The Design-Builder's Guide to Design Management

CHARLES PANKOW FOUNDATION

THE DESIGN-BUILDER'S GUIDE TO DESIGN MANAGEMENT

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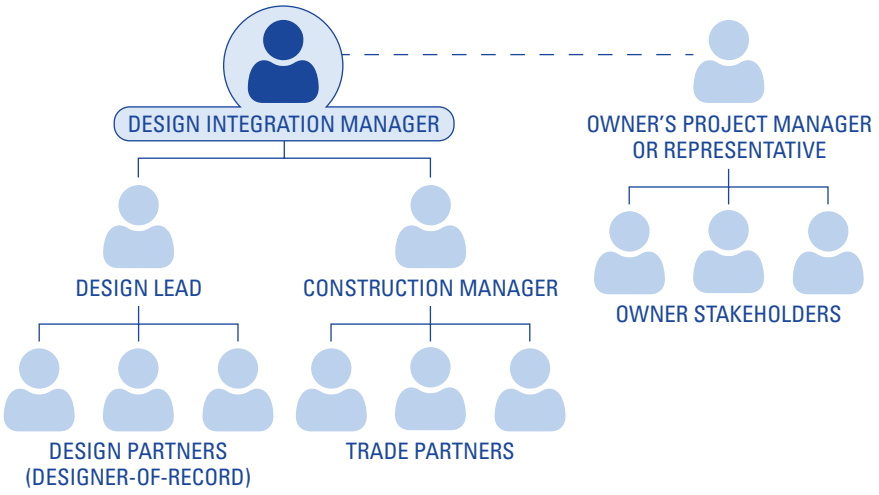
EXECUTIVE SUMMARY

This guide is intended to help owners, designers, and builders of design-build projects achieve greater success by understanding and fully leveraging the unique role of the design integration manager. While this role may go by different titles, such as design-build manager or design-phase manager, the responsibilities are the same. When using design-build contracting, the two parts of a project's solution—the design and the construction—must be considered simultaneously. In this context, it is the responsibility of the design integration manager to oversee the design process and ensure that the design meets the firm's contractual obligations with the owner.

The design integration manager plays a difficult role in the design-build process. Sitting at the intersection of multiple parties, the design integration manager must organize and manage the activities of many individuals—including the owner, builders, architects, engineers, interior designers, landscape architects, and specialty consultants—to conceptualize and develop the project design. Ultimately, the design integration manager assumes responsibility for ensuring that the design and construction are developed in unison. The activities of the design integration manager span many different stages of the project, starting with the proposal/pre-award phase and continuing until the completion of construction and project handover.



Role of the design integration manager within a design-build team

> *"The design integration manager assumes responsibility for ensuring that the design and construction are developed in unison."*

This guide is designed to act as a resource for those who have been assigned the role of design integration manager. To be successful, the design integration manager needs multiple competencies—the knowledge, skills, abilities, and other characteristics necessary to guide the project from start to finish. The guide will explain these competencies in specific detail, but they can be summarized as follows:

1. Team management and leadership, including motivating people, prioritizing work, resolving conflicts, and solving problems.
2. Effective communication with others, including writing, speaking, and listening in both formal and informal contexts.
3. Familiarity with construction means and methods, including construction work sequencing, change order processing, schedule forecasting, cost management, and record keeping.
4. Design process management, including procedures for effective information exchange and document management through the use of specialized software such as building information modeling (BIM) and cloud-based project management tools.
5. Navigation of the local context, including local market conditions, building code requirements at different levels (local, state, and federal), specific contractual terms and conditions, and technical requirements.

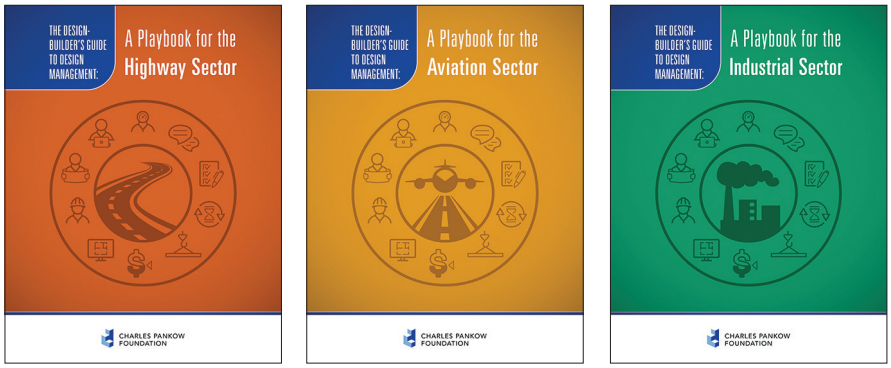
Five phases in a design-build project engage the design integration manager:

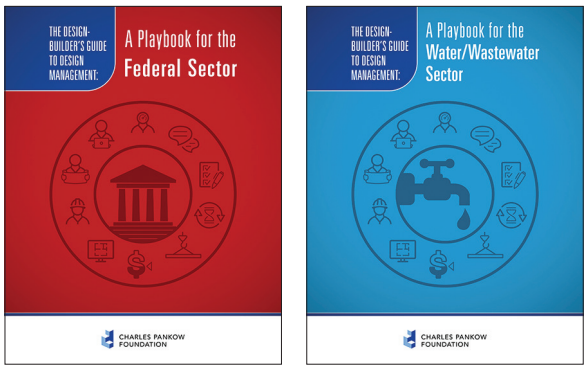
- The **Proposal/Pre-award Phase** begins when the project owner initiates the procurement process and ends when a notice of award is made by the owner to the selected design-builder.
- The **Post-award Phase** begins with validation of the project scope and execution of the contract and ends once all design and trade partner subcontracts are issued.
- The **Early Design Phase** begins after subcontracts are issued and ends with the owner's approval of the design concept or schematic design.
- The **Detailed Design Phase** begins after the design concept or schematic design is approved and ends with the completion of construction drawings and specifications.
- The **Construction Phase** begins after the preparation of construction documents and ends with the completion of construction and turnover of the project to the owner.

While these phases are presented linearly, they often overlap on a design-build project. During each phase, the design integration manager is responsible for a series of key tasks. The majority of this guide is dedicated to explaining the responsibilities of the design integration manager for each of these tasks and the rationale behind them. As summarized in the table on the following page, the tasks are organized by project phase and presented with the frequency at which the design integration manager must perform them.

Phase	Task	Frequency
Proposal/ Pre-Award	↗ Review the owner's project announcement and identify the design, supplier, and trade contracting partners	Once
	↗ Negotiate a teaming agreement with all partners	Once
	↗ Assign initial scopes of work to all partners based on the owner's project announcement	Once
	↗ Coordinate with partners to identify project-specific risks and create a risk register	Every few days to weekly until proposal submission
	↗ Develop a preliminary schedule for proposal and design deliverables	Every few weeks to monthly until proposal submission
	↗ Develop a conceptual cost estimate for professional services	Once
	↗ Verify that the design subcontracts to be issued to partners upon award meet the project requirements	Once
Post-Award	↗ Document the initial basis of design and review project program to reconcile the owner's "ask" with the design-build team's "offer"	Once
	↗ Manage and oversee the execution of the design subcontracts with partners	Once
	↗ Identify and communicate key project expectations to all partners	Once
	↗ Establish a communication plan with partners	Once
	↗ Build a supportive team culture	Daily throughout the project
	↗ Update and manage the project-specific risk register	Every few days to weekly throughout the project
	↗ Refine the schedule for design deliverables	Every few weeks to monthly before design begins
Early Design	↗ Confirm that the design aligns with the project budget	Weekly to every few weeks throughout design
	↗ Set goals for meetings, then plan and organize effective meetings	Every few days to weekly throughout design
	↗ Facilitate meetings with the authority having jurisdiction to discuss project-specific code compliance	Every few weeks to monthly throughout design
	↗ Mediate design questions and concerns between the project designer and the owner	Every few days to weekly throughout design
	↗ Create and maintain a log of design changes and their associated costs	Every few days to weekly throughout design
	↗ Oversee the progress of the design schedule	Weekly to every few weeks throughout design
Detailed Design	↗ Facilitate quality in the design process through design and constructability reviews with internal and external stakeholders	Every few weeks to monthly throughout design
	↗ Document the final basis of design and obtain owner approval	Once
	↗ Maintain morale and refocus the team	Every few days to weekly throughout the project
	↗ Track and monitor the actual design costs	Every few days to weekly throughout design
	↗ Monitor the procurement schedule with the construction team and coordinate deliverable deadlines with the design team	Every few weeks to monthly throughout design
Construction	↗ Bridge design team and construction team efforts to maintain project alignment	Every few days to weekly until project close-out
	↗ Document key design changes and communication with the authority having jurisdiction during construction	Every few weeks to monthly until project close-out
	↗ Facilitate the project close-out documentation process	Every few weeks to monthly until project close-out

Finally, it is important to note that this guide has been developed in the context of projects delivered in the building construction sector. However, design-build is carried out in a variety of other contexts, each with its own specific language and best practices for consideration. Therefore, multiple "playbooks," or brief supplementary documents, have been developed to expand on the recommendations offered in this guide for other market sectors that are seeing an increase in the use of design-build, including highways, aviation, industrial, federal, and water/wastewater.





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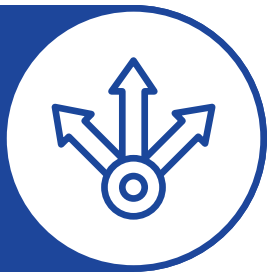


A Guide to this Guide

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 owners' needs. Builders want their projects to be safe and run smoothly. All three want a reasonable return on investment.

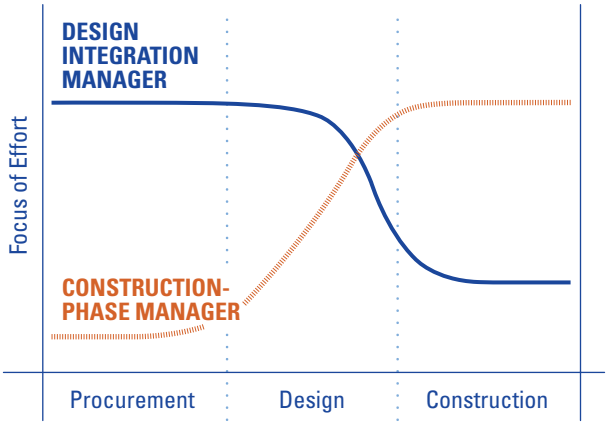
This guide is intended to help owner advisors, designers, and builders of design-build projects achieve greater success by understanding and fully leveraging the unique—and relatively new—role of the design integration manager. Within the design-build method of project delivery, the design integration manager is the design-build team's "master integrator."

It would not be an overstatement to say that the design integration manager is the most fundamental ingredient—the secret sauce, maybe—of a successful design-build project. A project without a competent design integration manager is likely to become an exercise in futility, destined to create frustration—or worse—within the project team. In most cases, the design integration manager is an employee of the design-builder, the latter of which holds and mitigates the design risk on the project.

By background or education, design integration managers may be architects, engineers, or constructors. Regardless of background, the design integration manager is the single most important project participant, connecting the design team to the construction team as well as the owner from project inception to close-out. This does not imply that the design integration 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 integration manager organizes and manages the activities of all parties in the design process (the owner, builders, architects, engineers, interior designers, landscape architects, and specialty consultants) to conceptualize and develop the project design.

When the design is substantially complete, some design-builders have the design integration manager change hats and also serve as the construction-phase manager. However, a good design integration manager is not necessarily an equally good construction-phase manager, and vice versa. Most design-build projects are led by design-builders, and many design integration managers employed by these firms have substantial knowledge of construction-phase issues and practices. The project manager for a general contractor or other design-build entity is well versed (and likely educated) in construction management but probably has fewer skills applicable to the design phase.

"The design integration manager organizes and manages the activities of all parties in the design process to conceptualize and develop the project design."



Involvement of the design integration manager throughout a design-build project

The primary purpose of this guide is to act as a resource for those who have been assigned to oversee the design process for a design-build project and who are responsible for ensuring that the design meets the 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 guide includes details of the design process for which the design integration manager may or may not be specifically responsible but that provide context regarding how the design process unfolds. The information in this guide is distilled from the experiences of facility owners, project developers, and senior design and construction practitioners.

This guide is organized as a handbook for design integration managers. **It contains practical explanations of what tasks the design integration manager does on a design-build project, when the tasks need to be performed, and why those tasks are vital to success**. **Where relevant, proven procedures are described that can be applied to specific situations.** While the guide is intended for design integration managers in design-build organizations, the principles in this guide may be broadly applied to comparable roles in organizations that use other project delivery methods.

What's New in Version 3.0

Version 1.0 of the *Design Management Guide* was published in 2011 and was received with enthusiasm. Version 2.0, titled the *Professional's Guide to Managing the Design Phase of a Design-Build Project*, was published in 2014 and offered new content to cover topics that have become increasingly relevant to design-build delivery, such as legal issues in contracting, fast-tracking, target-based design, cost estimation and control, specification development, and building information modeling (BIM).

Version 3.0 of the guide, now titled the *Design-Builder's Guide to Design Management*, further expands on the content in Version 2.0 by adding specific guidance on design-assist, offsite fabrication, and cloud-based collaboration tools. Version 3.0 has also undergone several structural changes. The guide is now organized chronologically according to the phases of a design-build project, from the proposal/pre-award phase through the post-award, early design, detailed design, and construction phases.

In addition, Version 3.0 has been redesigned from the ground up as an electronic document, making it easier to navigate through cross-referencing and searches. Lastly, Version 3.0 introduces a comprehensive glossary of terms intended to create a consistent language for discussing the design-build process. These changes will make the guide more accessible to new and experienced design integration managers alike, both of whom can benefit from more targeted guidance on their projects.

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 design-build for vertical structures: buildings such as multi-family residential units, office buildings, high-rises, municipal buildings, places of worship, medical facilities, and schools. For guidance on other types of projects, Version 3.0 also debuts distinct "playbooks" that expand on the information in this guide to explain how the design integration manager's role changes to accommodate the design-build process in other market sectors, including industrial, federal, highways, water/wastewater, and aviation.

You are encouraged to skip directly to those subjects or market sectors that address your current interests and concerns. Each chapter presents suggested procedures that can be used immediately and includes references for further information and study.

"The recommendations in this guide are most applicable to design-build for vertical structures."

Contributors to Version 3.0

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 Versions 1.0 and 2.0 of the *Design Management Guide* and to those who supported the development of Version 3.0, now titled the *Design-Builder's Guide to Design Management*:

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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 US 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 100 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 3.0 of the *Design Management Guide*, now titled the *Design-Builder's Guide to Design Management*. 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.

CHAPTER 1: THE DESIGN-BUILD PROCESS

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 other project delivery models. 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.

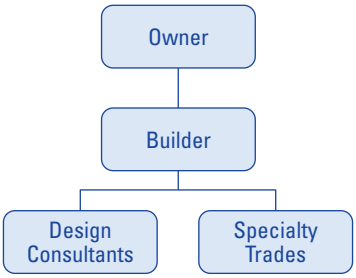
Design-build is an alternative to the more traditional design-bid-build method. Under design-bid-build, design and construction services are split between two separate entities, each performing separate work under separate contracts. In traditional design-bid-build delivery, gaps between the assumptions underlying the two contracts may increase the construction cost, which becomes the responsibility of the owner. In design-bid-build delivery, the owner ultimately holds the risk for design coordination.

One of the key benefits of design-build delivery is that just one entity is responsible for design and construction, so any gaps between design and construction become the responsibility of the design-builder. In many ways, the design integration manager's role is akin to the role traditionally fulfilled by the owner in design-bid-build delivery. Through the design-build contract, the owner transfers the risk and responsibility of managing the design coordination to a design-builder.

Types of Design-Builders

The design-build team can take many forms.

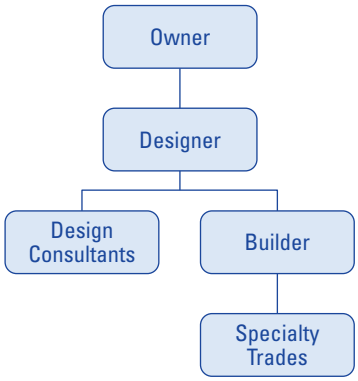
The most common model is where a builder serves as the design-builder and subcontracts design services to architects, engineers, and other professionals or consultants.



Design-build team in which a builder subcontracts design services

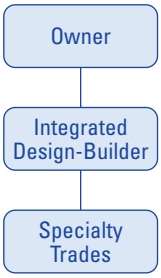
> *Through the design-build contract, the owner transfers the risk and responsibility of managing the design coordination to a design-builder.*

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



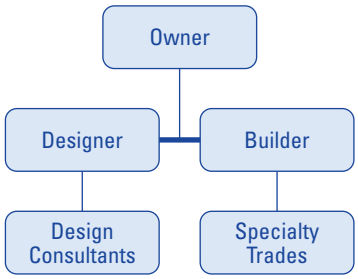
Design-build team in which a designer subcontracts building services

A third model is the integrated design-builder, in which the design-builder offers both design and construction management services in-house. These integrated firms usually specialize in specific market sectors, but they often face many of the same challenges as design-build teams comprised of individual firms that collaborate on specific projects.



Design-build team led by an integrated design-build firm

In a fourth model, the design-build relationship can be embodied in a joint venture or limited liability company (LLC) agreement between a designer and builder.



Design-build team formalized in a joint venture

Regardless of the form it takes, a design-build team encompasses 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 trade craftspeople. The design integration manager is expected to orchestrate the degree and timing of each member's contribution as the need for that contribution evolves with the project.

Traditional Design-Build

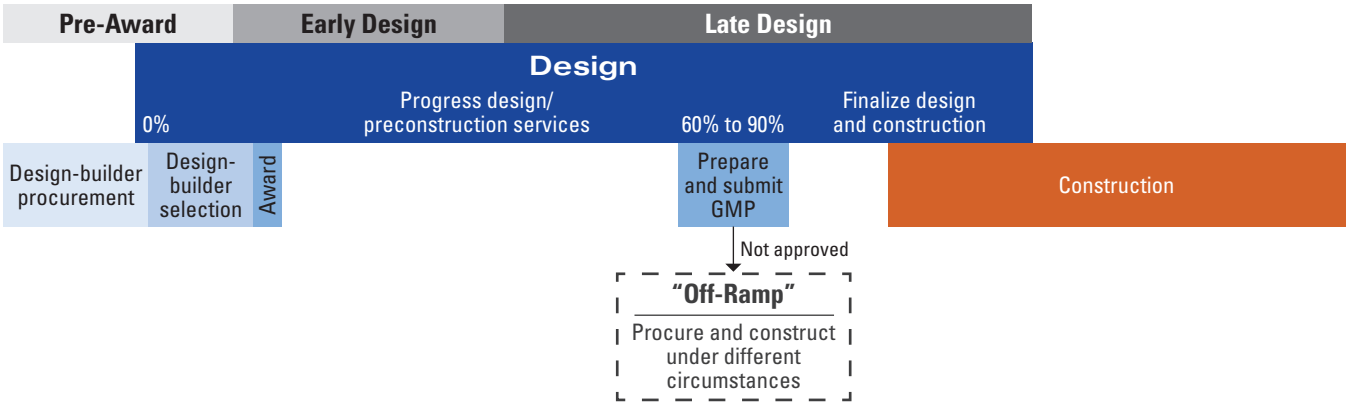
In the traditional design-build delivery method, an owner contracts with a design-build team to provide design, engineering, procurement, and construction services for a project at a competitively obtained fixed price. The owner provides the design-build team with performance and design criteria for the project. These design criteria may be only conceptual, or a certain percentage of the design may be completed prior to contracting with the design-build team if the owner has chosen to prepare "bridging documents" with an architect or engineer. In some cases, the owner may instead establish a fixed price for the project and competitively select the design-build team that can deliver the maximum project scope within this price constraint.

Progressive Design-Build

Progressive design-build is a subset of the design-build delivery method in which the project's initial design, cost estimate, and construction schedule are developed to a point where the owner and design-builder are comfortable with the project trajectory. Depending on the owner's requirements, the design-builder may be asked to design to a budget—in which case the project scope is flexible—or to design to a need—in which case the project scope is fixed. At the end of this validation phase, an "off ramp" option allows the owner and design-build team to consider various alternatives if they cannot reach an agreement about the final cost or scope. While rarely needed, these alternatives may include changing members of the design-build team, replacing a trade partner, pursuing a different project delivery method, or taking a few steps back and revising the project scope with the design-build team. If the owner and design-build team agree to proceed with the project, the final design, construction, and commissioning are completed at an agreed-upon fixed price or guaranteed maximum price (GMP).

> *"The design integration manager is expected to orchestrate the degree and timing of each member's contribution as the need for that contribution evolves with the project."*

Traditional design-build delivery



Progressive design-build delivery

Solicitation of Design-Build Services

The project owner may use a variety of processes to solicit proposals or interest for design-build services. These processes may be used independently or in combination, depending on the type of information the owner needs from design-builders to award the contract. The design integration manager should be aware of which process(es) the owner is using, as this will affect how the firm prepares and responds to the solicitation.

A word to the wise: the design integration manager should start establishing a team of design and trade partners early, even if information about basic project parameters is only preliminary or even just rumored. Do not wait until the owner's solicitation is issued, or the competition will have the advantage. An early start will also help the design-builder identify the design challenges and refine its strategy.

Request for Qualifications

The project owner may issue a request for qualifications (RFQ) describing the project. The RFQ will likely include information on the planned type, size, and location of the building and the planned budget and schedule. If the owner is using a two-step solicitation process, the RFQ may also include drafts of the request for proposal (RFP) and the design-build contract.

Request for qualifications solicitation process

The RFQ will also outline the owner's minimum requirements for the design-build team and list the criteria for selection. It will prescribe the information necessary for a complete qualifications statement, as well as the required contents, format, and deadline for the submittal. Typically, the owner's criteria (not all of which are related to the design team) will include items such as the following:

- The design-builder's experience in the design and construction of like facilities
- The design-builder's previous builder awards (for both value and delivery performance)
- The number and type of past design-build projects that used the same team
- The designers' previous design awards (for both aesthetics and sustainable design)
- The designers' familiarity with the local history, building regulations, and regional environmental conditions—especially for architects, landscape architects, and civil engineers
- The design-builder's bonding capacity, permanent staff, and principal office location(s)
- The design-build team's change order record and experience meeting initial budget and schedule objectives
- The qualifications of key personnel assigned to the project, as indicated by professional certifications such as Professional Engineer (PE), Leadership in Energy and Environmental Design (LEED) Accredited Professional (AP), and certifications granted by organizations such as American Institute of Architects (AIA), National Council of Architectural Engineering Boards (NCARB), DBIA, or Construction Management Association of America (CMAA)
- The builder's safety record
- Previous client satisfaction

The owner—or a selection panel appointed for their knowledge of the owner's project—will evaluate the qualifications packages. This evaluation may include in-person interviews with the design team leadership and even a submittal or presentation of initial design concepts (often called interviews-with-concepts).

The design integration manager should analyze the owner's evaluation criteria and translate them into specific standards that can be used to determine the choice of potential design and trade partners to round out the team. The design integration 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.

“The design integration manager should analyze the owner's evaluation criteria and translate them into specific standards that can be used to determine the choice of potential design team members.”

Request for Proposal

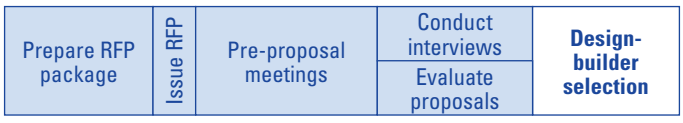
If a proposal process is chosen, the owner distributes an RFP. Among other items, the RFP will likely include the following:

- Stipulations about stipends or honoraria to be paid for preparing the proposal, including the ownership rights of intellectual property developed by the design-builder when preparing the proposal (as applicable)
- Facility requirements and performance criteria
- Project budget and delivery schedule
- Requirements for the use of building information modeling (BIM) or other technologies
- 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 to be held by the owner (as applicable)

If the RFP is part of a two-step solicitation that also involves an RFQ (see the following section), the design integration manager compares the project definitions and parameters in the RFQ with those in the RFP. If the RFP contains any scope ambiguities and/or a lack of technical specificity, the design integration manager needs to clarify these issues with the owner via the process specified in the RFP.

Typically, the owner holds one or more pre-proposal meetings or general information 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 one or more private or proprietary pre-proposal meetings (which may be attended by the owner, the building's users, and/or the selection panel), the design integration manager organizes the design team to prepare a number of conceptual design sketches. These sketches are used during the meeting(s) to elicit opinions of various design alternatives and expose any possible design preferences. Confidentiality during these meetings is essential, and the design integration manager should confirm with the owner that design sketches or ideas discussed during the meetings will not be shared with other proposers. The design integration manager should debrief the team immediately after the meeting(s).



Request for proposal solicitation process

The design integration manager then guides the team in evaluating and preparing conceptual designs to include in the team's proposal. The proposal preparation process includes pricing the conceptual designs, determining whether the team can add value to the design-build proposal, evaluating the balance of risk and reward in preparing 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.

The RFP dictates the deliverables that will be evaluated and the criteria by which they will be assessed. Generally, it is wise not to exceed the specified level of detail in order to maintain design flexibility if the design-build team is selected for the project.

While the RFP will likely require only the submittal of conceptual design documents, the reality of traditional 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.

Increasingly, design-build projects require the use of BIM. BIM is a digital representation of a building or structure, which includes information on its physical and functional characteristics. When a project requires BIM, the RFP will include the owner's requirements for the use of BIM in terms of scope, quality, cost, time, and performance. The RFP may also include technical specifications, design standards, and other project requirements that the design-build team must adhere to regarding the use of BIM, including the following:

- **Level of development (LoD) requirements.** These outline the expected level of detail and accuracy of the BIM model at different stages of the project and how the model will be used during the project life cycle.
- **BIM software and tools.** These outline the software and tools that the design-build team is expected to use in relation to BIM, including any interoperability requirements.
- **BIM data exchange.** This outlines the owner's requirements for the exchange of BIM data between different stakeholders in the project, including data formats and protocols.
- **BIM collaboration.** This outlines the expectations for collaboration and communication among the design-build team, the owner, and other stakeholders regarding the use of BIM.

During proposal preparation, the design integration manager tracks the design development and proposal production schedules, regularly reviewing 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 integration manager also periodically validates that the design-in-progress meets the owner's requirements.

“During proposal preparation, the design integration manager tracks the design development and proposal production schedules.”

"The design integration manager should consider the use of BIM for design development and analysis as well as for construction-related tasks."

