

THE DESIGN-
BUILDER'S GUIDE
TO DESIGN
MANAGEMENT:

A Playbook for the Highway Sector



CHARLES PANKOW
FOUNDATION

THE DESIGN-BUILDER'S GUIDE TO DESIGN MANAGEMENT: A PLAYBOOK FOR THE HIGHWAY SECTOR

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EXECUTIVE SUMMARY



Design-build projects in the highway sector require the expertise and experience of owners (in this case, departments of transportation [DOTs] and other owner entities such as turnpike authorities, counties, or municipalities) that understand the complex nature of these projects. Significant attention and consideration are especially necessary during the permitting and authorization processes, which can lead to lengthy project timeframes.

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.

This *Highway Sector Playbook* offers guidance tailored to the characteristics of design-build project delivery in the highway sector primarily for professionals who have been tasked with the role of design integration manager. This playbook is meant to be used in conjunction with *The Design-Builder's Guide to Design Management*. The guide aims 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. To complement the guide, this playbook provides detailed information specific to the design integration manager's role in the highway sector and describes how this individual interacts with project stakeholders across different project phases.

To succeed as a design integration manager in the highway sector, it is crucial to recognize the key characteristics that differentiate this sector from other sectors and to understand the diverse skills, abilities, and characteristics that the design integration manager needs to effectively guide a project from start to finish. This playbook addresses the skills and qualifications a design integration manager needs to effectively deliver a design-build project in the highway sector and outlines the design integration manager's roles, responsibilities, and involvement throughout all phases of highway design-build projects.

In highway design-build projects, the role of the design integration manager spans four distinct phases:

1. The **Pursuit Phase** begins when the owner (e.g., DOT) initiates the procurement process and concludes when the contract between the owner and the selected design-builder is finalized.
2. The **Post-Award Phase** begins when the design-build team executes and negotiates contract agreements among the task force groups and ends when subcontracts are issued to partners.

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This playbook provides detailed information specific to the design integration manager's role in the highway sector and describes how this individual interacts with project stakeholders across different project phases.

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3. The **Pre-Construction Phase** begins after subcontracts are issued, encompasses schematic design, and ends with the completion of construction drawings and specifications.
4. The **Construction Phase** begins after the release of construction documents and ends when the project is handed over to the owner (e.g., DOT).

Each phase involves a set of key tasks and presents unique challenges and opportunities, and the design integration manager plays a critical role in ensuring seamless coordination and integration across all project phases. By understanding the responsibilities and tasks expected during each phase, the design integration manager can effectively navigate the complexities of highway projects and contribute to their successful delivery.

To provide a clear overview of the highway design-build process, establish a structured approach to project management, and facilitate efficient decision-making throughout a project's life cycle, the following table organizes the tasks by project phase and notes the frequency at which the design integration manager must perform them. The highlighted tasks, indicated by a road icon, represent additional or alternative tasks specific to the highway sector that are not included in *The Design-Builder's Guide to Design Management*.

Phase	Task	Frequency
Pursuit	Review the owner's project announcement and identify 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 partners *	Once
	Verify that the design subcontracts to be issued to partners upon award meet the project requirements	Once
	 <u>Review the greensheet estimate and coordinate between the designers and estimators</u>	Daily throughout the pursuit phase
	 <u>Identify innovative ideas and potential alternative technical concepts</u>	Daily throughout the pursuit phase
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"	Several times depending on the project package*
	Manage and oversee the execution of the design contracts 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

Table continued on following page

* Phrasing has been modified slightly from *The Design-Builder's Guide to Design Management* to reflect the unique characteristics of the highway sector

Table continued from previous page

Phase	Task	Frequency
Pre-Construction	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
	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	Several times depending on the project package*
	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
	<i>↗ Perform a constructability review</i>	<i>Every few weeks throughout the project</i>
	<i>↗ Monitor construction quantities and scope growth</i>	<i>Every few weeks to monthly throughout design</i>
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



* Phrasing has been modified slightly from *The Design-Builder's Guide to Design Management* to reflect the unique characteristics of the highway sector



CHAPTER 1: CHARACTERISTICS OF THE HIGHWAY SECTOR



Prior to starting work, the design-builder needs to be aware of certain characteristics of highway sector projects that can potentially impact the role and responsibilities of a design integration manager. Awareness of these characteristics can help professionals better understand the challenges that arise and considerations that must be addressed when managing the design process in highway sector projects. Highway design-build projects are especially characterized by their complexity and the need for coordination with third parties to perform tasks such as acquiring right-of-way (ROW) and relocating utilities, as described in the following sections.

