and builder involvement, as appropriate
- Incorporation of contributing concepts from each discipline (including the builder) that support and expand the initial concept
- Documenting the refined concept into design and construction exhibits, with periodic checks for feasibility, code compliance, project budget, and alignment with the owner's expectations
- Acknowledgement of the owner's stated objectives for budget, schedule, quality, and operational constraints

The design-phase manager is responsible for facilitating collaboration among the design team, builder, owner's staff, and end users, as appropriate.

#### **Team Collaboration**

The design-phase manager can use a number of tried-and-true techniques to foster collaboration during the creative design process. The design-phase manager determines the likely participants for each stage of design collaboration, while remaining flexible enough to add members as the design progresses and needs are defined.

During the early stages of design, the idea-sharing process is informal, among a few design team members. The design-phase manager institutes "brainstorming" sessions involving a wide array of team members and invites suggestions and criticism without regard to rank or responsibility. The design-phase manager allows all team members to participate, regardless of their formal roles. He or she praises creative and resourceful suggestions, even if they are eventually found to be impractical.

Collaboration gradually increases in complexity and participation, as various disciplines are invited into the process. The design-phase manager facilitates pin-up sessions where critical team members have an opportunity to contribute to the process. Pin-ups should include major design professionals and builders, project managers, estimators, construction superintendents, and quality control personnel.

At the key milestones, the design-phase manager presents the developing concepts to the owner and the building user group to check for direction and receive user feedback.

A design-phase manager can use exercises to help team members view the design and its components from frames of reference other than their own. For example, her or she might ask the designers to define individual design problems for the team before they present solutions. Or he or she might ask the designers to show photographs or illustrations of historical examples of the subject building type.

After intra-team design presentations, ask recipients to summarize verbally what they heard and saw, and to conceptualize how the design scheme might be further defined within their own disciplines. The owner/client/user representatives can be included in some of these exercises.

### 3.4.2

#### Importance of Communication

People communicate with each other in many different ways and this holds true on design projects. Poor or non-existent communication is at the root of many misunderstandings, missteps, and misdirection. Effective communication, conversely, can be one of the most powerful tools a design-phase manager uses to improve collaboration and thus achieve an excellent design.

One of the key benefits of the design-build method of project delivery (compared to design-bid-build) is the opportunity for key participants to communicate with each other earlier and more frequently. The design-phase manager should use frequent communication with key players to his or her distinct advantage.

The design-phase manager must develop a strategy to engage owners, designers, subconsultants, contractors, and subcontractors in optimal communication. He or she establishes the systems, protocols, and expectations for beneficial communications among team members. He or she also verifies that all team members buy into and are proficient in the use of these communication protocols, thus vastly improving collaboration.

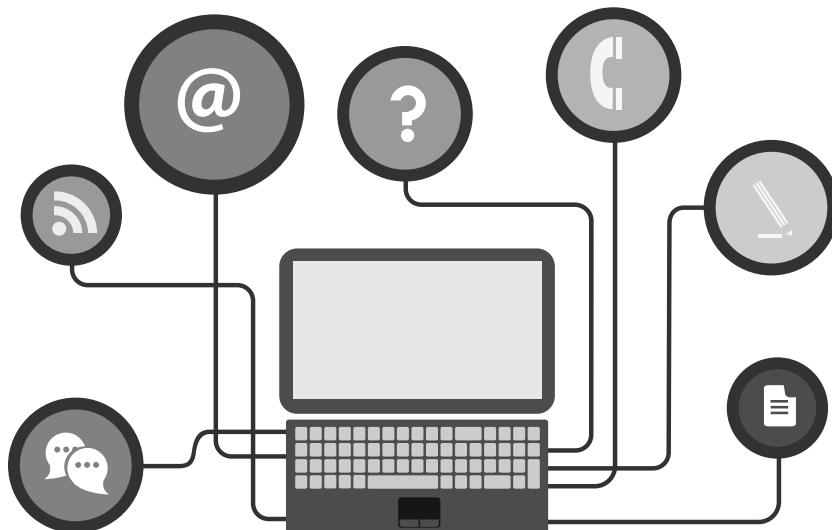
### 3.4.3

#### Information Management and Electronic Communication

A number of powerful tools are available to the design-phase manager to help guide the flow of information and facilitate communication. The trend in the industry is to rely on electronic tools for team communication and record keeping. These tools include Building Information Management (BIM), virtual mock-ups, project-specific websites, and file-sharing platforms, to name a few.

Often these tools are used to give the owner in-progress status information. Each of these tools requires a strategy and protocols, developed by the design-phase manager, tailored to the design team's needs and priorities.

At the outset of the project, the design-phase manager ascertains the most applicable communication and file-sharing software available to the team and establishes guidelines for use across all disciplines. Concurrently, the design-phase manager establishes an electronic storage location with open access for all team members, such as a cloud-based file sharing and collaboration site.



*The design-phase manager is the single most important project participant, connecting the design team to the construction team.*

### 3.4.4

The design-phase manager organizes an electronic file structure and determines who will manage it, then creates a document distribution and tracking process for both hard copies and electronic media. A project-specific website may also be created. The design-phase manager decides who will provide the labor and resources to build and maintain it.

Computer-aided design and drafting (CADD) and BIM standards and procedures are established during the initial design stages and maintained through construction. The design-phase manager assigns staff to lead and manage the BIM model effort along with the creation and implementation of a comprehensive BIM plan.

Each individual design discipline is responsible for contributing to the BIM. BIM is most often used for coordination among disciplines and for “clash detection” to discover elements that are trying to occupy the same space at the same time. The design-phase manager determines the file formats and submittal schedules.

Email is a highly useful tool, but it can also waste time, become overwhelming and disorganized, and result in postponed decision-making. **The design-phase manager is perfectly within his or her bounds to establish email protocols, including:**

- What types of issues require a meeting or conference call in lieu of an endless email chain
- When “Reply All” should be used (versus a direct response to the sender), and when the design-phase manager should be copied
- Whether only one subject (versus multiple subjects) should be addressed at a time, along with instructions on what to include in the subject line so distinct issues can be tracked more easily
- How emails will be stored and retrieved (i.e., stored in one place for the entire project versus stored in individual mailboxes)

In fact, many advanced cloud-based collaboration platforms have tools built in that preclude the need for excessive emailing, while consolidating and maintaining relevant communications in one centralized, accessible location.

### Meetings during the Design Process

Meetings (either in person, or via telephone or video conferencing) can be a highly effective way for people to share creative ideas, resolve issues rapidly, and propel the project forward collectively. However, meetings can also de-motivate and frustrate people if they are unfocused and/or too frequent.

#### Meetings may be needed for:

- Contract-required review cycles with the owner or others
- Owner-initiated meetings to review design concepts and make design-related decisions
- Integration of owner-initiated scope changes
- Regular team gatherings to discuss logistics and progress
- Project reviews, criteria compliance reviews, code analysis and compliance reviews, constructability reviews, cost and estimate reviews, and peer reviews

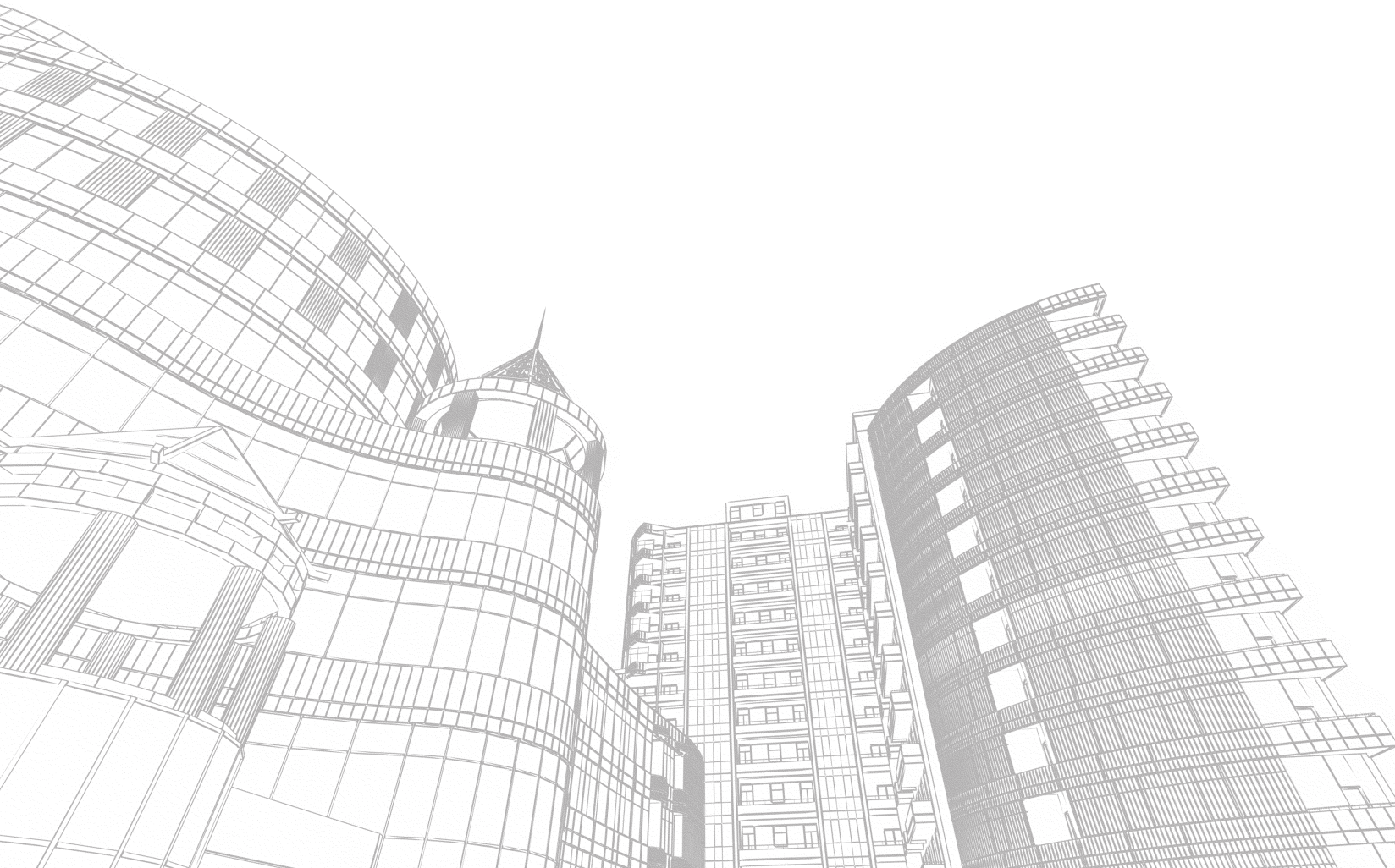
For each meeting, the design-phase manager should evaluate potential attendees to ensure that the appropriate people participate. He or she must balance between inclusiveness and wasting people's time.

**When planning or conducting meetings, key questions the design-phase manager should consider include:**

- Are any key people missing?
- Is the group too large?
- Are focused break-out sessions desirable/necessary?
- Are new team members being effectively integrated into the existing team?

Depending on the formality of the meeting and the attendees, the design-phase manager should also determine what meeting protocols are appropriate—for example, whether there is a formal presentation, or whether formal documentation (minutes) is needed. An agenda ensures that a meeting stays focused and on track, and meetings should always start and conclude on time.

Consider that the ultimate decision-makers may not attend a meeting, but can influence the team's performance at inopportune times. Therefore, the design-phase manager should set up communications protocols that keep key decision-makers in the loop, so that they can weigh in at important milestones or decision junctures. In doing so, the design-phase manager should avert inconvenient and potentially costly surprises throughout the design phase.





# CONTRACTS AND SUBCONTRACTS

## 4.1

### Best Practices in Contracting for Design-Build Services

*Merging design and construction brings to the forefront design reviews, design ownership, and design accountability, among other issues, and the contract must address them.*

One of the biggest mistakes participants in a design-build project can make is to think of the design-build contract as simply a variant of traditional design and construction contracts.

Some terms—such as indemnity, time extension remedies, and default—are similar across project-delivery methods. **However, the design-build process raises unique issues and questions between the owner and the design-builder that contracts and subcontracts need to address:**

- Which design submittals will the owner have the opportunity to review and approve?
- If the design-builder is terminated, does the owner have the right to use the design documents?
- If the original design-build contract is terminated, can the owner require an assignment of the subcontract with the lead architect/engineer to another design-build team?
- Can the design-builder rely on design documents the owner provides during the selection phase of the project, and does it assume the risk of errors in such documents?
- Can the design-builder bill for additional time spent developing a design for owner-requested changes in the work?
- Who assumes the risk of a change in law or regulations that requires design modifications after a lump sum design-build contract has been signed?
- What's the standard of care for design, particularly when there are performance specifications and guarantees in the design-build contract?
- Will the owner impose fee retention on the design billings? This is uncommon for most designers, and may need to be negotiated as part of the subcontract.

Typically, these would not be major issues when the owner holds separate contracts with its builder and designer. Merging design and construction brings to the forefront design reviews, design ownership, and design accountability, among other issues, and the contract must address them.

The differences in design-build contracts (compared to other types of contracts) do not end with the prime design-build contract between the owner



and the design-builder. They carry through directly to those working under (or with) the design-builder, and in particular, to the lead design firms.

The design-phase manager often takes the lead in facilitating the development and negotiation of these agreements. He or she may enlist the assistance of appropriate contracting or legal staff, as applicable.

As a starting point, the design-phase manager should recognize that there are some widely recognized best practices associated with design-build contracting that establish a foundation for effective contracting and team development. **DBIA's *Design-Build Done Right: Best Design-Build Practices* (March 2014) articulates three specific best contracting practices:**

- All contracts should be fair, balanced, clear, and supportive of the design-build collaborative process.
- The contract between the owner and design-builder should address the unique aspects of the design-build process, including expected standard of care for design services.
- The contracts between the design-builder and its team members should address the unique aspects of the design-build process.

In addition to these three major contracting best practices, *Design-Build Done Right* identifies a number of suggestions on how to implement these best practices, which will be discussed where appropriate in the sections that follow.

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## 4.2 Teaming Agreements or Memoranda of Understanding during Selection Process

To establish a successful working relationship among the team and enable each party to realize the benefits of its contract, the builder and designers should establish a "teaming agreement." Teaming agreements are specifically called out as one of the implementing techniques for DBIA's best contracting practices.

Section 3.3.1 introduced the concept of developing a mission statement and charter for the team. The teaming agreement is founded on those core principles, while providing more structure and detail to the tenets outlined in the charter.

Teaming agreements are relatively simple contracts documenting the roles of the team members, how they will work together, and how the team will manage itself, particularly during the proposal process. A well-crafted teaming agreement will also address what happens if the proposal is successful.