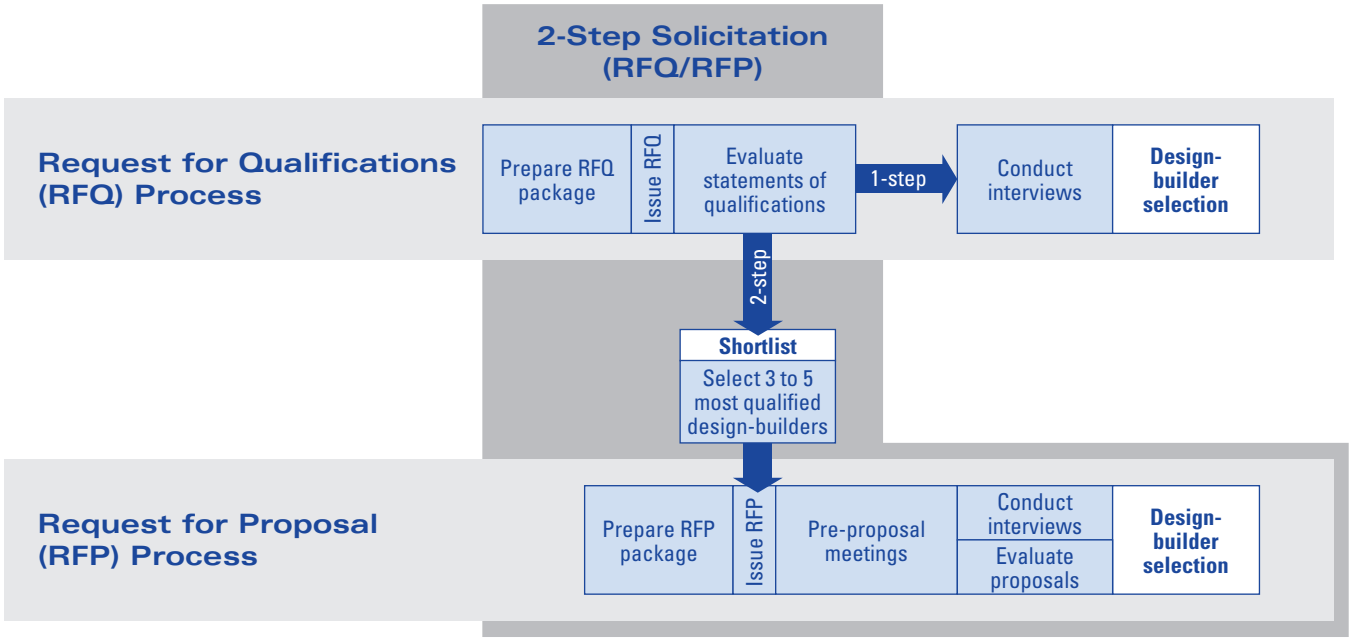
The design integration manager should consider the use of BIM for design development and analysis as well as for construction-related tasks (e.g., construction sequencing). If BIM is used, the design integration manager devises a BIM strategy and implementation plan and communicates it to the design team. This strategy may include many different uses for BIM, such as design authoring, energy modeling, construction sequencing, and other tasks. In some cases, the owner's requirements might specify specific open or proprietary software formats required for the handover of models at project completion.

Two-Step Solicitation

In some cases, the owner may decide to combine both the RFQ and RFP processes. Referred to as a two-step or two-stage solicitation, this combination allows the owner to first narrow the pool of potential design-builders to only those most qualified for the project by using an RFQ.

The owner or selection panel evaluates the qualifications packages submitted in response to the RFQ, using interviews and interviews-with-concepts as needed. Based on these evaluations, the owner or selection panel typically selects three to five firms for its shortlist. For larger projects for which honoraria may be offered, this shortlist will likely be limited to three finalists. Shortlisted firms are then asked to prepare full proposals according to the RFP process.

If the team is shortlisted, the design integration manager should ask the owner which competing design-build teams also made the shortlist. After analyzing the competing teams with input from the design team, the design integration manager should reexamine the proposal strategy in light of the competition's strengths and weaknesses. If the team needs to be strengthened with additional members, members from among the unsuccessful RFQ proposers may serve as potential candidates.



Two-step solicitation process

Most owners will require the design-build team to make one or more in-person presentations of its design proposal to the selection panel. This type of presentation is typically called an interview. An owner may conduct interviews for several important reasons. Interviews give the proposer an opportunity to expand on information in the proposal and 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 design-build team's interview performance.

Selection of the Design-Build Team by the Owner

The selection process—in which an owner chooses its design-build team—is where the project begins to take shape. By this point, the design-build team has typically been formed, teaming agreements have been put into place, and a preliminary design (with an associated price) has been created.

Generally, an owner may select a design-builder using any one of three criteria: price 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-value design, fixed price, and others. The design integration manager's role will vary slightly depending on the selection criteria.

Price-Based Selection

The owner's decision in a price-based selection is heavily weighted toward the design-builder's proposed price for the project. In a price-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, the location of the proposer's business, or the proposer's areas of operation in a defined geographical area. Owners may also elect to limit the number of cost proposals they consider.

For a price-based selection, the owner's RFP may include the following criteria:

- Quantified facility requirements
- Performance and/or prescriptive specifications
- Schedule requirements
- Warranty conditions
- The form of the 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 an architectural design concept for the project. If used, the bridging design allows the owner some participation in design development. The design-builder must then determine which design elements in the bridging design are prescriptive and non-negotiable (i.e., "sacred" to the owner) and which are flexible. If a bridging design is not used, the design-build team assumes full responsibility for the project's conceptual and final design.

If the design integration manager expects the owner to use price-based selection criteria, a team should be built that can meet the owner's objectives and RFP criteria at a competitive price. Upon award, the design integration manager facilitates the process of motivating this competitively priced team to develop the design within the defined project scope, schedule, and costs established during the solicitation.

Once the owner and the design-builder agree on the project scope, a fixed price is established for the project. Often the design work is broken down into distinct packages to monitor trends in the cost of the design as it develops and the impact of each package on the design schedule. At this point, the design integration manager assumes responsibility for ensuring that the final design documents reflect the agreed-upon scope and that the project stays on budget and on schedule.

Qualifications-Based Selection

The owner's decision in 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 federal government select engineering and architecture firms based upon their competency, qualifications, and experience rather than by price alone.

The owner may not even consider cost when making the initial qualifications-based selection of the 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, technical proficiency with BIM and other virtual design processes, 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 proposed cost scenarios fit within their budget constraints.

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

Best-Value Selection

Under best-value selection, the owner considers both qualifications and cost when selecting the design-build team. Best-value selection 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 most clearly expressed and understood for technical innovation, design excellence, management capability, past performance record, and overall proposal value, including cost. Under best-value selection, the owner will weight these criteria according to their importance and evaluate each proposal individually.

Best-value selection (and its variations) is the most prevalent means by which owners select their design-builders. Subsequent chapters within this guide are generally predicated on the assumption that a contract has been executed under a best-value scenario.

Contract Award

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

Regardless of whether the team is selected, the design integration manager should personally thank team members for their efforts. If the team wins the contract, the design integration 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!

CHAPTER 2: THE ROLE OF THE DESIGN INTEGRATION MANAGER

The most common structure for a design-build team involves a design-builder that subcontracts the design responsibilities to one or more design firms. Within this structure, the design integration manager is typically an employee or representative of the design-builder and is responsible for coordinating and integrating the design process. On large or complex projects, these responsibilities may be distributed across several people in different departments.

The design-builder typically provides design integration services because it is the party at greatest risk. The design integration manager is the manager of this risk—the risk that the design meets schedule and cost goals, is constructible, and satisfies the contractual obligations with the owner and the expected commercial outcome for the design-builder.

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

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

> *"The design integration manager coordinates the interface between the owner, the builder, and the design team."*

What the Design Integration Manager Does

In the design of modern, complex structures, the two parts of a building's solution—design and construction—must be considered nearly simultaneously. The design integration manager takes responsibility for ensuring that both parts are developed in unison. While the specific tasks performed by the design integration manager are detailed in Chapters 3 through 7, the following summarizes the general roles that the design integration manager plays on a design-build project.

Think of the design integration manager as an air traffic controller, constantly communicating with various aircraft and scheduling the exact moments for takeoffs and landings. The design integration manager similarly communicates with the project's design professionals to schedule their design services to arrive exactly when needed to support construction tasks.

To carry out these tasks, the design integration manager must also be the project's communication facilitator, diplomat, and design integrator. The requisite skills are teachable but not necessarily intuitive.

As the project progresses, different participants will take the lead. The design integration manager recognizes and empowers the most appropriate person to lead the process at any given point in the project's development. At the same time, design integration managers are themselves leaders who comfortably and effectively communicate with both senior business executives in the office and construction superintendents in the field. An effective design integration manager is also able to simultaneously communicate with the project's left-brained, creative design professionals while translating those concepts to the right-brained, practical problem solvers on the construction team. Design integration managers must possess a high degree of emotional intelligence to understand subtle cues and adapt to the psychological, social, and cultural differences among project participants.

Within this context, diplomacy is a prerequisite for the effective design integration manager. The design integration manager finds commonality among the stakeholders' diverse positions and understands that 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.

Using these and other skills, the design integration manager oversees and guides the project's design process so that the owner's objectives are satisfied and the design meets the design-builder's overall schedule. The design integration manager also guides the process so that the design satisfies the design-builder's construction budget and is executed within the constraints of codes, public safety/welfare, and the industry's standard of care. This is done within the contractual obligations of the agreement between the design-builder and the owner.

The design integration manager also acts as the hub of the information wheel, managing the flow of project information in and out of the design and construction processes. The design integration manager 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.

“The design integration manager also acts as the hub of the information wheel, managing the flow of project information in and out of the design and construction processes.”

The Design Integration Manager and New Technologies

The design integration manager plays a critical role in ensuring the successful integration of new technologies such as digital construction methods and prefabrication into design-build projects. This requires a collaborative and proactive approach as well as a deep understanding of the opportunities and challenges associated with these innovative construction processes and methods.

The design integration manager plays an important role in starting discussions on information management, document exchange, and oversight of the use of building information modeling (BIM) during design. The design integration manager is responsible for ensuring that the design-build team is well positioned to use BIM effectively to support the design process and to produce high-quality design documentation.

Some specific responsibilities of the design integration manager regarding BIM may include the following:

- Establishing and communicating BIM standards and level of development (LoD) to align expectations and ensure that all project stakeholders are working in a consistent manner
- Selecting and managing BIM software and tools, ensuring that they are suitable for the project and that they are being used effectively
- Coordinating with the design team to ensure that BIM is being used effectively to support the design process and that all relevant information is being included in the BIM model
- Ensuring that the BIM model is accurate and complete and that it includes all necessary information for the construction and maintenance of the building or structure

In addition, design-build projects are increasingly using methods of prefabrication (also sometimes referred to as offsite construction). The design-build approach is a good match for prefabrication because it encourages integration between design and construction. The design integration manager must ensure that prefabricated components and offsite construction methods are effectively integrated into the design. This requires close collaboration among the members of the project team, including the architect, engineers, construction manager, and prefabrication contractors.

Some specific responsibilities of the design integration manager regarding prefabrication may include the following:

- Identifying opportunities for prefabrication and working with the project team to determine the most effective approach for incorporating offsite construction into the design
- Coordinating between the design team and the prefabrication contractors to ensure that the design tolerances are compatible with the contractors' methods and that the prefabricated components are integrated seamlessly into the design
- Coordinating with the design professional of record to ensure that code compliance, fire ratings, and other third-party certifications (e.g., UL listings) are maintained
- Engaging in cross dialogue with other trades, including rethinking traditional construction methods and approaches to accommodate prefabrication requirements (e.g., ensuring that the design accounts for the path of travel and other logistical considerations that prefabrication requires)
- Coordinating the longer lead times of prefabricated components with design milestones, which may require that certain design details be finalized earlier than in a project that does not use prefabrication
- Engaging with authorities having jurisdiction (AHJs) to coordinate inspections of prefabricated components at the offsite prefabrication location

Differences between the Design Integration Manager and the Design Professional of Record

Design firms typically assign one person who is ultimately responsible for the content of the design, typically called the design professional of record. The design integration manager does not assume the role of design professional of record. The differences between these roles are summarized below.

Design Integration Manager

- Supports the designers and the design process
- Looks for opportunities for design innovations
- Communicates overall project budget and schedule information to the design team
- Makes sure that the design reflects budget and constructability considerations
- Manages design compliance according to the terms of the contract agreement
- Facilitates coordination of subconsultant designs and resolves any conflicts
- Assumes financial responsibility for keeping the design costs within the limits of the contract and delivering the design within a specified schedule
- Coordinates owner design reviews and approvals

Design Professional of Record

- Is often a licensed architect or engineer
- Is responsible for the content of the design
- Is accountable for the work and the work product
- Manages aesthetic and programmatic criteria
- Makes sure the design meets codes and other applicable guidelines or regulations
- Maintains public safety and welfare
- Conforms to the standard of care of the industry
- Produces and certifies plans and specifications
- Reviews shop drawings and submittals from subcontractors
- Corrects errors and omissions
- Incorporates select vendor documents to supplement drawings and specifications
- Holds limited responsibility for ensuring that construction costs meet a certain budget, with provisions for redesigning the project as necessary to stay within that budget

Design Integration Manager Credentials

Undergraduate and graduate degree programs that prepare individuals to be design integration managers are rare. Most degree programs are instead specialized and designed to produce qualified construction managers, architects, or engineers.

As a result, some additional training is often needed to give design integration managers a multidisciplinary perspective of the design-build process beyond their formal education. The Design-Build Institute of America's (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.

What the Design Integration Manager Needs to Be Successful

The design integration manager is an integrator and communicator. This individual brings together the efforts of various design disciplines but also serves as a bridge to the construction side of the design-build team and to the owner. As a result, this unique role requires a breadth of core competencies that are often found separately among designers, construction managers, and owner representatives. These core competencies encompass all the knowledge, skills, abilities, and other characteristics needed to successfully perform in the role. Many of these competencies can be developed through project experience and professional development activities.

Recommended Knowledge

Knowledge is an organized body of information, usually factual ("knowing that") or procedural ("knowing how"), that can be applied to a task. Knowledge can be acquired through formal education, technical training, or first-hand experience. Design integration managers need a combination of factual and procedural knowledge in the performance of their job responsibilities.

Procedural Knowledge ("Knowing how")

- Project roles and the work responsibilities commonly associated with each role
- The design process and stages of design
- Construction means and methods
- Document management procedures
- Construction work sequencing
- The change order process
- Sources of risk and risk management practices

Factual Knowledge ("Knowing that")

- Familiarity with applicable local, state, and federal building codes
- Local market conditions (e.g., competition, labor availability, quality of trade partners)
- Experience and reputation of local architectural and engineering design service providers
- Capabilities of design and drafting software
- Contractual terms and conditions
- Technical and operational requirements of various project types

In terms of procedural knowledge, the design integration manager needs to understand the relationships among the owner and the owner's third-party representatives (such as independent construction managers, cost/audit specialists, estimators hired to review change order requests, and others), including the responsibilities, fee structures, and personalities of key individuals. Knowing how these representatives influence the owner or how they will interpret the decision-making process is very important. A clear definition of responsibilities should be established at the project's inception to ensure that the third-party representatives are appropriately integrated into the team and envision the same goals and objectives as the design-builder and owner.

> *"Design integration managers need a combination of factual and procedural knowledge in the performance of their job responsibilities."*

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

The design integration manager also needs to know how to influence the design process positively and help mitigate risks. The design integration 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. If work is being procured based on design documents that are less than 100% complete, the design integration manager should understand what is not yet fully complete in the design and ensure that adequate budgets or contingencies are established to cover the associated risks. If the project is based on an owner-prepared conceptual design, the design integration manager should understand where the risks are, what is "sacred" to the owner and cannot be compromised, and what is appropriate for an alternative or innovative solution. If deviations or exceptions are identified, the design integration manager should be able to manage the resolution of the design issue, get approval from the owner, and document the outcome in the contract.

"The design integration manager also needs to know how to influence the design process positively and help mitigate risks."

In terms of factual knowledge, the design integration manager should also understand which software the specialty trades prefer to produce their work and the formats required to record documents at the time of project close-out. More and more firms are using BIM to produce their designs. Although it is not necessary that the design integration manager knows all the specifics of working within BIM, it is essential that the design integration manager is aware of the capabilities of the various BIM software platforms, how the design team uses these platforms, and how data will be managed and exchanged between platforms according to the BIM execution plan (BEP).

The design integration manager should be fluent with the terms of the prime contract and the obligations of the design-builder and should have an intimate knowledge of the owner's project requirements, as documented in the request for proposal (RFP), and any deviations or exceptions that were identified at the time of the agreement. The design integration manager should be able to distinguish between design development and scope creep and ensure that no design is presented to the owner before it has been vetted and approved by the design-build team.

Recommended Skills

Skills are the manual, verbal, or mental manipulations of data and objects needed to perform a task proficiently. Skills may be "hard" and technical in nature or "soft" and related to critical thinking, problem solving, or leadership. Generally, skills of either type can be trained and developed over time.

For the design integration manager, soft skills are extremely important. Communication and collaboration are key factors in the success of the design-build project, and the design integration manager needs to know how to foster close collaboration through negotiation, compromise, and motivation.

The following hard and soft skills are recommended for the design integration manager:

Soft Skills

- Conveying a message in written form
- Conveying information verbally
- Listening
- Delivering presentations to a variety of audiences
- Negotiating with partners and stakeholders
- Persuading others of a position
- Leading a project team
- Resolving conflict among people on the project team
- Delegating responsibilities and work to the right people
- Motivating people to a desired outcome
- Managing stress effectively
- Compromising and finding equitable solutions
- Determining client and stakeholder expectations
- Prioritizing work
- Managing time
- Organizing and leading effective meetings
- Organizing information and record keeping

Hard Skills

- Using scheduling software
- Leading pull planning processes
- Forecasting cost and schedule impacts
- Managing and tracking project costs
- Solving design problems
- Reading and understanding design drawings

Recommended Abilities and Other Characteristics

Abilities are the capacity to perform a task. Abilities tend to be stable characteristics, such as empathy, and have less to do with training and development than with characteristics that come naturally to an individual. On the surface, abilities may seem similar to skills. The main difference is that an ability represents a capacity or potential, whereas a skill involves application. An individual may have a particular ability but lack the skill set to translate that ability into action.

The abilities that the design integration manager needs to be successful are similar to those needed for effective leaders—the ability to establish and maintain relationships, to learn from mistakes, and to work well under time pressure. Ultimately, the design integration manager needs the ability to understand and work with the members of the design team individually and collectively.

Abilities

- Collaborating with partners
- Visualizing 2D drawings in 3D
- Devising innovative solutions
- Engaging in continuous learning
- Establishing and maintaining relationships
- Collecting, analyzing, and interpreting information
- Working well under time pressure
- Speaking comfortably in a group situation
- Focusing on and remembering details

Lastly, other characteristics are simply the qualities of an effective design integration manager that do not fit within the other competency categories. These are highly unique to the individual and may include personal values, working style, and personality traits. Design integration managers that embody these characteristics will find it easier to apply their knowledge, skills, and abilities successfully.

Other Characteristics

- Assertive
- Adaptable
- Self-motivated
- Trustworthy
- Decisive
- Accountable
- Creative
- Competitive
- Respectful
- Empathetic
- Timely
- Focused
- Patient

The Ethical Imperative

Morals are the guideposts that an individual follows to decide between right or wrong in everyday life. Morals are personal and are unenforceable by anyone except the individual. Ethics, on the other hand, are standards for right conduct. Ethics are especially useful when an individual meets the philosophical "fork in the road" and must choose a direction. Regardless of one's personal morals, ethics provide a common set of guidelines for action within a profession. Ethics are derived purposively over time and are often written to promote fairness in social and business interactions.

Design professionals carry additional ethical responsibilities not demanded of the general public. Because design professionals are qualified to make informed decisions based on their relevant training and experience, they are held to a higher standard than others faced with similar decisions. In their professional capacity, design 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 a building's occupants and those of the owner or the design-builder 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 integration manager's responsibilities require a generally familiarity with the ethical standards of the design disciplines within the industry. Early in the team's organization and mobilization, the design integration manager should discuss standards of ethical behavior—and the consequences to the project, to the team, and to individuals for failing to adhere to these standards.

The design integration 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 integration 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 lie at the very core of a successful project.

CHAPTER 3: PROPOSAL/PRE-AWARD PHASE

Description of Phase

The pre-award phase begins when the project owner initiates the procurement process (see Chapter 1) and ends when a contract agreement is fully executed between the owner and the selected design-builder. This phase may be as short as a few weeks or extend for several months or even years.

The pre-award phase is a busy time for the owner and for design-builders competing for the award. During this phase, the owner is responsible for preparing, distributing, and administering the request for proposal (RFP) package describing the project's constraints, and, if desired, a request for qualifications (RFQ) package to first narrow the pool of qualified design-builders. In response, the design-builder, with significant input from the design integration manager, organizes and coordinates a comprehensive team of designers, builders, specialty consultants, contractors, specialty contractors, vendors, material suppliers, and equipment manufacturers to develop a comprehensive statement of qualifications and/or a work proposal that responds to these constraints for the owner's consideration.

The Role of the Design Integration Manager

Major portions of the project design are often decided on during the proposal phase of a design-build project. Therefore, the design integration manager has a very active role during this phase.

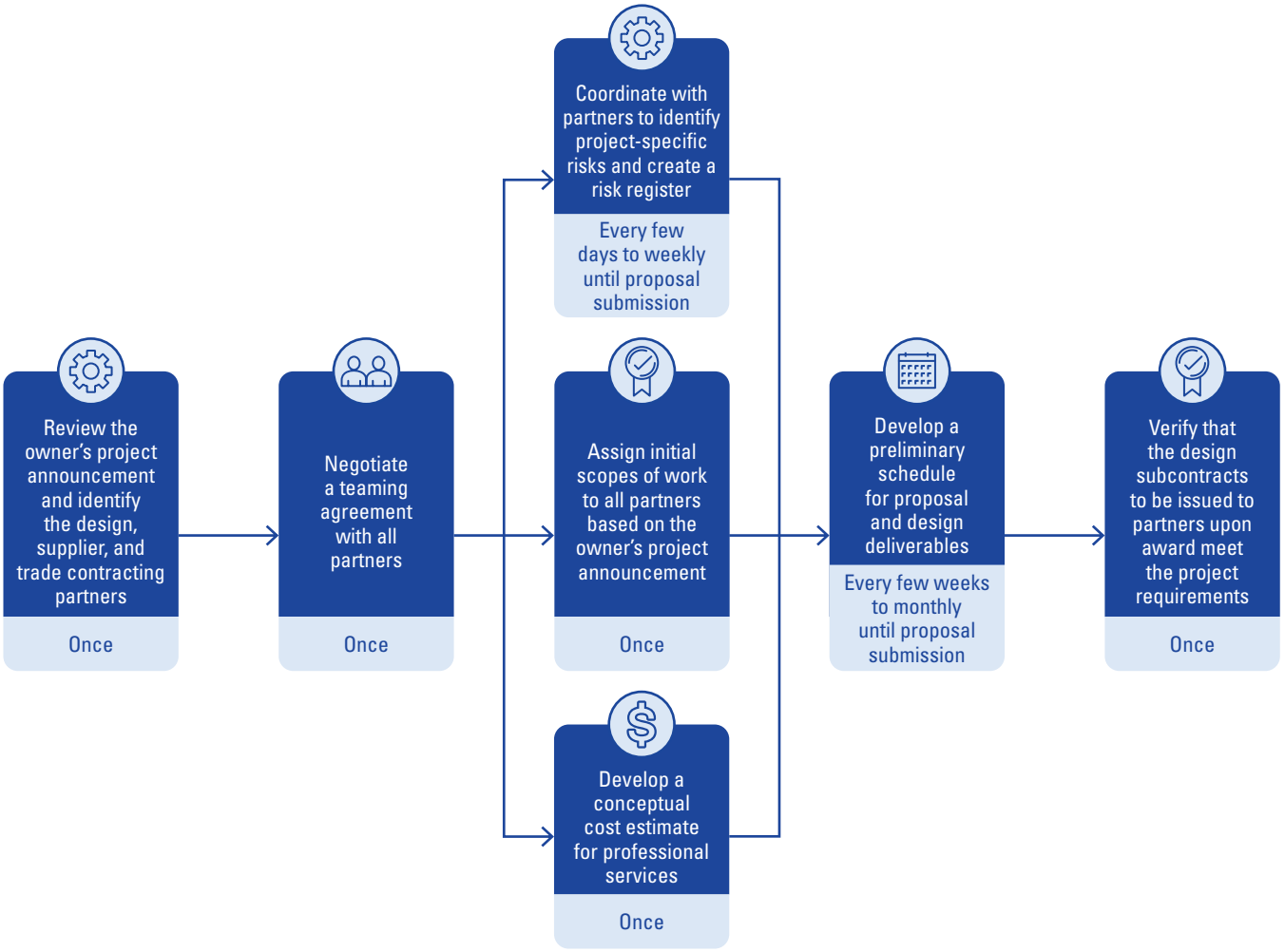
The design integration manager takes the lead in learning as much as possible about the project, the owner, the consultants and staff, and the competition. The design integration manager should know the owner's project announcement backward and forward, using that knowledge to convene design team leaders and other stakeholders to develop a strategy for pursuing the project.

With the support of the marketing, estimating, preconstruction, and other departments, the design integration manager develops a winning proposal strategy after considering the strengths and weaknesses of the competition and the design-build team. If the design-build team is shortlisted, the design integration manager then prepares for the interview(s) and determines how to add value to the conceptual plans to stay ahead of the competition.

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

> *"During the proposal phase, the design integration manager takes the lead in learning as much as possible about the project, the owner, the consultants and staff, and the competition."*

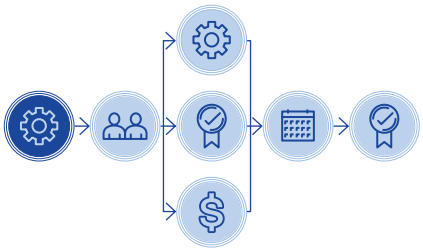
To the greatest extent possible and in a manner that would not disadvantage the design-builder against a compliant but lower cost solution, the design integration manager might guide the team to offer designs that exceed the minimum requirements set by the owner in the project announcement. Some examples of desirable bonus features include greater energy efficiency or a higher level of Leadership in Energy and Environmental Design (LEED) certification than required, additional functional spaces that would make the project more useful and efficient, and/or other amenities that the owner and the building's users would appreciate. The better the design integration manager understands the owner's unspoken objectives, the more successful this effort will be.



Workflow of the design integration manager's tasks during the proposal/pre-award phase

Task: Review the Owner's Project Announcement and Identify the Designer, Supplier, and Trade Contracting Partners

Once



In this task, the design integration manager chooses the primary or "lead" designer and then works with that individual to assemble the remaining specialty designers as members of the design-build team in order to address the criteria outlined in the owner's project announcement. Completing this task requires the design integration manager to be familiar with architectural and engineering design service providers and to match the capabilities of those providers with the project requirements.

Knowledge	Skills	Abilities	Other Characteristics
• Local market conditions (e.g., competition, labor availability, quality of trade partners) • Sources of risk and risk management practices • Experience and reputation of local architectural and engineering design service providers	• Conveying information verbally	• Collecting, analyzing, and interpreting information • Focusing on and remembering details	• Creative • Empathetic • Respectful

The design integration manager has a vested stake in helping the team win the project and helps assemble a team of design consultants and design-build subcontractors with this goal in mind. To assemble a competitive team, the design integration manager should understand the nuances of the various selection methods and optimize the team's composition to the specific selection criteria the owner will use to evaluate the design-builder's qualification statement and proposal. The resulting team should be highly collaborative, laser-focused on a single target, and unified by a "failure is not an option" attitude.