Complexity

Highway projects are in many ways more complex than building projects. This greater complexity arises from the need to consider a larger number of factors, such as geological conditions, environmental impacts, traffic flow, and multiple stakeholders' interests, and can result in longer planning and design phases, more significant risks of unexpected cost overruns and delays, and more extensive permitting requirements. Other factors unique to the highway sector that increase project complexity include the following:

- **Project scope and size.** Highway projects are horizontal projects that may involve many miles of roadways, multiple interchanges, and various disciplines (e.g., utilities, drainage, and structural engineering). Thus, highway projects are often larger in scope and scale than vertical projects such as those in the building sector, making highway projects more complex and difficult to manage and execute.
- **Public involvement.** Highway projects require extensive input and public participation that can complicate the delivery process and lengthen the project schedule because community and public concerns about environmental impacts, maintenance of traffic (MOT), pollution, and noise must be addressed. Additionally, public relations officers from the owner (e.g., department of transportation [DOT]) may need to provide regular updates to the public regarding the project.
- **Safety considerations.** Safety is a crucial aspect of highway projects that affects the delivery process. Highway projects require extensive safety measures, quality control, and inspection processes to ensure that the executed project is safe for all users, including road workers, the traveling public, and stakeholders. Safety is especially important when construction is occurring near—or on—an active highway.

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The design-builder needs to be aware of certain characteristics of highway sector projects that can potentially impact the role and responsibilities of a design integration manager.

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- **Construction phasing.** Since it is typically not feasible to shut down entire roadways for construction, highway projects are subject to complex construction phasing. Adding to the complexity is the fact that phased construction for highway projects requires coordinating traffic flow and maintaining the safety of workers and road users through measures that account for traffic congestion, the needs of the local jurisdiction, and accommodations for third parties such as utilities, local public and private services, businesses, residents, schools, and other impacted parties.
- **Planning requirements.** Planning for highway projects requires the identification of specific site characteristics—such as suitable soil conditions over a large and potentially varied area, appropriate topography, and sufficient access to major transportation routes and utilities—and coordination with third parties. These planning requirements add more complexity to highway projects compared to building projects.
- **Uncontrolled conditions.** Highway projects are subject to unforeseen and uncontrolled conditions that require extensive contingency planning and risk management strategies. Examples of uncontrolled conditions include traffic congestion levels, weather patterns, and environmental factors.

Third-Party Coordination

Acquiring the necessary approvals and permits and coordinating with various third parties are crucial aspects of highway projects and are governed by regulatory requirements. In collaboration with the design-builder and consultants, the owner (e.g., DOT) typically manages the negotiation process with third parties (for example, to acquire ROW) and seeks to minimize disruptions to landowners, utilities, local public and private services, and other stakeholders. Preliminary agreements are established before acquisitions are finalized, and early involvement of contractors, local agencies, and utilities can lead to cost savings and improved project efficiency.

Understanding and effectively managing third-party considerations are vital aspects of highway projects because these activities greatly influence the project's complexity and success. By proactively addressing the needs and concerns of third parties, highway projects can proceed smoothly and meet regulatory obligations and project goals. Specific third-party considerations include ROW acquisition, access to utilities, railroad accommodations, wetland and other environmental impacts, and challenges related to acquiring Coast Guard and environmental permits. These factors can significantly increase the complexity of highway projects, making effective coordination and communication with third parties a critical aspect of project management. Specific considerations include the following:

- **Land acquisition.** Unlike building projects, highway projects often require significant land acquisition for ROW, which involves negotiating with property owners and acquiring the necessary land and construction and permanent easements. The project owner (e.g., DOT) provides the ultimate footprint for contractors to operate within. However, contractors may propose alternative technical concepts that could necessitate additional acquisitions or reductions. To ensure a smooth process, the Federal Relocation Act governs these acquisitions, and the owner negotiates with landowners and utilities to minimize disruptions and avoid multiple impacts on affected parties.
- **Risk management in third-party coordination.** Coordination with third parties introduces specific risks that can lead to delays and increased costs if these risks are not managed effectively. Therefore, it is crucial to identify and proactively manage these risks. One essential consideration in this regard is the implementation of best practices, such as including appropriate items in the request for proposal (RFP) documents that clearly define and address the risks associated with third-party coordination, ensuring that potential challenges are addressed early in the process.