There are a number of industry resources available that help parties establish design-build teaming agreements. DBIA has a design-build teaming agreement guide as part of its Manual of Practice and, in 2012, published a model teaming agreement as part of its design-build contract suite (DBIA Document No. 580, Standard Form of Teaming Agreement between Design-Builder and Teaming Party). AGC and AIA have developed similar documents.



Negotiating a teaming agreement provides an excellent opportunity to discuss and address the unique aspects and risks posed by the particular design-build project, and to put in place a framework for dealing with the various issues that may arise during the project. DBIA recommends the following as a specific implementing technique:

“The design-builder and its designer(s) should develop an understanding, at the outset of their relationship, of the key commercial aspects of their relationship, including: (a) the designer’s compensation, if any, during the proposal period; (b) the designer’s role in reviewing/approving the proposal; (c) the contractual liability of the designer for problems, including delays, during execution; and (d) the designer’s right to use project contingency for its execution-related problems, and capture these understandings in the written teaming agreement.”

### Some Items to Address in the Teaming Agreement (in no particular order)

- The structure of the team (i.e., prime-sub, joint venture)
- The level of design that will be performed by the designer to support the proposal effort, and areas where specific estimating contingencies may be needed to address quantity growth, permit uncertainties, or other factors
- The designer’s involvement in establishing the proposal price and associated contingency factors
- The builder’s involvement in the design process
- A decision/authority tree that outlines who provides leadership and how disputes are resolved
- The production schedule, scope of work, and deliverables (interim and final), along with assignments of roles and responsibilities to member firms and individuals
- Commitments to confidentiality and exclusivity as discussed in Section 4.2.1
- Identification of any proprietary systems or processes
- A discussion of cost allocation, shared compensation, and cost assessment should a member firm drop off the team before the proposal has been completed
- Standard language and/or a draft of the formal subcontract as outlined in Section 4.2.2
- Meeting frequency and methods of communication between in-person meetings
- Communication technology, common drawing, and text formats to be used
- Coordination and administration of the proposal preparation effort (including stipulation of a “home-base” for production of the design proposal and the means by which the proposal will be prepared)
- Analytical requirements such as engineering analyses and energy models
- Presentation requirements, such as physical models, virtual models, or renderings
- Principals’ in-person participation in owner interviews
- Stipulation on how stipends, performance incentives, and other premium payments will be divided among the team members
- Ramifications of team members withdrawing from the selection or project
- Language that allows the design-phase manager to enforce the teaming agreement fairly and uniformly
- Discussion of how changes are handled, as described in Section 4.2.3

To be effective, the design-build process needs to ensure that the builder is aligned with the designer on the design development process. This naturally includes constructability and value engineering. It also includes how the design will be packaged to optimize procurement and schedule-related execution issues. All of this should be carefully considered by both parties during the proposal process, and reflected in the teaming agreement.

Because much of the work in the proposal process is performed by the design team, the builder and designer need to have an honest and realistic discussion of what it takes to submit a winning proposal and have enough money in the proposal price to account for the natural evolution of the design. Isolating the designer from these discussions during the proposal period carries significant risk to the team afterwards.

#### **4.2.1 Exclusivity and Non-Disclosure**

The design-builder and designers working on the project should have an open and candid discussion about whether their relationship will be exclusive or whether the parties may pursue the project with different teammates. Generally, this is not a problem with lead designers, as procurement documents frequently preclude lead builders and lead designers from being on more than one team.

There are two places where issues can arise. First, what happens if corporate affiliates pursue the same project? Second, what happens when a consulting engineer is part of the team and is the “only game in town,” or is unwilling to agree to an exclusivity arrangement? Each of these situations can give rise to divided loyalties, and it is important to discuss how to resolve these issues.

The issue of exclusivity also leads to a concern about the confidentiality of the proposal process. The parties involved need to address each party’s reasonable concerns and draft a teaming agreement to specifically address confidentiality. The design-phase manager may need to establish a “firewall” to prevent leaks of confidential information regarding competitive strategy.

#### **4.2.2 Inclusion of Subcontract as Part of the Teaming Agreement**

Most teaming agreements will address, in a general way, the contract arrangement that will be put into place after the project is awarded. The actual form of the subcontract can also be added as an appendix to the teaming agreement. This has the benefit of letting the parties determine, well ahead of time, whether they are aligned on some important legal issues – such as indemnity and liability for errors and omissions.

If there are disconnects over critical issues, it’s best to get them on the table early. Furthermore, including the subcontract can help mitigate the argument that the teaming agreement is just an “agreement to agree” versus being an enforceable contract.

#### **4.2.3 Addressing Changes in Circumstances during the Design Selection Process**

Teaming agreements should address, in specific terms, how things will be handled if there are changes in circumstances. Changed circumstances may include, for example, a party dropping out of the contract due to unforeseen but legitimate reasons (like key staff leaving the team or inadequate resources to handle the workload).

Even though it may create a less-than-desired atmosphere at first, the decision of one team to drop out when they realize they can’t perform the work will be appreciated by the entire team later on. The exiting team may or may not be subject to penalties in such a scenario, but it may be excluded from consideration for future work/projects.

## Standard Forms for Subcontracts Between the Design-Builder and Design Firms

- DBIA Document No. 540, *Standard Form of Agreement between Design-Builder and Design Consultant*, (2010 Edition)
- AIA Document B143, *Standard Form of Agreement between Design-Builder and Architect*, (2004 Edition). Two exhibits accompany this document: Exhibit A (Initial Information) and Exhibit B (Architect's Services)
- Consensus DOCS 420, *Standard Agreement between Design-Builder and Architect/Engineer for Design-Build Projects*, (2007 Edition)
- ASCE, Engineers Joint Contract Documents Committee, Document D-505, *Standard Form of Subagreement between Design/Builder and Engineer for Design Professional Services*, (2009 Edition)

## 4.3

### Standard Form Design-Build Subcontracts

Given the widespread use of design-build since the mid-1990s, the industry has become much more adept at establishing effective subcontracting relationships between design-builders and designers. Many builders who regularly work on design-build projects have developed their own design subcontract forms.

Sometimes these forms are based on trade subcontract forms, modified to reflect design-associated issues. More typically, design subcontract forms are based on standard form subcontracts, modified to reflect the builder's needs and expectations.

Four suites of standard form design-build contracts have been developed by various professional and trade associations in the U.S. Each suite includes a subcontract form that can be used between the design-builder and designer.

#### Consider the following when using standard subcontract forms:

- Each organization that develops and/or sponsors the form has its own underlying philosophy and objectives.
- Mixing and matching forms (e.g., using AIA Document B143 when the prime design-build contract is based on the DBIA forms) can create problems.
- Differences among the standard forms can be very subtle, with only a few word differences that may change risks substantially. Therefore, read these forms carefully, and consider seeking legal advice before signing.
- Parties who use standard forms as their baselines routinely change them. The "drafting" party should highlight the changes it makes through redlining to ensure that the "receiving" party knows what has been changed.

## 4.4

### Negotiating the Subcontract

With the design-phase manager as facilitator and go-between, the design-builder and designers need to thoroughly discuss the overall risk profile of their PR relationship and what each party needs from the other to perform successfully. To the extent that this is done when the teaming agreement is developed, those terms should be carried through to the final contractual relationship between the parties.

Both parties should keep in mind that it's acceptable to differ on issues, particularly when those issues can have major commercial ramifications or affect the balance of risk assumption. What's not acceptable is a party's unwillingness to discuss issues, or adopting a "take-it-or-leave-it" approach. The design relationship requires give and take, and this is just as true in contract development as it is in the actual performance of design work.

Unfair terms and unbalanced risks may look good on paper, but, in reality, they only serve to put the parties at commercial odds and—for the one assuming the unreasonable risks—on the defensive. At the end of the day, it's debatable whether a judge, jury, or arbitrator would enforce any unreasonable terms.

**Ways that the design-phase manager makes subcontract negotiations more constructive:**

- Identify all key issues for all parties and have sound, commercially appropriate solutions.
- Avoid starting from an extreme position on risk just for the sake of moving closer to the middle. This "negotiation" technique can be very harmful to building trust and establishing a long-term relationship.
- Use industry precedent to overcome impasses; look particularly to the approaches taken in standard forms.
- Consider the other party's position, paying attention to the discussions in Sections 1.4 and 1.5. Recognize how the counter-party is organized, how it thinks, what its risks are, and how it makes its money.
- Have senior people within each party's organization who are objective, reasonable, and available to resolve impasses.
- Use an "honest broker" or industry expert to advise on the most appropriate way to handle sticky issues.

## 4.5

### **Key Subcontract Terms and Issues to Consider in the Design Subcontract**

As outlined in Section 4.3, a subcontract between the design-builder and design firm(s) does not look like a typical trade subcontract. Nor does it look like a typical design contract with an owner. Rather, it has elements of both.

Sub-subcontracts among the lead design firms and specialty design firms need to be crafted carefully to reflect the professional nature of the design relationship. They also need to reflect the reality that subcontractors are required to assume certain responsibilities to the prime contractor that they might not have if they were contracting directly with the owner.

The design subcontract needs to address a variety of key concerns—from identifying the scope of work, to contract execution and risks. The following subsections address some of the more challenging issues in negotiating a design subcontract on a design-build project.

## 4.5.1

*The best way for the design-phase manager to manage the risk of "scope creep" is by being actively involved in design development and using a robust project controls and trend reporting system.*

### Scope of Work Definition

A good design subcontract specifies the designer's responsibility for the scope of work and for schedule and budget expenditures compliance (among other things). The design-phase manager should pay special attention to how the design work will actually be done, as this will affect the pricing of the designer's work. It's always good practice to develop a division of responsibilities matrix that identifies who has the responsibility to do what, and who is in a primary versus a review/support function.

Relative to advancing the design, the parties need to understand how the design will be packaged to best suit the design-builder's needs, and how modifications to the basis of design will be handled. The prime contract between the owner and the design-builder will provide some guidance in this regard. However, there is the potential that, as the design evolves, the designer may create documents that impose higher standards on the design-builder than required by the prime contract. The best way for the design-phase manager to manage the risk of "scope creep" is by being actively involved in design development and using a robust project-controls and trend-reporting system.

On a cost-based design-build project, there may be a tendency to rely on the bridging documents furnished by the owner. The parties should discuss whether they will accept the basis of design documents provided by the owner. The designer has an independent, professional duty that does not allow it to blindly accept certain documents (e.g., structural calculations or code compliance).

There are two other design-related scope of work issues that the design-phase manager should discuss with the design team. First is that the designer has access to speak directly with the owner during the design development process. Second is the lead designer's involvement in coordinating consulting engineers hired directly by the design-builder. Both of these issues impact the designer's scope of work.

The design team will continue to be active on the project through construction, but at a greatly reduced level of effort than during design. Relative to construction administration services, the design-phase manager should discuss the precise role and tasks of the designer. The breadth of the designer's involvement during construction depends on the complexity of the project, the requirements in the prime contract, and the preferences of the design-builder.

**There is no stock answer for how actively the designer should participate in these services, but a few things to consider include:**

- How often is the designer expected to visit the site?
- What will the designer need to do to support the design-builder in developing pricing sets of design documents for trade subcontractors, and when are these documents due?
- How will Requests for Information (RFIs) be handled during construction, particularly in terms of formality? Are sketches made at jobsite meetings or descriptions made verbally at the construction site acceptable?
- Will the designer be required to certify anything?
- How will shop drawings be reviewed?

## 4.5.2

### Commercial Terms in the Design Subcontract

In addition to clarifying the scope of work, the subcontract needs to address the commercial issues associated with the relationship between the design-builder and the designer.

#### The design-phase manager should facilitate discussion on:

- The standard of care for design services, and whether there is a performance guarantee associated with the design-build contract that will govern the designer's performance. If so, can that guarantee be attained by using the ordinary standard of care?
- Handling of ownership and use of the design documents.
- Payment to the designer: for example, will the design-builder pay the designer within a predetermined period of time, regardless of the status of the owner's payment to the design-builder, or will the parties use a "pay when paid" constraint? Will there be any retainage?
- Contingencies if the project is delayed beyond the control of the designer and whether the designer will be obligated to accelerate the design work. If so, whether the designer will be paid a premium for rush work.
- Handling of owner-directed changes to the project.

## 4.5.3

*There are many ways to address these risks in the subcontract, not the least of which is to have each party expressly responsible to the other for the problems it creates. However, it behooves both parties to consider creative ways to share risk arising out of the relationship.*

### Risk-Sharing Provisions

One of the most challenging aspects of reaching commercial agreement on a subcontract is addressing circumstances where something goes wrong and there are cost overruns, schedule delays, or operability problems.

#### When developing the design subcontract, the design-phase manager will need to work with the team to consider questions such as:

- What are the consequences if the designer is behind schedule through its own fault? Will there be liquidated damages? How are delays or acceleration costs incurred by trade subcontractors to be handled?
- How will the financial consequences of design mistakes be handled? Will each party bear the risk of its own mistakes? Will the parties use a project contingency—and under what circumstances can it be applied?
- Are the design-builder's obligations to the designer for owner-caused problems limited to what is ultimately recovered from the owner?

Mistakes are generally not a one-way street. For example, the design team may be late or commit an error or omission. The design-builder is confronted with its own challenges, like poor communication, miscalculating market conditions, failing to procure the complete scope of work from a trade subcontractor in a timely manner, or failing to construct the work according to the plans and specifications.



There are many ways to address these risks in the subcontract, not the least of which is to have each party expressly responsible to the other for the problems it creates. However, it behooves both parties to consider creative ways to share risk arising out of the relationship.

**Some possible areas the design-phase manager can consider are:**

- Using pre-established design and construction contingencies to cover the additional costs associated with the problems and sharing the savings from those contingency pools.
- Allocating savings that arise from value engineering used as a contingency pool and shared as appropriate.
- Giving the designer discretionary bonuses for exemplary performance in the same manner that an owner might use award fees to reward a design-builder.
- Capping a designer's liability for errors or omissions to either a specified dollar amount, the designer's fee, a percentage of the construction costs, or the limits of applicable insurance policies.

The design-phase manager should be particularly thoughtful about addressing the potential liability confronting an engineering firm under a design-build relationship. The fees generated for an engagement by design engineers are often highly disproportionate to their risks if something goes wrong. Careful management and oversight of these firms will help mitigate the likelihood of a problem occurring. The design-phase manager should consider whether some form of contractual liability relief is appropriate.

#### 4.5.4

### Professional Liability Insurance and Errors and Omissions Contingencies

It is important for the design-builder and designer to be aligned on what, if any, professional liability insurance (PLI) will be provided by the designer(s). Many owners using design-build are often indifferent as to whether PLI is provided. They will frequently either rely on the design-builder's balance sheet to handle the consequences of design problems, or require the design-builder to furnish a surety bond that covers all of the design-builder's obligations, including design.