The design team is assembled to ensure the following:

- Maximum likelihood of making the owner's shortlist in a competitive selection process
- Professional compatibility with the design-builder's organization and other team member firms
- Ethical business practices and sufficient production capacity
- Commitment to a common teaming agreement, contracts, and fee levels within the normal competitive range

"The design integration manager has a vested stake in helping the team win the project and helps assemble a team of design consultants and design-build subcontractors with this goal in mind."

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

Regardless, the design integration manager should assemble a design 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.

To gain an advantage during proposal evaluations, the design integration manager should try to offer better design talent than the competition across every discipline. The result should be more talent than the owner ever imagined could be attracted to the project. This is, of course, subject to budget considerations, but setting the bar for qualifications or talent high in the owner's mind—and then meeting or exceeding expectations—will give the team the highest chance at success.

"To gain an advantage during proposal evaluations, the design integration manager should try to offer better design talent than the competition across every discipline."

Lead Design Consultants

For a building project, the lead design professional is usually an architect but can sometimes be an architectural-structural engineering team. The design integration manager may use a formal selection process to evaluate the suitability of prospective lead design consultants and select the most appropriate team. Alternatively, the design integration manager may assemble a team based on previous working relationships or other less formal means.

In a formal selection process, the design integration 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 criteria such as the following:

- Years of experience in designing the specific building type and previous experience on design-build projects
- Ability of team members to collaborate in a design-build environment
- Direct experience on past projects with the owner, design-builder, or other design team members, including past awards/recognitions or disputes/claims between parties
- Minimum value or size of previous projects
- Fee structure
- Engagement in activities addressing diversity, equity, and inclusion (DEI) in the firm, including hiring, training, promotion, leadership priorities, and policies
- Commitment to environmental, social, and corporate governance (ESG) strategies
- Certification as a small business enterprise (SBE), disadvantaged business enterprise (DBE), woman-owned business enterprise (WBE), or minority-owned business enterprise (MBE)
- Current workload commitments, staff size, and availability of key staff for the project

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

Specialty Design Consultants

Specialty design consultants are experts that deal with narrowly focused but crucial elements of the facility's design. The need for specialty consultants may be specified in the owner's project announcement or identified by the lead architects and engineers on the design team.

Similar to how the lead design consultants are assembled (as discussed above), the design integration manager can use a formal or informal selection process to evaluate the suitability of specialty consultants. Specialty consultants should always be selected in collaboration and consultation with lead design team members and not by the design-builder in a vacuum.

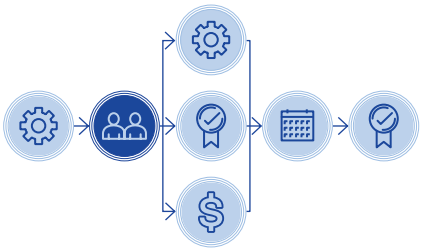
The design integration manager develops a shortlist of qualified specialty consultants early in the proposal phase and determines their availability and willingness to be exclusive, when appropriate, to the design team for the project. If the specialty consultant specializes in the owner's core business (such as kitchen consultants for a restaurant owner or hospital consultants for a healthcare organization), the design integration manager should involve the owner in the selection if allowed by the procurement method.

Based on the nature of the project and contract, the design integration manager coordinates with the lead designer to determine which specialty consultants will be included on the lead designer'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, however, may elect to subcontract directly with structural engineers, mechanical/electrical engineers, or other design-build or design-assist specialty subcontractors. In most cases, however, the lead designer will recommend and contract directly with his or her desired specialty design consultants after consultation with the design-builder.

Specialty consultants' fees are not normally included in the cost of architects' or engineers' basic services. Therefore, the design integration 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 a project is to include a specialty consultant and a related specialty design-build subcontractor (for example, a geotechnical engineer and a foundations contractor), the design integration manager should clearly delineate the scope of work of each to ensure that the entire scope is covered and that there is no redundancy of effort or scope gaps.

Task: Negotiate a Teaming Agreement with All Partners



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In this task, the design integration manager formalizes the working relationships among the members of the design-build team, builds alignment among partners, and establishes governance procedures for the design-build team should the project be awarded.

Knowledge	Skills	Abilities	Other Characteristics
• Document management procedures • Contractual terms and conditions • Capabilities of design and drafting software	• Conveying a message in written form • Conveying information verbally • Negotiating with partners and stakeholders • Resolving conflict among people on the project team • Organizing information and record keeping • Compromising and finding equitable solutions	• Collaborating with partners • Devising innovative solutions • Focusing on and remembering details	• Focused • Trustworthy • Adaptable

A teaming agreement is a relatively simple but legally binding contractual agreement between the parties involved in a design-build project, including the builder and designers.

A teaming agreement is a relatively simple but legally binding contractual agreement between the parties involved in a design-build project, including the builder and designers. It outlines the roles and responsibilities of the team members, the objectives in working together on the project, how the team will work together, and how the team will manage itself, particularly during the proposal process. A well-crafted teaming agreement also addresses what happens if the proposal is successful.

The teaming agreement establishes a successful working relationship among the team members and enables each party to realize the benefits of the design-build contract. The teaming agreement is based on the core principles articulated in the mission statement and charter for the team but provides more structure and detail to the tenets outlined in the charter. The use of teaming agreements is specifically named as one of the recommended implementing techniques in the Design-Build Institute of America's (DBIA's) *Universal Best Practices*.

For the design-build process to be effective, the builder must be aligned with the designer on the design development process. This naturally includes constructability and value engineering but also 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 about what it takes to submit a winning proposal. The project budget should include enough money in the proposal price to account for the natural evolution of the design throughout the project. Excluding the designer from discussing such considerations during the proposal period poses significant risk to the team afterwards.

What Should Be in the Teaming Agreement?

A number of industry resources are available to help parties establish design-build teaming agreements. The Design-Build Institute of America (DBIA) includes 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 580, *Standard Form of Teaming Agreement between Design-Builder and Teaming Party*). Associated General Contractors (AGC) of America and the American Institute of Architects (AIA) have developed similar documents.

Negotiating a teaming agreement provides an excellent opportunity to discuss and address the unique aspects of 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 additional items to address in the teaming agreement include the following (in no particular order):

Team Structure and Relationship

- The structure of the team (e.g., prime-sub, joint venture)
- The design-builder's involvement in the design process
- A decision/authority tree that outlines who provides leadership and how disputes are resolved
- Ramifications of team members withdrawing from the selection process or project
- Language that allows the design integration manager to enforce the teaming agreement fairly and uniformly
- Meeting frequency and methods of communication between in-person meetings

Payment and Contracts

- Standard language and/or a draft of the formal subcontract
- Stipulations regarding how stipends, contract performance incentives, and other premium payments will be divided among the team members
- Identification of any proprietary systems or processes
- Analytical requirements such as engineering analyses and energy models
- A pre-contract building information modeling (BIM) execution plan (BEP), including expectations for data formats, level of development, and methods for exchange when using BIM
- How changes are handled

Qualifications and Proposal Development

- 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)
- 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
- The designer's involvement in establishing the proposal price and associated contingency factors
- Details regarding cost allocation, shared compensation, and cost assessment should a member firm drop off the team before the proposal has been completed
- 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
- Requirements for work packaging to accommodate the timing and scope overlap between design and construction activities
- Principals' in-person participation in owner interviews
- Presentation requirements such as physical models, virtual models, or renderings

Exclusivity and Nondisclosure

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 pursuit teams. Generally, this is not a problem for lead designers, as procurement documents frequently preclude lead builders and lead designers from being on more than one team.

Issues regarding exclusivity can arise in three scenarios. First, what happens if corporate affiliates pursue the same project? Second, what happens when a consulting engineer on the team is the "only game in town" or is unwilling to agree to an exclusivity arrangement? Third, what happens when the owner will not allow a small business to be exclusive but that business is the desired lead designer? Each of these situations can give rise to divided loyalties, and it is important for team members to discuss how to resolve these issues.

The issue of exclusivity also leads to concerns about the confidentiality of the proposal process. The parties involved need to address each party's reasonable concerns and draft a teaming agreement that specifically addresses confidentiality. This may include the signing of nondisclosure agreements (NDAs), which can be structured to apply to an entire company or tailored to an individual. The design integration manager may need to establish a "firewall" to prevent leaks of confidential information regarding competitive strategy.

Inclusion of Subcontracts 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 between the builder and designer can also be added as an appendix to the teaming agreement. This has the benefit of letting the parties determine early in the process whether they are aligned on important legal issues—such as indemnity and liability for errors and omissions.

If disconnects over critical issues may arise, it's best to get them on the table early. Furthermore, including the subcontract in the teaming agreement can help mitigate the argument that the teaming agreement is just an "agreement to agree" rather than an enforceable contract.

Addressing Changes in Circumstances during the Design Selection Process

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

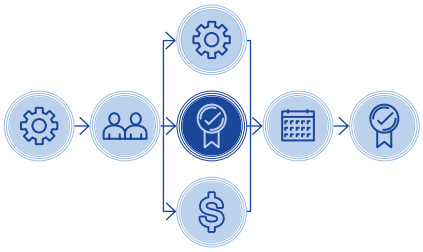
Even though it may create a less-than-desired atmosphere at first, the decision of a team to drop out when it realizes it can't perform the work expected will be appreciated by the entire team later. The exiting team may or may not be subject to penalties in such a scenario, and it may be excluded from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

For more information:

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 integration manager should consider using the DBIA Teaming Checklist included in Manual of Practice 308 to develop a teaming agreement that addresses the unique factors of the project at hand and the design-builder's own policies on design consultants and subcontractors.

Task: Assign Initial Scopes of Work to All Partners Based on the Owner's Project Announcement

Once



In this task, the design integration manager decides which portions of the project design will be performed by each partner and how the design will be packaged and delivered according to the deliverable schedule.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Construction means and methods • Local market conditions (e.g., competition, labor availability, quality of trade partners) • Construction work sequencing • Technical and operational requirements of various project types • Project roles and the work responsibilities commonly associated with each role	• Conveying a message in written form • Conveying information verbally • Negotiating with partners and stakeholders • Organizing information and record keeping • Delegating responsibilities and work to the right people	• Collaborating with partners	• Timely • Empathetic • Respectful

A good design subcontract specifies the designer's responsibility for the scope of work and for compliance with schedules and budget expenditures (among other things). The design integration manager should also pay special attention to how the design work will be divided and the expected level of detail for each delivered scope of work. These will affect the pricing and duration of the designer's work.

To identify how the design work will be divided, it is always good practice to develop a division-of-responsibilities matrix that identifies who has the responsibility to do what and who plays a primary versus a review/support role. Furthermore, 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 keys to success in scope assignment are transparency and knowing what parts of the design can and cannot be delegated. The prime contract between the owner and the design-builder will provide some guidance in this regard.

However, the potential remains 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 integration manager to manage the risk of scope creep is by being actively involved in design development and using a robust project-control and trend-reporting system.

> *"The design integration manager should pay special attention to how the design work will be divided and the expected level of detail for each delivered scope of work."*

Level of Development

Level of development (LoD) identifies the specific minimum content requirements and the associated authorized uses for each element included in a building information modeling (BIM) model during the design and construction process. LoD also defines the various development stages (i.e., project milestones).

The design integration manager and design team identify each component, or "model element," of the BIM. For each project milestone, two critical pieces of information about that model element should be indicated: the LoD to which each model element shall be developed and who is responsible (model element author [MEA]) for the development of that information at that specific time.

The American Institute of Architects (AIA) has outlined an LoD framework (document AIA G202-2013, *Project Building Information Modelling Protocol Form*) that defines the five levels of development:

1. LoD 100. Each model element is represented graphically with a symbol or other generic or schematic representation.
2. LoD 200. Each model element is graphically represented as a generic system, object, or assembly with an approximate quantity, size, shape, position, and orientation.
3. LoD 300. Each model element is graphically represented as a specific system, object, or assembly with a specific quantity, dimension, shape, position, and orientation.
4. LoD 400. Each model element is graphically represented as a specific system, object, or assembly with a specific dimension, shape, position, quantity, and orientation, with further details for its fabrication, assembly, or installation.
5. LoD 500. Each model element is a verified representation in terms of size, shape, position, quantity, and orientation.

On a traditional design-build project, there may be a tendency to rely on the bridging documents furnished by the owner in developing the design after award. 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 blind acceptance of certain documents (e.g., structural calculations or code compliance assurances).

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

For example, the detail needed for early permits will most likely be less than that required for the final construction documents or for bid packages for equipment and subcontractors. 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 integration manager should identify and plan for the progressive development of all information and deliverables.

To respond to the owner's requirements for virtual design and construction (VDC), the design integration manager should ensure that the team begins preparation of a preliminary building information modeling (BIM) execution plan (BEP), also known as a BIM management plan (BMP) or BIM protocol. The pre-contract BEP aims to demonstrate the team's proposed approach, capability, capacity, and competence to meet the owner's requirements in general terms. It should address everything requested by the owner, including key BIM milestones and how they fit with the broader project.

The pre-contract BEP will often include the level of development (LoD) for the systems and subsystems 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. This information will later be formalized and shared among team members in the post-contract BEP, but at this stage it is most important to agree upon the delivery requirements needed to meet the owner's requirements. It is also wise not to promise more than is required, as modeling to a higher LoD will require more effort and increase the design budget.

The design integration manager should discuss two other design-related scope-of-work issues with the design team. The first is whether the designer has access to speak directly with the owner during the design development process. If so, the design integration manager needs to be included in those communications and ensure that in-progress designs are not shared with the owner until they are vetted by the design-build team. The second is the lead designer's involvement and responsibility in coordinating any consulting engineers hired directly by the design-builder. Both issues impact the designer's scope of work.

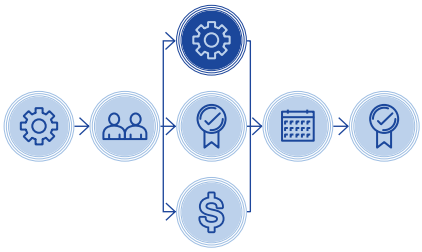
Planning Design Team Involvement during the Construction Phase

The design team will continue to be active on the project through the construction phase but at a greatly reduced level of effort compared to the design phase. Relative to construction administration services, the design integration 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 generic answer for how actively the designer should participate in construction services, but the following are a few items to consider:

- 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?

Task: Coordinate with Partners to Identify Project-Specific Risks and Create a Risk Register



Every few days to weekly until proposal submission

In this task, the design integration manager works alongside the partners involved in the project to establish a list of risks that may limit the design-build team's ability to meet the project requirements.

Knowledge	Skills	Abilities	Other Characteristics
• Document management procedures • Contractual terms and conditions • Local market conditions (e.g., competition, labor availability, quality of trade partners) • Construction work sequencing • Sources of risk and risk management practices	• Conveying information verbally • Using scheduling software • Leading pull planning processes • Organizing information and record keeping • Forecasting cost and schedule impacts • Prioritizing work	• Collaborating with partners • Establishing and maintaining relationships • Collecting, analyzing, and interpreting information	• Accountable • Decisive

While construction-phase risks are well recognized, design-phase risks are often less obvious. As part of due diligence during proposal preparation, the design integration manager is responsible for leading the process of identifying, assessing, and monitoring risks related to the design of the project.

Risk Identification

The first step in any risk identification process is to brainstorm events that could expose the project to schedule delays, cost overruns, quality defects, or other performance failures that could result in a loss in value to the owner, such as failure to comply with the owner's project announcement. Risks identified during the proposal/pre-award phase are often related to the owner's project announcement and could include items such as outdated specifications, unrealistic requirements or schedule milestones, and code compliance.

During this brainstorming exercise, design integration managers should avoid letting the discussion shift from risk identification to risk mitigation procedures. While mitigation is an important step in risk management, discussing potential solutions before the problems have been thoroughly identified can rapidly derail the brainstorming effort and lead to an incomplete list of project risks.

Consider the following during this task:

- Each identified risk should include any assumptions made by the design-build team, a description of the uncertainty leading to the risk, and a summary of the concerns raised by partners.

- The list of risks should be comprehensive and nonoverlapping. Similar risks should be combined, and overlapping risks should be separated.
- Project-specific risks should be categorized into logical groupings.
- While it may be tempting to use risk registers from similar previously completed projects to start the brainstorming discussion, this practice often constrains creativity. A better practice would be to use those risk registers after the discussion to check for missing risks and help categorize risks.
- A risk brainstorming exercise should be held whenever new information is learned during the proposal phase or whenever the project scope changes significantly.

Risk Analysis and Assessment

The risk assessment performed in this task builds on the list of project-specific risks identified during the previous step. The design integration manager leads the discussion of risk assessment with the owner, design partners, and construction manager.

The purpose of a risk assessment is to systematically consider each identified risk event in terms of its probability of occurrence and the consequences should it occur. The probability of a risk occurring can be difficult to define with certainty—a design omission, for example, is not a simple die roll with a one in six chance of occurring. As a result, design and construction risks are often evaluated qualitatively along a continuum from "very unlikely" to "very likely." This evaluation is based on the experience and assumptions of the design-build team members performing the assessment. The consequences of a risk are easier to quantify. They represent the chance that the design-build team does not achieve the target outcome and are typically expressed as exposure to financial loss. Even when the consequence of a risk may be classified as a schedule delay, the design-builder will translate that delay into a cost for remediation—in this case, the additional costs for overtime or resequencing work to regain the lost time.

Several existing tools are available to compare risks, ranging from a simple color-coded matrix to more complex Monte Carlo simulations. Regardless of the risk assessment method used, the design integration manager is responsible for recognizing those risks that are both likely to occur and carry serious financial consequences.

Once the most serious risks have been evaluated, they are entered into a risk register. A risk register is a tracking tool designed to document each assessed risk as well as any mitigation or response options and a clear statement of who on the team "owns" the management of the risk. The risk register should be updated during each subsequent phase of design, as the nature of each risk may change as the design evolves, project conditions may change, or the project scope may grow or shrink. In addition, some mitigation plans may succeed while others fail. The risk register should reflect the current status of each risk and the efficacy of any mitigation efforts that have been attempted, if applicable.

Risk Registers

A risk register is commonly organized as a table, where each row represents a unique risk and the columns provide detailed assessment information about that risk. At a minimum, the risk register should have six columns outlining the following information:

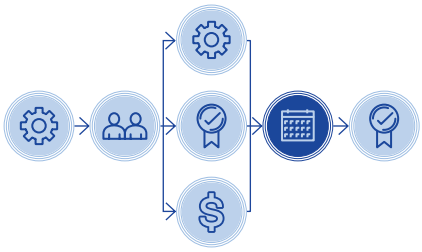
- An identification number (e.g., R1) to quickly identify and reference each risk
- The name or a brief description of the issue that poses the risk
- An evaluation of the probability (e.g., 25%) or likelihood (e.g., "very likely") of the risk occurring, determined based on the nature of the risk
- An assessment of the exposure or impact to the project should the risk occur, typically expressed as a cost to address or recover from the identified issue
- A response strategy, including a description of how the risk might be addressed (e.g., reduction, transfer) and specific actions that will be taken to implement the response strategy
- A responsible partner or specific person within a partner organization who will "own" the risk and oversee its management

The design integration manager may also consider adding columns to the risk register that provide additional information to assist in risk tracking, such as the following:

- A risk category (e.g., material availability, site work) to group risks stemming from similar issues or risks that affect similar design disciplines
- A timeframe (e.g., early design, construction) in which the risk may occur

Task: Develop a Preliminary Schedule for Proposal and Design Deliverables

Every few weeks to monthly until proposal submission



In this task, the design integration manager works with the marketing, estimating, and preconstruction departments to identify what proposal deliverables need to be prepared (e.g., lists of similar completed projects, conceptual design documents) and when they are expected from partners. Looking beyond the proposal phase, the design integration manager coordinates with the design team and construction manager to prepare a milestone schedule for design package deliverables should the project be awarded.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Document management procedures • Contractual terms and conditions • Construction work sequencing • Technical and operational requirements of various project types	• Conveying information verbally • Negotiating with partners and stakeholders • Using scheduling software • Leading pull planning processes • Organizing information and record keeping • Reading and understanding design drawings • Forecasting cost and schedule impacts • Prioritizing work • Determining client and stakeholder expectations	• Visualizing 2D drawings in 3D • Collecting, analyzing, and interpreting information	• Assertive • Adaptable

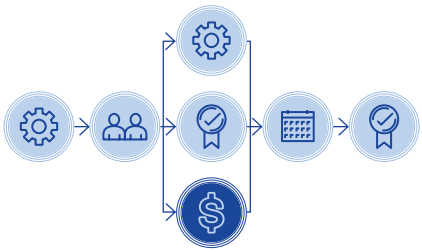
During the proposal phase, the design integration manager needs to lead two collaborative scheduling efforts.

The first is the proposal deliverable schedule, which governs when the various parts of the RFQ or RFP response are expected from design partners. For example, when do the design partners need to provide team member resumes, a recently completed projects list, or a preliminary design package? Based on the conceptual design and depending on the specific project pursued, the design-builder may be asked to 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
- LEED checklist
- BEP
- Material and equipment cut sheets for key systems
- Specifications at a certain completion level, depending on specific project requirements
- RFP compliance checklist and other miscellaneous documents required by the RFP
- Fast-tracking plan, if needed

The second is the milestone schedule for design deliverables. This milestone schedule outlines how the project's design will be packaged and when each of the packages is expected to be complete if the design-builder were to be awarded the project. The milestone schedule is often first developed by the lead design consultant and then reviewed by the design integration manager for alignment with the project specifications and planned construction activities. Specifically, this schedule needs to reconcile the time needed in design with material release and delivery lead times, permitting process requirements, and the ability to start work on site. Through negotiation, the design integration manager ensures that the milestone schedule for design package deliverables is acceptable to both the design team and the construction manager.

Task: Develop a Conceptual Cost Estimate for Professional Services



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In this task, the design integration manager works with the estimating department to assign costs to each of the detailed scope-of-work items for each design partner (e.g., architectural, structural engineering, civil engineering, and so forth) and facilitates the development of a construction cost model.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Construction means and methods	• Organizing information and record keeping	• Collecting, analyzing, and interpreting information • Working well under time pressure • Focusing on and remembering details	—

"The design integration manager is responsible for staying ahead of the budget at all phases of project delivery, which makes cost estimation an integral part of his or her responsibilities."

The design integration manager is responsible for staying ahead of the budget at all phases of project delivery, which makes cost estimation an integral part of his or her responsibilities. The design integration 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. The design integration manager also stays involved with the overall construction cost estimate to ensure that the builder effectively develops estimates in agreement with the design.

Developing the Design Cost Estimate

Several typical methods are used to calculate design fees, including percentage of construction cost, lump sum, time and materials, or cost plus a percentage or fixed fee. Combinations of these methods are also common. Typically, estimated costs will be calculated in 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 the results of other cost estimation methods. However, this method 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 work (project analysis, schematic design, design development, and preparation of construction documents such as plans, details, and specifications) and construction administration or construction-phase services. However, the expectation for basic design services can vary from project to project and from owner to owner.

The design team should understand how the owner defines basic design services prior to preparing an estimate. The costs associated with specialty design consultants—such as structural, mechanical, and electrical engineering consultants—may not be 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 documentation of environmental impacts to waterways or submissions to historic preservation boards). Reimbursable expenses for travel, printing and reproduction services, telecommunications, and postage or courier services are also typically not included in the estimate of basic design services.

Within the cost plus fixed fees method of cost estimation, the "cost" refers to the labor and project-specific expenses. "Fixed fees" are usually based on the project's allocated construction value and depend on a project's size and complexity. Renovation projects typically command higher fees.

Regardless of the method, the cost estimation 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 estimation process entails defining the design components and applying target costs to each design element.

A full discussion of cost estimation strategies and methods is beyond the scope of this guide. However, the following are some considerations involved 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 engineering, civil engineering, etc.) organized by the phases of the project?
- Has each design discipline included the cost of all of the services that will be provided (drawing count, specifications, calculations, reports, onboarding of stakeholders, submittal review, construction administration, punch lists, etc.)?
- Do the scope-of-work items and services included in the design fee meet the owner's requirements as indicated by the RFP or the owner's scope-of-work document? Do they meet the requirements for all regulatory agencies?
- How confident is the design-build team that the scope-of-work items will remain relatively unchanged throughout the design and construction process? How much funding may need to be set aside for design contingency to address any uncertainty?

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

Developing the Construction Cost Estimate

Typically, the builder takes the lead in developing the construction cost estimate during the proposal/pre-award phase. However, because this cost estimate is based on an evolving design, cost estimation is an iterative process that starts during the proposal phase with a very simple conceptual design and continues until the design is completed.

The design integration 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 help complete this task, the design integration manager needs to ensure that the designers and estimators are working as a team.

"The design integration 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."

Within the design-build environment, cost estimators must be able to develop accurate estimates using 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 and may provide too much detail in one area and not enough in another. To provide an accurate estimate, the estimator must understand the design process and how to work with the varying levels of completion of the design documents.

The estimator, with the assistance of the design integration manager, also needs to be able to "fill in the blanks" or complete aspects of the scope of work that have not yet been detailed in the conceptual design documents. For example, the conceptual design documents may not show the full details 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 the details have not yet been included in the drawings shows a lack of understanding of the conceptual design process and how and where HVAC systems are integrated into the design process.

Conversely, the design team needs to find ways to help the estimator identify scope-of-work items that have not yet been detailed in the drawings. Providing a quick note on the drawings to the estimator helps avoid omissions in the construction cost estimate.

What often separates design-build from design-bid-build projects is that the design-builder is being asked by the owner to assume cost and schedule risks for the delivery of a project without the benefit of a complete design. As a result, even good conceptual construction cost estimators will often try to get more complete design documents than the design team can or should develop at a given stage in the hopes that their estimate will be more accurate. At the same time, the design team will often try to make the design documents as complete as possible—potentially more than what is planned for or required at a given point—to avoid the possibility that the cost estimator may miss something.

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 process to meet the submission deadline.
- The design team, preferring to spend more time on the documents, will delay its delivery, also resulting in a rushed bid process.
- If cost overruns occur, the estimator might blame the design team for not providing complete documents and/or the design team might blame the estimator for not including all the costs in the estimate.
- Time may be wasted and schedule slippage may occur.
- Inconsistent estimating can drive design down an ineffective path and waste design budget.

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

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

Understanding the Business Drivers of Design-Build

Relative to design-bid-build and other traditional project delivery methods, design-build shifts the business models and the roles played by the designer and builder. Consider, for example, how risk and reward influence the design-build team's decision-making processes. Unlike arrangements under other project delivery methods, the design-build team typically assumes any risk that may occur during the design process. As a result, scope creep, constructability 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 the builder to minimize risks.

"The design integration manager must know what level of completion is appropriate for the conceptual design, obtain buy-in from the design and estimation teams on what those conceptual design deliverables will be, and hold both teams accountable for their portions of the work."

The Business of Designers

The size and structure of design firms vary 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).

Within these firms, architects and engineers offer their skills, talents, and intellect by the hour, typically at a multiplier on direct personnel expenses to account for overhead, marketing, training, and other nonbillable time, as well as profit.

Profit is not a design firm's only motivator, of course. Other major motivators include peer recognition, innovation, 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. Firms sometimes justify a failure to achieve productivity goals on the basis of design merit.