- **Regulatory requirements.** Highway projects are subject to various regulatory requirements, including those concerning coordination with third parties (such as in the acquisition of ROW); compliance with local, state, and federal regulations; and accommodations to meet the needs of local public and private services and utilities. The owner (e.g., DOT) oversees and coordinates the regulatory negotiation process with the support of the design-builder and engages consultants to assist with coordination.
- **National Environmental Policy Act (NEPA) considerations.** Compliance with NEPA and coordination with third parties play a significant role in highway projects, particularly in terms of environmental permits, wetland considerations, and Coast Guard permits.
- **Preliminary agreements.** The project owner negotiates with contractors to establish preliminary agreements before proceeding with actual ROW acquisitions. This proactive approach helps mitigate delays and minimize costs associated with multiple disruptions to landowners and utilities. On a design-build project, however, negotiations with landowners could potentially cause significant schedule impacts, which adds to the complexity of the project.
- **Cost and schedule considerations.** It is crucial to avoid multiple disruptions to railways, landowners, and utilities during the ROW acquisition process. Such disruptions can significantly increase costs and cause delays in project delivery. When contractors are involved early in the highway construction process, potential modifications to the design can be suggested, such as eliminating certain walls or structures. These modifications can free up the budget for investment in other project areas, leading to more efficient resource allocation.



CHAPTER 2: THE DESIGN-BUILD PROCESS



Unlike in private industry, the use of design-build and other alternative delivery methods by highway contracting agencies is dictated by national and local policies and laws. Since the 1980s, the number of design-build highway projects has been increasing as regulations and initiatives have changed.

Design-build and construction manager/general contractor project delivery methods were identified as “proven yet underutilized innovations” in the first round of the Federal Highway Administration (FHWA) Every Day Counts (EDC) initiative in 2011–2012. Prior to this designation, many state departments of transportation (DOTs) had already been employing design-build and some were using construction manager/general contractor to successfully complete transportation projects and achieve the identified benefits of those methods. Since being included in the first EDC initiative, these alternatives to traditional design-bid-build project delivery have continued to see increased utilization in DOTs across the country. These DOTs have developed skill sets among employees, established methods for identifying projects that would most benefit from utilizing various project delivery methods, and compiled lessons learned.

In the highway sector, progressive design-build can be an attractive project delivery option for owners because it includes the advantages of the design-construction integration of design-build delivery without requiring early commitment to a price based on a very limited design. Progressive design-build is sometimes described as a combination of design-build and construction manager/general contractor. While design-build has been used in the highway sector to varying degrees for over 30 years, progressive design-build is relatively new and is currently only used in a few states, though more are exploring the option. That said, a few states still do not allow any type of design-build to be used on highway projects.

Highway sector design-build projects can be divided into four main phases: the pursuit phase, the post-award phase, the pre-construction phase, and the construction phase. These phases differ slightly from those in *The Design-Builder’s Guide to Design Management*. The two differences are that (1) the pursuit phase on highway projects replaces the proposal/pre-award phase and (2) the pre-construction phase is a combination of the early design and detailed design phases.

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Highway sector design-build projects can be divided into four main phases: the pursuit phase, the post-award phase, the pre-construction phase, and the construction phase.

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In each of these phases, the design integration manager's tasks vary somewhat from those outlined in *The Design-Builder's Guide to Design Management*. Chapters 5 through 8 describe the typical tasks of a design integration manager in each phase of the project. While most of these tasks are described in detail in *The Design-Builder's Guide to Design Management*, additional tasks specific to highway projects are highlighted and described in more detail in this playbook. While this playbook primarily focuses on highways, it is worth mentioning that the concept, roles, and responsibilities of the design integration manager are strongly similar across both the highway and rail sectors.