Design-builders, on the other hand, will almost always have a strong interest in knowing how the designer will mitigate any liabilities associated with the work. The capital structure of most design firms (particularly smaller consulting firms) is inadequate to pay any meaningful damages arising out of an error or omission.

As a result, design-builders will often require designers to have and maintain a certain level of PLI over the course of the project and for several years thereafter. **There are some significant features about PLI that impact its effectiveness at mitigating risk:**

- PLI policies are typically structured on a claims-made basis – i.e., the policy only covers claims made during the policy period. As a result, claims that relate to incidents occurring before the coverage was active may not be covered, and there is no coverage if the policy is not maintained.
- PLI policies cover all of the claims against an insured. This means that if the designer has the unfortunate experience of having several claims, the policy limits may be eroded by the time the design-builder's claim is resolved. Depending on the policy, attorney's fees may also erode coverage limits.
- Unlike commercial general liability (CGL) insurers, PLI insurers do not allow the insured to add additional insureds. As a result, a design-builder will not have the right to make a claim directly against the designer's policy. Rather, the designer is obligated to notify the insurer that a claim has been made against it. The practical effect of this is that the design-builder may never have a true sense of how much money is really available to satisfy a claim, and has no direct right to sue the carrier.

These limitations prompt some design-builders to obtain, especially on very large projects, project-specific PLI that will provide dedicated limits committed to project errors or omissions. PLI limitations have created a market for PLI policies written for design-builders and contractors, now generally available from multiple insurance carriers. This PLI insurance is generally an excess layer over the designer's PLI, but also handles any allegations of professional negligence by the design-builder's own professional staff.

#### 4.5.5 Indemnification Clauses and the Duty to Defend

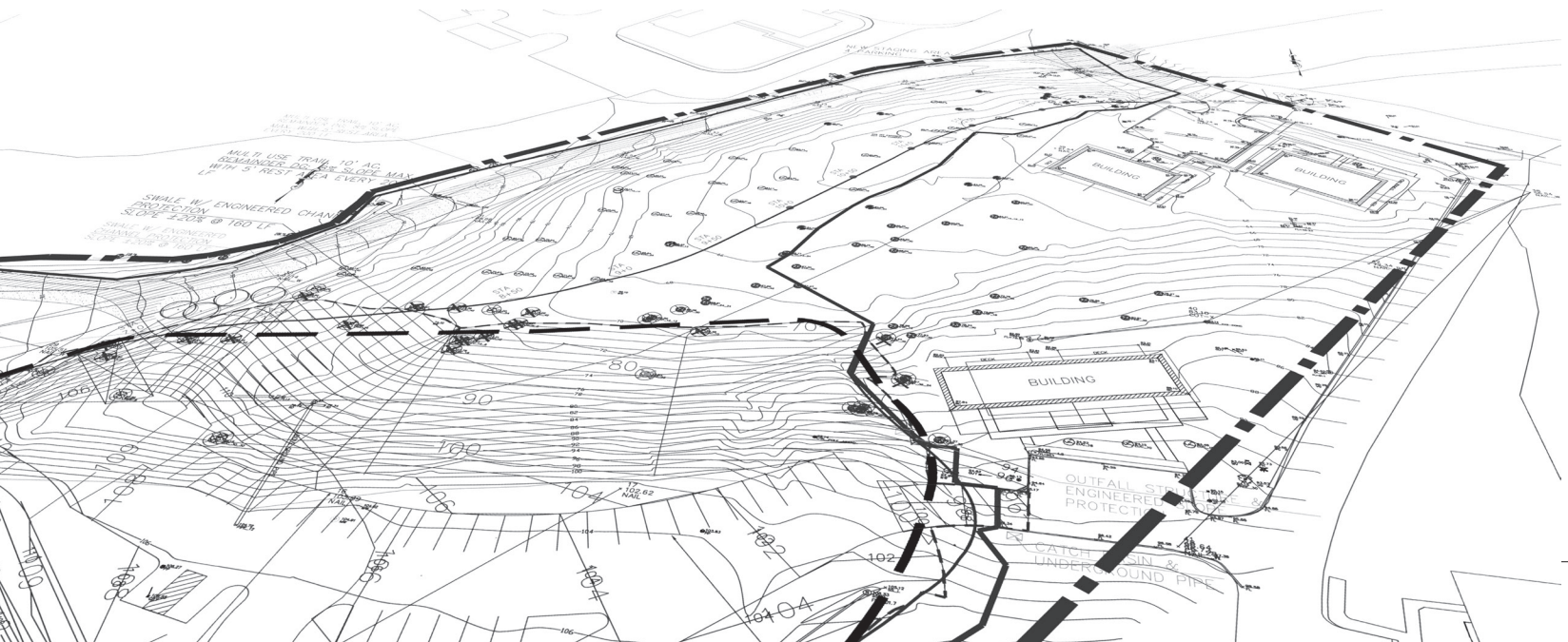
The extent of the designer's indemnification obligations can be one of the most challenging aspects of subcontract negotiations. Negotiations are relatively simple if the parties use the indemnity clauses established by the standard form contracts discussed in Section 4.3 above. In the standard form contracts, the designer's defense and indemnity is tied to personal injury or third party property damage caused by the designer's negligence, as this is covered by the typical CGL policy.

Problems arise when the design-builder wants defense and indemnity for something beyond the "standard" indemnity, like any losses caused, in whole or in part, by the designer's actions.

##### **Broader indemnities create major practical and commercial challenges to the designer, such as:**

- Being fully liable when the designer may only be partially responsible for a problem.
- Being liable even though the designer did not do anything wrong, as the indemnity is tied to the designer's actions, which may not have been negligent or wrongful.
- Requiring the designer to defend the design-builder when it does not have the ability to ask the insurer to assume this defense. As noted above, PLI insurance does not extend to anyone other than the insured, and it will not provide defense coverage to the designer's clients that would be available under a CGL policy.

It is incumbent upon the design-phase manager, when negotiating the subcontract, to be realistic about commercially available insurance and the reasons behind the indemnity clause. While this is a matter that will often be decided by lawyers, commercial negotiators need to have a full understanding of the nuances of these obligations.



## 4.5.6

### Flow-Down Clauses

One of the biggest decisions in crafting the subcontract and sub-subcontracts is deciding what “flow-down” requirements from the primary owner/design-builder contract the designers will be obliged to meet.

Essentially, the design-builder will flow down most of its obligations in the prime contract to its lower-tier subcontractors and suppliers. However, a simple “you are responsible for everything we are responsible for” approach is not workable. Many obligations in the prime contract have nothing to do with design services.

Both parties must figure out what is—and what is not—appropriate to flow down from the prime to the design subcontract. Design firms should participate in the review of the prime contract so that unreasonable or inappropriate clauses are not assigned.

## 4.6

### Other Legal Considerations in Contracting

In addition to understanding critical terms of the subcontract, the design-phase manager should be aware of other legal considerations associated with the design services on a design-build project. While a detailed discussion of the following topics is beyond the scope of this publication, an overview of how these topics impact the design management process is appropriate.

### 4.6.1

#### Public-Private Partnerships

Public-private partnership (P3) projects have become much more common in the United States in the past decade, as an increasing number of states have passed enabling legislation authorizing the use of P3s on infrastructure projects. The industry often thinks of P3s as combining the design-build process with financing, operations, and maintenance.

In reality, P3s are dependent upon the statutory authority vested in an agency and can include the concessionaire entering into a contract that does not require at-risk financing, operations, and/or maintenance. **For example, P3s include:**

- Design-build projects fully funded by an agency, where the design-builder provides some front-end seed money to advance the project’s viability.
- Design-build projects where the design-builder provides short-term (e.g., 5 years) gap financing to cover an agency’s shortfall on a particular project.
- Design-build projects fully funded by the agency, where the design-builder might provide short-term operations and/or maintenance support to the agency.

Generally speaking, most P3 contracts shift more risk to the concessionaire than under a conventional design-build contract. This is something that the designer will have to understand as it agrees to be part of the concessionaire’s team.

Regardless of the type of P3 used, it is important for the design-phase manager to fully understand the obligations flowing to the concessionaire. For example, if the project has long-term ownership obligations, then the concessionaire and design-build team need to think in terms of life cycle costing. If the project has significant uncertainty around permitting, then the design-builder and designer need to determine who has primary responsibility during contract execution to address these issues.

## 4.6.2

### Guidelines for BIM

- AIA, *Guide, Instructions and Commentary to the 2013 AIA Digital Practice Documents* (2013)
- DBIA, *Building Information Modeling Exhibit* (2010)
- The Construction Users Roundtable, *BIM Implementation: An Owner's Guide to Getting Started*, April 2010

### BIM Ownership

Building information modeling (BIM) has had a major positive effect on design development. The use of BIM has also created a host of contractual and legal challenges, many of which center on a fundamental tenet of the process: because so many parties collaborate on the design and “touch” the model, who is ultimately responsible if something goes wrong?

#### The design-phase manager should consider the following:

- If members of the project are working on different models (e.g., the architect, structural engineer, and steel fabricator each has its own model), what happens if there are errors in translation or if data are dropped as information is transferred?
- How does one deal with differences of tolerances between disciplines (e.g., structural steel tolerances may differ from those assumed by a window wall manufacturer), where each discipline is inputting its own data into the model?
- Who owns the information in the BIM? For example, a specialty mechanical, electrical, or plumbing contractor who inputs detailed design into a model shared with all team members may want to maintain the right to that data when the project is over. If the model is owned by the owner, proprietary information could find its way to a competitor after the project is done.
- What is the designer’s standard of care for design when so many different players—including the construction team—are inputting to and using the BIM model? Stated differently, do design-builders and lead designers really understand what they are legally obligated to do to satisfy their standard of care in managing the design development process under BIM?
- Will the Spearin doctrine (i.e., the implied warranty of the specifications) still apply when all of the plans and specifications are merged into BIM models? Will the parties really be able to determine who prepared what part of the plans and specifications?

Several construction industry associations have responded to these legal and contractual challenges by publishing BIM contract language and guidance on how to successfully implement BIM.

AIA’s guide is particularly helpful in that it discusses the “second generation” of AIA’s digital practice documents that were originally published in 2007. Consequently, the guide includes a comprehensive discussion of AIA Document E203™–2013, *Building Information Modeling and Digital Data Exhibit*; AIA Document G201™–2013, *Project Digital Data Protocol Form*; and AIA Document G202™–2013, *Project Building Information Modeling Protocol Form*. The latter document is especially useful in answering some of the questions above, as it advocates for agreement among the parties involved in the BIM process on commercial issues, such as ownership and accountability.

The true liability exposure of those involved in the BIM process is “at this point” left to educated guessing. To date, there have been no court decisions focused on problems created by the collaborative aspects of developing a design through BIM. If history is any indication, it is unlikely that issues like standard of care among the design team and Spearin liability will be conclusively resolved through contract language, and case law will ultimately be needed to help the industry better understand legal exposure.

## 4.6.3

### Electronic Communications, Project Documentation, and Copyrights

Section 3.4.3 highlighted some best practices in information management and electronic communication. From a contracts perspective, the construction industry has provided guidance

on how to address the electronic transmission of data as an alternative to paper copies. AIA's Guide (see Section 4.6.2) is quite useful in explaining the issues associated with electronic communications, as is the contract language developed by those organizations publishing design-build standard form contracts.

**Article 12 of DBIA's *Standard Form of General Conditions of Contract between Owner and Design-Builder (2010)* addresses some of the key commercial points related to design-build in the digital era, including:**

- The parties will agree upon the software and the format for the transmission of electronic data.
- Each party will be responsible for securing the legal rights to access the agreed-upon format.
- Neither party is deemed to make any representations or warranties to the other with respect to the functionality of the software or computer program associated with the electronic transmission of work product.
- The transmission of work product in electronic form will not affect ownership rights of the work product.
- The parties acknowledge that electronic data may be altered or corrupted by circumstances beyond the reasonable control or knowledge of the parties, and disclaim all warranties with respect to the media transmitting the electronic data.

It is generally appropriate for the agreed-upon provisions between the owner and design-builder to be flowed down to the designers.

#### 4.6.4

#### Performance-Based Criteria

Because design-build lends itself to performance-based design criteria, there can be liability to the owner if the performance requirements are not met. This is something that the design-builder and designer should discuss as they negotiate the subcontract. The specific question is whether the performance criteria would require something beyond the designer's ordinary industry standard of care.

The DBIA contract documents directly address performance-based requirements, and assume that the design standard of care associated with performance specifications will be that which is needed to meet the specification (if the parties acknowledge this directly in the subcontract agreement by checking the appropriate box).

Design-builders should note that most PLI does not cover performance guarantees agreed upon by a designer. Rather, breaches of the ordinary standard of care are what triggers coverage.

#### 4.6.5

#### Authority to Change the Design

All standard form design-build contracts state that minor changes to the design can be made by either the owner or design-builder if those changes do not alter the contract price, contract duration, or quality of the work. Importantly, if the design-builder desires to make such a change, the design-phase manager will need to promptly notify the owner, giving the owner a chance to react to the proposed change.

The design team may (erroneously) believe that a change from a previously issued design document is not material. The design team may or may not notify the design-builder for what it considers to be small changes. The design-phase manager needs to keep on top of changes and how they are being addressed.

*The design-phase manager should approach each unresolved conflict with an open mind, open ears, and patience. The design-phase manager works with the parties to categorize and frame the issues in dispute, so they are clear and organized.*

#### 4.6.6

#### Warranties and Post-Occupancy Issues

It has become increasingly important for the design-phase manager and team to fully understand warranty and post-occupancy issues in the new and evolving world of design-build. It is not uncommon to find multi-year warranty requirements, as well as contract provisions, to maintain and operate various building systems over extended periods.

The motivation for such provisions may be the owner's desire to assure that complex mechanical, security, or energy management systems (for example) are fully operational before turning over operations to building staff. Owners may also be motivated by the desire to buy some period of operating expense while in the procurement phase of the project.

**Whatever the motivation, the design-phase manager should be aware that these types of provisions can present unique challenges, including:**

- Subcontractor bonding may not extend to warranties beyond one year, leaving the design-builder unprotected from a future default.
- Not all subcontractors chosen for the initial installation of systems will be properly positioned to operate those systems post-occupancy. This could necessitate securing additional team members to fulfill the requirements, some of whom may be new to the design-builder's typical list of vendors.
- The design-builder's surety firm may object to the extended nature of the agreements, necessitating alternate forms of guarantee to satisfy the contract provisions.

How these and other challenges are solved presents an area of potential risk. They also provide an opportunity for a design-builder to differentiate itself with a creative offering. Regardless, the cost of managing the post-occupancy responsibilities needs to be acknowledged and provided for in project cost estimating.