The design profession has undergone a significant change over the past two decades, with large, publicly held architecture and engineering firms increasing in size and becoming more prevalent. As this trend continues, the design integration manager should understand that the risk model underlying firms' decision-making processes may change. Primary motivators may shift toward profit and shareholder value rather than design merit alone.

A design firm's insurance requirements also differ from those of a builder. A design firm's professional liability insurance is not for minor errors (which occur) but rather for negligent errors and omissions of significant magnitude. Professional liability insurance should not be treated as a form of design contingency.

Regardless of the nature of the design-build contract, design firms always face at least two 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.

The Business of Builders

Builders have a totally different business model than designers, largely because builders require substantial capital and credit at initial startup. 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 than they might otherwise choose to take. Higher risks can mean higher profits but, occasionally, considerable losses. Factors that affect profit and loss are sometimes unpredictable and subject to economic forces beyond the builder's control.

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-size, or exceptionally large. They can be employee-owned, family-owned, privately held, or publicly 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 publicly held corporation's upper management may emphasize risk management much more than its lower-level (non-owner) personnel, who have less incentive to mitigate risk.

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

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.

Factors Affecting Design Costs

Factors that Tend to Increase Design Costs

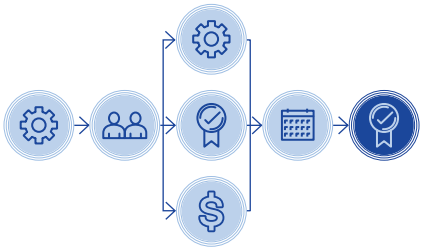
- The designers agree to provide competitive proposal-phase design services for the amount of the honorarium offered by the owner (or for no fee) if they are guaranteed a higher fee than usual if the proposal is successful.
- The designers agree to a firm fixed price for design without additional compensation for changes. Typically, higher fees are used to help offset possible redesign costs.
- The designers have to provide out-of-sequence construction documents for fast-track projects.
- The design team agrees to provide proposal-phase or construction documents on an accelerated schedule.
- The demand for design services exceeds the supply of designers with the desired design experience and reputation in a given geographic area or economic climate.
- Additional design expertise is required for especially complex phased projects or exceptionally high-performance buildings, or the project involves greater-than-normal building information modeling (BIM) requirements, such as the inclusion of a facilities management program.
- The owner has a reputation for requiring significant additional project administration (for example, the federal government).
- The project has an excessively long construction schedule that may significantly increase the designers' construction administration costs.
- The project involves historic restoration or unusual environmental remediation.
- The owner's decision-making process is multilayered, fluid, and/or undefined.

Factors that Tend to Decrease Design Costs

- 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 a design-bid-build project. This improves efficiency by eliminating redundant work. To this end, design integration managers should ask questions such as the following: What details are needed by the builder? If manufacturers are known, where can their cut sheets and standard details be incorporated into the design documents? Where can delegated design be used effectively to avoid duplicative work?
- The design team agrees to share in the profits or losses of the project at the conclusion of construction.
- The designers, for strategic business reasons, are breaking into a new market, are new to the owner/client, are new to the building type, or have not designed a project of this magnitude. Fees may be lower to allow the designer to build a portfolio or because the designers develop naïve estimates.
- The design-builder's contract provides a project design liability policy covering the entire design team.
- The supply of designers with the desired design experience and reputation exceeds the demand for such services in a given geographic area or economic climate.
- The owner provides a complete bridging design. Fees will vary depending on the amount of design risks the design-builder must assume for the bridging design, if any.
- The design-builder and lead design team have collaborated on previous projects, allowing them to leverage past familiarity and working relationships.

Task: Verify that the Design Subcontracts to Be Issued to Partners upon Award Meet the Project Requirements

Once



In this task, the design integration manager prepares draft subcontracts for all partners that will be executed if the proposal is successful and the project is awarded. These subcontracts should be treated carefully, as they need to include contractual language specific to the design-build process.

Knowledge	Skills	Abilities	Other Characteristics
• Familiarity with applicable local, state, and federal building codes • Contractual terms and conditions • Technical and operational requirements of various project types • Sources of risk and risk management practices	• Conveying a message in written form • Negotiating with partners and stakeholders • Determining client and stakeholder expectations	• Collecting, analyzing, and interpreting information • Focusing on and remembering details	• Accountable • Focused

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 various 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:

- What is the procedure for obtaining owner sign-offs and approvals for the design?
- Which design submittals will the owner have the opportunity to review and approve?
- If the original design-build contract 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 reassignment 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 the design-builder assume the risk of errors in such documents?
- Can the design-builder bill for additional time spent developing a design to accommodate 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?

- Will the owner impose fee retention on the design billings? This is an uncommon practice 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 the builder and designer. However, merging design and construction brings to the forefront questions regarding design reviews, design ownership, and design accountability, among other issues, and the contract must address them.

The differences between design-build contracts and 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 integration manager often takes the lead in facilitating the development and negotiation of these agreements, enlisting the assistance of appropriate contracting or legal staff, as applicable.

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

- All contracts should be fair, balanced, clear, and supportive of the collaborative process on a design-build project.
- The contract between the owner and design-builder should address the unique aspects of the design-build process, including the 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.

> *"The design-build process raises unique issues and questions between the owner and the design-builder that contracts and subcontracts need to address."*

Negotiating Subcontracts with Partners

With the design integration manager as facilitator and go-between, the design-builder and designers need to thoroughly discuss the overall risk profile of the project and what each party needs from the other to perform successfully. To the extent that this is done when the teaming agreement is developed, these 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, even 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 the adoption of 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 seem acceptable on paper, but they only serve to put the parties at commercial odds and—for the party 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.

The design integration manager can make subcontract negotiations more constructive in the following ways:

- Identify all key issues for all parties and seek 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. Recognize how the counterparty is organized, how it thinks, what its risks are, and how it makes its money.
- Involve 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.

Ultimately, a subcontract between a 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 similarly 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 identification of the scope of work to contract execution and risks. The following sections address some of the more challenging issues in negotiating a design subcontract on a design-build project.

Commercial Terms in Design Subcontracts

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 integration manager should facilitate discussion on the following:

- The standard of care for design services and whether a performance guarantee for engineered systems is 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?
- 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, will the designer be paid a premium for rush work?
- Handling of owner-directed changes to the project.

"The design subcontract needs to address a variety of key concerns—from identification of the scope of work to contract execution and risks."

Risk Sharing Provisions

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

When developing the design subcontract, the design integration manager will need to work with the team members to consider questions such as the following:

- 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 fall behind schedule or commit an error or omission. The design-builder is confronted with its own challenges, like poor communication, miscalculation of market conditions, failure to procure the complete scope of work from a trade subcontractor in a timely manner, or failure to construct the work according to the plans and specifications.

The subcontract can address these risks in many ways, 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 the risks arising out of the relationship.

The design integration manager can consider the following possible means of sharing risks:

- Use pre-established design and construction contingencies to cover the additional costs associated with the problems and share the savings from those contingency pools.
- Allocate savings that arise from value engineering to a contingency pool and share as appropriate.
- Give the designer discretionary bonuses for exemplary performance in the same manner that an owner might use award fees to reward a design-builder.
- Cap 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 integration manager should be particularly thoughtful about addressing the potential liability confronting an engineering firm under a design-build relationship. The fees generated by design engineers for their engagement on a project are often highly disproportionate to the risks to which the firm is exposed if something goes wrong. Careful management and oversight of the engineering firms involved in a design-build project will help mitigate the likelihood of a problem occurring. The design integration manager should also consider whether some form of contractual liability relief is appropriate.

"The design integration manager should be particularly thoughtful about addressing the potential liability confronting an engineering firm under a design-build relationship."

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 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, almost always have a strong interest in knowing how designers will mitigate any liabilities associated with their 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. Some significant features about PLI impact its effectiveness in 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 coverage lapses if the policy is not maintained.
- PLI policies cover all of the claims against the insured. This means that if the designer has the unfortunate experience of being subjected to 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 insurance carrier.

These limitations prompt some design-builders, especially on very large projects, to obtain project-specific PLI that provides dedicated limits committed to project errors or omissions. The limitations of traditional PLI policies have created a market for PLI policies written specifically for design-builders and contractors, now generally available from multiple insurance carriers.

> *When negotiating the subcontract, it is incumbent upon the design integration manager to be realistic about commercially available insurance and the reasons behind the indemnity clause desired by the design-builder.*

Indemnification Clauses and 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 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, such as any losses caused, in whole or in part, by the designer's actions.

Broader indemnity creates major practical and commercial challenges for the designer, such as the following:

- Full liability when the designer may only be partially responsible for a problem.
- Liability even when the designer did nothing wrong, as the indemnity is tied to the designer's actions, which may not have been negligent or wrongful.
- Requirement of the designer to defend the design-builder when the designer does not have the ability to ask the insurer to assume this defense. As noted above, PLI 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.

When negotiating the subcontract, it is incumbent upon the design integration manager to be realistic about commercially available insurance and the reasons behind the indemnity clause desired by the design-builder. While these matters will often be decided by lawyers, commercial negotiators need to have a full understanding of the nuances of these obligations.

Flow-Down Clauses

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

Essentially, the design-builder flows 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 contract to the design subcontract. Design firms should participate in the review of the prime contract so that unreasonable or inappropriate clauses are not assigned.

BIM Ownership

BIM has had a major positive effect on design development. However, 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?

Working with a BIM manager, the design integration 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 errors in translation occur or if data are dropped as information is transferred?
- If members of the project are working within the same models, what is the process for locking content and controlling changes so that users do not change things that they are not responsible for?
- How does one deal with differences in tolerances between disciplines (e.g., structural steel tolerances that 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 that inputs detailed design information into a model shared with all team members may want to maintain the right to those data when the project is over. If ownership of the model is transferred at the end of the project, proprietary information could find its way to a competitor.
- What is the designer's standard of care for design when so many different players—including the construction team—are inputting information into 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 supporting the successful implementation of BIM.

The Architect's Handbook of Professional Practice published by the American Institute of Architects (AIA) is particularly helpful in that it discusses the "second generation" of AIA's digital practice documents, the first versions of which 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, no court decisions have focused on problems created by the collaborative aspects of developing a design through BIM. The first reported legal case involving BIM in the United Kingdom, Trant v. Mott MacDonal (2017), emphasized the importance of agreeing to fundamental BIM obligations at the outset of the project (https://www.fenwickelliott.com/research-insight/annual-review/2017/uk-bim-trant-mott-macdonald). If history is any indication, it is unlikely that issues such as standard of care among the design team and liability in terms of the Spearin doctrine will be conclusively resolved through contract language, and case law will ultimately be needed to help the industry better understand legal exposure.

Electronic Communications, Project Documentation, and Copyrights

Best practices in information management and electronic communication are discussed in Chapter 4. However, from a contract perspective, the construction industry has provided guidance on how to address the electronic transmission of data as an alternative to paper copies. AIA offers a series of Digital Practice Documents (https://learn.aiacontracts.com/contract-doc-pages/27086-digital-practice-documents/) that offer a detailed overview explaining the issues associated with digital data and electronic communications, as does the contract language developed by organizations that publish standard form design-build contracts.

Article 12 of DBIA 535, *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:

- The parties will agree upon the software and the format used in 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 any software or computer program associated with the electronic transmission of the work product.
- The transmission of the work product in electronic form will not affect ownership rights to 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 regarding electronic communications to be flowed down to the designers.

Performance-Based Criteria

Because design-build lends itself to performance-based design criteria, the owner can be exposed to liability 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 ordinary standard of care for the designer's industry.

DBIA contract documents such as DBIA 501, *Standard Form of Contract for Design-Build Consultant Services*, 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 specifications (if the parties acknowledge this directly in the subcontract agreement by checking the appropriate box).

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

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 integration manager will need to promptly notify the owner, giving the owner a chance to react to the proposed change. The owner also has the ability to issue change directives to make more significant modifications to the project design or scope.

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

It is imperative that the design team maintain a detailed RFP compliance matrix that covers all RFP requirements and that notes whether the design team complies with, exceeds, or does not meet the requirements of the RFP. The design integration manager is responsible for managing the matrix.

Warranty and Post-occupancy Issues

It has become increasingly important for the design integration manager and the design team to fully understand warranty and post-occupancy issues in the evolving world of design-build. It is not uncommon to find multiyear 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 ensure 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.

"The design integration manager needs to keep on top of changes and how they are being addressed."

Standard Form Design-Build Subcontracts

Given the widespread use of design-build since the mid-1990s, the construction 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.

Standard form design-build contracts have been developed by various professional and trade associations in the United States, such as the Design-Build Institute of America [DBIA], American Institute of Architects (AIA), ConsensusDocs, and Associated General Contractors (AGC) of America. Each suite of standard forms 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 standard forms 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 DBIA forms) can create problems.
- Differences among standard forms can be very subtle, with differences of only a few words changing risks substantially. Therefore, read all standard forms carefully and consider seeking legal advice before signing.
- Parties that use standard forms as their baselines routinely change them. The "drafting" party should highlight the changes it makes to a standard form through redlining to ensure that the "receiving" party knows what has been changed.

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

- 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. Additional team members, some of whom may be new to the design-builder's typical list of vendors, may need to be secured to fulfill the requirements of the contract.
- 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.

Resolving these and other challenges presents an area of potential risk. However, these challenges 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 estimation.

CHAPTER 4: POST-AWARD PHASE

Description of Phase

The post-award phase begins when the design-build team receives a notice of award from the owner and ends with the start of early design. Several key activities occur during this phase that will set the tone and pace of the project going forward.

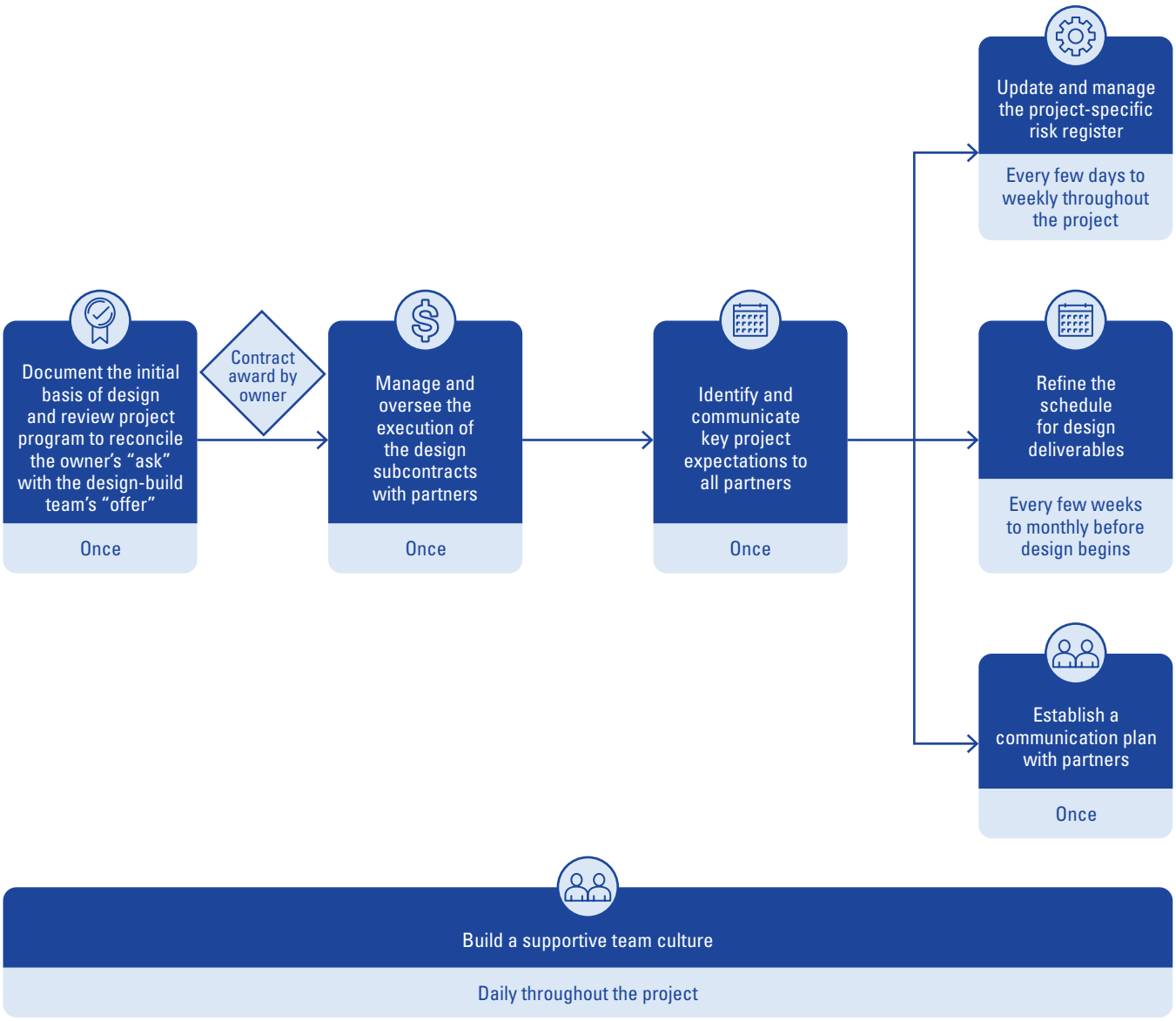
First, the design-builder, its partners, and the owner must reach a shared definition for the project by reconciling the design-builder's proposed work with the owner's project requirements. Once the project definition is agreed upon, a formal contact award from the owner to the design-builder follows. The design-builder can then execute the design and trade partner subcontracts, taking care to ensure that key project expectations are clearly identified and communicated to the team. Once the team is under contract, the design-builder may plan various team-building activities or partnering sessions to begin developing a supportive culture that fosters collaboration and cooperation. The team then revisits assumptions made during the proposal phase to update the risk register and the schedule of design deliverables.

The Role of the Design Integration Manager

For the design integration manager, the post-award phase is the time to set up the team and partners for success. In this phase, the design integration manager's primary responsibility is to build alignment among the design-builder, its partners, and the owner regarding the project definition.

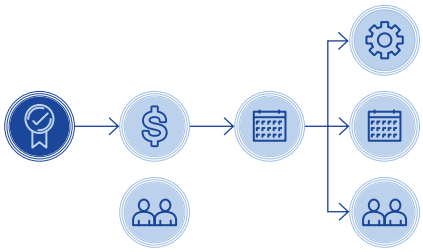
To accomplish this task, the design integration manager needs to create an environment that fosters collaboration among the design-build team. Developing this type of culture is vital to ensuring open communication, accountability, and commitment to the project objectives when the team transitions into the early design phase. The design integration manager also oversees the creation of a formalized communication plan that describes how information will be shared and specifically the tools or technologies that will be used by the team.

> *"For the design integration manager, the post-award phase is the time to set up the team and partners for success."*



Workflow of the design integration manager's tasks during the post-award phase

Task: Document the Initial Basis of Design and Review the Project Program to Reconcile the Owner's "Ask" with the Design-Build Team's "Offer"



Once

In this task, the design integration manager works with his or her partners to reconcile the shared definition of the project with what the design-build team had proposed. The intent is to precisely define the initial basis of design in terms of what is included in the project.

Knowledge	Skills	Abilities	Other Characteristics
• Familiarity with applicable local, state, and federal building codes • The design process and stages of design • Capabilities of design and drafting software • Contractual terms and conditions • Technical and operational requirements of various project types • Sources of risk and risk management practices	• Conveying a message in written form • Listening • Negotiating with partners and stakeholders • Persuading others of a position • Organizing information and record keeping • Reading and understanding design drawings • Forecasting cost and schedule impacts • Compromising and finding equitable solutions • Determining client and stakeholder expectations	• Visualizing 2D drawings in 3D • Engaging in continuous learning • Collecting, analyzing, and interpreting information • Working well under time pressure • Focusing on and remembering details	• Adaptable • Creative • Trustworthy • Respectful • Decisive • Focused

After further discussion with the owner, the design integration manager works with the design team to reconcile the shared definition of the project with what the team had proposed. The intent is to define precisely what is included in the project, thereby reconciling the owner's "ask" in the request for qualifications (RFQ)/request for proposal (RFP) with the design-build team's "offer."

A key first step in this reconciliation is to document the initial basis of design. The basis of design is a narrative, prepared for a general audience, that documents the reasoning and decisions made during the design phase. The initial basis of design is commonly created during development of the schematic design and is continually updated throughout the design process into a detailed technical document that can be used by the owner's facilities management staff to support building operation, commissioning plans, and maintenance.

"After further discussion with the owner, the design integration manager works with the design team to reconcile the shared definition of the project with what the team had proposed."

The specific expectations for a basis of design will vary by project type and market sector. However, the basis of design commonly highlights the various assumptions and performance expectations made by or given to the design-build team at the outset of the project. The initial basis of design establishes a vision for the project and may include the following:

- Project background information that is relevant to understanding the design, including design standards, programmatic requirements, or any other information provided by the owner during the proposal/pre-award phase. A description of the building type and occupancy class are also typically included.
- Any schedule or budget limitations that may result in modifications to the owner's requirements.
- A narrative description of the function of each building system and significant subsystems. For example, a narrative for a building's heating, ventilation, and air conditioning (HVAC) system would describe the indoor environmental design conditions, such as temperature, relative humidity, maximum air velocity, air changes per hour, and so forth.
- A listing of specific codes or standards, guidelines, and regulations that will be followed during the project design, with a commentary on the key impact of each listed reference on the design. This section would include any relevant sustainable design goals, such as Leadership in Energy and Environmental Design (LEED).

"The design team, under the design integration manager's leadership, compares the initial basis of design to what is achievable given the contracted construction cost estimate."

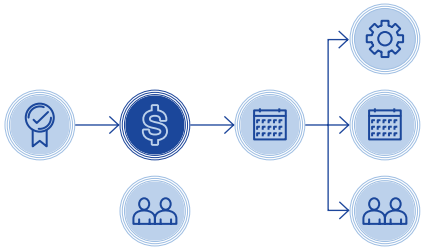
As part of this process, the design team, under the design integration manager's leadership, compares the initial basis of design to what is achievable given the contracted construction cost estimate. The objective is to identify any remaining questions or ambiguities so that subsequent rework or redesign can be avoided. The design integration 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 the 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 integration manager should consider the importance of sharing detailed cost estimates between the design team and the construction team.

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

Task: Manage and Oversee the Execution of the Design Subcontracts with Partners

Once



In this task, the design integration manager formally executes the subcontract agreement between the design-builder and the lead designer and oversees the execution of the design subcontracts that were negotiated with the specialty design partners during the proposal/pre-award phase.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Contractual terms and conditions • Technical and operational requirements of various project types • Sources of risk and risk management practices	• Negotiating with partners and stakeholders • Organizing information and record keeping • Delegating responsibilities and work to the right people	• Collaborating with partners • Establishing and maintaining relationships	• Trustworthy • Accountable

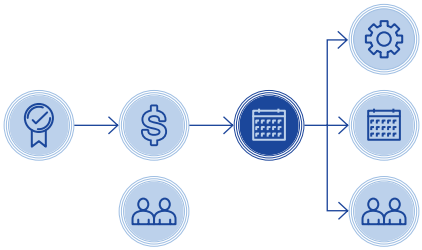
Upon award of the design-build contract from the owner, the design integration manager should oversee the issuance of design subcontracts for the needed design services (e.g., architectural, structural engineering, civil engineering, and so forth), first with the design-builder's chosen lead designer(s) and then with specialty design partners. If adequate time was available during the proposal/pre-award phase to fully draft and negotiate these subcontract agreements, then this task is relatively straightforward. Some updates to a partner's scope of work or commercial terms may be needed to reflect new information learned during the selection process or subsequent meetings with the owner and the owner's team. However, these updates should be minor and should not prevent the design subcontracts from being executed shortly after award.

If the design subcontracts were not fully negotiated during the proposal/pre-award phase (see Chapter 3), then the design integration manager must lead that effort during the post-award phase.

"Upon award of the design-build contract from the owner, the design integration manager should oversee the issuance of design subcontracts for the needed design services."

Task: Identify and Communicate Key Project Expectations to all Partners

Every few weeks to monthly until proposal submission



In this task, the design integration manager leads the team to establish a mission and vision statement for the project and documents the responsibilities and performance expectations of the design-build partners.

Knowledge	Skills	Abilities	Other Characteristics
• Familiarity with applicable local, state, and federal building codes • The design process and stages of design • Technical and operational requirements of various project types • Project roles and the work responsibilities commonly associated with each role	• Conveying a message in written form • Conveying information verbally • Organizing information and record keeping • Determining client and stakeholder expectations	• Collecting, analyzing, and interpreting information • Speaking comfortably in a group situation • Focusing on and remembering details	• Empathetic • Respectful

"A successful design integration manager knows the importance of planning and establishing several key expectations at the project's outset."

A successful design integration manager knows the importance of planning and establishing several key expectations at the project's outset. These actions will pay dividends later in terms of the smooth and efficient functioning of the design team and the quality of the design itself.

Mission Statement and Team Chartering

A team charter is a document developed in a group setting that clarifies the team's direction and establishes the boundaries of the collaboration. The charter encourages a shared understanding among team members and buy-in from the overall team. It should be developed early in the process, during the formation of the team.

The purpose of a team charter is twofold. First, the team charter serves as an opportunity for the team members to define the mission, vision, focus, and direction of the team. The team charter clearly identifies the members of the team and their roles and responsibilities to ensure the efficient execution of the project. It also outlines operating guidelines for the entire team, which include expectations regarding communications, participation, and outside party involvement.

Second, the team charter educates others on the mission, structure, and operation of the team. Over the life of the project, new team members will join. The team charter can serve as a key document for onboarding and will ensure that new team members understand the vision, roles, and responsibilities of the project team.

In a design-build environment, the design integration manager is responsible for leading the development of the team charter and updating it throughout the life of the project if priorities change. In addition, any new team members added post-award should be familiarized with the team charter.

Project Vision

All building projects start with a vision—whether 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 vision is where a design starts, and, in the end, the vision sets the criteria by which it will be judged.

The design integration manager, with support from key design team members, takes a lead role in documenting the owner's vision. Therefore, it is essential for the design integration manager to obtain a vision statement from the owner, either through the RFP, discussions with the owner, or other preliminary communications. The design integration 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 integration manager should later communicate to the team the resulting expectations regarding project deliverables and requirements, including review sets, bid sets, permit sets, and construction documents.

Throughout the design process, the design integration manager and key design team members should conceptually evaluate the design against the project vision. The design integration manager might consider developing a project poster with relevant graphics to provide the team with a constant reminder of this vision. Remember—the end result achieved and the satisfaction derived from the project by all parties will relate directly to realizing the project vision.

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 lay the groundwork for a successful project.

To arrive at a workable set of performance expectations, consider having each project stakeholder express to the team how project success should be defined. 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 set the vision and performance expectations more efficiently than the design integration manager because a design integration manager who also serves as a facilitator may find it difficult to participate effectively as an individual.

> *"The design integration manager, with support from key design team members, takes a lead role in documenting the owner's vision."*

The design integration manager should consider implementing a process for periodically evaluating team members' performance against performance expectations. Examples of evaluation approaches include management check-in meetings focused solely on the performance of the project, periodic team performance surveys asking participants to evaluate how they feel the project is going, or an ongoing performance recognition program to highlight top-performing members of the team. To address cases where performance falls short of expectations, the design integration manager should also develop a process to correct deficiencies on a regular basis so that problems do not spiral out of control.