CHAPTER 3: ROLE OF THE DESIGN INTEGRATION MANAGER



The design integration manager is crucial in coordinating and integrating the design process within the overall project and is a vital link between the owner, the builder, and the design team. While the design integration manager does not assume the role of designer or builder, the design integration manager ensures efficient collaboration and integration of the design process. The design integration manager bridges the gap between design and execution by utilizing skills in civil engineering or construction engineering and management and a broad range of knowledge to synthesize the needs of various disciplines. The design integration manager contributes to managing project timelines, mitigating conflicts, and ensuring compliance with industry standards and regulations. This role is crucial in delivering high-quality design outcomes while optimizing project resources and timelines.

Organizational Structures of Highway Sector Projects

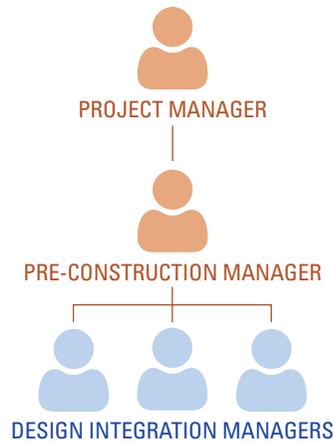
The organizational structure of a highway project plays a vital role in successful project management. To effectively implement the guidance provided in the *Highway Sector Playbook*, it is essential to understand the different organizational structures that highway projects may use. Several organizational charts are presented in this chapter to illustrate how the design integration manager fits into the different hierarchies found in highway design-build projects. Project hierarchies may change depending on the size or complexity of the project, but the role of the design integration manager remains the same.

In one type of hierarchical structure, the project manager holds the top-level position. Reporting to the project manager is the pre-construction manager, who is responsible for coordinating pre-construction activities. Below the pre-construction manager, multiple design integration managers may exist depending on the project's size. In this hierarchical structure, the pre-construction manager oversees the coordination of the design integration managers. Each design integration manager works closely with the pre-construction manager to assist in scheduling, phasing plans, milestone estimates, and other crucial aspects of the project, acting as the glue that connects pre-construction, design, and construction services and ensuring effective communication between the pre-construction manager and the design teams.

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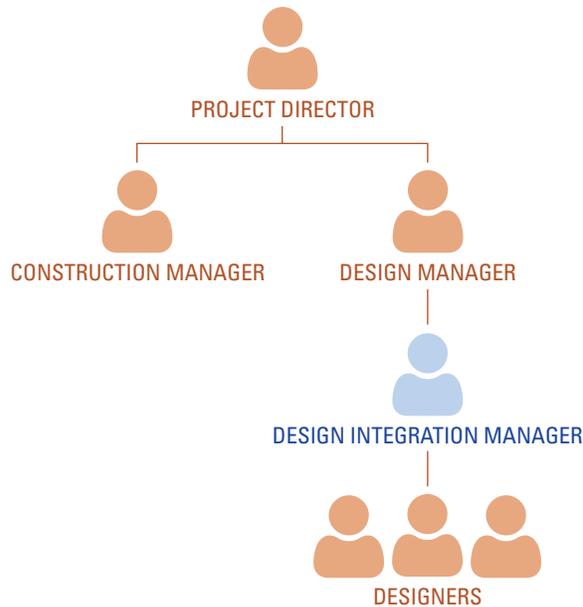
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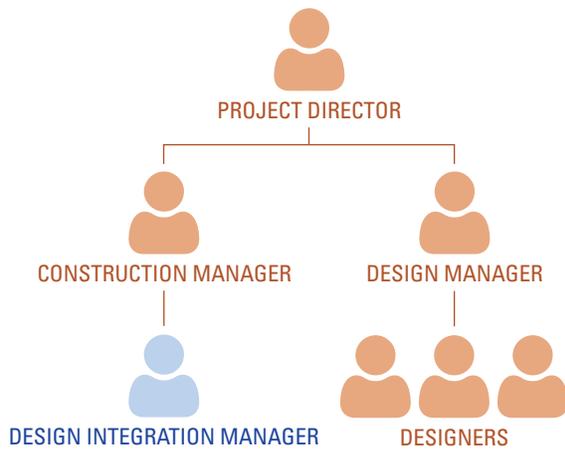


Organizational structure featuring a project manager, a pre-construction manager, and multiple design integration managers

A second type of hierarchical structure features a project director who oversees the overall project. Below the project director are the construction manager and the design manager, both of whom report to the project director. Below the design manager is the design integration manager. In some organizations, the design integration manager reports directly to the design manager. In other organizations, the design integration manager reports to the construction manager. Regardless of reporting structure, the design integration manager plays a crucial role in managing the designers and ensuring seamless integration of design activities.