#### 4.7

#### Resolving Conflict

Design-build creates a contracting environment that reduces conflict among the project team, because the direct contractual relationship between the design-builder and designer creates common goals and fosters teamwork. There is nothing to be gained by the designer and design-builder blaming each other for problems.



Furthermore, to be successful, all parties must work collaboratively throughout the project, providing regular communication and feedback. As discussed in Section 3.4, this creates an environment where misunderstandings surface early and openly, and are generally resolved with a team-oriented approach.

Despite the best intentions, however, problems can and do occur on design-build projects. Sooner or later, the design-phase manager will have to resolve strongly held differences of opinion among participating team members.

The design-phase manager should approach each unresolved conflict with an open mind, open ears, and patience. In doing so, the design-phase manager helps the parties categorize and frame the issues in dispute, so they are clear and organized.

Because simple misunderstandings can lead to conflict, the design-phase manager needs to ensure that all participants fully understand the issues. If conflicts appear to be developing, the design-phase manager should allow proponents on each side of the issue ample opportunity to state their positions.

On issues of legal responsibilities for aspects of design, the design-phase manager should support the accountable professional and favor the party that has the most at stake.

## 4.7.1

### Avoiding Disagreements

The best way for design-builders and designers to avoid disagreements is to establish, at the outset, an open, collaborative, and trusting relationship where the parties understand the key concerns of the other. The “softer” side of collaboration and team building was discussed in Section 3.3 and 3.4. **From a contracting perspective, ways to accomplish respectful and productive working relationships include:**

- Understanding the design contingency assumptions built into the estimate and establishing a reasonable way to manage and mitigate those contingencies.
- Having the design-builder prepare and discuss trend logs with the designer to help it understand potential/actual problem areas, and help develop solutions to mitigate these problems.
- Ensuring that the parties conduct a post-award risk management discussion to orient them to potential problem areas.
- Establishing a “no surprise” philosophy with the project team, and letting them know promptly about problems and how they will be mitigated.
- Convening regular senior level management meetings between the design-builder and designers to forecast problems and deal with any project-level management issues.

All of these practices are calculated to forecast problems before they manifest as cost overruns, delays, or accusations.

## 4.7.2

### Dealing with Errors and Omissions

The teaming agreement (see Section 4.2) and subcontract (see Section 4.3) are excellent places to deal with the consequences of errors and omissions. Once a problem appears—and consistent with the principles for avoiding a dispute—it is critical for all parties to talk, understand the problem and potential solutions, and develop a mitigation plan. It is not helpful for the design-builder to blame the designer and become isolated from the solution.

### 4.7.3

#### Addressing Changed Conditions

Changed conditions in a design-build project can and will occur. The teaming agreement is the appropriate place to define a protocol or lay down ground rules for dealing with changed conditions.

The most significant element in the changed conditions scenario is who will address the financial burden or costs resulting from the changed condition. As an example, the owner decides after the fact that a physical model will be needed. The designer may not have the resources to pay for it. The builder may then consider bearing the financial burden, because the builder also gets 90 percent of the revenue for the project. It may be appropriate to decide beforehand which costs may be incurred by each team, and how the costs will be proportional to the revenue.

Another example involves discovery of additional information that the designers were not aware of prior to or during the design, which leads to significant redesign and associated costs. In this situation, the party responsible for investigating and securing all the pertinent information should be responsible for the cost of redesign. The designer should be compensated for its time, including the redesign, unless an alternate agreement has been reached in advance and is included in the contract.

A common example of this situation is changed geotechnical conditions (or receiving additional geotechnical information) after the structural design is complete. Because this kind of change may warrant a significant redesign, the structural engineer should be paid for the redesign.

### 4.7.4

#### Techniques for Dispute Resolution

Regardless of the nature of the dispute between the design-builder and designer, it is critical for the parties to maintain a professional relationship and work to resolve the problem. The design-phase manager should consider establishing a conflict resolution process—either informal or formal—that defines the hierarchy of strategies to be used to resolve conflicts. This conflict resolution process includes protocols so conflicts can be elevated to progressively higher levels of authority.

Senior management should encourage the design-phase manager to resolve conflicts at the lowest possible rung of the authority ladder. Only issues that cannot be resolved there should be escalated higher for resolution.

Several types of disputes require “real time” resolution. For example, the design-builder and designer might disagree over what design will satisfy a code, permit, or even a standard of care. It is rarely productive or prudent in these cases for the design-builder to take a “do it my way” position, given the professional duties owed by the designer.

*The design-phase manager should consider establishing a conflict resolution process—either informal or formal—that defines the hierarchy of strategies to be used to resolve conflicts.*

Remember that architects and engineers have legal obligations to protect the safety, health, and welfare of building occupants (see Section 1.5.4 for more discussions). This is a condition of their license to practice.

The design-phase manager should understand that all professionals are obligated to put the welfare of their clients and the public ahead of their own (or the design-build team's) interests. When conflicts involve issues of safety, health, or welfare, the design professionals must prevail.

**For those disputes that involve resolving the impact of an event (e.g., errors and omissions, design delays, or owner-caused problems), the parties should consider the following non-binding processes:**

- **Stepped Negotiations**—This is a sequential process, starting at the project level, by which the dispute is raised through the management levels of the parties. First, try to resolve conflicts by frank discussion, based on reason, with all parties being asked to remain at least somewhat willing to compromise. If conflicts appear to be developing, allow proponents on each side of the issue ample opportunity to state their positions. Because simple misunderstandings can lead to conflict, ensure that all participants fully understand the issues. Require team members with opposing viewpoints to listen and paraphrase what they've heard—allowing the original team member to confirm or clarify—before they counter-argue. Second, elevate the issue to senior management within the respective organizations. Senior managers typically will not want to interfere unless the design-phase manager asks for help. With a successful stepped process, the parties meet and negotiate within a reasonably short period of time, and the representatives (particularly those who are most senior) are objective and open to compromise.
- **Advisory Opinions**—When the issue is discrete (e.g., did the designer satisfy its standard of care in a highly specialized area), it may be helpful to bring in a neutral party who is an expert in that area to render an informal, advisory opinion on the issue.
- **Mediation**—A mediator helps the parties reach agreement on their disputes. The sessions with the mediator are confidential, and each party is expected to have an appropriate representative with authority to resolve the dispute. The mediation process is, in essence, a structured negotiation; therefore, success depends on the same factors mentioned above for stepped negotiations, as well as the skill of the mediator.

All of the processes above envision that the parties will reach agreement on the dispute resolution. If they are unable to do so, the dispute will ultimately be resolved in a binding manner, either by a contractually required arbitration process or through litigation. These other types of dispute resolution techniques should be used only as a last resort.





# WORK BREAKDOWN STRUCTURE AND SCHEDULE

## 5.1

### Project Phases and the Work Breakdown Structure

*At the core of a workable design schedule is a comprehensive, logical work breakdown structure.*

At the very outset of planning for the project, the design-phase manager works with the designers to define the scope and sequence of design delivery. This will result in a collaboratively developed project schedule that defines each participant's required level of developed information, along with the format to be produced. It's the design-phase manager's responsibility to make sure the project is set up in logical sequence to obtain each segment of information at the appropriate time.

At the core of a workable design schedule is a comprehensive, logical work breakdown structure. The work breakdown structure identifies discrete work elements hierarchically, which helps organize and define the project's total scope of work. The work breakdown structure provides the necessary framework for detailed schedule development and control, as well as guidance for cost estimating and control.

Many different work breakdown structure systems (including numerical ordering and work category definitions) are used in the design-build industry. The design-phase manager, along with the lead designers, determines which system is most workable for the project. That decision may be based on standards already in place within the design-builder's organization.

One powerful tool the design-phase manager and project team can use to establish the work breakdown structure and project schedule is the ASTM E1557 *Standard Classification for Building Elements and Related Sitework —UNIFORMAT II*. This standard provides a common structure that links the building program, specifications, and estimates. The standard's classification of building elements provides all project stakeholders with a common point of reference for identification of design elements.

Using *UNIFORMAT II* in the design process results in improved communications and coordination among all project participants, an accelerated design, and significantly increased productivity. These classifications provide the design-phase manager with an essential tool to control project scope, cost, time, and quality.

Another type of framework for defining the schedule elements is the Model Progression Specification, which defines levels of detail for systems, assemblies, and elements as they are developed. In essence, the process of

moving from approximations to progressively more precise information is divided into the following categories:

- 100 Conceptual
- 200 Generic placeholders, approximate dimensions
- 300 Specific assemblies/elements, precise dimensions
- 400 Detailed assemblies/elements
- 500 As-built assemblies/elements

A third way to look at the design progression is outlined in AIA Document B101 (2007), *Standard Form of Agreement Between Owner and Architect*, which categorizes design services into five phases: schematic design, design development, construction documents, bidding or negotiation, and construction, which provides a nice conceptual framework on how the design will progress.

To keep the design process in perspective, remember that all deliverables by the design team are ultimately geared toward constructing the project. The design deliverables are used by the builder, subcontractors, vendors, and fabricators to produce their own deliverables necessary for construction.

Design deliverables encompass everything the design team may produce—from concept drawings, to detail schedules, to complete 3-dimensional models. While there is no one set of design deliverables that is the same for all projects, here is a rough list of the types of deliverables that may be expected.

**This is just a partial list, and many items will have multiple subsets of deliverables:**

- Preliminary Zoning and Code Analysis
- Master Plan
- Program
- Concept Design
- Code Analysis
- Site Plan and Design
- Plan Design and Layout
- Exterior Enclosure Design
- Specifications
- Jurisdictional Submittals and Approvals
- Bid Analysis
- Addenda
- As-Built Model

The design-phase manager needs to be crystal clear about the level of detail needed for each design deliverable. The level of detail is dictated by the anticipated use of the documents. If the level of detail is not known, the design-phase manager should discuss document needs with the recipients (including the final approval authorities and other team members).

For example, the detail needed for early permits will most likely be less than that required for bid packages for equipment and subcontractors, or for the final construction documents. Conversely, some permits may require detailed, focused information that is out of sequence with the rest of the design process.

Each design deliverable will have multiple iterations over the course of the project as information is learned, decisions are made, and the design progresses. Therefore, when developing the work breakdown structure, the design-phase manager should identify and plan for the progressive development of all information and deliverables.

While this process-thinking can and should apply to every project regardless of delivery platform (BIM or non-BIM), BIM advocates have developed a semi-formal methodology of defining the necessary level of development (LOD) at each stage of the project. This



methodology helps define the stages of development of the model in a way that best delivers the necessary information when it is needed.

The design-phase manager and design team identify each component, or “model element,” of the BIM. For each project phase or timeframe, the team defines two critical pieces of information about that model element: who is responsible (model element author) for the development of that information at that specific time, and what level of information is expected at that phase.

While the approach and format may be the same from one project to another, the definition of each stage of LOD will vary depending on the specific needs of a each project. The BIMForum has developed a guide, *Level of Development Specification for Building Information Models* (Version 2013) that details this process.

## 5.2 Developing the Design Schedule

The development and execution of the design schedule is a joint and collaborative effort of the entire project team: owner, architects, engineers, contractor, and possibly, key consultants and/or trade contractors. The design-phase manager leads the process.

Once the team has agreed upon and developed the framework or work breakdown structure for the schedule elements, it develops the schedule (and associated cost estimates) collaboratively by establishing milestones and deliverables. The design-phase manager then manages the project against the schedule and budget, adjusting as necessary to accommodate changes and unforeseen circumstances.

In a design-build project, the design schedule is a subset of the overall big picture project schedule, and is intertwined with the construction schedule. The overall project schedule informs the design, procurement, and phasing schedules. It is imperative, therefore, for designers to be involved in developing the overall project schedule. This effort will help identify what needs to be in each design deliverable to support the construction schedule.

A useful strategy for design scheduling may be for the design-phase manager to convene a series of “scheduling charrettes” among all design professionals, along with the owner’s representatives and the construction management team. A charrette is an intense session in which a group drafts a solution to a problem.

In this way, the whole design-build team understands both the iterative process and the importance of timely decision-making. If a task fails to meet its assigned completion date, the team recognizes the implications and can implement recovery strategies.

### 5.2.1 Design Schedule Elements

In its most basic form, the design schedule is defined from a series of tasks and subtasks, each ending in either a milestone or a deliverable. Developing the design schedule involves defining the work and the amount of time needed to perform each task.

A milestone is a significant event in the project used as a checkpoint to validate how a project is progressing. Some example milestones include kick-off meetings, master plan confirmation, program confirmation, mock-up review, and post-occupancy evaluation.

A deliverable is an item that the design team prepares and delivers to the owner or to other design-builder team members. Design deliverables are defined in the designers' subcontracts or professional agreements. Many deliverables are defined after the project schedule is developed, which allows the design deliverables to be prioritized to support the construction schedule for permits, purchasing, fabrication, delivery, and installation.

Using the work breakdown structure, the design-phase manager and design team identify the amount of time needed to execute a specific task, along with the predecessors and successors to that task. At the same time, decision-makers are identified and decisions they are responsible for are articulated. This exercise results in a collective project schedule that reflects the agreed-upon sequence and duration of every element.

The schedule must reflect knowledge of the design process and include appropriate review periods, owner operational restraints, government permits, pre-construction activities, early procurement, and construction phasing.

As part of the design schedule development process, a schedule element owner should be assigned to each task or subtask. The schedule element owner is responsible for developing the content of, or facilitating the execution of, a specific schedule element.

**In addition to the actual design work required to perform the design deliverables, time for the following items should be built into the schedule:**

- Project quality management
- Budget evaluations
- Budget reconciliations
- Value engineering/target costing
- Bid support for trade packages
- RFI processing
- Submittal processing
- Pay application processing
- Contract modification documents
- General construction administration activity/coordination
- Site observations and reports
- Final inspections and punch-listing
- Record documents
- Move-in support
- Owner review cycles

## 5.2.2

### **How to Accommodate the Owner's Decision-Making Process**

One of the overarching keys to the success of a project, after clearly understanding (and helping to set) the owner's goals and expectations, is to then manage them. The owner's goals and expectations may change over the course of the project for very legitimate reasons; for example, both the owner and design team learn more as the project progresses. With this learning comes the need for reassessment of initial ideas.

**The design-phase manager's role in this iterative process of learning, re-evaluating, and modifying, is to:**

- Accept it. It happens on every project so don't fight it.
- Encourage it. It is a necessary step in the project development in order to ensure proper project and owner satisfaction, so don't discourage it.
- Support it. Guide the owner through the process of learning from the project and the development of the design, and appropriately re-evaluating expectations.
- Manage it. Track the goals, information, and decisions over time, but refrain from building a case against an owner. Help the owner understand both the evolution of the design and the impacts of the decisions.