Roles and Responsibilities

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

Different design firms may use a variety of job titles for the same function. Design integration managers should confirm that they understand the following:

- 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

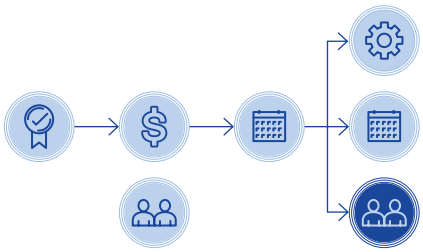
The following are pertinent questions to explore with each firm involved in the design-build team:

- How is the company organized? How might this affect the design-build team's organization?
- Who has decision-making authority? Will this person also be the main point of contact?
- What are the team's and individual staff members' talent sets?

The design integration manager should also consider whether 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.

Task: Establish a Communication Plan with Partners

Once



In this task, the design integration manager develops a strategy to engage the owner and its staff, the designer, the engineers, and the builders in optimal communication. The design integration manager establishes the systems, protocols, and expectations for beneficial communication among team members and verifies that all team members buy into and are proficient in the use of these communication protocols, thus vastly improving collaboration.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Construction means and methods • Contractual terms and conditions • Construction work sequencing • Sources of risk and risk management practices	• Delivering presentations to a variety of audiences • Managing stress effectively • Managing time	• Establishing and maintaining relationships • Collecting, analyzing, and interpreting information • Working well under time pressure • Focusing on and remembering details	• Assertive • Adaptable • Accountable • Empathetic

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

One of the key benefits of the design-build method of project delivery is the opportunity for key participants to communicate with each other earlier and more frequently than they would on a design-bid-build project. The design integration manager should use frequent communication with key players to his or her distinct advantage.

Information Management and Electronic Communication

A number of powerful tools are available to the design integration manager to help guide the flow of information and facilitate communication. Often these tools are also used to give the owner in-progress status information.

The trend in the industry is to rely on electronic tools for team communication and record keeping. These tools include building information modeling (BIM), virtual mock-ups, project-specific websites, and cloud-based document management systems (DMS), to name a few. Each of these tools requires a strategy and protocols, developed by the design integration manager, that are tailored to the design team's needs and priorities.

"At the outset of the project, the design integration manager ascertains the most applicable communication and file sharing software for the team and establishes guidelines for its use across all disciplines."

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

If the task is not assigned to a dedicated document control manager, the design integration manager organizes an electronic file structure, determines who will manage it, and then creates a document distribution and tracking process for both hard copies and electronic media. A project-specific website may also be created, with the design integration manager deciding who will provide the labor and resources to build and maintain it.

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

- 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 integration 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 that distinct issues can be tracked easily
- How emails will be stored and retrieved (e.g., stored in one place for the entire project versus stored in individual mailboxes)

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

BIM Execution Plan

At this point, the design integration manager oversees development of the post-award BIM execution plan (BEP) and gets approval for the BEP from both the owner and the design-build team. A pre-contract BEP was likely either provided by the owner or submitted by the design-builder with the proposal, but that plan focused on intentions and capabilities. Post-award, the BEP should be formalized by the BIM manager to describe exactly how information management will be performed by the project team during design and construction. The design integration manager should be able to understand and use this BEP. The BEP must satisfy the owner's BIM requirements and be delivered either as an online deliverable or as a compiled document to the requesting party.

The BEP must also include the computer-aided design and drafting (CADD) and BIM standards and procedures to be established during the initial design stages and maintained through construction.

An open standard to consider for BIM data is industry foundation classes (IFC), an object-based file format with a data model that is maintained by buildingSMART. Most design-authoring BIM software applications can export to IFC format. However, the design integration manager should work with the BIM team to verify that the owner's software systems can receive and import this format. Many government agencies, including the United States General Services Administration, require BIM data to be delivered in IFC format.

The BEP should also do the following:

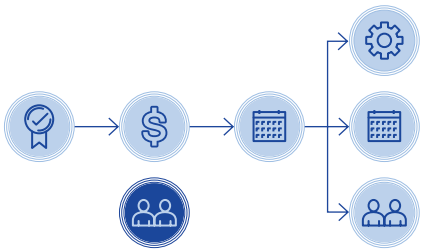
- Identify model uses, such as design authoring, 4D modeling, cost estimation, space management, and record modeling
- Outline the process for integrating the model uses with identified information exchanges by developing both a high-level map and detailed process maps for each BIM use
- Define the content for each information exchange
- Identify the project infrastructure, which includes defining contract language, communication procedures, technology infrastructure, and quality control procedures to ensure high-quality information models

Overall, it is the design integration manager's role to ensure that that the BEP is clear, comprehensive, achievable, and agreed upon across the relevant project participants, including the BIM manager(s).

"It is the design integration manager's role to ensure that that the BEP is clear, comprehensive, achievable, and agreed upon across the relevant project participants."

Task: Build a Supportive Team Culture

Daily throughout the project



In this task, the design integration manager creates an environment that fosters collaboration among the design disciplines, the builder, the owner and its staff, and the end users of the project. This task is ongoing throughout the project, in that the design integration manager may need to intervene to resolve conflicts or disagreements at various points to ensure that the team culture remains supportive. On some projects, the design-builder may contract with a third-party mediator or facilitator to assist in the performance of this task.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Construction work sequencing • Technical and operational requirements of various project types	• Listening • Resolving conflict among people on the project team • Motivating people to a desired outcome • Managing stress effectively • Compromising and finding equitable solutions	• Collaborating with partners • Establishing and maintaining relationships • Speaking comfortably in a group situation	• Empathetic • Respectful • Adaptable • Trustworthy

Anyone in the design and construction industry can recognize 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 (2D and written) 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. The builders then 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.

All of the design-build team members' individual job responsibilities, their training, their experiences, and their psyches are well suited to their individual tasks. At the same time, the team's architectural and engineering professionals are culturally different from the builders and are trained to approach problems differently. The successful design integration manager must recognize and appreciate 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 a unified, high-performance team.

"The successful design integration manager must recognize and appreciate differences, understand the motivators that drive each member of the design-build team, and bring a commonality to the process."

The Culture of Designers

The designers on a design-build team include both architectural and engineering professionals as members of the lead design firm or specialty design firms.

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

Engineers are trained to solve problems. They apply the techniques they've learned, as well as analytical skills and logic, to select and develop systems. Engineers are the critical link between a project's goals and its realization.

Both architects and engineers are licensed design professionals. The paramount charge of the licensed design professional is the public's safety, health, and welfare. 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 design professionals work for, or who pays their fees, a designer's first and ultimate duty is to the public welfare—and compliance with codes and standards of care. Licenses are granted to individuals, not to the companies that employ them, and design firms must operate in full compliance with these mandates.

The design professional 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 this individual's direct supervision.

The Culture of Builders

Builders are often trained as engineers or construction managers, so, like engineers, 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 they recognize that 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 foundations, 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 work with independent design consultants.

Merging these Cultures

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

In short, team members need to understand the workflows 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 may oversimplify the task, but the concept is clear: understanding the differences among team members' approaches is a necessary foundation to developing and implementing efficient and effective design-management practices.

The architect's design concept will often challenge the 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 quickly.

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

"When confronted with strongly held but conflicting opinions from qualified team members, the design integration manager must resolve issues quickly or the design effort will suffer."

Team 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, where no judgments are made early in the process. This eliminates the fear of failure and encourages maximum participation in the initial concept phase of design. The design integration manager is responsible for facilitating collaboration among the design team, the builder, the owner's staff, and end users, as appropriate.

The design integration manager can use a number of tried-and-true techniques to foster collaboration during the creative design process. The design integration manager determines the likely participants for each stage of design collaboration while remaining open to adding participants as the design progresses and needs are defined.

During the early stages of design, the idea-sharing process is informal and involves a relatively small number but wide array of design team members.

The design integration manager institutes brainstorming sessions and invites participation, suggestions, and criticism without regard to formal role, rank, or responsibility. The design integration manager might praise creative and resourceful suggestions, even if they are eventually found to be impractical.

Collaboration gradually increases in complexity and participation as various other disciplines are invited into the process. The design integration manager facilitates "pin-up" sessions by putting early design documents in front of a group of critical team members, who are then given the opportunity to contribute to the process. Pin-up sessions should include major design professionals and builders, project managers, estimators, construction superintendents, and quality control personnel.

At the key milestones, the design integration manager presents the developing concepts to the owner and the building's users to check for direction and receive user feedback.

The design integration manager can use exercises to help team members view the design and its components from frames of reference other than their own. For example, designers might be asked to define individual design problems for the team before solutions are presented or to show photographs or illustrations of historical examples of the subject building type.

After intra-team design presentations, the design integration manager can 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. Owner, client, and user representatives can be included in some of these exercises.

Addressing Disagreements

Healthy conflict can be a productive way to work through differences in professional culture and project objectives. The best way for design-builders and designers to address disagreements is to establish, at the outset, an open, collaborative, and trusting relationship where the parties understand the key concerns of the others. While the "softer" side of collaboration and team building is often effective, ways to accomplish respectful and productive working relationships from a contracting perspective include the following:

- Ensure that the parties understand the design contingency assumptions built into the design fee estimate and establish a reasonable way to manage and mitigate those contingencies.
- Have the design-builder prepare and discuss trend logs with the designer to help the designer understand potential/actual problem areas and to help develop solutions to mitigate these problems.
- Ensure that the parties conduct a post-award risk management discussion to orient them to potential problem areas.
- Establish a "no surprise" philosophy with the project team and let them know promptly about problems and how they will be mitigated.
- Convene 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.

Dealing with Design Conflicts

The teaming agreement and design subcontracts are excellent places to deal with the consequences of design conflicts. Once a problem appears, it is critical—and consistent with the principles for avoiding a dispute—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 attempt to isolate itself from the solution.

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. In this environment, the designer and design-builder gain nothing from blaming each other for problems. Furthermore, to be successful, all parties must work collaboratively throughout the project, providing regular communication and feedback. 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 integration manager will have to resolve strongly held differences of opinion among participating team members. The design integration manager should approach each unresolved conflict with an open mind, open ears, and patience. In doing so, the design integration manager helps the parties categorize and frame the issues in dispute so that they are clear and organized.

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

On issues of legal responsibility for various aspects of design, the design integration manager should support the accountable professional and favor the party that has the most at stake.

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 integration 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 should include protocols that allow conflicts to be elevated to progressively higher levels of authority. However, senior management should encourage the design integration manager to resolve conflicts at the lowest possible rung on the authority ladder. Only issues that cannot be resolved there should be escalated for resolution.

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

Several types of dispute require "real-time" resolution. For example, the design-builder and designer might disagree over what design will satisfy a code, a 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. Remember that architects and engineers have a legal obligation to protect the safety, health, and welfare of building occupants (see the discussion above on the cultures of designers and builders). This is a condition of their license to practice.

The design integration manager should similarly 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.

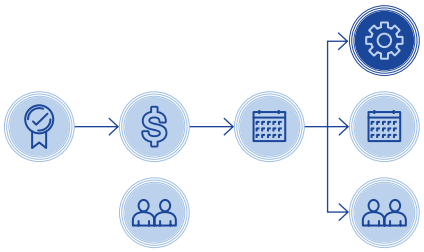
For disputes that involve resolving the impact of an event (e.g., errors and omissions, design delays, or owner-caused problems), the parties should consider the following nonbinding processes:

- 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. Allow proponents on each side of the issue ample opportunity to state their positions, and ensure that all participants fully understand the issues in dispute. Require team members with opposing viewpoints to listen and paraphrase what they've heard—allowing the original team member to confirm or clarify—before any counterarguments are made.
  - Second, elevate the issue to senior management within the respective organizations. Senior managers typically do not want to interfere unless the design integration manager asks for help. In a successful stepped negotiation 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., whether the designer satisfied 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 dispute. Sessions with the mediator are confidential, and each party is expected to have an appropriate representative present with the 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 resolution for the dispute. 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 types of dispute resolution techniques should be used only as a last resort.

Task: Update and Manage the Project-Specific Risk Register

Every few days to weekly throughout the project



In this task, the design integration manager builds on the initial list of risks identified in the proposal/pre-award phase by updating the risk register with any new information learned post-award from the owner or design partners. Though the risk register was created during the proposal/pre-award phase, the task of identifying, assessing, and monitoring risks continues throughout the project.

Knowledge	Skills	Abilities	Other Characteristics
• Contractual terms and conditions • Technical and operational requirements of various project types • Sources of risk and risk management practices	• Organizing information and record keeping	• Collaborating with partners • Devising innovative solutions	• Decisive

"For the design integration manager, updating and maintaining the risk register should be a continuous process throughout the project."

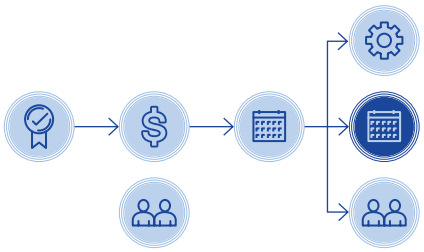
As the design develops, new information can lead to the identification of new risks. Changes in the design can also result in the introduction of new risks. Starting in the post-award phase and continuing throughout the design phase and construction phases, it is imperative that the project-specific risk register begin to involve the owner and be kept up to date to reflect the current reality of the project.

For the design integration manager, updating and maintaining the risk register should be a continuous process throughout the project. In addition to expanding the risk register with new risks, the design integration manager should also monitor changes in risk probabilities or impacts and prepare risk resolution schedules when needed. With respect to risk resolution schedules, the design integration manager should coordinate with other team members to establish key milestone dates when more information will be known about certain risks or to establish dates when certain risks must be resolved.

Periodic risk reviews can be scheduled to ensure that project risks remain an agenda item for all regularly occurring design and construction meetings. When an unexpected risk is encountered or when the estimated consequences of a previously identified risk become larger than anticipated, the risk mitigation plan may need to be revisited. At that point, the design integration manager should facilitate additional response planning meetings with the design-build team to control the newly identified or newly understood risk. Active management is key to ensuring that the response to the risk is both timely and adequate.

Task: Refine the Schedule for Design Deliverables

Every few weeks to monthly before design begins



In this task, the design integration manager coordinates with the lead designer to refine the initial design deliverable schedule prepared during the proposal phase by expanding the number of relevant design subtasks, capturing the interdependencies of those tasks, and updating the duration of design tasks based on any new information from the owner or design partners.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Construction means and methods • Contractual terms and conditions • Construction work sequencing • Technical and operational requirements of various project types • Sources of risk and risk management practices	• Conveying information verbally • Negotiating with partners and stakeholders • Using scheduling software • Leading pull planning processes • Prioritizing work	• Collaborating with partners • Establishing and maintaining relationships • Speaking comfortably in a group situation • Focusing on and remembering details	• Assertive • Accountable

The development and execution of the design schedule is a joint and collaborative effort of the entire project team: the owner, architects, engineers, the contractor, and possibly key consultants and/or trade contractors. The design integration manager facilitates this 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. Later, the design integration manager will manage the project against this schedule and budget, adjusting both as necessary to accommodate changes and unforeseen circumstances.

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

A useful strategy for design scheduling may be for the design integration manager to convene a series of scheduling "charrettes"—or intense sessions in which a group drafts a solution to a problem—among all design professionals, the owner's representatives, and the construction management team. During these charrettes, the design integration manager can lead a pull planning effort to understand the tasks and commitments needed to reach such a solution.

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

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 that is used as a checkpoint to validate how the project is progressing. Some example milestones include the kick-off meeting, 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-build 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 project's work breakdown structure, the design integration manager and design team identify the amount of time needed to execute each specific task, along with the predecessors and successors to that task."

Using the project's work breakdown structure, the design integration manager and design team identify the amount of time needed to execute each specific task, along with the predecessors and successors to that task. At the same time, decision-makers are identified and the decisions they are responsible for are articulated. This exercise results in a shared 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 produce 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
- Request for information (RFI) processing
- Submittal processing
- Pay application processing
- Contract modification documents
- General construction administration activities/ coordination
- Site observations and reports
- Final inspections and punch listing
- Record document development
- Move-in support
- Owner review cycles

Work Breakdown Structure

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 estimation and control.

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

One powerful tool the design integration manager and project team can use to establish the work breakdown structure and project schedule is 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 identifying design elements.

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

Another type of framework for defining the schedule elements is the level of development (LoD) described in Chapter 3, which defines levels of detail for systems, assemblies, and elements as they are developed.

A third way to look at the design progression is outlined in American Institute of Architects (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. This document provides a useful conceptual framework for envisioning how the design will progress.

To keep the design process in perspective, remember that all deliverables produced 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 detailed schedules to complete 3D models. While each project has its own unique set of design deliverables, the following is a rough list of the types of deliverables that may be expected:

- 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

Note that this is just a partial list and that many of these items will have multiple subsets of deliverables.

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 those goals and expectations. The owner's goals and expectations may change over the course of the project for legitimate reasons; for example, both the owner and design team may learn new information as the project progresses. The design integration manager should make every effort to understand the owner's internal decision-making process and help the owner reassess initial ideas or assumptions.

The design integration manager's role in this iterative process is as follows:

- Accept it. Design evolves on every project, so don't fight it.
- Encourage it. Change is is a necessary step in project development and ensures the owner's satisfaction with the project, so don't discourage it.
- Support it. Guide the owner through the process of learning from the development of the project and the design and appropriately re-evaluating expectations.
- Manage it. Track the goals, information, and decisions over time, but refrain from building a case against the owner. Help the owner understand both the evolution of the design and the impacts of the decisions made.

Special Considerations for Developing a Fast-Tracked Project Schedule

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

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

- Rough grading plans from the civil engineer to allow site work to begin before the civil engineer's drawings are fully detailed
- Drawings of major structural steel members to allow a steel mill order to be placed before the structural detailing is completed
- Equipment purchase specifications to allow long-lead-time items, such as chillers, boilers, and electrical switchgear, to be ordered

For example, after the conceptual design of the building is complete, work can begin on select fast-tracked packages such as demolition, grubbing, grading and excavation, site civil engineering, utilities, and foundations. The design-builder can embark on construction of those items while detailed design work for 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 project schedule stands in contrast to that of a design-bid-build contract, in which the project is sequentially and fully designed by the architects and engineers, bid on by general contractors, awarded by the owner, and then constructed.

The design integration manager needs to be aware of the scheduling strategy from the beginning of the project to ensure that the design team incorporates these interim design packages into their design fees and schedule. Multiple submissions and requirements for out-of-sequence work (compared to a traditional design process) will impact the design team. Multiple bid packages can both be 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 may then result in corresponding construction change orders. If designers are not used to producing these types of packages, the design integration 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 integration manager's roles as facilitator between the design and scheduling/procurement teams is to ensure that the design team knows what is expected of it under a fast-tracked strategy and to work with the team to ensure that the necessary documents can be delivered on schedule. The design integration 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.

Fast-tracking creates a push-pull relationship between the construction team, who want completed design deliverables faster to get started in the field, and the design team, who want more time to adequately coordinate and perform quality control checks on the design documents. Often to satisfy a fast-tracked schedule, the time to review these documents is reduced. The design integration manager needs to understand the factors on both sides of this push-pull relationship that influence the design schedule and ensure that the design package schedule includes appropriate review durations while still supporting the design-builder's procurement and construction schedule.

Proceeding with construction before resolving and completing all design issues or obtaining a full and complete building permit involves some inherent risk. For example, early work may have to be torn out and rebuilt based on subsequent design. The design integration manager, by working closely with the design team and carefully managing the design process, works toward reducing this risk.

CHAPTER 5: EARLY DESIGN PHASE

Description of Phase

During the early design phase, the team further works with the project owner to confirm the project scope, develop a design concept, and create a preliminary design that meets the project requirements and specifications. The team also works closely with the client and other stakeholders to gather information and input on the project, identify any potential challenges and constraints, and develop a design that meets the client's needs and budget. This collaboration with the client helps ensure that the design-build team fully understands the owner's vision for the project and can develop a design that meets the owner's needs within the budget constraints. The design team may also conduct site visits, research, and analysis to ensure that the design is feasible and compliant with all relevant regulations and codes.

As the design concepts are refined, the design team may develop schematic designs, which are more detailed representations of the designs created during earlier phases of the project. Schematic designs typically include floor plans, elevations, and other drawings or models that depict the general layout and form of the building. At this stage, the design team will likely also decide on the main structural systems, materials, and other technical aspects of the project. Near the end of this phase, the design will typically be 30% complete. However, decisions regarding when early design ends and detailed design begins should be made on a project-by-project basis. The design integration manager needs to coordinate the meaning of each design phase (schematic design, detailed design, etc.) and align expectations among the design partners, owners, and builders. This is especially important for coordination of permitting for different work packages.

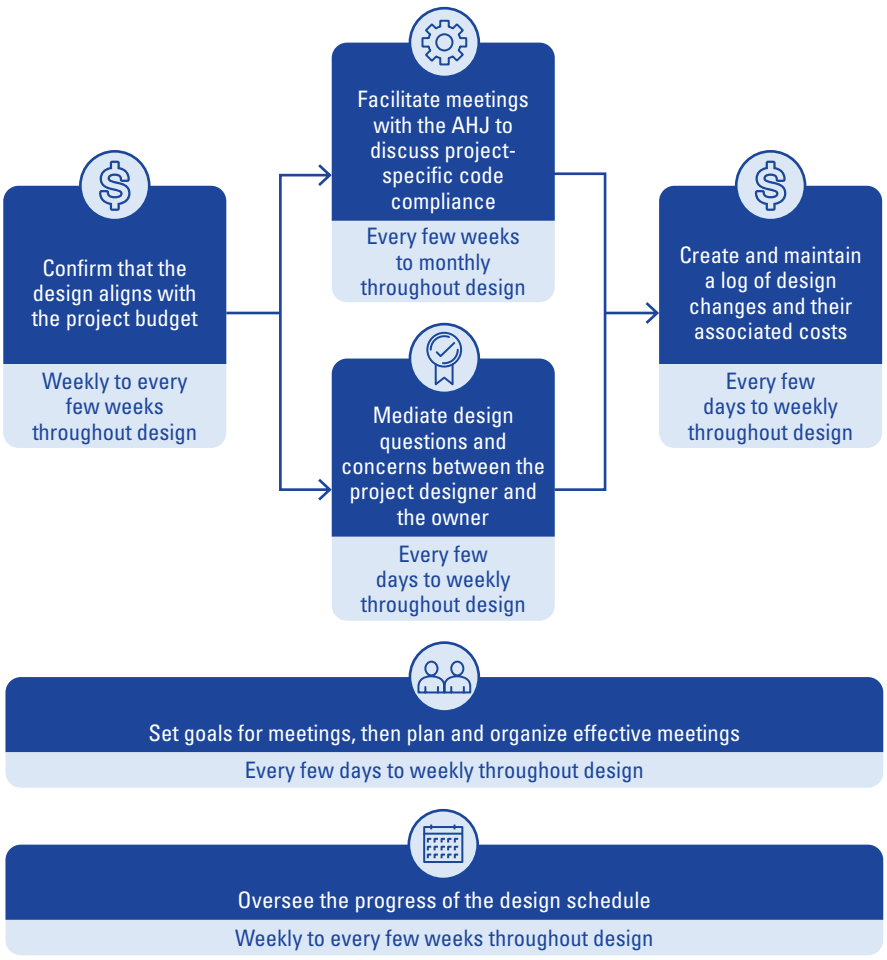
The Role of the Design Integration Manager

Based on the conceptual design and the reconciled project definition, the design team embarks on a full architectural and engineering design of the building. The design integration manager tracks the progress at every step, comparing the work accomplished against the project's schedule and budget—and against the project's goals. During this phase, the design integration manager oversees the development of the design in collaboration with the lead design team, coordinating with the client and other stakeholders, and ensures that the design meets the project requirements and specifications.

“During this phase, the design integration manager oversees the development of the design in collaboration with the lead design team, coordinating with the client and other stakeholders.”

The design integration manager also works closely with the construction manager and other members of the design-build team to track and confirm the project's scope against the owner's confirmed scope and works with the design team if there is a deviation in the scope or the scope is not being met. Additionally, the design integration manager is responsible for ensuring that timely decisions are made and documented and that the project is on track to meet its schedule milestones and budget. The design integration manager may also conduct design reviews and provide guidance and feedback to the design team to ensure that the design is feasible, is compliant with all relevant regulations and codes, and meets the client's needs.

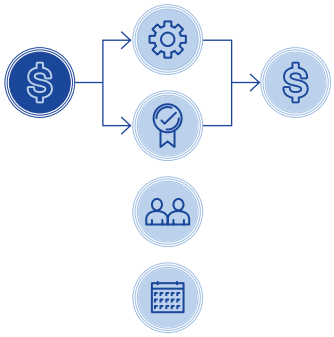
> *"The design integration manager is responsible for ensuring that the project is on track to meet the project's schedule, budget, and milestones."*



Workflow of the design integration manager's tasks during the early design phase

Task: Confirm that the Design Aligns with the Project Budget

Weekly to every few weeks throughout design



In this task, the design integration manager compares cost estimates for the design in progress against the budget established for the project in the contract award. If cost estimates begin to deviate from the budget, the design integration manager should work with the design-build team to develop ideas to recover or reallocate costs. This task recurs throughout the early design and detailed design phases.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Contractual terms and conditions • Technical and operational requirements of various project types • Sources of risk and risk management practices	• Prioritizing work • Negotiating with partners and stakeholders	• Focusing on and remembering details	• Patient

On many design-bid-build projects, the design is created independently of construction considerations, which may result in projects that are unaffordable and/or not constructable. Within the design-build environment, a relatively new technique is gaining traction: target-based (also called target-value) design. In 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, a project delivery schedule, or some other stated performance measure (or likely all three), the design integration manager plays a key role in ensuring that the targets are achieved. For the purpose of this discussion, we will assume that the target is financial (the most common), but the principles apply to other targets as well.

As an example of target-based design, construction cost management is a process by which the design concepts are 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 integration manager, the designers, and the design-builder. Construction cost management is implemented at 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 integration manager can make 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 integration manager's credibility and create divisions within the team.

The design integration manager is therefore 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 integration 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 to estimate a design at predetermined milestones.

At the outset, the design integration manager needs to obtain input and buy-in from the design and construction estimation 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 work on the detailed design commences, it's beneficial for the design integration manager to review with the design team the scope of work used to create the 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.

"After the project is awarded and before work on the detailed design commences, it's beneficial for the design integration manager to review with the design team the scope of work used to create the construction cost estimate."

If projected construction costs appear to be deviating from the construction budget for a given element, the design integration manager may want to consider the following:

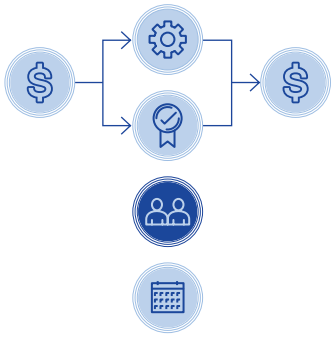
- Redesigning that element to the budget. The design integration manager can work with the design and construction teams to identify value engineering options or, with the approval of the owner, cost reduction options that could be implemented to offset the cost increases from changes.
- Increasing or decreasing the budget for that element by modifying the 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, which would ultimately increase the project budget and eliminate the conflict.