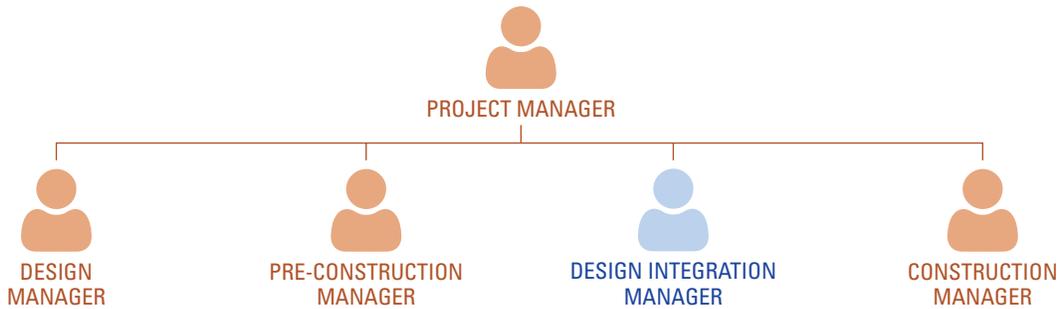


Organizational structure featuring a project director, a construction manager, a design manager, and a design integration manager under the design manager



Organizational structure featuring a project director, a construction manager, a design manager, and a design integration manager under the construction manager

A third type of hierarchical structure emphasizes a collaborative approach. The project manager assumes the top-level position and is supported by a multidisciplinary team that includes the design manager, pre-construction manager, design integration manager, and construction manager, all positioned at the same level. Each manager reports directly to the project manager, fostering efficient communication and coordination.



Organizational structure featuring a project manager, design manager, pre-construction manager, design integration manager, and construction manager

These organizational charts highlight different approaches to structuring teams within a given highway project. The choice of organizational structure depends on various factors, including the project's size, complexity, organizational strategy, and specific requirements. By using a carefully designed organizational chart, a highway project can benefit from clear reporting lines, effective collaboration, and streamlined decision-making processes, all of which ultimately contribute to project success.

As the project progresses from the pursuit phase to the construction phase, the design integration manager takes on various roles and may be referred to by different unofficial titles. These titles include pre-construction coordinator, design phase manager, lead design coordinator, design-build coordinator, or design lead manager. Regardless of the title, the design integration manager consistently coordinates and integrates the design process, fostering collaboration between pre-construction services, design services, and construction teams.

Roles and Responsibilities of the Design Integration Manager in the Highway Sector

In addition to the responsibilities discussed in *The Design-Builder's Guide to Design Management*, the design integration manager also takes on several **specific key roles and responsibilities** within highway sector projects, as described in the following sections.

Communication

The design integration manager is crucial as the point of contact between design and construction services in the highway sector. Since it is important for the owner to work closely with the contractor and for the design and construction teams to understand the organizational dynamics, the design integration manager must act as a bridge, facilitating effective communication and collaboration among various entities such as designers, the owner, and contractors. The design integration manager navigates between these different levels within the organizational hierarchy and ensures smooth information flow throughout the project. For instance, collaboration with the project manager and coordination with the construction manager and various construction coordinators (such as roadway or retaining wall coordinators) are essential for the design integration manager. The project manager oversees the entire project, while the design integration manager focuses on managing the design process.

Furthermore, the design integration manager needs to have a comprehensive understanding of the complex components of the project and to see the overall picture as changes occur. Effective communication and collaboration between the design integration manager and various parties are vital because the project's components may overlap. If disputes or conflicts arise among participants, the design integration manager is responsible for overseeing the completion of an issue resolution report (IRR) to address and resolve the issues.