### 5.2.3

#### Special Considerations for Developing a Fast-Tracked Project Schedule

The use of fast-tracked scheduling on design-build projects is so prevalent that it's easy to forget that the two are separate and distinct practices. It's almost always an advantage for projects to be completed earlier, and the advantages of the designer and builder working as an integrated team greatly facilitate fast-tracked construction.

On the other hand, an owner may prefer to have all drawings completed and reviewed before beginning construction work. While such a decision may take away one of design-build's obvious advantages (i.e., faster completion), it does not eliminate the many other reasons for choosing design-build.

To reduce the duration of the project, the scheduler may suggest dividing the design deliverables into many separate design packages so that construction can get started on certain elements before the entire design is completed. **Early or interim design release packages may include:**

- Rough grading plans from the civil engineer to get the site work started before the civil drawings are fully detailed.
- Major structural steel members' drawings to place a steel mill order before the structural detailing is completed.
- Equipment purchase specifications to get long lead items, such as chillers, boilers and electrical switchgear ordered.

As an example, after the conceptual design of the building is complete, work begins on select fast-tracked packages such as demolition, grubbing, grading and excavation, site civil engineering, utilities, and foundations. The design-builder embarks on construction of those items while detailed design of the rest of the structure proceeds. The structural steel bid package may also be fast-tracked so that long lead-time steel can be fabricated.

This is in contrast to a design-bid-build contract in which the project is sequentially and fully designed by the architects and engineers, bid by general contractors, awarded by the owner, and then constructed.

The design-phase manager needs to be aware of the scheduling strategy from the beginning of the project, to make sure that the design team has incorporated these interim design packages into their design fees and schedule. Multiple submissions and requiring out-of-sequence work, compared to a traditional design process, will impact the design team. Multiple bid packages can be both inefficient and introduce the need for resources earlier in the design cycle than might otherwise be assumed. Subsequent revisions to the contract documents may be needed, which then may result in corresponding construction change orders. If designers are not used to producing these types of packages, the design-phase manager may suggest some examples or templates to assist the design team in understanding what is required and, perhaps more importantly, what is not required.

Architects and engineers are often hesitant to issue design documents before the overall design is complete. One of the design-phase manager's roles as facilitator between the design and scheduling/procurement teams is to make sure that the design team knows what is expected of them for the fast-tracked strategy, and works with them to assure the necessary documents can be delivered on schedule. The design-phase manager, in conjunction with the entire design-build team, also determines the composition of each fast-tracked package and the schedule for subcontractor bidding and award.

There is some inherent risk in proceeding with construction before resolving and completing all design issues or obtaining a full and complete building permit. For example, early work may have to be torn out and rebuilt based on subsequent design. The design-phase manager, via the design team and a careful design process, works toward reducing this risk.

## 5.3 Managing to the Project Schedule

The design-phase manager drives the design schedule and manages the design team to achieve milestones and deliverables. The design-phase manager's approach needs to be tailored and responsive to the design-builder's overall project approach.

For example, in many design-build contracts, the owner's schedule for substantial completion drives the overall schedule. That date will likely be linked to liquidated damages for late delivery. If this is the case, the design schedule is under as much pressure as the construction schedule and needs to be managed quite aggressively.

Similarly, if the design-builder has offered the owner a lump-sum proposal, or even a guaranteed maximum price, the design-builder will be eager to complete the design, finalize the subcontractors' contracts, and issue purchase orders for materials before their prices expire.

At the outset of the project, typically while negotiating the teaming agreement (see Section 4.2) and/or design subcontract (see Section 4.3), the design-phase manager, in conjunction with the design team, should decide how to handle changes that will impact the project schedule and cost. When there are deviations (typically, if there is schedule slippage or cost overruns), the design-phase manager needs to investigate the root causes of the deviation and then devise corrective measures.

Once the design-builder has mobilized to the construction site, the schedule will be driven even more aggressively. Then, general conditions costs rise appreciably and continue at a much higher level than during the design phase. **Regardless of the project's pace, the design-phase manager may want to investigate these questions if there are schedule deviations:**

- Has a circumstance caused any change in schedule decisions that were previously agreed upon?
- Was the deviation within the schedule contingency for the particular phase?
- How can the team correct for the deviation?
- What preventive measures can be taken to avert a repeat of the schedule deviation?

Designers are rarely familiar with the process of issuing a formal "Notice of Delay" for changes requested by the owner that cause a time slippage. Notices of delays are critical under a design-build contract with liquidated damages, allowing the liquidated damages milestone to be adjusted accordingly. The design-phase manager should work closely with the design team to identify items that may constitute a Notice of Delay.



# COST ESTIMATING AND COST CONTROL

## 6.1

### Developing the Cost Estimate

The design-phase manager is responsible for staying ahead of the budget at all phases of project delivery, which makes cost estimating an integral part of his or her responsibility. The design-phase manager is responsible for guiding the development of the design cost estimate (which includes professional fees for design services), usually with the direct input of designers and estimators. He or she also stays involved with the overall construction cost estimate, to ensure that the builder effectively develops its estimates in agreement with the design.

#### 6.1.1

##### Developing the Design Cost Estimate

Several typical methods are used to calculate design fees, including percentage of construction cost, fixed lump sum, time and materials, or cost plus fixed fees. Combinations of these structures are also common. Typically, estimated costs will be calculated multiple ways for comparison.

Percentage of construction cost is a common way of developing a ballpark estimate and/or cross-checking the cost of basic design services against other cost estimating structures. However, it is not typically used as the only method of establishing fees.

When using the percentage of construction cost method, “construction cost” is defined as the total cost of the owner’s contract with the design-builder, less the cost of design services and the cost of the design-builder’s pre-construction services. “Pre-construction” is typically defined as happening before the date of the initial building permit (if multiple permits are required).

“Basic design services” typically include basic design (project analysis, schematic design, design development, and construction documents such as plans, details, and specifications) and construction administration. The costs associated with specialty design consultants like structural, mechanical, and electrical engineering are not typically included in basic design services. Similarly, basic design services do not include the cost of legal services, independent cost estimators, renderings, physical models, computer animations, measured drawings of existing facilities, construction standards, full-time construction administration, or extraordinary regulatory agency approvals (such as environmental impact to waterways or submissions to historic preservation boards). Reimbursable expenses for travel, printing and reproduction services, telecommunications expenses, and postage or courier services are also typically not included in the “basic design services” estimate.

*The design-phase manager is responsible for guiding the development of the design cost estimate (which includes professional fees for design services), usually with the direct input of designers and estimators.*

## Typical Basic Design Services Costs Based on a Percentage of Construction Cost Type and Complexity of Project

Construction Cost (\$)	Type I		Type II		Type III		Type IV		Type V		Type VI	
	New	Renovation	New	Renovation	New	Renovation	New	Renovation	New	Renovation	New	Renovation
500,000	6.4	8.0	7.2	9.0	8.0	10.0	8.8	11.0	9.6	12.0	9.0	11.2
1,000,000	5.8	7.3	6.6	8.2	7.3	9.1	8.0	10.0	8.8	11.0	8.2	10.2
2,500,000	5.4	6.7	6.1	7.6	6.7	8.4	7.4	9.3	8.1	10.1	7.5	9.4
5,000,000	5.2	6.5	5.8	7.3	6.5	8.1	7.1	8.9	7.8	9.7	7.2	9.0
10,000,000	5.0	6.3	5.6	7.0	6.3	7.8	6.9	8.6	7.5	9.4	7.0	8.8
15,000,000	4.8	6.1	5.5	6.8	6.1	7.6	6.7	8.3	7.3	9.1	6.8	8.5
20,000,000	4.7	5.9	5.3	6.6	5.9	7.3	6.4	8.1	7.0	8.8	6.6	8.2
25,000,000	4.5	5.7	5.1	6.4	5.7	7.1	6.2	7.8	6.8	8.5	6.3	7.9
30,000,000	4.4	5.5	4.9	6.1	5.5	6.8	6.0	7.5	6.6	8.2	6.1	7.6

### Project Type I

Considerably less than average complexity: farm structures, shop and maintenance facilities, warehouses, storage facilities, single-use parking structures

### Project Type II

Less than average complexity: multi-family housing, student dormitories, office buildings, complex mixed-use parking structures

### Project Type III

Average complexity: K-12 schools, college classroom facilities, medical offices, clinics and gymnasiums

### Project Type IV

More than average complexity: complex college buildings, teaching laboratories, college libraries, dining halls and kitchens, theaters, sports arenas, auditoriums, medical schools

### Project Type V

Considerably more than average complexity: science and medical research facilities, hospitals, museums

### Project Type VI

Engineering-intensive projects: campus-wide utility systems, retrofitting building

mechanical, electrical, voice and data, security, fire alarm, plumbing, and fire protection systems

**Note:** This table was adapted from University of Missouri System's *Facilities Management Policy and Procedure Manual*. The fee ranges referenced herein are historical costs and not a schedule of fees suggested by any professional organization.

Within the "cost plus fixed fees" method of cost estimating, the "cost" refers to the labor and project-specific expenses. "Fixed fees" are usually based on a project's allocated construction value and can range from 3 percent to 12 percent of the new construction value, depending on a project's size and complexity. Renovation projects typically command higher fees, as high as 20 percent.

Regardless of methodology, the cost estimating process is undertaken to create smaller, more manageable, incremental components of the budget, which allows more effective cost management and informed decisions about component design. The cost estimating process entails defining the design components and applying target costs to each design element.

**A full discussion of cost estimating strategies and methodologies is beyond the scope of this guide; however, the following are some considerations in either developing a design fee estimate or evaluating a design fee proposal:**

- Has the design fee been determined by assigning costs to each of the detailed scope of work items for each design discipline (architecture, structural, civil, etc.) organized by the phases of the project?
- Has each design discipline included the cost of all the services that will be provided (drawings, specifications, calculations, reports, submittal review, construction administration, punch-list, etc.)?
- Do the scope of work items and services included in the design fee meet the owner's requirements as indicated by the Request for Proposal or the owner's scope of work document? Do they meet the requirements for all regulatory agencies?

A detailed design fee estimate can be the basis of a solid project execution plan, by identifying key deliverables and milestones through all phases of a project that can be measured during the design. The time taken to develop a design fee estimate can really pay off during the project.

## Design Cost Trends

### Factors that tend to increase design costs:

- Projects where the designers agree to provide competitive proposal-phase design services for the amount of the honorarium offered by the owner (or for no fee), if they are guaranteed a higher fee than usual if the proposal is successful.
- Projects where the designers agree to a firm fixed price for design, without additional compensation for changes. Typically, higher fees are used to help offset possible redesign costs.
- Fast-track projects where the designers have to provide out-of-sequence construction documents.
- Projects where the design team agrees to provide proposal phase or construction documents on an accelerated schedule.
- Geographic areas or economic conditions where the demand for design services exceeds supply of designers with the desired design experience and reputation.
- Especially complex phased projects or exceptionally high-performance buildings where additional design expertise is required. Similarly, projects with greater-than-normal BIM requirements, such as the inclusion of a facilities management program.
- Projects having an owner with a reputation for requiring significant additional project administration (such as the federal government, for example).
- Projects with an excessively long construction schedule that may significantly increase the designers' construction administration costs.
- Projects involving historic restoration or unusual environmental remediation.

### Factors that tend to decrease design costs:

- Projects where the design-builder and designers agree up front that the construction documents do not need to be as extensive or detailed as those normally required for the design-bid-build project delivery method.
- Projects where the design team agrees to share in the profits or losses of the project at the conclusion of construction.
- Projects where the designers, for strategic business reasons, are breaking into a new market, are new to the owner/client, new to the building type, or have not designed a project of this magnitude. Fees may be lower to gain a portfolio in those areas or because the designers are naïve.
- Contracts where the design-builder provides a project design liability policy covering the entire design team.
- Geographic areas or economic conditions where the supply of designers with the desired design experience and reputation exceeds the demand for such services.
- Projects where the owner provides a "bridging design." Fees will vary depending on the amount of design risks the design-builder must assume for the bridging design, if any.



## 6.1.2

*The design-phase manager is the intermediary between the design team and the cost estimator in the preparation of a cost model that accurately allocates the owner's budget into appropriate cost centers.*

### Developing the Construction Cost Estimate

Typically, the builder takes the lead in developing the construction cost estimate during the project selection phase, which represents the entire cost to design and construct the project. Because the cost estimate is based on the design, developing the estimate is an iterative process that starts at the beginning of the selection process with a very conceptual design, and continues until the project is awarded.

The design-phase manager is the intermediary between the design team and the cost estimator in the preparation of a cost model that accurately allocates the owner's budget into appropriate cost centers. To do this, the design-phase manager needs to make sure that the designers and estimators are working as a team.

Within the design-build environment, cost estimators must be able to develop accurate estimates at various conceptual levels of design. An estimator who is used to putting together hard bid estimates may not be able to estimate at a conceptual level. To provide an accurate estimate, the estimator must understand the design process, and how to work with varying levels of completion of the design documents.

The estimator also needs to be able to "fill in the blanks" or complete aspects of the scope of work that were not detailed in the conceptual design documents. For example, the conceptual design documents may not show full detail for the heating, ventilation, and air conditioning (HVAC) system, but the estimator needs to know to include the cost of the missing components or to ask the HVAC engineer for clarification. To simply leave the HVAC cost out of the estimate because they aren't on the drawings shows a lack of understanding of the conceptual design process and how and where HVAC systems integrate into the design process.

Conversely, the design team needs to help the estimator identify scope of work items that they were unable to detail in the drawings in other ways. A quick note on the drawings to the estimator helps to avoid an omission in the construction cost estimate.

Designers that have only designed for hard-bid projects can find it difficult to develop conceptual design documents that can be accurately estimated (which is critical for a design-build project). They may provide too much detail in one area and not enough in another.

What often separates design-build from design-bid-build projects is that the design-builder is being asked by the owner to take cost and schedule risk for the delivery of a project without the benefit of a complete design. Even good conceptual construction cost estimators will often try to get more complete design documents than the design team can or should develop, in the hopes that their estimate will be more accurate.

Furthermore, the design team will try to make the design documents as complete as possible (potentially more than what was planned for or required) to avoid the cost estimator missing anything.

#### **If left unchecked, this can result in several potentially unacceptable consequences:**

- The cost estimator will delay putting together the estimate and wait for more detailed design documents, resulting in a rushed bid process to meet the submission deadline.
- The designer, preferring to spend more time on the documents, will delay its delivery, also resulting in a rushed bid process.
- If there are cost overruns, the estimator might blame the designer for not providing complete documents and/or designer might blame the estimator for not including all the costs in the estimate.
- There may be time wasted and schedule slippage.