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

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

Task: Set Goals for Meetings, then Plan and Organize Effective Meetings

Every few days to weekly throughout design



In this task, the design integration manager coordinates meetings, as needed, among the owner and its team, the design disciplines, the builder, and the end users. Meetings are called for a variety of reasons, and it is the design integration manager's responsibility to ensure that the right people are involved and that their time is used productively. The design integration manager must coordinate owner participation and stakeholder participation and review. This task recurs throughout the early design and detailed design phases.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Construction work sequencing • Technical and operational requirements of various project types • Sources of risk and risk management practices	• Conveying information verbally • Listening • Leading a project team • Solving design problems • Organizing information and record keeping • Motivating people to a desired outcome • Managing time • Organizing and leading effective meetings	• Collaborating with partners • Speaking comfortably in a group situation	• Self-motivated • Focus • Patient

Meetings (whether in person or via 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 demotivate and frustrate people if they are unfocused and/or too frequent.

Meetings may be needed for the following reasons:

- Contract-required review cycles with the owner or other stakeholders
- Owner-initiated reviews of design concepts and design-related decision-making
- Integration of owner-initiated scope changes
- Regular discussions of logistics and progress with the team
- Project reviews, criteria compliance reviews, code analysis and compliance reviews, constructability reviews, cost and estimate reviews, and peer reviews
- Stakeholder engagement (including the many forms this may take)

For each meeting, the design integration manager should evaluate potential attendees to ensure that the appropriate people participate. A balance must be struck between including critical participants and wasting people's time. The design integration manager should also prepare the agenda for each meeting and make sure that attendees are prepared with the requisite materials.

When planning or conducting meetings, the design integration manager should consider the following questions:

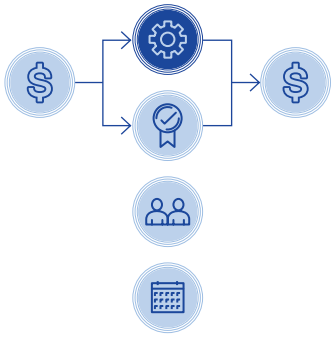
- Are any key people missing?
- Is the group too large?
- Are focused breakout sessions desirable/necessary?
- Are new team members being effectively integrated into the existing team?
- What decisions need to be made?
- What needs to be presented and what must be vetted by the design-build team before being presented publicly (e.g., presentation slides, drawings, renderings, boards, models, materials, samples)?

Depending on the meeting's formality and the attendees involved, the design integration manager should also determine what meeting protocols are appropriate—for example, whether a formal presentation should be made or whether formal documentation (i.e., minutes) is needed. Regardless of formality, meetings should always start and conclude on time, and an agenda can help ensure that meetings stay focused and on track.

Consider that the ultimate decision-makers for a particular issue may not attend meetings on that issue but can influence the team's performance at inopportune times. Therefore, the design integration 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 integration manager can help avert inconvenient and potentially costly surprises throughout the design phase.

Task: Facilitate Meetings with the Authority Having Jurisdiction to Discuss Project-Specific Code Compliance

Every few weeks to monthly throughout design



In this task, the design integration manager works with the lead designer to review project-specific conditions that require code interpretations or guidance from the applicable authorities having jurisdiction (AHJs). By completing this task early in the design process, the design integration manager can avoid potential delays and the need for redesign during the permitting process.

Knowledge	Skills	Abilities	Other Characteristics
• Familiarity with applicable local, state, and federal building codes • Contractual terms and conditions • Technical and operational requirements of various project types • Sources of risk and risk management practices	• Negotiating with partners and stakeholders • Persuading others of a position • Managing stress effectively	• Collaborating with partners • Establishing and maintaining relationships	• Trustworthy • Assertive • Focused

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

As a critical aspect of code compliance, the design integration manager should lead the establishment of the dates of the project's governing codes. These dates should be established at the beginning of the project and documented formally in writing and approved by the AHJ.

The following are some of the codes evaluated in a code analysis:

- Building codes
- Fire and life safety codes
- Health and sanitation codes
- Accessibility codes
- Sustainability or green codes
- Energy codes
- Design review board regulations
- Zoning regulations
- Utility regulations
- The local jurisdiction's codes, ordinances, amendments, and policies

> *"The design integration manager works with the lead designer to review project-specific conditions that require code interpretations or guidance from the applicable authorities having jurisdiction."*

The design integration manager reviews the code analysis for thoroughness and completeness and 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. Although it may appear that some codes are objective, in practice they are not, and it is not unusual to find that building codes are interpreted quite differently from one jurisdiction to the next. When the design integration manager encounters one or more of these conditions during design, a meeting should be held between the design professionals and the AHJ to obtain the AHJ's interpretation of the code. During this meeting, the AHJ can provide guidance to the designers on how to best meet the intent of the codes.

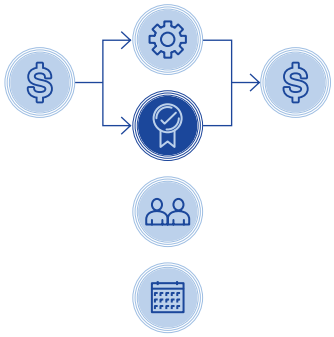
The use of automated code analysis and code validation is likely to increase in the future. Automated code analysis entails a process in which code validation software is utilized to check the building information modeling (BIM) parameters against project-specific codes. The BIM model can also be used to demonstrate to the AHJ that a particular aspect of the design is up to code, such as exiting, signage, and so forth. This approach has the following potential benefits:

- Validation that the building design follows specific codes
- Completion of code validation early in design, thus reducing the chance of errors, omissions, or oversights that would be time-consuming and expensive to correct later in the process
- Automatic code validation while work on the design progresses and continuous feedback on code compliance
- Reduced time spent meeting with the AHJ or fixing code violations during the project close-out phase

Sometimes, the owner may call for compliance with certain codes that compete with the owner's own prescriptive criteria. In such cases, the onus of responsibility for decision-making is on the owner. The design integration manager should prompt the owner to adjudicate the conflict and should document that process to protect the design-builder from liability.

Task: Mediate Design Questions and Concerns between the Project Designer and the Owner

Every few days to weekly throughout design



In this task, the design integration manager facilitates interaction between the design partners and the owner, the owner's team, and the end users. At this stage in the design process, questions are common, and many small and large decisions are made that need to be documented as part of the design. However, this task may recur as needed throughout the early design and detailed design phases.

Knowledge	Skills	Abilities	Other Characteristics
• Familiarity with applicable local, state, and federal building codes • The design process and stages of design • Contractual terms and conditions • Sources of risk and risk management practices	• Conveying a message in written form • Conveying information verbally • Compromising and finding equitable solutions • Determining client and stakeholder expectations	• Collecting, analyzing, and interpreting information • Focusing on and remembering details	• Respectful • Trustworthy

Overseeing the Development of Specifications

Well-defined project specifications are critical to meeting the project's requirements and reducing the number of requests for information (RFIs) later in the project. However, in many cases a specifications writer is only brought onto the project during the final phase of the design and asked to prepare specifications to match the documents with the assumption that addressing the owner's requirements will be straightforward.

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

The technical specification development process should be started during the proposal/pre-award phase. The design integration manager should assign a team or individual to create, at a minimum, an outline or table of contents. This outline can be expanded during the post-award phase into 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.

Sustainability in Design

Buildings in the United States consume almost 50% of the nation's total energy production, with vast amounts of natural resources used in construction and transportation. Sustainable building design is becoming increasingly common in the United States due to its potential to create a more sustainable natural and built environment. This design approach focuses on improving a building's efficiency in its use of energy, water, and materials and may include strategies outlined in the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Checklist.

The design integration manager plays a critical role in green building design by evaluating sustainable strategies and facilitating charrettes focusing on LEED and other green building practices with the project design and construction teams. The design integration manager works closely with any consultants hired to lead the certification effort and may be responsible for reviewing preliminary drawings and construction documents to ensure that sustainable measures are incorporated, performing site inspections to verify implementation during construction, and compiling documentation packages for sustainable building certification at the end of construction.

The design integration manager may also consider a full life-cycle assessment to evaluate the environmental impacts and the carbon footprint associated with all stages of the project, from raw material usage and transport to future repair and maintenance requirements and eventual building reuse or decommissioning. Sustainable design elements commonly considered include energy conservation, natural lighting, indoor air quality, water conservation, waste management, erosion control, transportation strategies, use of recycled materials, and user recycling practices.

Sustainable building certification programs, such as LEED and the Envision Sustainable Infrastructure Rating System, provide frameworks for evaluating and recognizing outstanding sustainable building strategies and practices. The design integration manager must be well versed in sustainable design strategies and green certification programs and should ensure that appropriate strategies are incorporated into building design and construction. The result will be a more environmentally, economically, and socially sustainable built environment.

Special Considerations for Resolving Questions on Fast-Tracked Projects

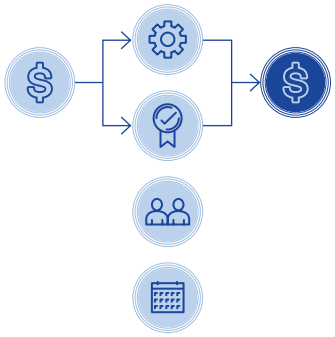
In a fast-tracked design-build project, construction work begins before all design work is complete, so the construction team may need to make educated assumptions about design issues that have not yet been finalized. Making somewhat conservative assumptions (within reason) is generally better than later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

Starting construction before completion of the design work can have various impacts on the design process. Designers may be asked to complete certain parts of their designs well outside of the normal sequence to support early-release packages. This design work, which includes specifications, needs to be at a level of detail that allows trade bidding to occur. While this work would have been required as part of the design, the out-of-sequence timing can add hours to the design effort. Additionally, as designs progress and better information becomes available, certain components may require redesign.

When the project scope and fees are being finalized, the design integration manager should discuss, with all affected parties, his or her philosophy about redesign and the accompanying cost and schedule impacts to the design team. Even if the impact of new information does not result in redesign, additional design analyses are often required, if only to verify that early assumptions are matched by actual, final information.

Task: Create and Maintain a Log of Design Changes and Their Associated Costs

Every few days to weekly throughout design



In this task, the design integration manager establishes a process to manage changes that occur during the project. Changes can result from, for example, a new direction from the owner, unforeseen physical conditions, political influences, or new technology. Regardless of the source of the change, its cost and impact of the schedule should be documented. This task recurs throughout the early design and detailed design phases.

Knowledge	Skills	Abilities	Other Characteristics
• Document management procedures • The change order process • Sources of risk and risk management practices	• Organizing information and record keeping • Forecasting cost and schedule impacts	• Focusing on and remembering details	• Accountable • Trustworthy

Design integration managers need to understand that changes will be encountered on every project. Design changes can be initiated by the owner, the design team, the construction team, or external sources such as AHJs. Some design 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 were not originally included in the design contract and have implications for the designer, the designer should be compensated for the additional work. Sometimes, however, the design team may make changes internally. These changes should be thoroughly discussed and documented in the design meeting minutes or in action logs.

The builder may also make post-design changes. Sometimes, the builder proposes a better way to build the project; the approach underlying this type of change is sometimes referred to as value engineering. In theory, value engineering changes are proposed to reduce project costs. However, the design integration manager needs to ensure that such changes do not have unanticipated impacts on other scopes of work in the project. It is also the responsibility of the design integration manager to document any value engineering changes in order to validate their success in achieving the final budget.

Other times, builder changes are due to further development of the design. This type of change may be covered by the design contingency cost, which is agreed upon at the outset of the design work and included in the teaming agreement. Minor or non-negligent design errors typically range from 1% to 5% of the overall project cost. The design integration manager is responsible for communicating and coordinating the use of this contingency with relevant members of the project team.

> *“Design integration managers need to understand that changes will be encountered on every project.”*

Addressing Changed Conditions

The teaming agreement is the appropriate place to define a protocol or lay down ground rules for dealing with changed conditions.

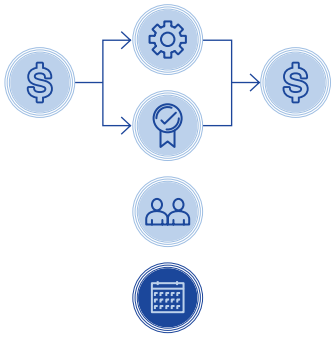
The most significant element in a changed conditions scenario is who will address the financial burden or costs resulting from the changed conditions. For example, the owner decides after the fact that a physical mock-up of the façade will be needed to make a decision on the exterior skin. The project team may decide not to ask for a change order for the mock-up but rather to handle the costs within the project budget. However, the designer may not have the resources to pay for the mock-up. The builder may then consider bearing the financial burden, because the mock-up will assist in the identification and prevention of expensive mistakes when the façade is installed. 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 the 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. The design professionals should be compensated for their time, including the redesign, unless an alternative agreement has been reached in advance and is included in the contract. A common example of this situation is changed geotechnical conditions (or the discovery of 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.

Time is of the essence in these cases, so the design integration manager should have a mechanism in place to reconcile the changes to ensure that 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.

Task: Oversee the Progress of the Design Schedule

Weekly to every few weeks throughout design



In this task, the design integration manager monitors the progress of the design and investigates the causes of any deviations from the plan. If corrective measures are needed, which may include resequencing of the design schedule, the design integration manager works with the design lead to implement those changes and informs all partners of the new schedule. This task recurs throughout the early design and detailed design phases.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Construction means and methods • Construction work sequencing • Sources of risk and risk management practices	• Using scheduling software • Leading pull planning processes • Leading a project team	• Collaborating with partners • Collecting, analyzing, and interpreting information	• Accountable

The design integration manager coordinates the design schedule with the construction schedule and manages the design team to achieve milestones and deliverables. The design integration 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 scheduled date of substantial completion drives the overall project 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 often be eager to complete the design, finalize its trade partners' contracts, and issue purchase orders for materials before their prices expire. However, there is a limit to how quickly the design can progress. The design integration manager needs to work closely with the design lead to balance the design demands of procurement, permitting, and construction activities with the time needed for proper coordination and quality control of design documentation.

> *"The design integration manager drives the design schedule and manages the design team to achieve milestones and deliverables."*

BIM has become a powerful tool to help manage the design process and keep it on schedule. BIM acts as a robust visualization and communication platform that can give both the project team and the owner a clear understanding of the status of the project design, thus helping to achieve milestones and deliverables. The BIM model helps the design team members coordinate their efforts and avoid delays and rework through, for example, tasks such as spatial coordination and clash detection. BIM also enables the design team to work collaboratively in real-time. With BIM, multiple design team members can work on the same model simultaneously, which can increase efficiency and reduce the risk of errors and omissions. Additionally, remember that design is an iterative and nonlinear process, so progress can be difficult to track—monitoring progress requires substantial communication between the design integration manager and the design team. BIM also increases transparency. The design integration manager and other designers can see the progress of the BIM model. Such transparency helps the design integration manager understand when the team is falling behind schedule.

"When a deviation arises, the design integration manager needs to investigate the root causes of the deviation and then devise corrective measures."

At the outset of the project, typically during negotiation of the teaming agreement and/or design subcontract, the design integration manager, in conjunction with the design team, should decide how to handle changes that will impact the project schedule and cost. When a deviation arises (typically if schedule slippage or a cost overrun occurs), the design integration manager needs to investigate the root causes of the deviation and then devise corrective measures.

The design integration manager may want to investigate the following questions if a schedule deviation occurs:

- Has a circumstance caused any change in schedule decisions that were previously agreed upon?
- Is 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 schedule slippage. Notices of delays are critical under a design-build contract, especially for those that contain a liquidated damages component, in that they allow the contractual completion date to be adjusted. The design integration manager should work closely with the design team to identify items that may necessitate a notice of delay.

CHAPTER 6: DETAILED DESIGN PHASE

Description of Phase

The detailed design phase is a critical part of the design-build project, as it sets the foundation for successful construction. This phase encompasses both the design development stage and the preparation of construction documents. Detailed engineering and system designs are underway, and often the construction team is becoming more involved in the project. This collaboration between the design and construction teams allows for a more streamlined and efficient construction process.

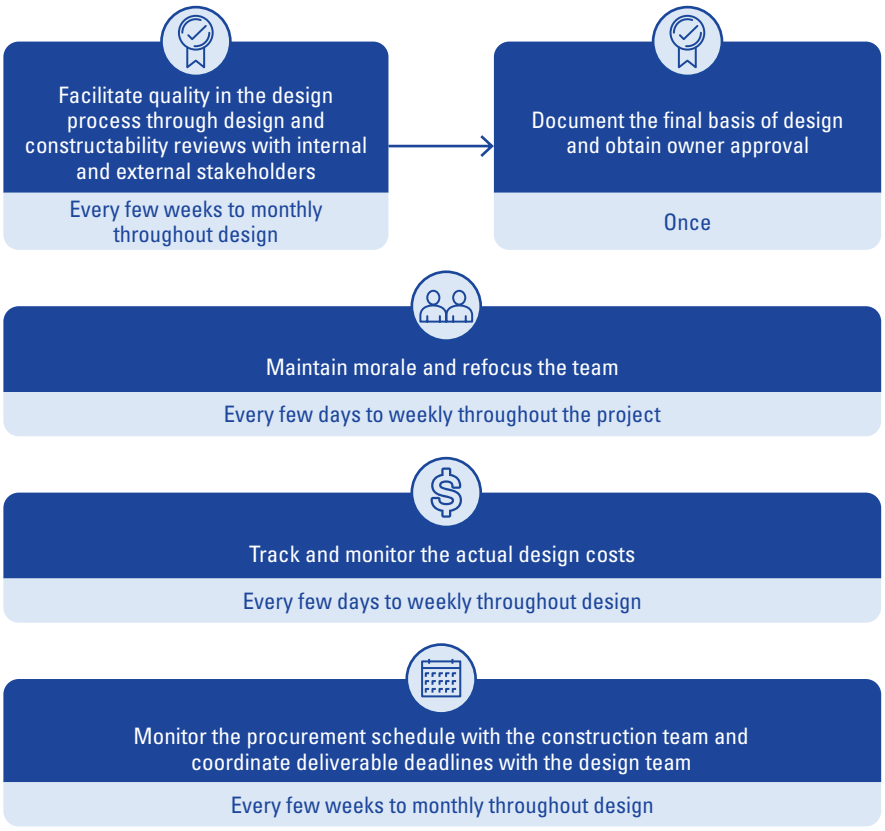
The design development phase of a design-build project is typically considered complete when the design is around 60% complete. However, it is worth noting that the exact point at which the design development phase is considered complete can vary depending on the project's size, complexity, and specific requirements.

After reaching the end of design development, the design team prepares plans and specifications for construction.

The Role of the Design Integration Manager

At this stage, the design integration manager has set up the systems and processes to guide the project. Now the design integration manager shifts into a management, monitoring, review, and maintenance role to ensure that the project stays on track. For example, the design integration manager periodically reviews the cost trends and works with the designers to adjust the designs so that the project remains within budget. In conjunction with the design professional of record, the design integration manager ensures that all specialty design subconsultants are engaged at the right junctures throughout the design phase. The design integration manager also coordinates the various review cycles among the project team, for example, review cycles between the design partners or between the design-builder and the owner. Importantly, the design integration manager also monitors the morale of the team and refocuses or reenergizes the team when needed.

> *"Now the design integration manager shifts into a management, monitoring, and maintenance role to ensure that the project stays on track."*



Workflow of the design integration manager's tasks during the detailed design phase

Task: Facilitate Quality in the Design Process through Design and Constructability Reviews with Internal and External Stakeholders

Every few weeks to monthly throughout design

In this task, the design integration manager leads the design quality assurance (QA) and quality control (QC) efforts by participating in multiple design reviews. These design reviews typically address coordination, code compliance, and constructability as a means of reducing design conflicts, errors, and construction issues in the field. Participants in these design reviews will include both internal stakeholders (e.g., design and trade partners) and external stakeholders (e.g., authorities having jurisdiction [AHJs], the owner, end users).

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Construction means and methods • Document management procedures • Contractual terms and conditions • Construction work sequencing	• Listening • Negotiating with partners and stakeholders • Resolving conflict among people on the project team • Compromising and finding equitable solutions	• Collaborating with partners • Speaking comfortably in a group situation	• Adaptable • Self-motivated • Accountable • Creative • Respectful

Design QA/QC 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 QA/QC programs are intended to limit the occurrence of errors and omissions that can lead to costly changes and delays in the project.

The design integration manager 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.

An approved, published design QA/QC program should be established at the outset of design and administered throughout the design process. This program should include all interdisciplinary design checks, code compliance reviews, request for proposal (RFP) compliance reviews, scope reviews, constructability reviews, and so forth.

“The design integration manager 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.”

An effective QA/QC program has the following characteristics:

- It follows a systematic approach that starts at the inception of the design and continues through the construction process.
- It requires the participation of the owner, designers, and construction team.
- It enhances the likelihood of procuring the most efficient subcontractor and supplier bids.
- It promotes maximum productivity in the field.
- It reduces the need for field changes.

Building information modeling (BIM) tools have come to play a key role in QA/QC programs, with design and constructability reviews reported to be among the most common tasks for which BIM is used in the context of design-build projects. Specifically, the use of BIM in clash detection has become an important QA/QC tool in the critical design-phase task of detecting clashes, errors, and omissions automatically before construction begins.

BIM offers several advantages for design and constructability reviews, such as detecting clashes in the shared 3D BIM model automatically and early in the process and facilitating communication among different professionals because of the use of a common 3D environment and the associated data consistency.

Another useful tool for QA/QC is peer reviews with appropriate specialized consultants (e.g., food service or waterproofing specialists). When such specialized services are needed, the design integration manager must actively work with the design team to find the most cost-effective solution.

Informal Design Reviews

Periodically, the design integration manager will hold pin-up sessions—either in-person or virtual—that involve putting the in-progress drawings in front of the project team and asking for an informal presentation by each design discipline leader. The design integration manager should encourage the whole team to critically review and comment on the design in progress. Pin-up sessions are performed early in the design process and typically occur several times during each design phase. Some pin-up sessions may focus on a single design element, such as site development, lighting, or interior design.

Periodically throughout design process, the design integration manager, in conjunction with each design discipline leader, also conducts coordination reviews. These can be done during the pin-up sessions but may also rely heavily on BIM clash detection. A 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.

Compliance Reviews

The design integration 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. To this end, the design integration manager determines whether the project design is compliant or noncompliant with the owner's criteria. If it is noncompliant, re-evaluation and/or redesign may be necessary to ensure that the design meets the owner's requirements and budget.

The design integration manager, independently of the designers, reviews the design at regular intervals. To the best of the design integration manager's ability, these reviews should answer the question, "Are the owners getting what they asked for?" Similarly, for each criterion or hot-button issue, the design integration manager answers the question, "Does the design comply with the owner's expectations and requirements?" When the design integration manager sees a clear conflict, he or she should try to collaborate with the design professionals to resolve it before bringing it to the owner. Only as a last resort should the owner be made aware of the conflict and decide how to resolve it. For example, the owner may decide to increase the budget for some important requirements or deprioritize some requirements so that the project stays within budget.

This process of review and analysis requires the design integration 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.

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, storage, lifting, installation, and finishing.

The design integration manager facilitates constructability reviews at key junctures during the design process. The key question is, "Can this design be built efficiently?" The constructability review team should include the construction project manager, construction superintendent, major subcontractors, the design team, and the design integration manager. It is also common to include third-party designers in the constructability review, sometimes individuals from the same design firm as the design team. The design integration manager needs to communicate the results of the constructability review to the design team with clear comments, explanations, and instructions.

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. If concerns are raised, the designers can argue the rationale of the design solution and the logic applied in the evaluation of design quality and appropriateness. In addition to in-person meetings, cloud-based document editing platforms can also be used to track and resolve comments.

As the design progresses, the constructability review should also address construction sequencing. One common way to address construction sequencing is through the use of 4D BIM. 4D BIM is a digital representation of a construction project that includes both the physical geometry of the building and its construction sequence over time. In other words, 4D BIM adds a time dimension to the standard 3D model, which allows for the visualization and analysis of the construction schedule and phasing.

"The design integration manager should be knowledgeable of where potential clashes might occur, staying a couple of steps ahead of the design team in order to identify risks and then collectively addressing them with the team."

By incorporating the construction sequence into the BIM model, 4D BIM can be used to identify and analyze potential conflicts between different building components, systems, or trades. For example, typically the installation of the ducts would be scheduled to occur after the structural framing has been completed in order to avoid conflicts between the ducts and other building elements. However, due to an oversight in the scheduling process, the duct installation could be scheduled to occur before the framing is completed. The 4D model can be used to visualize the construction sequence, allowing stakeholders to see how the installation of the ductwork conflicts with the completion of the framing. By identifying this out-of-sequence work early in the process, stakeholders can take corrective action to adjust the schedule and avoid costly delays or rework.

In addition to identifying conflicts, 4D BIM can be used to improve communication and coordination between project stakeholders. By visualizing the construction sequence and phasing, stakeholders can better understand the construction process and identify potential conflicts or issues before they arise. 4D BIM can also promote good working relationships and collaboration among the different parties involved in the project with clear and transparent task sequencing and deadlines.

Additionally, BIM can help in clash detection and conflict resolution. Clash detection is the process of using BIM software to identify and resolve potential clashes or conflicts between different building components or systems. BIM clash detection allows project teams to identify and resolve potential issues before construction begins, which can help prevent costly rework and delays during construction. BIM models can include data on building components such as walls, ceilings, and floors and systems such as mechanical, electrical, and plumbing (MEP). Clash detection software can then compare these data to identify any conflicts, overlaps, or interferences between different components or systems. This process allows project teams to adjust their designs and coordinate their work to ensure that all components fit together correctly, thereby improving constructability and reducing the risk of errors during construction.

The design integration manager has several responsibilities during clash detection. To avoid clashes in the first place, the design integration manager can coordinate and communicate a clear understanding of the zoning of the building. This includes who occupies which space or "no fly zones" within the design, such as the distribution of space within the overhead ceiling. In addition, nonphysical objects should also be modeled, such as lift zones and clearance zones, access ways, crane locations, and walkways that must be kept clear.

Clash detection and—when clashes do arise—clash resolution should be carried out at regular intervals using common means and methods and a standard workflow. Utilizing version history and a standard agenda for model review can help ensure that all aspects of the design are evaluated. It is also crucial to support discussions among all designers, such as architectural, MEP, and structural, to determine what can be moved and what cannot.

For example, if structural brace frame is found to be located behind a window, the design integration manager can discuss with the design team which elements can possibly be moved and what the implications of each move will be on cost and schedule. Coordination among all parties involved is essential to identifying potential congested areas, known as "pinch points," and prioritizing actions to resolve conflicts in these areas. The design integration manager should be knowledgeable of where potential clashes might occur, staying a couple of steps ahead of the design team in order to identify risks and then collectively addressing them with the team. BIM and clash detection can be further enhanced when the project team is co-located in the same space during design and construction.

A typical issue management process, overseen by the design integration manager, looks like this:

1. Identification. Issues are identified using clash detection and other BIM analysis tools, as well as through input from project team members.
2. Documentation. Issues are documented in a central database or other project management system, which can be accessed and updated by all team members.
3. Prioritization. Issues are prioritized based on their severity, impact on the project schedule or budget, and other factors.
4. Assignment. Issues are assigned to specific team members, who are responsible for resolving them.
5. Resolution. Issues are resolved using BIM tools and processes, for example, by redesigning elements of the model or adjusting the construction schedule.
6. Verification. After each issue is resolved, the solution is verified to ensure that it was effective and the issue is no longer present.