Managing and Controlling

The design integration manager typically focuses on one project at a time. This dedicated focus enables the design integration manager to provide the necessary attention, coordination, and oversight throughout the project life cycle and to play a vital role in managing and controlling the design process in highway projects.

A task force group of relevant parties, for example partners, senior project leaders, and discipline-specific leaders, holds meetings early in the project to ensure that all participants are aligned and working towards the project's objectives. These task force meetings also serve as platforms for feedback and the exchange of innovative ideas to save time and money. Designers typically lead these meetings, while the builders or contractors provide input on means and methods, present constructability reviews, and collaborate with pre-construction coordinators who conduct quantity takeoffs at specific milestones. The design integration manager, along with the discipline-specific leaders and the design manager, verify that all performance specifications and technical requirements set by the owner (e.g., department of transportation [DOT]) are met without going beyond what is necessary.

Value Engineering and Innovation

The design integration manager contributes to value engineering (VE) and innovation efforts within the design team, providing ideas and suggestions to enhance the design process and promoting innovative approaches while maintaining stakeholder collaboration. Alternative technical concepts (ATCs) (which are normally discussed during the pursuit phase) and VE principles (which are discussed during the pre-construction and construction phases) are employed to optimize solutions, reduce costs, mitigate or minimize risks, and expedite project timelines.

Risk Management

As part of risk analysis, the design integration manager collaborates with designers to perform technical risk assessments (TRAs) in order to identify and manage project risks and assess project reliability. By closely evaluating potential risks, assessing reliability, and implementing mitigation strategies, the design integration manager helps ensure project success.

Quality Management

During the design integration process, the design integration manager is responsible for implementing quality standards and quality control through the development of a design quality management plan (DQMP). This plan, which is officially submitted to the owner, is crucial for ensuring that high quality standards are upheld throughout the design phase. Through regular meetings, the design integration manager actively engages in quality management by obtaining feedback on constructability, cost, schedule phasing, and the overall impact of design decisions on quality. The design integration manager also plays a role in quality design reviews as an additional over-the-shoulder reviewer to ensure that the project meets the required standards.

Decision-Making

The design integration manager is involved in over-the-shoulder reviews, making prompt decisions while adhering to the performance specifications set by the owner (e.g., DOT). The design integration manager also oversees the progression of the design and makes critical decisions that align with the project's goals. The co-location of the owner (e.g., DOT) with the design team and the various disciplines involved in the project enhances communication and facilitates efficient decision-making processes.

Monitoring and Reviewing

The design integration manager conducts periodic performance audits to ensure that the design meets the required standards and is responsible for closely monitoring the progress of revisions and changes made to the design as part of the design services during construction (DSDC) and engineering services during construction (ESDC). In this role, the design integration manager helps manage the design and construction process, addresses any issues that arise, handles submittals related to the DSDC and ESDC, and assesses the constructability of the design.

Establishing consistent processes and procedures is crucial for executing design-build projects effectively, regardless of their size. As a result, the design integration manager tracks costs for non-conformance reports (NCRs) and ensures that the design remains within budget. Utilizing the earned value system, the design integration manager tracks the project schedule and reviews shop drawings created as part of the ESDC. The design integration manager also actively participates in reviewing requests for information (RFIs) to ensure that all queries are properly addressed.

What the Design Integration Manager Needs to Be Successful

The Design-Builder's Guide to Design Management provides a list of competencies that the design integration manager needs to be successful. In addition to the knowledge, skills, abilities, and other characteristics outlined in the guide, the design integration manager working in the highway sector requires a supplementary set of competencies to ensure that the design integration manager is qualified to engage in all stages of the project, from the pursuit phase to the construction phase. Knowledge, skills, abilities, and other characteristics unique to the highway sector are indicated by a road icon.