*The design-phase manager is responsible for seeing that the design never grows in scope or becomes more elaborate than the construction cost estimate can accommodate.*

### 6.1.3

The design-phase manager should be aware of these common behaviors and prevent them from interfering with a successful conceptual construction estimate. The design-phase manager must know what level of completion is appropriate for the conceptual design, obtain buy-in from the design and estimating teams on what those conceptual design deliverables will be, and hold both teams accountable for their portion. The design-phase manager guides the design team away from overdoing the conceptual design, to avoid delaying the cost estimating process or to prevent over-designing scopes that may need to be redesigned later.

Whenever a design-build firm is in the position of having to submit an overall project cost proposal to an owner that exceeds the owner's stated budget, it should consider including voluntary alternatives that bring the proposal price within budget. Alternatives must not violate applicable codes or reduce the program's minimum functional requirements below the owner's expectations.

#### **Target-Based (Target-Value) Design and Designing within the Construction Cost Estimate**

On many design-bid-build projects, the design is performed somewhat independently of construction considerations, which may result in projects that are unaffordable and/or unconstructable. Within the design-build environment, a relatively new technique is gaining traction: target-based design. With target-based design, a budget model is established first, with initial target values for various elements of the structure. Then the designers, in close collaboration with the builders and estimators, design to meet those estimated budgets.

Whether the target of the design is a financial objective, project delivery schedule, some other stated performance measure (or likely all three), the design-phase manager plays a key role in assuring the targets are achieved. For the purpose of this discussion, we will assume the target is financial (the most common), but the principles apply to other targets as well.

Construction cost management is a process by which the design thinking is tested and validated against the overall project cost targets. It's a collaborative process that involves the participation of the full project team, including the design-phase manager, designers, and design-builder. Construction cost management is implemented from the very beginning of a project. Then, through continuous iterative reevaluation of the design, the discussions and results proactively inform design and cost decisions.

One of the most common mistakes an inexperienced design-phase manager makes is to allow the design to become too advanced before determining its cost. The eventual redesign results in more than lost time and money: it can damage the design-phase manager's credibility and create divisions in the team.

The design-phase manager is responsible for seeing that the design never grows in scope or becomes more elaborate than the construction cost estimate can accommodate. If it appears that the design is trending toward a more costly solution, the design-phase manager must ensure that discrepancies are discovered and addressed in the early stages of design. Remember, the goal is to design to an estimate, rather than estimating a design at predetermined milestones.

At the outset, the design-phase manager needs to obtain input and buy-in from the design and construction estimating and procurement teams on the initial price submitted to the owner for the overall project; otherwise, keeping the design on-target will be much harder. After the project is awarded and before the detailed design commences, it's beneficial for the design-phase manager to review with the design team the scope of work used to create the

*Remember, the goal is to design to an estimate, rather than estimating a design at predetermined milestones.*

construction cost estimate. This should include sharing the breakdown of the construction cost estimate, so that the designers are aware of which components of the design have the greatest impact on the project budget.

Controlling costs during a competitive design process can be difficult. One technique some design-build teams use is to design a “black box” solution. The black box is the absolute minimum design solution in every aspect. It will meet the minimum program requirements and applicable codes—but with no consideration for the subjective aspects of function, quality, quantity, durability, or aesthetics.

When the estimated cost of the black box design is compared to the available budget, the design team then knows how much of the remaining budget it can spend for design improvements. As each upgrade is added to the design scheme, the incremental cost is estimated and the available balance reduced, until the full budget is expended.

The team carefully considers improvements against their potential point value in the owner’s design evaluation process. The team then decides to adopt or reject each improvement. This incremental cost-per-point process allows a degree of budget analysis and control during the early conceptual design process, and keeps the solution focused on a successful proposal. However, this approach may also involve more design time and higher fees because it depends on multiple solutions.

**If projected construction costs appear to be deviating from the construction budget, the design-phase manager may want to consider:**

- Redesigning that element to the budget. The design-phase manager can work with the design and construction teams to identify value-engineering options that could be implemented to offset the cost increases from changes.
- Increasing or decreasing the budget for that element by modifying budgets for other elements.
- Approaching the owner with a request to modify the overall project budget. Changes that are not required for the project can be presented as potential change orders for the owner to approve and ultimately increase the project budget so there is no longer a conflict.

The earlier changes are identified, the more likely it is that they will be easily resolved. Continuous communication on the scope of work and progress of the design is crucial to a successful target-based design.

If the design-build team cannot manage project costs collaboratively, the design-phase manager may need to resort to higher authority levels to resolve the issues. The teaming agreement and/or designer subcontracts, if written carefully (see Chapter 4), should include a decision and/or authority tree to resolve disputes.

## 6.2 Managing Project Design Costs

On a design-build project, once the overall project schedule is established, designers are responsible for managing their own schedules and budgets. However, changes occur, and managing against a project-wide cost estimate and overall design schedule is the crux of the design-phase manager's role during the design phases of a design-build project.

This is an iterative process of ongoing validation of the predefined cost estimate compared to actual conditions. Methods and approaches vary widely and should be tailored to support project particulars.

At the outset of the project, the design-phase manager, in conjunction with the design team, should decide how to handle scope and cost changes. For example, costs can be managed in real time or in pre-determined intervals, based on periodic (perhaps weekly) reconciliation. The team needs to establish how the budget will be verified. When there are deviations (typically, if there is schedule slippage or cost overruns), the design-phase manager needs to investigate the root causes of the deviations and then devise corrective measures.

### 6.2.1 Managing the Design Budget

Once the project has been awarded and detail design ensues, the design-phase manager works with the design team to monitor the design costs.

#### Key drivers that impact design costs include:

- Additional services – above the basic design services
- Administration – staffing and document management
- Decision-making – slow decision-making process
- Planning – improper planning or not following the plan
- Changes – due to owner, contractor, or design team
- Technology – new or unfamiliar technology, such as BIM or project management websites
- Complexity – extensive permitting requirements or excessive fast-track design packages

#### Strategies to manage design costs include:

- At the beginning of each design phase, and periodically throughout the design process, review the scope of services with the design team and make sure there are no major changes.
- Review the technology that the team intends to use, and verify that it's appropriate for the project. For example, the team may want to do a full BIM 3D model on a very simple project that doesn't need it.
- Make sure the design team is leveraging the subcontractors, vendors, and construction team in detailing certain aspects of the design. As an example, the design team can have detailers at the steel fabrication shop draw steel connection details.
- Avoid having different team members swapped in and out of a project. In an attempt to more efficiently utilize resources, many organizations will move staff on and off teams. This can actually have a detrimental effect on the efficiency of the project design. If staff needs to change, which will happen at times, this will have less impact on the project if sufficient planning is done up front.

## 6.2.2

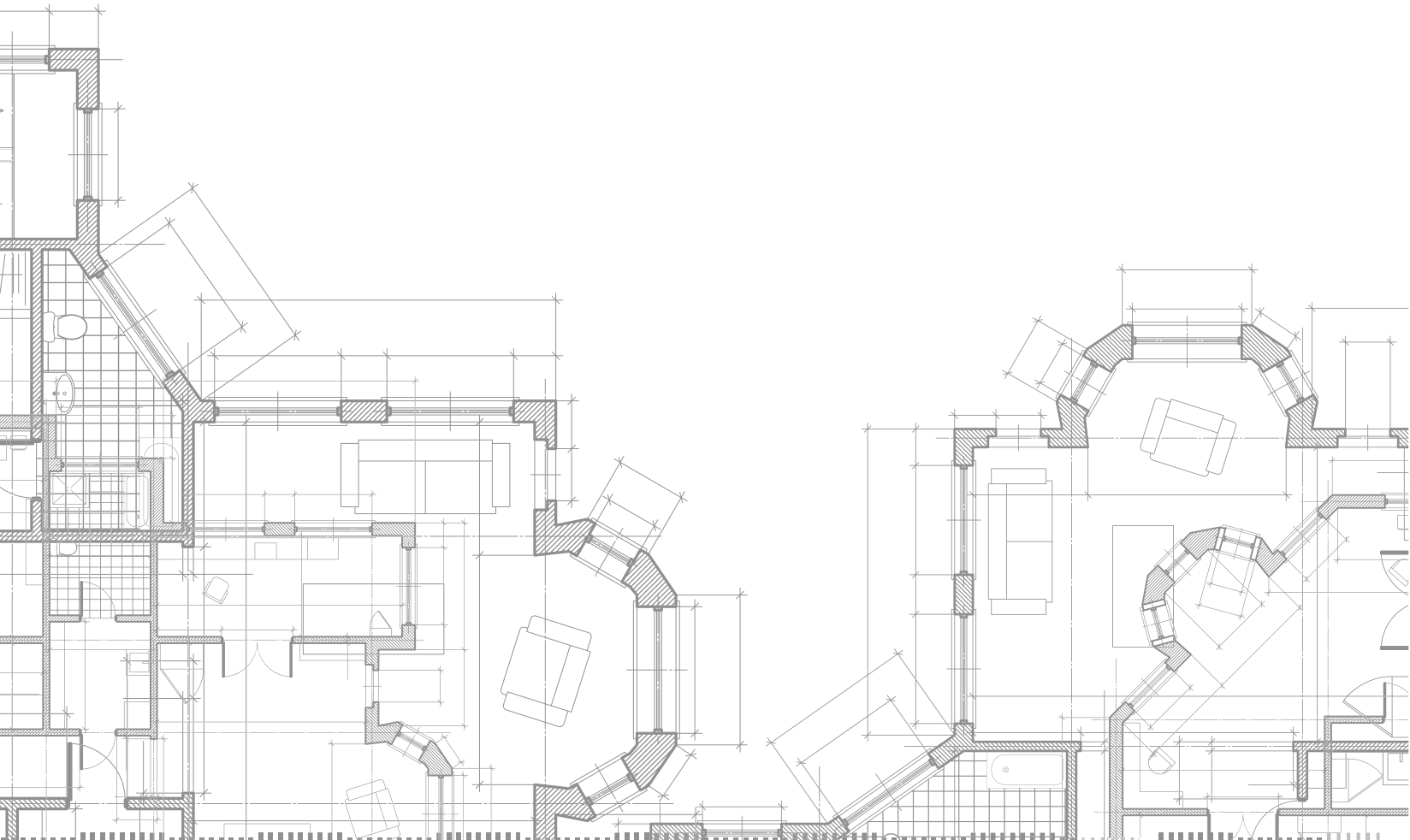
### Special Cost Tracking Considerations for a Fast-Tracked Project

Fast-tracked design and construction is described in more detail in Section 5.2.3. The design-phase manager, knowing that design assumptions are a normal part of most fast-tracked projects, should not be naive to the potential cost or re-work issues that could result from fast-tracking the schedule. An experienced design and construction team, working together, will have the best chance of preserving the schedule advantages while mitigating the potential inefficiencies of early design assumptions.

One of the primary focuses of the construction scheduler is to determine how quickly the project can be completed. This will reduce the cost of the work overall, because the builder's significant duration-related costs—such as renting construction trailers for offices, salaries for project management staff, utility costs during construction, site security, and waste disposal—are lowered. By reducing the duration of the project by weeks or even months, a project can often cut down costs considerably.

During the design process, it's likely that the construction manager and schedulers will discover new opportunities to save time. However, these opportunities may have unintended consequences for the design team that increase design costs above what was budgeted, and create unnecessary risk due to performing the design out of normal sequence. In this case, it is the design-phase manager's role to understand what these costs and risks are, and to resolve any conflicts with the overall project team on fast-tracked design deliverables.

*During the design process, it's likely that the construction manager and schedulers will discover new opportunities to save time.*





# DESIGN

## 7.1

### Design Phases

*During design, the design-phase manager orchestrates the design team until all design tasks have been completed, the documents necessary for permitting and construction have been wrapped up, and the project equipment and materials procurement activities are complete*

A typical design process proceeds from conceptual design, through preliminary design, detailed design, and final design. During the selection phase of the project (as described in Chapter 2), design may encompass the conceptual through preliminary design so that enough specificity is obtained that accurate schedules and cost estimates can be made.

After project award and notice-to-proceed, the design-phase manager takes the design process through several additional phases, each with its own types of design activities and level of detail. It's beyond the scope of this guide to go into great detail about the requirements and nature of each design phase. These discussions and clarifications will be ongoing between the design-phase manager and design team.

A design-build project may be structured several different ways, considering schedule, cash flow, payment, and incentives. The design-phase manager's approach to managing the project's design phases will be tailored accordingly. For example, the project may be fast-tracked or it may be a design-build with bridging designs. It may be qualifications-based selection with design to follow contract award, or design-assist, with the contractor assuming the design-builder role after acceptance of a guaranteed maximum price, sometime in the middle of the design-development phase. It may be structured as design-build-operate-maintain.

During design, the design-phase manager orchestrates the design team until all design tasks have been completed, the documents necessary for permitting and construction have been wrapped up, and the project equipment and materials procurement activities are complete. Thereafter, the design-phase manager typically becomes the design-builder's construction-phase manager, but continues to interface with the design team.



## 7.1.1

### Conceptual and Preliminary Design

Based on the conceptual design and depending on the specific pursuit, the design-builder will likely prepare some or all of the following as part of the proposal submittal:

- Project approach and system narratives, also called the “basis-of-design”
- Floor plans, wall and building sections, and building elevations
- Program square footage confirmation by room or specific usage
- Leadership in Energy & Environmental Design (LEED) checklist
- BIM implementation plan
- Material and equipment cut sheets for key systems
- Specifications at a certain completion level, depending on specific pursuit requirements
- RFP compliance checklist and other miscellaneous documents required by the RFP

## 7.1.2

### Project Definition after Award

After project award and further discussions with the owner, the design-phase manager works with the design team to reconcile the collective definition of the project with what the team had proposed. The intent is to define precisely what is included in the project.

Once the vision and performance expectations are articulated, all of the key elements of the project need to be defined. The key elements include the nuts-and-bolts of project execution, such as the design scope, budget (see Section 6.1) and schedule (see Section 5.2). Key elements also include the softer side of the project, such as performance goals, aesthetics, public perception, sustainability, and industry recognition.

As part of this process, the team, under the design-phase manager’s leadership, compares the basis-of-design to what is achievable, given the contracted construction cost estimate. The objective is to identify any remaining questions or ambiguities so that subsequent re-work or redesign can be avoided. The design-phase manager also needs to be prepared to resolve conflicts if gaps are identified in the reconciliation process.

Information collected to this point is used to clarify goals, priorities, risks, and concerns of all project participants in order to develop and adopt a vision of collective success on the project. The design-phase manager should consider the importance of sharing detailed cost estimates between the design team and the construction team. This is particularly necessary in a target-based design (see Section 6.1.3).

A systems-verification process might also be conducted as part of the project definition. Key systems may include, for example, curtain walls, structural, mechanical, electrical, and plumbing systems, etc. The verification process conducted by the design team gets everyone on the same page as to what will be required to complete the design successfully.