Peer Reviews

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

The design integration manager secures the services of the individual peer reviewer or peer review team, depending on the size of the project. The contract with the peer reviewer(s) is an agreement that defines the roles and responsibilities of the reviewer(s), the scope of the review, professional service fees, and liabilities.

The review should be conducted under limited liability to the reviewer. Any penalties 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.

Task: Document the Final Basis of Design and Obtain Owner Approval

Once

In this task, the design integration manager finalizes all design solutions and formally documents the project scope and rationale for approval by the owner.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Construction means and methods • Contractual terms and conditions • Construction work sequencing	• Conveying information verbally • Negotiating with partners and stakeholders • Organizing information and record keeping	• Focusing on and remembering details	• Decisive

The final basis of design is a document targeted toward the owner and its building operators and managers that fully articulates the project that will be constructed and commissioned. This document should expand on the initial basis of design to include all design solutions that have been proposed and implemented throughout the project. Of particular importance are those solutions that relate to how the building is operated and maintained, such as considerations for future expansion, designed spare capacity in the various systems, and so forth.

The design integration manager is responsible for collecting this information and producing the final basis of design document for approval by the owner's team. Once approved, the final basis of design becomes part of the project close-out documentation, alongside warranties, as-built documents, and operation and maintenance manuals.

For this task, the use of BIM is essential. Once the final basis of design has been completed, the BIM model serves as its repository. Based on the BIM model, for example, the necessary documentation for final approvals and permits can be exported. During this task, the design-build team works closely with the owner but also with the other parties involved in the project to ensure that the final basis of design has been defined to the owner's requirements and is sufficient to obtain final approval.

Task: Maintain Morale and Refocus the Team

Every few days to weekly throughout the project

In this task, the design integration manager must recognize when any members of the team are struggling, help get them get back on track, and reintegrate them with the other team members. This task recurs as needed throughout the project.

Knowledge	Skills	Abilities	Other Characteristics
• Contractual terms and conditions • Technical and operational requirements of various project types	• Conveying information verbally • Motivating people to a desired outcome • Managing stress effectively	• Focusing on and remembering details	• Decisive • Empathetic

Design is a complex intellectual and creative process, and motivating creative people is challenging. To achieve results in a design team environment, the design integration manager needs to understand the nature of creativity, the effects of rewards on creative performance, the individual personalities of team members, and the ways individuals interact with each other in a creative organization.

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

- Intrinsically, through the nature of the work itself, the chance to express creativity, and individual interests and passions
- Extrinsically, through money, professional recognition, awards, praise, and appreciation
- Personally, through an individual's own personal values and self-discipline
- Interpersonally, through creative collaboration with and recognition by other individuals

The design integration manager uses this knowledge to gain insight into the designers' motivations and to propel the design forward in a manner that rewards them personally and professionally while continuing to align their work with the project's 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 with other team members. Because of differences in work cultures, for example, architects and engineers may sometimes have difficulty working together. Similarly, design firms that are team members on one project may have been adversaries on another. "Bad blood" from previous competitions may spill over into the current project.

The design integration 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 also important in helping team members gain mutual respect. In a successful project, each person is held accountable for his or her task and schedule commitments, 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 or delivering a successful client presentation. Deal quickly and directly with problems, and—if necessary—be prepared to go as far as replacing team members to ensure harmony and productivity.

Another essential strategy in building a motivated team is to get to know individual team members, regardless of rank or responsibility, and to help them get to know each other more personally. For complex projects, consider engaging an outside expert (such as a professional facilitator or a 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 prevent the perception that the design integration manager is manipulating the team to his or her (or the 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 comprised of a variety of people with different personalities is almost always a successful team.

Also consider establishing regular social get-togethers and events (group sporting events, happy hours, etc.) during the project so that team members can have fun and enjoy each other's company in a non-work environment. These events should be varied so that everyone on the team feels included. Trust and friendship among peers are essential for a healthy and productive work environment.

Task: Track and Monitor the Actual Design Costs

Every few days to weekly throughout design

In this task, the design integration manager compares actual and forecasted design costs against the budget for design services and coordinates with the lead design team to devise strategies for staying on budget.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Contractual terms and conditions • Technical and operational requirements of various project types • Sources of risk and risk management practices	• Prioritizing work • Managing and tracking project costs • Negotiating with partners and stakeholders	—	• Patient

On a design-build project, designers are responsible for managing their own expenses once the overall project budget is established. However, changes do occur, and managing design costs against a project-wide cost estimate is the responsibility of the design integration manager during the design phase. This is an iterative process that involves ongoing validation of the predefined cost estimate compared to actual expenses. Costs can be managed in real-time or at predetermined intervals based on periodic (perhaps weekly) reconciliation. Methods and approaches for this task vary widely and should be tailored to support the particulars of the project.

As detailed design work ensues, the design integration manager works with the design team to monitor the design costs. Key drivers that can impact design costs include the following:

- The need for additional services beyond the basic design services
- Administrative needs for staffing and document management
- The timeliness of the decision-making process
- The level of planning and adherence to established plans
- The number and extent of changes introduced by the owner, contractor, or design team
- Project complexity, including permitting requirements or the number of fast-track design packages
- The timeliness of stakeholder input

> *Managing design costs against a project-wide cost estimate is the responsibility of the design integration manager during the design phase.*

When deviations (typically cost overruns) occur, the design integration manager needs to investigate the root causes of the deviations and then devise corrective measures. Strategies to manage design costs include the following:

- At the beginning of each design phase, and periodically throughout the design process, review the scope of services with the design team and ensure that no major changes have occurred.
- Review the technology that the design team intends to use and verify that it's appropriate for the project. For example, if a simple project is using BIM, the team may be tempted to over-model beyond the level of development (LoD) requirements of the proposal.
- Ensure that the design team is leveraging the design subcontractors, vendors, and construction team in detailing certain aspects of the design. For example, the design team can have detailers at the steel fabrication plant draw steel connection details.
- Avoid rotating different team members in and out of a project. Many organizations move staff on and off different teams in an attempt to more efficiently utilize resources, but this can actually have a detrimental effect on the efficiency of the project design. Sufficient up-front planning can ensure that any staffing changes, which are certainly necessary at times, will have a minimal impact on the project.

Cost Tracking Considerations for Fast-Tracked Projects

The design integration manager, knowing that reliance on design assumptions is a normal part of most fast-tracked projects, should not be naive to the potential cost or rework 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 of a fast-tracked project while mitigating the potential inefficiencies resulting from the use of early design assumptions.

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

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—including increased design costs above what was budgeted and the introduction of unnecessary risk because the design work must be performed outside of the normal sequence. In this case, the design integration manager's role is to understand what these costs and risks are and to resolve any conflicts with the overall project team on fast-tracked design deliverables.

Task: Monitor the Procurement Schedule with the Construction Team and Coordinate Deliverable Deadlines with the Design Team

Every few weeks to monthly throughout design

In this task, the design integration manager works with the construction team to identify what materials and equipment are most critical to the project schedule and when they are needed. The design integration manager then adjusts the design deliverable schedule to accommodate the time needed to procure those items.

Knowledge	Skills	Abilities	Other Characteristics
• The design process and stages of design • Construction means and methods • Construction work sequencing • Sources of risk and risk management practices	• Conveying information verbally • Using scheduling software • Leading pull planning processes • Managing and tracking project costs • Prioritizing work	• Collaborating with partners	• Assertive • Self-motivated • Accountable

On most design-bid-build projects, designers typically specify the types of equipment and materials to be used on the project, and the 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.

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

The construction manager typically 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 the project's cost, quality, and schedule. Regardless of strategy, the design integration manager works with the design team to facilitate cost review cycles and communication with the construction manager and the procurement team. Interim pricing review documents can help guide decisions pertaining to the cost of equipment and materials.

As part of the procurement strategy, the design integration manager works with the design-build 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 accounted for in the project schedule and incorporated into the design and procured at appropriate phases of the project.

If issues regarding the budget, schedule, or availability of materials arise during the procurement process, the design integration manager coordinates any additional services from the design team for any required redesign work. The design integration manager also confirms the feasibility of any offsite prefabrication strategies being considered in the design.

The design integration manager also serves as the liaison between the owner and the design team in developing a procurement strategy for the furniture, fixtures, and equipment.

CHAPTER 7: CONSTRUCTION PHASE

Description of Phase

The construction phase of a design-build project involves obtaining necessary approvals and permits, procuring materials and equipment, and executing the construction work. During this phase, the design-build team works closely with the owner and any other stakeholders to ensure that the project is being built to their satisfaction. Depending on the amount of overlap between the design and construction activities planned in the project schedule, construction may begin during the early design phase or as late as the end of the detailed design phase.

The construction phase typically includes site preparation, foundation work, framing, mechanical and electrical system installation, and finishing work. Depending on the design-builder's approach to the project, several of these construction activities may begin before the end of the detailed design phase. Early design packages are released to support the start of construction while the remaining design is completed. As the project nears the completion of the construction phase, the project team will conduct final inspections and complete any necessary punch list items before turning the project over to the owner.

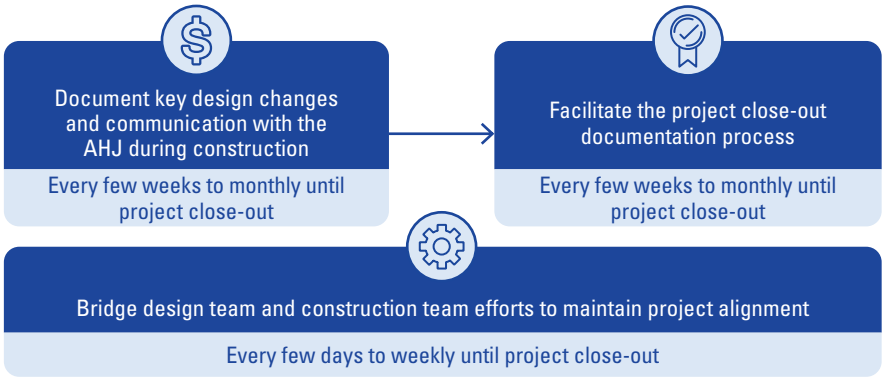
The Role of the Design Integration Manager

During this phase, the design team's efforts may taper off as the focus shifts towards construction. However, the design integration manager is still an important resource for the builder and must remain involved and available to answer any questions or resolve any ambiguities in the design.

Furthermore, in this phase the design team will continue to work in collaboration with the construction team to ensure that the design is being executed properly and to mitigate any issues that may arise during the construction process. The design integration manager will continue to manage the design team's support during construction and will coordinate the team to provide professional services as needed, such as reviews of shop drawings to ensure that they align with the approved design and project specifications.

"The design integration manager is still an important resource for the builder and must remain involved and available to answer any questions or resolve any ambiguities in the design."

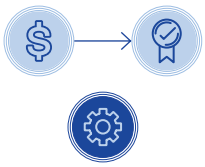
Lastly, the design integration manager may participate in the development of record documents, which document the construction process and final design and serve as a reference for future maintenance activities and any potential modifications to the project. An important distinction must be made between these record documents and other documents commonly referred to as "as-builts." While the record design documents that the design integration manager is responsible for developing are sometimes referred to mistakenly as as-builts, the latter are a different set of documents that the construction manager is responsible for providing.



Workflow of the design integration manager's tasks during the construction phase

Task: Bridge Design Team and Construction Team Efforts to Maintain Project Alignment

Every few days to weekly until project close-out



In this task, the design integration manager aligns the day-to-day needs of the construction team with the ongoing efforts of the design team. This typically involves the prioritization of requests for information (RFIs) and submittals to clarify design issues that arise so that construction efforts are not interrupted or delayed.

Knowledge	Skills	Abilities	Other Characteristics
• Familiarity with applicable local, state, and federal building codes • The design process and stages of design • Local market conditions (e.g., competition, labor availability, quality of trade partners) • Technical and operational requirements of various project types	• Conveying information verbally • Listening • Negotiating with partners and stakeholders • Leading a project team • Forecasting cost and schedule impacts	• Collaborating with partners • Focusing on and remembering details	• Empathetic • Focused

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

These clarifications are made in one of three ways:

- RFIs, where the builder asks the design team for specific information. An RFI is a written request for more specific information about certain aspects of the project. An RFI may be used to confirm the interpretation or absence of a detail, specification, or note during the development of design and construction drawings or to secure a documented directive or clarification needed to continue work. RFIs help resolve doubts and inaccuracies with the owner and are used to request information so that the project team does not proceed on assumptions that may later turn out to be incorrect.
- Shop drawings, where the builder (or specialty contractor) prepares detailed fabrication and assembly drawings (or specifications for particular specialty items) and submits them to the designers for review and approval
- Supplemental instruction (SI), as the design team determines the need, where the design team issues revisions, changes, or interpretations to previously distributed design documents

“The designers provide clarification and guidance during construction on the intent and details of various aspects of the design.”

These three means of clarification are similar to those used on 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. Review and approval by the architect or engineer of record are still necessary, however.

Construction typically occurs at a rapid clip. Once the design-builder has mobilized to the construction site, the schedule will be driven even more aggressively because at that point general conditions costs rise appreciably and continue at a much higher level than during the design phase. Responses to RFIs and/or review and approval of shop drawings must therefore occur in a timely manner so that construction is not delayed.

The design integration 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 logged, distributed, and returned; 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 ahead to the designers before sending an RFI so that the designers are not surprised by an unexpected request. Similarly, criteria should be established up front to help guide decisions on what constitutes an RFI versus an SI versus a change order.

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

When a request is received, the design integration manager orchestrates the review process. During review, the design integration manager should be informed of and involved in any communication between the design-builder and the designer.

The design integration manager determines how and when to become involved in the review process but typically assigns responsibility for the tracking, distribution, and review cycle to key members of the design team. The design integration 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 is responsible for both the schedule and the design, so the design team may be given a short timeframe to review RFIs and submittals in order to avoid construction delays.

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

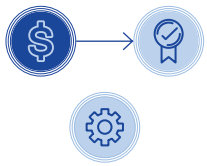
Trade subcontractors are often brought into the project early in the design process. This gives the design team and the trade partners an opportunity to determine where the design documents end and the respective shop drawings begin in an effort to eliminate any duplicate efforts. The design integration manager will often facilitate working sessions with the architect and trade partners to efficiently review and approve shop drawings.

Throughout this task, the use of building information modeling (BIM) is essential. The BIM model can serve as an accurate repository and record of the project geometry and other information included in the final building design. Additionally, the BIM model can help maintain progress information throughout the construction phase and eliminate field conflicts through detailed coordination of the model's files.

Additionally, the management of RFIs can be supported by cloud-based BIM platforms. These centralized platforms provide a space where project team members can submit, review, and respond to RFIs in a streamlined manner. For example, an RFI can be submitted through the platform and automatically assigned to the relevant parties, who will receive an alert. These parties can then use the platform to collaborate and provide a response, which is logged and tracked in the system. Additional features offered by these platforms include customizable RFI templates, prepopulated data fields, and the ability to attach relevant documents, such as design drawings or specifications, to the RFI. These features can help streamline the RFI process and reduce the risk of errors or misunderstandings.

Task: Document Key Design Changes and Communication with the Authority Having Jurisdiction during Construction

Every few weeks to monthly until project close-out



"It is important for the design integration manager to understand what level of detail the owner expects in the record drawings."

In this task, the design integration manager formally acknowledges and documents any design decisions made during the construction process. The need for these decisions could arise from the resolution of field conflicts, requests made by authorities having jurisdiction (AHJs) during inspections, or value engineering, among other reasons.

Knowledge	Skills	Abilities	Other Characteristics
• Familiarity with applicable local, state, and federal building codes • The design process and stages of design • Construction means and methods • Construction work sequencing	• Using scheduling software • Leading pull planning processes • Persuading others of a position • Leading a project team • Organizing information and record keeping	• Devising innovative solutions • Focusing on and remembering details	• Accountable

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 of this documentation may range from periodic updates to the various record documents to the development of a full-blown facilities management program and database. The owner may also require final submission of the BIM and Leadership in Energy and Environmental Design (LEED) documentation. It is important for the design integration manager to understand what level of detail the owner expects in the record drawings in order for the designers and trade partners to include the appropriate amount of effort in their scopes of work.

Ways of achieving the required level of detail vary and may consist of, for example, the following:

- Red-lining the existing hard-line drawings and providing references to the respective RFIs. This is typically performed monthly by the design-builder's staff. At the conclusion of the project, the documents are digitally scanned and turned over to the owner.
- Digitally red-lining the existing digital drawings and providing references to the respective RFIs. This is also typically performed monthly by the design-builder's staff. At the conclusion of the project, electronic copies are turned over to the owner.
- Updating the various computer-aided design and drafting (CADD) drawings and publishing them monthly.
- Updating the BIM or other 3D models and publishing them monthly. Additionally, ownership of the BIM model should be clearly defined.

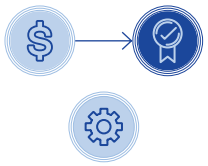
Over the years, "as-builts" has been the common term for such record documents. However, as-builts are not quite the same as record documents. As-builts are measured drawings that document the finished (or "built") condition of the structure at completion. Courts have interpreted the term "as-builts" literally as a certification of the accuracy of the information.

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

While as-builts are typically the responsibility of the construction manager, the design team can be asked to prepare as-builts as an additional service. To provide this service, the design integration manager should develop a process by which the design-builder documents all deviations in fabrication and installation as they occur.

Task: Facilitate the Project Close-Out Documentation Process

Every few weeks to monthly until project close-out



In this task, the design integration manager ensures that the design and construction teams are coordinated in their delivery of project close-out documentation. This delivery includes the preparation and turnover of punch lists, record drawings, warranties, operations and maintenance information, and any commissioning requirements.

Knowledge	Skills	Abilities	Other Characteristics
• The change order process • Technical and operational requirements of various project types • Sources of risk and risk management practices	• Conveying information verbally • Negotiating with partners and stakeholders • Using scheduling software • Leading pull planning processes	• Collaborating with partners • Collecting, analyzing, and interpreting information • Focusing on and remembering details	• Accountable • Decisive

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

The close-out process for a design-build project is similar to the close-out process for a design-bid-build project. However, since the design-builder has an active role in creating the design, the design-builder is accordingly more proactive in ensuring that the owner's objectives are met.

Close-out documentation is generated through the following process:

1. The owner provides the design-build team with a list of the owner's project requirements.
2. The design-build team delivers a basis of design to the owner.
3. The design-build team creates construction documents (drawings, specifications, and other documents that define the scope of work).
4. The design-build team processes and documents submittals and substitution requests.
5. The design-build team and the owner or the owner's representative (as appropriate) perform quality control job walks and survey the work at appropriate times during construction.
6. The design-build team prepares close-out documentation.

In addition to the close-out documentation, the other key element of the project close-out process is the punch list. The punch list documents all instances of constructed work that requires correction or repair by the builder. On typical design-bid-build projects, the architect, as the owner's agent, provides the contractor with a punch list. The owner may or may not elect to participate in the creation of the punch list. 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.

Upon receipt of the owner's punch list, the design integration manager or a designated construction team representative 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 integration 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, the design integration manager should incorporate additional elements of the close-out process into the project from the beginning:

- Record drawings (or models), including the owner's preferences, expectations, and requirements related to level of detail in the record drawings
- Warranty, operations, maintenance, and training considerations, including incorporation of the owner's needs (whether or not they are included in the request for proposal [RFP]) into the project specifications
- Commissioning considerations, including an understanding that the design-builder is responsible for ensuring and demonstrating through a commissioning report that the building will operate as intended

BIM Turnover for Future Use

The design integration manager works with the BIM manager to ensure that all facility management data contained in the BIM, including as-built information and equipment specifications, are successfully turned over to the owner. The details of this handover should be based on the BIM execution plan (BEP) for the project.

After completion of the late design and construction phases, the BIM model can be used as an accurate record of the final building design during coordination of the handover of as-built data according to the BEP. When used in this way, the BIM model is referred to as a record model, which, at a minimum, should contain information related to the architectural, structural, and mechanical, electrical, and plumbing (MEP) systems. The benefits of compiling a record model are (1) to allow easier modeling of future renovations, (2) to improve documentation for future uses, and (3) to provide the owner with an accurate model of the building, the equipment, and the spaces within the building to create possible synergies with other BIM uses.

"The design integration manager ensures that all facility management data contained in the BIM, including as-built information and equipment specifications, are successfully turned over to the owner."

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 integration manager must understand the end state of the BIM data when planning the execution of the project at the beginning.

Only a few standards support BIM turnover for future use, and these are slowly being integrated into facility management and operations software systems. The main standard for nongeometric facility data is Construction-Operations Building Information Exchange (COBie). 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 (https://www.wbdg.org/bim/cobie/cobie-guide).

Beyond facility management and maintenance data, the owner may also require 3D models to be delivered. Again, the design integration manager must understand the reasons and future uses for which these data are requested. Future uses for 3D models may include the following:

- 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 inclusion of fully detailed fabrication models may provide too much detail for the intended use. 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.

CHAPTER 8: LOOKING TO THE FUTURE

The design integration manager's primary responsibility is to ensure that the design and construction processes are developed in unison—a seemingly simple role that is difficult to execute effectively in practice. Design-build teams bring together many architectural and engineering design disciplines, each with their own (sometimes conflicting) system requirements. To manage the work of these design partners, the design integration manager needs a combination of technical knowledge of the design process, an understanding of construction means and methods, and exceptional communication and leadership skills.

To assist the design integration manager in his or her role, this guide has outlined the key tasks that need to be performed or delegated during each phase of a project and the specific competencies that support the completion of those tasks. As the construction industry continues to evolve with the use of new technologies (e.g., building information modeling [BIM], automation) and processes (e.g., offsite fabrication, fast-tracking), the design integration manager will need to adapt his or her role. The task framework provided in this guide can be expanded as tasks are added or changed to meet the needs of future projects.

While this guide has been written from the perspective of the building construction sector, much of the guidance is universal and can be readily applied in other market sectors. However, some important characteristics of other sectors may affect how the design integration manager interacts with stakeholders, sequences work, and so forth. For design integration managers working in the following sectors, additional guidance is offered through a series of "playbooks" tailored to their needs:

- **Highways.** Projects in the highway sector are characterized by complexity arising from project sites that can span miles and multiple interchanges, varying geological conditions throughout the project area, complex construction phasing, public involvement, third-party coordination, and the need to consider environmental impacts, traffic flow, multiple stakeholder interests, and the safety of both workers and the traveling public. Different highway project owners follow different regulations and requirements regarding the use of design-build. The highway design-build process typically starts years before the project is in procurement, and the pre-construction phase incorporates early and detailed design tasks. The design integration manager must have a working knowledge of processes, means, and methods specific to highway construction while also being skilled at problem solving, coordination, and communication.

> *"The design integration manager needs a combination of technical knowledge of the design process, an understanding of construction means and methods, and exceptional communication and leadership skills."*

- **Industrial.** Industrial projects are characterized by their innate complexity resulting from specialized equipment and piping processes, uncertainty regarding project definition that extends into design and construction, and strict time-to-market demands that make project delivery speed a primary concern for owners. Design-build projects in the industrial sector commonly use the front-end loading (FEL) approach to the phase-gate project management process and engage in front-end engineering and design (FEED), both of which provide structure to the design-build process. The design integration manager needs to understand the expectations of each phase gate and may need to oversee a significant amount of preliminary design and engineering work.
- **Federal.** Projects in the federal sector are characterized by especially rigorous rules and regulations (e.g., the Federal Acquisition Regulation [FAR]), significant oversight, and strict security procedures. Design-build projects in the federal sector commonly employ bridging documents or a highly detailed program of requirements (POR) during the proposal phase. Additionally, as the design develops it is reviewed by many external stakeholders and subject matter experts working with federal agencies. The design integration manager must be familiar with the rules and regulations affecting federal projects and must learn to navigate interactions with external stakeholders.
- **Aviation.** Aviation design-build projects are characterized by lengthy project timelines, the use of dynamic equipment and technology, the need to consider both air-side and land-side requirements, and extensive security and other regulations. Visioning sessions are used throughout project development to support the development of project goals and objectives and later to facilitate strategic planning for enhancing the overall user experience. Aviation projects often use progressive design-build in addition to design-build. The successful design integration manager in the aviation sector needs to understand the dynamic and regulated nature of aviation operations, aviation-related terminology, and the need for consistent communication.
- **Water/Wastewater.** Water/wastewater design-build projects are characterized by the need to maintain plant operations during the project, unique environmental and regulatory requirements, differing sizes and types of owners, the prevalence of performance guarantees and risk management, the need to facilitate stakeholder collaboration and user feedback, and an emphasis on operations and maintenance planning. Water/wastewater projects often use progressive design-build in addition to design-build. The successful design integration manager in the water/wastewater sector needs regulatory expertise, knowledge of environmental standards and permitting processes, an understanding of different funding mechanisms, technical proficiency in both the public and private sectors, problem solving and decision-making skills, and the ability to adapt to evolving technologies.

GLOSSARY

This glossary provides definitions for key design-build terms used within the guide. Where possible, the definitions have been drawn from resources produced by leading professional organizations, including the *Architect's Handbook of Professional Practice, 15th Edition*, from the American Institute of Architects (AIA) and the *Design-Build Manual of Practice* from the Design-Build Institute of America (DBIA), among others. The intent of this glossary is not to present an exhaustive list of terms used in contracting and managing design-build projects but rather to provide a quick reference for users of the guide.

A

Addendum (addenda)
Per the AIA, "a written or graphic instrument issued by the architect before execution of the construction contract that modifies or interprets the [procurement] documents by additions, deletions, clarifications, or corrections." The types of procurement documents may differ and may include, but are not limited to, the request for qualifications (RFQ), request for proposal (RFP), drawings, specifications, or other documents. Addenda are typically initiated by the owner but may be initiated by the author of any of the project documents to amend the documents.

Allowance
Per the AIA, "an amount established in the contract documents for inclusion in the contract sum to cover the cost of prescribed items not specified in detail, with the provision that variations between such amount and the finally determined cost of the prescribed item will be reflected in change orders appropriately adjusting the contract sum."

Arbitration
Per the AIA, "a method of dispute resolution in which an arbitrator or panel of arbitrators evaluates the merits of the positions of the respective parties and renders a decision." The arbitrator's final decision is often a binding ruling. Arbitration is a private and confidential process and is an alternative option to litigation.

Architect of record
See Design professional of record (DPOR).

Augmented reality (AR)
Per the BIM Dictionary, "an interactive experience of a real-world environment where the objects occupying the real-world are enhanced by computer-generated perceptual information." In an AR environment, virtual objects are superimposed on physical reality to provide users with supplementary contextual information.

Authority having jurisdiction
Per the AIA, "the organization, government agency, or individual who holds the legal power and responsibility to enforce codes, regulations, and standards within a specific jurisdiction or geographical area."

Award fee
A form of owner's incentive program to a design-builder that is typically outside of the prime agreement and that rewards the design-builder for exceptional performance above and beyond the minimum requirements of the contract.