Key Recommended Knowledge in the Highway Sector

Construction means and methods	
Sources of risk and risk management practices	
	Right-of-way (ROW), utility, and environmental processes
	Understanding of the agency and its standard specifications
	Discipline-specific experience
	Discipline-specific knowledge
	Background in civil engineering or construction engineering management
	Professional engineering license

On highway projects, possessing the right knowledge can make all the difference. Of the recommended knowledge documented in *The Design-Builder's Guide to Design Management*, the following is key in the highway sector:

- **Construction means and methods.** A deep understanding of construction techniques and methods is essential in the highway sector, where complicated roadwork is common. This knowledge empowers the design integration manager to effectively facilitate the transition from design to construction. For instance, insights into asphalt overlay techniques or the nuances of bridge construction can significantly impact project success.
- **Sources of risk and risk management practices.** Recognizing potential risks and mastering the practices of risk management is especially crucial on highway projects, which often involve complex variables. For instance, understanding the risks that geological factors might pose for a project is vital. Risk-related knowledge is particularly significant for effectively mitigating and transferring risks, such as when managing geological risks through insurance or contractual arrangements.

In addition to the key recommended knowledge highlighted above, the following supplementary knowledge is required to ensure that the design integration manager is qualified and successful in the highway sector:

- **Right-of-way (ROW), utility, and environmental processes.** Understanding the complicated processes of securing right-of-way, managing utilities, and addressing environmental concerns is essential for success in highway projects. This includes knowing how to navigate the complexities of land acquisition, utility relocation, and environmental impact assessments, which are frequent challenges in the highway sector.

- **Understanding of the agency and its standard specifications.** Knowing the unique practices and key individuals within the agency that owns the project is critical for building productive relationships, as each agency may have distinct approaches to project management. In the highway sector, this could involve understanding state-specific regulations for road design, safety, or environmental compliance, which can vary significantly from one area to another.
- **Discipline-specific experience.** The design integration manager should ideally possess relevant experience in the highway sector. This experience will help the design integration manager understand the complexities and challenges specific to highway projects, such as managing extensive road networks, dealing with highway-specific materials like asphalt and concrete, and navigating regulatory requirements unique to highway construction. This experience is invaluable for effective decision-making and problem-solving in highway design and construction projects.
- **Discipline-specific knowledge.** The design integration manager should have discipline-specific knowledge that centers on specific technical areas such as drainage, geotechnical engineering, or other relevant fields. The primary purpose of this knowledge is to empower the design integration manager to effectively address intricate technical requirements unique to the highway sector, navigate and resolve specialized challenges that may arise during the design and construction phases, and ultimately contribute to the successful execution of highway projects.
- **Background in civil engineering or construction engineering management.** A background in civil engineering or construction engineering management is highly desirable for the design integration manager. This educational foundation equips the design integration manager with a broad and comprehensive understanding of engineering principles and project management techniques specific to the highway sector. Unlike discipline-specific knowledge, which focuses on specific technical areas, this background encompasses a wide range of aspects within the highway sector that enable the design integration manager to oversee various facets of highway projects, from technical disciplines to project management and overall project coordination. Together, these two sets of recommended knowledge provide a well-rounded and effective skill set for the design integration manager in the highway sector.
- **Professional engineering license.** The design integration manager should be licensed as a professional engineer (PE) or be able to obtain a PE license. While a contractor may not require that the design integration manager be licensed, a PE license demonstrates technical competency and the ability to oversee the engineering aspects of the project.

Key Recommended Skills in the Highway Sector

Conveying a message in written form



Solving design, construction, and system-wide problems



Integrating design and construction



Conducting constructability reviews



Coordinating design and construction services



Using design and management tools



Estimating costs

On highway projects, possessing the right skills can make all the difference. Of the recommended skills documented in *The Design-Builder's Guide to Design Management*, the following is key in the highway sector:

- **Conveying a message in written form.** The design integration manager in the highway sector needs exceptional written communication skills, which, in the highway sector, are particularly vital when writing proposals for government contracts and permits. Clear, persuasive communication is essential when dealing with regulatory bodies and stakeholders in highway projects.