## 7.1.3

### Detailed Design

Based on the conceptual design and the reconciled project definition, the design team then embarks on full architectural and engineering design of the building. The design-phase manager tracks the progress at every step, comparing the work accomplished against the project’s schedule and budget—and against the project’s vision and goals.



*7.2*

*The design-phase manager's ultimate goal is to ensure that the design meets the owner's project criteria, while protecting the business interests of the design-build team.*

Throughout the detailed design phase, the design-phase manager periodically reviews the cost trends and works with the designers to adjust the designs so the project remains within budget. The design-phase manager, in conjunction with the principal architects and engineers, ensures that all specialty design subcontractors are engaged at the right junctures throughout the design phase. The design-phase manager also coordinates review cycles among the project team, including the design-builder and the owner.

## **Design-Phase Manager's Role in Managing BIM**

Building information modeling (BIM) is a valuable technology for designing, validating, and delivering facility projects; however, it must be managed carefully in order to maximize the value of the data. A building information model can be seen as a virtual or digital prototype of a proposed building design. The design-build environment is ideally suited to support collaboration on the design within a BIM platform.

The design-phase manager's role in managing the BIM process is first to set the expectations of the design team and establish a realistic BIM execution plan. A great resource is the *BIM Project Execution Planning Guide*, which can be downloaded from the Penn State Center for Integrated Construction Research Program.

Developing good model data is the primary objective of the plan, and any required 2D documentation must be derived from the model data. Once that expectation is established with the team, the design-phase manager can oversee the development of the model data to avoid redundant efforts. BIM data can then be used to validate the design for compliance with the owner's requirements, constructability considerations, and code compliance.

**In establishing a BIM platform, the design-phase manager needs to address the following issues:**

- What BIM software applications do the design team members use?
- What is the team members' level of expertise and experience in conducting BIM processes?
- Which BIM-enabled processes are the most valuable or relevant to achieving the project goals?
- How will compliance with the plan be measured?
- How are modeling decisions coordinated with the overall design and construction leaders?

## **7.3**

### **Design Considerations for a Design-Build Project**

Several special design considerations govern a design-build project. The success of the project is contingent on how well the design-phase manager understands the considerations, and to what extent the team understands and follows the criteria that the project builds upon.

#### **7.3.1**

##### **Best Practices for Overseeing the Development of Specifications**

Well-defined project specifications are critical to meeting the project requirements. However, a specifications writer is often brought on only at the final phase of the design, and asked to prepare

*The model development specification is a tool developed to concisely define the amount, type, and precision of information to be included in BIMs for project milestones and deliverables at various stages of the project's progress.*

### 7.3.2

specifications to match the documents, with the assumption that addressing the owner's requirements will be straightforward. The specifications writer is also asked to select systems and products that match the project schedule, budget, and special requirements, and to do so in an abbreviated timeframe.

A better practice for the design-phase manager is to make certain that the specifications writer is identified early and made a part of the decision-making process for system and assembly selections. This is the best way to facilitate seamless coordination between the owner's project requirements, estimate, schedule, and quality factors.

The technical specification development process should be started at the proposal stage. The design-phase manager should assign a team or individual to create an outline or table of contents, at minimum.

This outline can be expanded at the award stage to develop a short-form specifications package, which can be further enhanced to the full form as the design details are finalized. The drawings and specifications should be submitted as a combined design package.

Sometimes, the owner may call for certain specific codes that compete with the owner's own prescriptive criteria. In such a case, the onus of responsibility to make a decision rests on the owner. The design-phase manager needs to prompt the owner to adjudicate the conflict and document that process to protect the design-builder from liability.

The use of standard reference specifications is common and necessary for most projects. However, a significant burden is placed on the design-builder if the specifications are voluminous or obscure. This presents a risk that expensive components could be overlooked in the cost estimate or entirely left out of the project.

#### **Level of Development Specification**

Design-phase managers frequently use the BIM process to facilitate designs that involve a large number of components. However, controlling the amount of information that goes into the BIM, such that the BIM remains useful, is not easy. The model development specification is a tool developed to concisely define the amount, type, and precision of information to be included in BIMs for project milestones and deliverables at various stages of the project's progress.

The model development specification defines models using the level of development (LOD) definition, which is an outgrowth of the level of detail framework first created by Vico Software and further developed by the AIA California Council IPD Committee. It has evolved to the current form by the AIA Contracts Development Committee as the core of its E202-2008 BIM Protocol Exhibit, and currently serves as the integral framework for BIM development.

The LOD definition enables practitioners in the AEC industry to clearly specify and communicate the content and reliability of the BIM at various stages in the design and construction process.

*Designers may be asked to complete certain parts of their designs well out of the normal sequence to support early-release packages.*

### 7.3.3

#### Special Design Considerations for a Fast-Tracked Project

In a fast-tracked project, construction work begins before all design work is complete, so the construction team may need to make educated assumptions about design issues that have not yet been finalized. Making somewhat conservative assumptions is generally better (within reason) than later discovering that more elaborate changes could have damaging cost and schedule implications.

Starting construction before completion of the design work can have various impacts. Designers may be asked to complete certain parts of their designs well out of the normal sequence to support early-release packages. This design work needs to be at a level of detail, including specifications, to allow trade bidding to occur.

While this work would have been required as part of the design, it is the timing that can add design hours to the effort. As designs progress and better information becomes available, certain components may require redesign.

The design-phase manager should discuss, with all affected parties, his or her philosophy about redesign and the accompanying cost and time impact to the design team. Even if the impact of new information does not result in redesign, some additional analysis is often required, if only to verify that early assumptions are matched by actual, final information.

### 7.4

#### Sustainable Design Strategies

Buildings in the U.S. account for nearly half of the nation's total energy consumption. Additionally, the construction of buildings uses a vast amount of natural resources, such as steel, wood, and concrete, along with the energy needed to manufacture and transport those resources.

Many people now recognize that a more environmentally, economically, and socially sustainable natural and built environment is essential and achievable. The design of "green" buildings—buildings with improved efficiency in their use of energy, water, and materials—is becoming common in the U.S.

If the owner elects to incorporate green elements into the project, the U.S. Green Building Council's "LEED Checklist" or other similar criteria may be helpful in determining which strategies are appropriate for the project. Additionally, the design-phase manager may consider a full life cycle assessment to evaluate the environmental impacts and carbon footprint associated with all the stages of the project, cradle-to-grave. This life cycle assessment would include raw material usage and transport to the site, carbon-friendly design elements, future repair and maintenance requirements, and eventual building re-use or decommissioning.

Even when the owner does not have a specific green strategy, there are many sustainable design and construction approaches that can result in a more responsible building with no negative impact on cost or schedule.

## Design Deliverables

The design-phase manager and design team are required to deliver some or all of the following documents as part of the design process.

### Design Documents

- Preliminary zoning and code analysis
- Master plan for long-term development
- Program verification (design compared to owner's minimum program)
- Scope validation checklist (design compared to design-build proposal)
- Plans and specifications to allow start of construction for each phased task
- Early permit packages (e.g., civil, structural, underground plumbing)
- Owner's approval set(s) of plans and specifications
- Review authorities' set(s) of plans and specifications
- Shop drawings and samples
- Mock-ups for testing and constructability analysis

### Supporting Documents

- Design and construction schedule, including long-lead items
- Design change management plan
- Pricing trend log
- Commissioning plan
- Compilation of peer review comments
- Americans With Disabilities accessibility study
- Fire and life-safety analysis
- LEED checklist
- Other specialty consultants' analyses
- BIM documentation
- Jurisdictional submittals and approval

Sustainable design elements that are typically considered in buildings include energy conservation; "daylighting" for natural (solar) indoor lighting; indoor air quality and natural ventilation; water conservation; waste management; erosion control; a transportation strategy (possibly with transit) to reduce the amount of carbon fuel used in and around the project; use of recycled materials in design; and user recycling practices integrated into the design.

Leadership in Energy & Environmental Design (LEED) is a green building certification program that recognizes outstanding building strategies and practices. In order to receive LEED certification, building projects must satisfy prerequisites and earn points to achieve different levels of certification.

There are five rating systems that address multiple project types—building design and construction is one of them. Each rating system has its own distinct set of prerequisites and credits. Teams choose the most appropriate rating system for their project and accordingly plan and execute their project to receive the desired certification.

Another set of green design criteria, Envision™ Sustainable Infrastructure Rating System, provides a framework for evaluating the community, environmental, and economic benefits of infrastructure projects of all types and sizes. It is used by owners, designers, community groups, environmental organizations, regulators, and policy makers to evaluate, grade, and recognize projects that use collaborative approaches to assess the sustainability indicators over the course of the project's life cycle.

The design-phase manager needs to be well versed in sustainable design strategies and green certification programs. As a leader on a green design project, the design-phase manager is responsible for analyzing and evaluating the sustainable strategies to be implemented in building design.

The design manager facilitates LEED and other green building charrettes with the project design and construction teams. The design-phase manager reviews preliminary drawings and construction documents to ascertain that the sustainable measures are incorporated appropriately, and performs site inspections to verify that the green measures are incorporated during the construction phase. At the end of the construction and closeout, the design-phase manager reviews and compiles documentation packages for green building certification.

## 7.5

## Building Quality into the Design Process

Design quality assurance (QA) is a process that helps the design and construction documents meet the standard of care for contract program requirements, coordination, constructability, and performance. Both formal and informal quality assurance and quality control (QC) programs are intended to limit the occurrence of errors and omissions that can cause costly changes and delays in the project.

An approved, published design QC program should be submitted and administered throughout the design. This program should include all interdisciplinary design checks, code compliance, RFP compliance reviews, constructability reviews, and so forth.

**An effective QA/QC program:**

- Requires a systematic approach that starts at the inception of design and continues through the construction process.
- Requires the participation of the owner, designers, and construction team.
- Enhances the likelihood of procuring the most efficient subcontractor and supplier bids.
- Promotes maximum productivity in the field.
- Reduces the need for field changes.

It is the design-phase manager’s responsibility to ensure the highest quality design. This can be achieved by utilizing tools and services listed in other sections, such as BIM, clash detection, peer review, and appropriate specialized consultants (e.g., food service, theater, acoustic, water proofing, and others as required by the specialized nature of the scope). When such specialized services are needed, the design-phase manager must actively work with the design team to find the most cost-effective solution.

The design-phase manager also facilitates the process by which an effective QA/QC program is developed—typically concurrently with the project schedule—and then oversees the implementation of the QA/QC program.

## 7.5.1

### Informal Design Reviews

Periodically, the design-phase manager will put the drawings up on the wall (“pin-ups”) for an informal team presentation by each discipline leader. The design-phase manager encourages the whole team to critically review and comment on the design progress.

Pin-ups are performed early, and typically occur several times during each design phase. Some pin-up presentations may focus on a single design element, such as site development, lighting, or interior design.

Periodically throughout design, the design-phase manager, in conjunction with each design discipline leader, conducts coordination reviews. These can be done during the pin-ups, but may also rely heavily on BIM clash-detection exercises. The coordination review will reveal space interferences, but it may also look at how the drawings have been coordinated with the specifications, and whether different disciplines have been coordinated adequately.

## 7.5.2

### Criteria Compliance

A typical design-build project starts with the owner issuing an RFP and the design-build team responding with a proposal (as described in Chapter 2). The vision for the project may not be clear from the RFP. If it’s not, the design-phase manager should consult with the owner and ensure that the RFP outlines the owner’s priorities and objectives. Having a clear understanding of the owner’s criteria is imperative to the project’s success, and may prevent expensive redesign.

The design-phase manager’s ultimate goal is to ensure that the design meets the owner’s project criteria, while protecting the business interests of the design-build team. This can be achieved by thoroughly understanding the owner’s needs, using some innovative ideas, and/or communicating with the owner so that the design proposal is reconciled against the criteria and the proposal is

compliant. At the outset of the project (during the proposal-preparation phase), the project criteria should be examined in detail to determine the owner's performance and prescriptive requirements. The team creates a conceptual design, or proposal, in response to those criteria.

The next step should be to cross-check the proposal against the owner's requirements to make sure the owner's requirements are met. For small projects, this may be as simple as comparing the proposal to the RFP. For larger projects, however, the design-phase manager should create a matrix of project requirements from the RFP and proposals, assigning a value (based on cost, importance, owner's budget, or a combination thereof) to each of the criteria.

After going through the exercise of tallying the requirements and assigning points, the design-phase manager determines if the project design is compliant or non-compliant. If it does not comply, re-evaluation and/or redesign may be necessary to ensure that the design meets the owner's requirements and budget.

The design-phase manager, independent of the designers, reviews the design at each design phase. These reviews should answer the question to the best of the design-phase manager's ability, "Are the owners getting what they asked for?" Similarly, for each criterion or hot-button issue, the designer answers the question, "Does the design comply?" When the design-phase manager sees a clear conflict, the owner should decide how to resolve it (for example, the owner may decide to increase the budget for some important requirements, or prioritize some requirements over others so the project stays within budget).

This process of review and analysis requires the design-phase manager to possess an intimate knowledge of the owner's criteria, and may require discussions with the designers regarding how and where in the design each criterion has been addressed.

## 7.5.3

### Code Analysis and Compliance

Designers are required to conduct a code analysis of the proposed building project. In it, the designers list the applicable codes and summarize how the design complies with those codes. The code analysis must be performed early, then updated as the design progresses.

#### **Some of the codes that are evaluated in this code analysis include:**

- Fire and life safety
- Health and sanitation
- Accessibility
- Sustainability or green codes
- Energy codes
- Design review boards
- Zoning regulations
- Utility regulations

The design-phase manager reviews the code analysis for thoroughness and completeness. The design-phase manager may also assign a third-party code consultant to review the code analysis that the designers have prepared.

Some or all of the information included in the code analysis may be required by permitting agencies. It is not unusual to find that building codes are interpreted quite differently from one jurisdiction to the next. Although it may appear that some codes are objective, in practice they are not.

It is beneficial (if not essential) that both the architect-of-record and engineer-of-record be highly experienced and familiar with how local code officials interpret the codes in the project's location. It may be necessary to add local professional team members for the specific purpose of supplementing the team's knowledge of code interpretation and enforcement.

An alternative strategy may be to schedule a preliminary permit application meeting with the permitting review agency to determine its interpretation of codes. When unfavorable interpretations arise, it may be possible to appeal to higher authorities, but that is usually not a cost-effective strategy.

#### 7.5.4 Constructability Reviews

The design team might develop a stunning and highly functional building design, but the design must also be constructible for the design-builder to be successful. The constructability review considers the design in relationship to the realities of construction—including fabrication, shipping, assembly, storing, lifting, installing, and finishing.