B

Basis of design (BOD)
Documentation of the design assumptions, criteria, and items necessary to meet a project's requirements. Also known as the program of requirements.

Best-value selection
Per the AIA, "the evaluation and selection of [a design-builder] where total costs are considered along with other specialized qualification criteria." These qualification criteria may include, but are not limited to, the proposed design concept; the design-build team's skills and experience, past completed projects, and safety record; the design-builder's organization and prior experience with the owner; and anything else the owner deems important. A weighted formula is used to determine which design-builder represents the best value to the owner for the price. The qualifications and price proposal may be weighted the same or differently.

Bid
Per the AIA, "a complete and properly executed proposal to do the work or a designated portion of the work for sums stipulated therein, submitted in accordance with the [procurement] documents." Also known as a financial proposal.

BIM execution plan (BEP or BXP)

A plan that describes how information management is performed by the project team during design and construction. The plan must satisfy the owner's BIM requirements and be delivered either as online input or as a compiled document to the requesting party. Also known as a BIM management plan (BMP) or BIM protocol.

Building codes

Per the AIA, "government regulations, ordinances, or statutory requirements relating to building construction and occupancy, generally adopted and administered for the protection of public health, safety, and welfare."

Building information modeling (BIM)

According to Version 3 of the National BIM Standard-United States (NBIMS-US), "BIM is a term which represents three separate but linked functions: (1) BIM is a business process for generating and leveraging building data to design, construct, and operate the building during its life cycle. BIM allows all stakeholders to have access to the same information at the same time through interoperability between technology platforms. (2) BIM is the digital representation of the physical and functional characteristics of a facility. As such, it serves as a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its life cycle from inception onwards. (3) BIM is the organization and control of the business process by utilizing the information in the digital prototype to affect the sharing of information over the entire life cycle of an asset. The benefits include centralized and visual communication, early exploration of options, sustainability, efficient design, integration of disciplines, site control, as built documentation, etc.—effectively developing an asset life-cycle process and model from conception to final retirement."

BIM protocol

See BIM execution plan (BEP or BXP).

Building permit

Per the AIA, "a permit issued by an appropriate governmental authority allowing construction or renovation of a project in accordance with approved construction documents." In essence, a building permit allows construction to begin on a project.

Bulletin

See Supplemental instruction (SI).

C

Change directive

A mechanism for making a change in the work prior to approval of a change order proposal. A change directive is typically made when the timeliness of implementing the change is urgent and when following the change order approval process may delay the implementation of the change. Under a change directive, the directed party proceeds with the change per the prescribed means outlined in the contract and then negotiates under the terms of the contract the cost and schedule impacts of the change.

Change order (CO)

Per the AIA, "an amendment to the [design-build] contract signed by the owner and [design-builder] authorizing a change in the work, an adjustment in the contract sum or the contract time, or both." Also known as a work order.

Clash detection

A spatial modeling process coordinated between different project disciplines, such as structural engineering and mechanical engineering, to identify and resolve potential clashes between components before fabrication or installation. The outcome is a modeling report that detects spatial conflicts between components, typically between virtual model elements from different disciplines.

Cloud-based document

Per the definition of cloud computing in National Institute of Standards and Technology (NIST) SP 800-145, "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

Commercial general liability (CGL)

Per the AIA, "a broad form of liability insurance covering claims for bodily injury and property damage that combines, under one policy, coverage for business liability exposures (except those specifically excluded) and new and unknown hazards that may develop. Commercial general liability insurance automatically includes contractual liability coverage for certain types of contracts and personal injury coverage. Products liability and completed operations liability are included as well. This policy may be written on either an occurrence form or a claims-made form." In the case of design-build contracting, CGL is a standard insurance policy issued to protect the design-builder against liability claims for bodily injury and property damage arising out of premises, operations, products, completed operations, advertising, and personal injury liability. Also known as general liability insurance.

Commissioning

Per the AIA, "a process for achieving, validating, and documenting that the performance of the completed building and its systems meet the design requirements." Traditionally, commissioning has referred to the process by which the heating, ventilation, and air conditioning systems of a building are tested and balanced according to established standards prior to acceptance by the building owner. However, the scope of commissioning has broadened to encompass other systems.

Commissioning plan
A deliverable developed during the planning stage that describes the commissioning process, including the roles, responsibilities, and sequence of activities needed to bring the project into operation. Also known as a Cx plan.

Commissioning report
A comprehensive document that outlines the process, results, and findings of the commissioning activities performed on a building or facility.

Computer-aided design and drafting (CADD)
Per the AIA, "a term applied to systems or techniques for design and drafting using integrated computer hardware and software systems to produce graphic images" in the form of 3D and 2D representations or models of the project design.

Constructability
The optimal use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives.

Constructability review
A proactive evaluation of the design from a construction perspective to ensure that it can be effectively executed within the project's constraints. The review identifies potential construction challenges and recommends design modifications, if necessary, to enhance quality, safety, efficiency, and overall project value.

Construction manager
Per the AIA, "an individual or entity that provides construction management services."

Construction Operations Building Information Exchange (COBie)
A nonproprietary data format for collecting and delivering a specific set of digital information related to a building. COBie specifications can be collected and organized using a spreadsheet template or COBie-capable software.

Contingency
Per the AIA, "a sum included in the construction budget and project budget to cover unpredictable or unforeseen items of work or changes in the work." Unforeseen items of work may arise from known or unknown project circumstances, such as pricing, escalation, scheduling issues, omissions, and errors. The owner and/or design-builder may hold contingency based on equitable risk allocation under the contract.

Contract agreement
Per the AIA, "a legally enforceable agreement between two or several parties that creates an obligation to do or not to do a particular thing. It also refers to the document that describes the agreement of the parties with the terms and conditions and that serves as evidence of the obligation." A contract agreement can also be considered a written agreement between two or more entities that establishes the obligations of the parties relative to the performance of the work. Contract agreements often include and reference multiple documents, including general and supplementary conditions, drawings and specifications, and addenda.

Contract completion date
See Final completion.

Contract duration
The number of working days or calendar days allowed for the completion of a project. The contract duration is typically defined from notice to proceed (NTP) through substantial or final completion. If defined in the contract documents, a design-builder could receive a bonus for finishing early or receive a fine for late completion. See also Liquidated damages.

Contract incentive
An explicit incentive, defined in the contract agreement between owner and design-builder that rewards the design-builder for achieving a specific project goal, such as early completion or completion below budget.

Cost plus fee
A type of contract where the owner reimburses the design-builder for the cost of work that was incurred plus a fixed, predetermined fee or a percentage fee based on the actual costs. The fee amount may be determined through a bid or negotiation. Also known as cost plus fixed fee and cost plus percentage fee.

Cost estimate
The expected cost to complete the project as outlined in the scope of work. This estimate includes the expected costs for design, construction, contingencies, and allowances. The estimate may also include other items as specified by the owner.

Cost model
A specific type of cost estimation tool or approach used to estimate and analyze the expenses associated with a construction project.

Cx plan
See Commissioning plan.

D

Diversity, equity, and inclusion (DEI)
A set of principles and practices that organizations and communities adopt to promote diversity, ensure equitable opportunities, and foster an inclusive environment for all individuals regardless of their background, characteristics, or identities.

Deliverable
Any contractually required document submission (e.g., project schedule, design drawing, shop drawing).

Design excellence
The practice of good judgment throughout project procurement, development, and execution, as well as sound decision-making within the limitations imposed by budget, scope, and schedule.

Design-bid-build (DBB)
A commonly used delivery method in which an owner first procures and contracts with a design team to prepare detailed design plans and specifications for a project. The owner then conducts a second procurement process and contracts with a separate firm to construct the project based on the previously completed plans and specifications. This process is sequential and does not allow for overlap of the design and construction phases.

Design-build (DB)
Per the AIA, "a method of project delivery in which the owner contracts directly with a single entity that is responsible for both design and construction services for a construction project." This entity, the design-builder, works to meet the owner's stated performance and design criteria.

Design-build coordinator
See Design integration manager.

Design-build manager
See Design integration manager.

Design-builder
The entity that holds the design-build contract with the owner and is responsible to perform both design and construction services. In contractor-led design-build, this role may be referred to as the prime contractor or general contractor.

Design integration manager
The person on the design-build team who 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 on a design-build project. Also known as the design-build manager, design-build coordinator, or integration manager.

Design optimization
See Value engineering (VE).

Design professional of record (DPOR)
The design certifying authority, typically a registered design professional. The DPOR accepts the responsibility for the design for each respective design discipline by stamping and approving the final construction documents. Also known as the engineer of record or architect of record.

Document management system (DMS)
Per the BIM Dictionary, "a software solution for the storage, retrieval, and workflow management of electronic resources and their metadata through a central repository. Workflow management includes permission rules, check-in/check-out, and approval processes." Also known as an electronic document management system.

Drawings
Per the AIA, "the graphic and pictorial documents depicting the design, location, and dimensions of the elements of a project. Drawings generally include plans, elevations, sections, details, schedules, and diagrams. When the term is capitalized, it refers to the graphic and pictorial portions of the contract documents." The architectural and engineering drawings and specifications together represent the approved design for permitting and approval by the authority having jurisdiction (AHJ) for construction.

Due diligence
The process of gathering and analyzing information about a project's existing conditions before commencing the design phase.

E

Electronic document management system
See Document management system (DMS).

Engineer of record
See Design professional of record (DPOR).

Errors and omissions (E&O) insurance
See Professional liability insurance (PLI).

F

Fast-tracking
Per the AIA, "any project or process where there is an overlap between two or more project phases." Fast-tracking is often used to allow portions of construction to start prior to completion of the overall design.

Feature creep
See Scope creep.

Financial proposal
See Bid.

Flow-down clause
A provision in a subcontract that binds a subcontractor to the design-builder by the terms of the contract documents with the owner. The subcontractor assumes toward the design-builder all of the obligations and responsibilities that the design-builder assumes toward the owner, including the responsibility for the safety of the subcontractor's work.

Final completion
Per the AIA, "term denoting that the work has been completed in accordance with the terms and conditions of the contract documents, all contract requirements for project closeout have been satisfied, and the [design-builder's] final application for payment has been sent to the owner." Completion of work typically includes full satisfaction of all contract obligations, acceptance of the work by the owner, resolution of all outstanding change orders, completion of all punch list items, delivery of all closeout documentation, and fulfillment of any other requirements specific to the contract.

G

General liability insurance
See Commercial general liability (CGL).

Guaranteed maximum price (GMP)
Per the AIA, "a sum established in an agreement between the owner and [design-builder] as the maximum compensation to be paid by the owner to the [design-builder] for performing specified work on the basis of the cost of labor and materials plus overhead expenses and profit." More broadly, GMP is an approach to pricing services in a collaborative-delivery proposal and contract. The GMP is the maximum sum guaranteed by the design-builder of all estimated direct and indirect reimbursable costs plus a fee that usually includes overhead, profit, contingency, and allowances. Costs incurred above the GMP or savings under the GMP are negotiated according to the terms of the contract. Savings incurred under the GMP may revert wholly to the owner or may be shared between the design-builder and owner (shared savings or savings).

I

Indemnification clause
A provision in a contract that typically requires one party to defend, indemnify, and hold harmless the other party from specific types of claims identified in the provision.

Industry foundation classes (IFC)
Per Version 3 of the National BIM Standard-United States (NBIMS-US), "a neutral and open specification for object-based data models developed by buildingSMART to facilitate interoperability in the building industry."

Integration manager
See Design integration manager.

Intellectual property (IP)
Creative and innovative assets that are developed during the planning, design, and execution phases of a construction project. These assets can be intangible and may include original designs, plans, specifications, methodologies, processes, and other proprietary information developed by architects, engineers, construction firms, or other stakeholders involved in the project.

J

Joint venture (JV)
Per the AIA, "a business relationship consisting of two or more persons or entities that has legal characteristics similar to those of a partnership." The parties to the joint venture manage the enterprise—sharing all profits, losses, expenses, and assets—and have joint and several liability to the owner. Joint ventures can be formed for any collaborative-delivery method; they may involve an engineering firm and construction firm, multiple construction firms, multiple design firms, or any combination thereof.

L

Leadership in Energy and Environmental Design (LEED)
A green building certification program that recognizes outstanding building strategies and practices. Requirements for LEED certification are often included in the basis of design.

Level of development (LoD)
A metric to identify the information to include in a BIM model during the design and construction process and to define the various development stages (i.e., milestones) of the construction project in BIM. The LoD abbreviation can refer to multiple terms, definitions, and numbering systems even within the same country, such as level of detail or level of modeling detail. Also known as model progression specification.

Life-cycle assessment (LCA)
A tool for analyzing the environmental impacts and resources used throughout a product's life, from raw materials extraction to production and extending through product use and disposal.

Limited liability company (LLC)
A corporate structure that protects its owner from being personally pursued for repayment of the company's debt or liabilities.

Liquidated damages
Per the AIA, "a sum established in a construction contract, usually as a fixed sum per day, as the predetermined measure of damages to be paid to the owner because of the [design-builder's] failure to complete the work within a stipulated time." Liquidated damages may also be assessed for the failure of the design-builder to achieve contractual performance requirements.

Lump sum
An agreed-upon fixed price for completing the entire scope of work outlined in a design-build contract. Also known as firm price, fixed price, or stipulated sum.

M

Mediation
Per the AIA, "a voluntary, confidential process often mandated by a contract whereby a neutral third party assists the parties to a dispute in achieving resolution." Recommendations made through mediation are nonbinding.

Milestone
A significant date identified in the project schedule that is used as a checkpoint to understand and validate how a project is progressing. Milestones may be used as checkpoints to progress to a subsequent phase. Also known as a phase gate.

Model development specification
Per the BIM Dictionary, "a specification used on collaborative BIM projects to identify who the model element author is of each model element (or set of elements), what elements are exchanged between project participants, when to exchange these, and at what level of development." Also known as model progression specification.

Model progression specification
See Model development specification.

N

Notice to proceed (NTP)
Per the AIA, "written owner's directive issued to the [design-builder] authorizing the [design-builder] to proceed with the work and establishing the date for commencement of the work." In design-build delivery, a partial NTP may be issued to authorize only a subset of work. A full NTP typically commences the contract duration.

O

Offeror
See Proposer.

Off ramp
Used metaphorically in a progressive design-build context, a provision or clause that allows one or more parties to exit or terminate the contract under certain specified conditions. Such a provision or clause could be a contractual mechanism that provides a way out of the contract or an option to end the contractual relationship before its original completion date.

Owner
Per the AIA, "a person or entity who retains services for building design and contracts for construction or acquisition of furniture, furnishings, and equipment, so called because this person or entity typically owns or is the lessee of the site or building premises." In some cases, the owner may refer to a tenant, the owner's authorized representative, or a developer.

Owner advisor
See Owner representative.

Owner representative
Typically, a third-party consultant or firm hired by the project owner to provide specialized expertise, advice, and guidance throughout the various phases of the construction project. Also referred to as an owner advisor.

P

Performance criteria
See Performance specification.

Performance specification
Per the AIA, "a set of specified performance-related requirements to be satisfied by the [design-builder] or subcontractor." Also known as performance criteria.

Phase gate
See Milestone.

Prefabrication
Offsite manufacturing (e.g., milling, cutting, casting, welding) and pre-assembly of units, elements, or modules that are then transported for subsequent installation onsite. Example prefabricated building elements include bathroom pods, headwalls for hospital rooms, and large electrical or mechanical modules.

Procurement
The process of acquiring goods, services, or works from an external source. Procurement typically includes both a method of solicitation (for example, bid, RFQ/RFP, or sole source) and a method of selection (for example, low price, best value, or qualification based).

Professional liability insurance (PLI)
Per the AIA, "insurance coverage for the insured professional's legal liability for claims arising out of damages sustained by others allegedly as a result of negligent acts, errors, or omissions in the performance of professional services. Claims-made coverage is typically purchased annually to cover all claims on all projects during the coverage period (the 'practice policy')." Also known as errors and omissions (E&O) insurance.

Professional certification
A designation earned by a designer, engineer, or contractor to indicate an individual's qualification to perform a task. Common certifications include membership in the American Institute of Architects (AIA), professional engineer (PE) licensure, and professional certification by the Design-Build Institute of America (DBIA).

Professional development
A continuous and deliberate process of acquiring new knowledge, skills, competencies, and experiences to enhance one's professional growth and advance in his or her career.

Professional ethics
Per the AIA, "statements of principles promulgated by professional societies or public agencies governing professional practice in order to guide members or licensees in their professional conduct."

Program of requirements
See Basis of design (BOD).

Progressive design-build
A subset of the design-build delivery method in which the design, cost estimation, construction schedule, and final guaranteed maximum price (GMP) or fixed price are collaboratively developed to a mutually acceptable level between the owner and design-builder. This process may include one or more "off ramps" that enable the owner and design-builder to part ways if they cannot reach an agreement. However, if they agree to move forward, the final design, construction, and commissioning will proceed under the agreed-upon GMP or fixed price.

Project delivery method
A strategy used to organize and execute design and construction services. The project delivery method is selected by the owner during or immediately following the feasibility assessment. Common project delivery methods include design-bid-build (DBB) and design-build (DB).

Proponent
See Proposer.

Proposal
A written offer from a design-builder typically to the owner, preferably in a prescribed proposal format, to perform the work and to furnish all labor, materials, equipment, and/or services for the prices and terms quoted by the design-builder. The proposal may include information about the design, technical qualifications, and/or the price or fee as requested by the owner in an RFP.

Proposer
Any company, firm, partnership, joint venture, corporation, association, or other entity that formally submits a proposal in response to a solicitation for the work contemplated, or for any portion thereof, acting directly or through a duly authorized representative. Also known as a proponent, offeror, or, during a bid process, bidder.

Punch list
Per the AIA, "a list made near the completion of the work, including items to be furnished or work to be performed by the [design-builder] and/or subcontractors in order to complete the work as stipulated in the contract documents." Successful remediation of all items on the punch list is needed for final completion.

Q

Quality assurance
The evaluation of overall project performance on a regular basis to ensure that quality management processes are followed.

Quality control
The responsibility of an individual or business to ensure that its products and deliverables comply with applicable legal, ethical, and regulatory standards. The quality control process involves the continuous review, certification, evaluation, inspection, and testing of components, products, techniques, and participants.

Qualification-based selection (QBS)
Per the DBIA, "a competitive procurement method in which the final criteria for selection are qualifications and demonstrated competence."

R

Record drawings
Documentation of revisions to the design-builder's contract drawings that reflect changes made during the progression of a project. The drawings provide the owner with a record that reflects the actual constructed and installed work, including modifications resulting from requests for information, change orders, supplemental instructions, and field changes.

Retainage
Per the AIA, "a sum withheld from the progress payments to the [design-builder] and later paid in accordance with the terms of the agreement between the owner and [design-builder]." The withheld amount encourages the design-builder to complete the work in accordance with the contract and may be used to correct defective work if the design-builder is unwilling or unable to do so.

Request for expression of interest (REI)
An owner-released document used to gather information on a design-builder's interest in an upcoming project opportunity or to obtain information on a design-builder's qualifications.

Request for information (RFI)
Per the AIA, "a written request for more specific information about certain aspects of the work." An RFI process may be used to confirm the interpretation or absence of a detail, specification, or note during the development of the design and construction drawings, or to secure a documented directive or clarification from the parties involved on the project that is needed to continue the work.

Request for proposal (RFP)
A document issued by an owner to solicit potential design-builders for a project that requests technical and pricing information for the completion of design and construction services. In response, design-builders submit proposals with the required information for evaluation and selection by the owner.

Request for qualifications (RFQ)
A document issued by an owner that requires interested design-builders to submit a letter of interest and a statement of qualifications and certifications. The RFQ does not include pricing information but identifies the technical requirements the owner needs to evaluate the design-builders' ability to execute the work. Technical requirements may include previous experience, company history, past projects, safety performance, sample design details, etc. When used as a first step in a two-step process, the RFQ may be used to reduce the number of design-builders invited to submit proposals in response to an RFP.

Requirement creep
See Scope creep.

Risk management
Per the AIA, "the strategies and processes used to minimize the probability and severity of an unfavorable outcome at the lowest long-term cost to an individual or organization."

S

Savings
Remaining funds when the actual costs of a project are lower than the GMP. The savings may be shared between the design-builder and owner. Quantifying the savings typically requires an open book approach to pricing.

Scope change
A change to the agreed-upon scope of work. In design-build, scope changes may result from owner-directed changes, new requirements introduced by regulatory agencies, or undocumented existing conditions.

Scope creep
The tendency of a project's requirements to increase over time. Scope creep can occur when the project requirements are not adequately defined, documented, or controlled. Also known as requirement creep or feature creep.

Scope of work (SOW)
A document that describes the work to be done on a project. The SOW may include a list of construction obligations, administrative duties, management duties, work activities, milestones, and deliverables that the design-builder, designers, subcontractors, and suppliers are obligated to provide under their respective contracts.

Shortlisting
A step in the procurement process where prospective bidders or proposers are initially compared and evaluated by the owner to determine which bidders or proposers will move into the next phase of selection. In other words, a "short" or narrowed down list is created of the most qualified bidders or proposers.

Spearin doctrine
An important concept in construction law that governs the allocation of design responsibility between the owner and the contractor in construction projects. The Spearin doctrine essentially holds that when a contractor follows the plans and specifications provided by the owner, the owner implicitly warrants the adequacy and accuracy of those plans and specifications. In other words, the owner bears responsibility for the design information it provides to the contractor, and the contractor can rely on the accuracy of that information.

Selection criteria
The criteria stated by the owner that will be used for the evaluation of potential design-builders during procurement. These criteria are typically listed in the RFQ and/or RFP documents.

Specialty contractor
See Subcontractor.

Specifications
Per the AIA, "a part of the contract documents contained in the project manual consisting of written requirements for materials, equipment, construction systems, standards, and workmanship."

Stakeholder
An individual or entity with a vested interest in or an influence on a construction project's outcome. Stakeholders may be either internal to the design-builder (e.g., estimating department) or external to the design-builder (e.g., the owner's end users or financers).

Standard of care
Per the AIA, "what a reasonably prudent architect [or engineer], in the same community at the same time, facing the same or similar circumstances, would do. It is the measure by which professional negligence is judged. The standard of care is established in the common law of each state or may be written into the services agreement. Expert witness testimony is normally required to establish a breach of the standard of care."

Statement of qualifications (SOQ)
Per the AIA, "a means of verifying the background, references, and financial stability of any [design-builder] being considered." Potential design-builders prepare a SOQ in response to the owner's RFQ that summarizes the qualifications of the company and presents why the company is suitable for the project.

Stipend
A form of compensation that is provided to design-build teams for their participation in the procurement process. Stipends are typically used in competitive procurement methods to encourage the submission of responsive and high-quality proposals from design-build teams. Also known as an honorarium.

Subcontractor
Per the AIA, "a person or entity who has a direct contract with the [design-builder] to perform any of the work at the site." Also known as a specialty contractor or trade partner.

Submittal
Per the AIA, "documents and physical samples prepared by the [design-builder], subcontractors, suppliers, or manufacturers that describe in detail how the [design-builder] will construct the work, submitted to the [owner or designer] for review and processing. Submittals are closely scheduled and coordinated with the project construction schedule and include shop drawings, project data, physical samples, and similar submittals, which can include coordination drawings, details, calculations, and other supporting data as specified." Submittal requirements are often provided in the project specifications.

Substantial completion date
Per the AIA, "the stage when the work or a designated portion thereof is sufficiently complete in accordance with the contract documents so that the owner can occupy or utilize the work for its intended use." Substantial completion is a "practical completion" and is short of final completion, in that some outstanding work or punch list items may need to be addressed. Upon substantial completion, the responsibility for the physical property (e.g., insurance, security, and maintenance) typically shifts to the owner, and the warranty period begins.

Supplemental instruction (SI)
Per the AIA, "a directive issued to provide additional information within the scope of the contract documents or to make minor changes to the work that will not result in adjustment to the contract sum or time." Also known as a bulletin.

Sustainability
Per the AIA, "the concept of meeting present needs without compromising the ability of future generations to meet their needs." When applied to the design and construction of building projects, sustainability generally addresses site considerations, energy conservation, renewable material use, water efficiency, and indoor air quality.

T

Target-based design (TBD)
See Target value design (TVD).

Target value design (TVD)
Per the AIA, "the process of establishing early financial targets for the project and then designing to an associated detailed estimate rather than estimating a detailed design." This process is iterative, and if the financial targets are estimated to be exceeded at any point in the process, the design-builder's team must find savings elsewhere without compromising value. Also known as target-based design.

Teaming agreement
A contractual arrangement between two or more construction-related entities, such as contractors, subcontractors, design professionals, or suppliers. The purpose of a teaming agreement is to establish a collaborative relationship for the joint pursuit of a specific project or business opportunity.

Trade partner
See Subcontractor.

Turnover
The point in the project's life cycle when the completed building or facility is handed over from the design-builder to the owner or client for occupancy, use, and operation. Turnover marks the completion of the construction phase and the beginning of the building's operational phase.

V

Validation
The process of verifying and confirming that the construction project meets the intended design requirements, quality standards, and regulatory codes. This process involves checking and validating various aspects of the construction work to ensure that it is completed accurately, safely, and in accordance with the approved plans and specifications.

Value engineering (VE)
The process of reviewing elements of the project design in terms of costs and benefits. Value engineering involves substitution of less costly systems or materials without changing the function, quality, or overall appearance of the building. Also known as value management or design optimization.

Virtual design and construction (VDC)
Per BIM Corner, "a combination of new technologies (BIM) with an adequate work and management scheme, supporting people working together on the project, in an integrated and simultaneous way [e.g., integrated concurrent engineering]. The scheme is focused on achieving the project's objectives, which should help the client to achieve its goals while collecting data and tracking workflow progress."

W

Warranty
Per the AIA, "legally enforceable assurance of the quality or performance of a product or work or of the duration of satisfactory performance." A warranty period for material and installation defects extends for a specified period per the contract documents, typically starting from the date of substantial completion. Specialized equipment and material may have longer warranty periods provided by the respective manufacturers.

Weighted criteria
A type of evaluation where the technical criteria listed in the procurement documents are used to evaluate the proposals received for a given project. Different weights are assigned to the price and each of the technical evaluation factors, and the technical and price proposals submitted by each proposer are evaluated separately. The sum of the weighted scores for each of the criteria becomes the total score, and the proposer with the highest total score is selected.

Work
Per the AIA, "The [design,] construction, and services required by the contract documents—whether completed or partially completed—including all labor, materials, equipment, and services provided or to be provided by the [design-builder] to fulfill the [design-builder's] obligations. The work may constitute the whole or a part of the project."

Work order
See Change order (CO).

Work breakdown structure (WBS)
A hierarchical breakdown of the project components. A work breakdown structure is often used to integrate design, engineering, and construction activities.

Z

Zoning
The process by which local governments regulate the use of land and buildings through rules regarding what can be built as well as the use, size, shape, and other characteristics of buildings.

Sitting at the intersection of multiple parties in a design-build project, the design integration manager must organize and manage the activities of many individuals to conceptualize and develop the project design.

Five phases in a design-build project engage the design integration manager:

PROPOSAL/PRE-AWARD PHASE

POST-AWARD PHASE

EARLY DESIGN PHASE

DETAILED DESIGN PHASE

CONSTRUCTION PHASE

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