The design-phase manager facilitates constructability reviews at key junctures during the design. The constructability review team should include the construction project manager, construction superintendent, major subcontractors, and the design-phase manager. The presence of the designers may be optional. However, it is common to include third-party designers in the constructability review, sometimes individuals from the same design firm. Regardless, the design-phase manager needs to communicate the results of the constructability review to the design team with clear comments, explanations, and instructions.

In addition to basic criteria regarding "Can this design be built efficiently?", the constructability review should also address procurement and construction sequencing.

One technique that some design-builders use is to require designers to present their designs to the assembled design and construction team, and then open the discussion to critiques from all sources. In this exercise, if there are concerns, the designers can argue the rationale of the design solution and the logic applied in the evaluation of design quality and appropriateness.

#### 7.5.5 Peer Reviews

Peer review is the evaluation of the design by a second set of eyes involving an independent qualified party or team of people. The purpose of peer review is to maintain or enhance the quality of the work, reduce errors and omissions, and cut costs. When a fresh and diverse group of people evaluates the design impartially, they usually find some design weaknesses and/or errors.

The design-phase manager secures the services of the individual peer review or a peer review team, depending on the size of the project. The contract may constitute a very simple agreement which defines the roles, responsibilities, scope of the review, professional service fees, and liabilities.

The review should be conducted under limited liability to the reviewer. The penalty should be limited to the professional service fees of the reviewer, or a multiplier of the fees, as mutually decided upon in advance and specified in the contract.



## 7.5.6

### The Design-Builder's Role during Design

Design-builders have a design function just as critical to a project's success as the work of the architects and engineers. The design-phase manager helps facilitate the involvement of builders, trade subcontractors, and specialty subcontractors at the proper stages throughout the design.

Team members with real-life construction, scheduling, and procurement experience need to be involved with the design team at project kick-off, and at least weekly thereafter. The design-builder(s) should be involved in every internal design review. Their contributions and suggestions need to be evaluated by the design team and implemented, as appropriate, and in keeping with the owner's objectives for the project.

## 7.6

### Managing Change during the Design Process

Design-phase managers need to understand that they will encounter changes on every project. These changes can result from, for example, a new direction from the owner, unforeseen physical conditions, political influences, or new technology. At the outset of the project, the design-phase manager needs to create a strategy and process to manage change during design.

Some changes may result in additional compensation by the owner to the design team firms, and some may not. Typically, if the owner requests changes that have implications to the designers, the designer should be compensated for the additional work. Sometimes the design team may make changes internally. These changes should be thoroughly discussed and documented in the design meeting minutes or action logs.

The contractor may make changes, post-design, upon determining a better way to build the project, and/or due to changes or omissions in designs. This type of change may be covered by the design contingency cost, which is agreed upon at the outset of the design and included in the teaming agreement. Minor or non-negligent design errors typically range from one to five percent of the overall project cost.

Design changes may also occur due to changed conditions (such as those related to the geology or subsurface geotechnical conditions). Time is of the essence in these cases, so the design-phase manager should have a mechanism in place to reconcile the changes to ensure that the design and/or construction can move forward without costly penalties, fees, or expenses. The owner should be involved in the discussion so that sound decisions can be made reasonably quickly.

*The design-phase manager helps facilitate the involvement of builders, trade subcontractors, and specialty subcontractors at the proper stages throughout the design.*



# CONSTRUCTION

## 8.1

### Design Support during Construction

After the design is complete, the design team’s involvement tapers off considerably. However, the design team must still be available to clarify any ambiguities in the design and to help the builder select proper materials and supplies.

The designers continue their professional services for shop drawing review, and will mostly likely participate in developing record documents (sometimes mistakenly referred to as “as-builts”) for the project. The design-phase manager will continue to manage the design team’s support during construction.

### 8.1.1

#### Assisting with Equipment, Materials, and Supplies Procurement

On most build projects, designers typically specify the types of equipment and materials to be included in the project. Builders then purchase the equipment and materials. On a design-build project, because the designers and builders are on the same team, there are distinct advantages in the equipment and materials specification and procurement processes compared to design-bid-build.

For example, communication between the designers and the procurement team can be much more fluid. Procurement can be implemented on a just-in-time basis, in accordance with the project schedule. Procurement staff can help the design team with preliminary pricing, scheduling delivery, and defining early procurement needs.

The design-phase manager establishes the basic procurement strategy. For instance, the procurement strategy can be either a prescriptive strategy or a performance-specification strategy. The overarching procurement strategy may have a significant impact on cost, quality, and schedule. Interim pricing review documents can help guide decisions pertaining to the cost of equipment and materials. The design-phase manager works with the design team to facilitate communication and cost review cycles.

As part of the procurement strategy, the design-phase manager works with the design team to identify which equipment, materials, and supplies need to be procured using formal bid packages—and then delivers those packages to the procurement team. Particular attention needs to be paid to long-lead-time materials and equipment. Long-lead-time items need to be built into the project schedule and designed and procured at appropriate phases of the project.

*The design-phase manager typically becomes the design-builder’s construction-phase manager but continues to interface with the design team.*

The design-phase manager serves as the liaison between the owner and design team to develop a procurement strategy for the furniture, fixtures and equipment.

The design-phase manager calls on the design team if there is a need to redesign during the procurement process because of budget, availability, or schedule. The design-phase manager also confirms the prefabrication strategies.

## 8.1.2

### **Clarifying Design Issues that Arise during Construction**

For a design-build project, it is cost-prohibitive, unrealistic, and nearly impossible to make the construction plans and specifications absolutely comprehensive. Therefore, during construction, designers provide clarification and guidance on the intent and details of various aspects of the design.

#### **These clarifications occur in a number of ways:**

- RFIs, where the builder asks the design team for specific information
- Shop drawings, where the builder (or specialty contractor) prepares detailed fabrication and assembly drawings, and specifications for particular specialty items, and submits them to the designers for review and approval
- Architect's supplemental instruction (ASI), as the design team determines the need

These three means of clarification are similar to those performed in a design-bid-build project. However, on a design-build project, the process is less complicated because the owner is not in the review and approval loop. The owner receives copies of the shop drawings, but the owner's approval is not necessary for the design-builder to proceed. Reviews and approvals by the architect or engineer of record are still necessary, however.

Construction typically occurs at a rapid clip. Responses to RFIs and/or review and approval of shop drawings must occur in a timely manner, so construction is not delayed. The design-phase manager establishes methods by which these clarifications and reviews can occur efficiently. Some of the nuts-and-bolts considerations include which forms will be used; how the RFIs and submittals will be tracked via logging, distributing, and return; and agreements on acceptable turnaround times.

Perhaps more important, however, is establishing the standing communication rules for RFIs and submittals. For example, the design-builder may be required to call before sending the RFI—so designers are not surprised by something unexpected. Similarly, criteria should be established up front to help guide decisions on what constitutes an RFI versus an ASI versus a change order.

Next, the design-phase manager orchestrates the review process. During review, there should be no communication between the design-builder and the designer unless the design-phase manager is informed and involved.

The design-phase manager determines how and when to be involved. He or she typically assigns responsibility for the tracking, distribution, and review cycle to key staff members of the design team. The design-phase manager also works with the design team to verify that the team can adequately support the submittal review and on-site inspection schedule. The design-builder owns the schedule and design responsibility; therefore, the designer may be given a shorter duration to review RFIs and submittals so construction is not delayed.

The construction team should work with the design-phase manager to provide possible solutions to RFIs prior to their issuance to the designers. This allows the team to come together to determine the best-value solution for each problem, while minimizing added cost and construction delay.

During the shop drawing and approval process, physical mock-ups for aesthetics, constructability, or testing may be required. The design-phase manager needs to work closely with the design team and fabricators to ensure requirements are being met. The owner should be included in all mock-up reviews.

Trade subcontractors are often brought into the project early in the design process. This will allow the design team and the trade subcontractors to determine where the design documents end and the respective shop drawings begin, in an effort to eliminate any duplicate efforts by these team members. The design-phase manager will often facilitate working sessions with the architect and trade subcontractors to efficiently review and approve shop drawings.

## 8.2 Project Closeout

It is critical to begin with the end in mind. Planning for closeout documentation is perhaps more important to the closeout process than many other facets of the design and construction process.

The closeout process for a design-build model is similar to the design-bid-build model. However, since the design-builder has an active role in creating the design, accordingly, it moves away from a passive state and becomes proactive, to ensure that the owner's objectives are met.

### **Closeout documents become a derivative of the following process:**

1. Owner provides the design-build team an owner project requirements list.
2. Design-build team delivers to owner a basis of design.
3. Design-build team creates construction documents (drawings, specifications, and other documents to define the scope of work).
4. Design-build team processes and documents submittals and substitution requests.
5. Design-build team and owner or owner's representative (as appropriate) perform quality control job walks and surveys the work at appropriate times during construction.
6. Design-build team prepares closeout documentation, as described in Section 8.2.1.

Two key elements of the project closeout stage are the punch list and closeout documentation. On typical design-bid-build projects, the architect, as the owner's agent, provides the contractor a punch list. The owner may or may not elect to participate (at his or her discretion) in the creation of the punchlist. On a design-build project where the designers are under contract to the design-builder, the designers and design-builder often create the punch list together and transmit it to the owner.

The owner (or the owner's agents) usually verify the accuracy of the punch list provided, add to it, or create their own punch list.

*The design-build contract will generally require record documents, but not as-builts, as a deliverable at final completion.*

## 8.2.1

Upon receipt of the owner's punch list, it is the design-phase manager who merges all punch lists and delivers the integrated document to the design team, so that it can be attached to the Certificate of Substantial Completion.

It is important for the design-phase manager to advise the owner that, even though the designers are under contract with the design-builder, the designers have a professional duty to provide a complete and thorough punch list document.

**In the spirit of "beginning with the end in mind," there are many additional elements to closeout that the design-phase manager should understand and incorporate into the project from the beginning:**

- Record drawings, including the owner's preferences, expectations, and requirements related to level of detail in the record drawings.
- Warranty, operations, maintenance, and training, including incorporating the owner's needs (whether or not they are included in the RFP) in the project specifications.
- Commissioning, including an understanding that it's the design-builder's responsibility to ensure that the building will operate as intended.

### **Record Drawings, As-Builts, and Turnover Documentation**

At the end of the project, most owners require the design-build team to prepare record documents for the project that record changes to the construction documents made during construction.

The extent and level-of-detail may vary from basic updated record documents to a full-blown facilities management program and database. The owner may also require final submission of the BIM and LEED documentation. It is important for the design-phase manager to understand what level of detail the owner expects in the record drawings, in order for the designers to include this work in their scopes.

**This level of detail varies and could consist of, for example:**

- Red-lining the existing hard line drawings and providing references to the respective RFIs. At the conclusion of the project, digitally scan the documents and them turn over to the owner. This typically can be done by the design-builder's staff and should be updated monthly.
- Digitally red-lining the existing digital drawings and providing references to the respective RFIs. At the conclusion of the project, turn over electronic copies to the owner. This typically can also be done by the design-builder's staff and should be updated monthly.
- Updating their respective CADD drawings and publishing them monthly.
- Updating the BIM or other 3D models and publishing them monthly.

Over the years, "as-built" was the common term for such documents. As-builts are measured drawings that document the finished (or "built") condition of the structure at completion. Courts have interpreted as-builts literally as certification of the accuracy of the information.

The design-build contract will generally require record documents, but not as-builts, as a deliverable at final completion. The owner may, however, require as-builts for future building additions, renovations, and other modifications.

If required, as-builts are typically an extra service of the project design team. To provide this service, the design-phase manager should develop a process by which the design-builder documents all deviations in fabrication and installation as they occur.

## 8.2.2

### BIM Turnover for Future Use

The owner may require a final submission of BIM data from the design-build team. These data may be delivered in various formats, but the design-phase manager must understand this end state when planning the execution of the project at the beginning. There are only a few standards that support BIM turnover for future use, and these are slowly being integrated into facility management and operations software systems.

The main standard for non-geometric facility data is COBie – Construction-Operations Building Information Exchange. Most BIM authoring software applications can export to this format, but the input of properly formatted values during the development of the design is paramount to a successful transfer at the end of the project. A good reference for COBie is the *Whole Building Design Guide* website.

Another open standard to consider for BIM data is IFC—Industry Foundation Classes—an object-based file format with a data model that is maintained by buildingSMART. Like COBie, most design authoring BIM software applications can export to IFC format; however, the design-build team should verify that the owner’s software systems can receive and import this format. Many government agencies in Europe and the Scandinavian countries already utilize and require BIM data to be delivered in IFC format.

Beyond facility management and maintenance data, the owner may also require 3D models to be delivered. Again, it is necessary to understand the reasons and future uses for which these data are requested.

#### Future uses may include:

- Management of future renovations
- 3D support (augmented reality) for facility maintenance
- Space management
- Asset management

The design-build team must understand how the owner intends to utilize the BIM data early in the design process, in order to deliver the most appropriate data at turnover. For example, if the owner only wants to use the model for space management, the fully-detailed fabrication models will be too detailed for this purpose. For space management, the owner would likely only need a simplified version of the architectural model with detailed parameters assigned to the occupied spaces or rooms in the model.

# ACRONYMS

<b>ADA</b>	Americans with Disability Act
<b>AEC</b>	Architecture Engineering & Construction
<b>AIA</b>	American Institute of Architects
<b>ASCE</b>	American Society of Civil Engineers
<b>ASI</b>	Architect's Supplemental Instruction
<b>ASTM</b>	American Society for Testing and Materials
<b>BIM</b>	Building Information Modeling
<b>CADD</b>	Computer Aided Design and Drafting
<b>CGL</b>	Commercial General Liability
<b>COBie</b>	Construction-Operations Building Information Exchange
<b>DBIA</b>	Design Build Institute of America
<b>EJCDC</b>	Engineer's Joint Contract Documents Committee
<b>GC</b>	General Contractor
<b>HVAC</b>	Heating, Ventilation, and Air Conditioning
<b>IAQ</b>	Indoor Air Quality
<b>IFC</b>	Industry Foundation Classes
<b>IPD</b>	Integrated Project Delivery
<b>IT</b>	Information Technology
<b>LEED</b>	Leadership in Energy and Environmental Design
<b>LLC</b>	Limited Liability Corporation
<b>LOD</b>	Level of Development
<b>MDS</b>	Model Development Specification
<b>P3</b>	Public-Private Partnership
<b>PLI</b>	Professional Liability Insurance
<b>QA</b>	Quality Assurance
<b>QC</b>	Quality Control
<b>REI</b>	Request for Expression of Interest
<b>RFI</b>	Request for Information
<b>RFP</b>	Request for Proposals
<b>RFQ</b>	Request for Qualifications
<b>TBD</b>	Target Based Design
<b>TVD</b>	Target Value Design
<b>VE</b>	Value Engineering