In addition to the key recommended skill highlighted above, the following supplementary skills are required to ensure that the design integration manager is qualified and successful in the highway sector:

- **Solving design, construction, and system-wide problems.** The design integration manager should be proficient in problem-solving, especially within the context of construction and system-wide challenges. This skill includes resolving issues related to traffic flow, infrastructure complexities, and unforeseen conditions.
- **Integrating design and construction.** The ability of the design integration manager to bridge the gap between design and construction, solving problems across both services, is a valuable skill in the highway sector. This skill includes ensuring that the design aligns seamlessly with the construction requirements, materials, and methodologies specific to highway projects.
- **Conducting constructability reviews.** The design integration manager needs to be proficient in conducting constructability reviews, which are vital in the highway sector. This skill ensures that the design is practical and cost-effective in light of factors unique to highway construction, such as traffic management and safety.
- **Coordinating design and construction services.** The design integration manager works with the pre-construction manager and his or her team to coordinate pre-construction services, design services, and construction teams. Therefore, the design integration manager must possess excellent communication and collaboration skills to ensure seamless integration and effective information flow among project stakeholders and partners.
- **Using design and management tools.** The design integration manager needs to have a working knowledge of the modeling software commonly used in the highway sector, such as MicroStation, Open Roads, HEC RAS, AutoCAD, and similar tools. These tools are essential for developing precise highway plans and ensuring compliance with industry standards.
- **Estimating costs.** The design integration manager should possess cost estimation skills tailored to the highway sector. These skills should be sufficient for the design integration manager to compare pricing for various design alternatives during the conceptual stage of a project and evaluate cost estimates for road construction, materials, labor, and other factors specific to highway projects. Effective cost estimation contributes to cost-effective project planning and execution.

Key Recommended Abilities and Other Characteristics in the Highway Sector



Competent



Experienced in several areas

In addition to the key recommended abilities and other characteristics documented in *The Design-Builder's Guide to Design Management*, the following supplementary characteristics are required to ensure that the design integration manager is qualified and successful in the highway sector:

- **Competent.** Competence, as a comprehensive characteristic encompassing a broad range of skills and knowledge, plays a significant role in the design integration manager's effectiveness in the highway sector. This characteristic allows the design integration manager to navigate complex highway regulations, safety standards, and environmental considerations while managing the integration of design and construction.
- **Experienced in several areas.** A design integration manager with diverse experience across various aspects of the highway sector brings invaluable knowledge and adaptability to the role. Especially valuable is experience in areas such as highway design, traffic management, environmental impact assessments, and project management. Such multifaceted experience allows the design integration manager to effectively address the multidimensional challenges specific to highway projects.



CHAPTER 4: PURSUIT PHASE



Description of Phase

The pursuit phase in the highway sector replaces the proposal/pre-award phase from *The Design-Builder's Guide to Design Management*. This phase begins when the owner initiates the procurement process through the project procurement documents and concludes with the finalization of the contract between the owner and the selected design-builder. The phase is characterized by heightened activity for both the owner and design-builder.

The owner is responsible for developing the procurement documents (e.g., project announcement, request for qualifications [RFQ], request for proposal [RFP]) and overseeing the distribution and management of these documents. The owner can streamline the selection process by adding a qualifications stage via an RFQ to narrow down the field of qualified design-builders before issuing the RFP.

For the design-builder, the design integration manager is pivotal in coordinating and supervising a diverse team of designers, contractors, specialty consultants, vendors, and material suppliers. This group collaboratively generates a comprehensive proposal that aligns with the owner's requirements. Early in this phase, the design integration manager works with the design manager to develop task force groups, which may be established around discipline-specific topics, to ensure that all participants are aligned with the project objectives and to facilitate open communication, feedback, and collaboration. The meetings of these task force groups serve as platforms to explore innovative ideas and discuss potential alternative technical concepts (ATCs) that offer solutions equal to or surpassing the requirements outlined in the RFP.

The Role of the Design Integration Manager

The activities of the design integration manager can begin before the release of the procurement documents. The design integration manager is involved in forming the project team early by identifying partners, including but not limited to design suppliers, vendors, and subcontractors. Preliminary work can be conducted with the owner (e.g., department of transportation [DOT]) and partners to better understand the project through tasks such as site investigations and group discussions. Additional tasks the design integration manager can perform before the key tasks in the pursuit phase begin include negotiating early teaming agreements among partners and ensuring that the level of design requirements in the agreements are communicated so that estimates can be produced. The teaming agreements negotiated in this phase are official once the contract is awarded to the design-build team.

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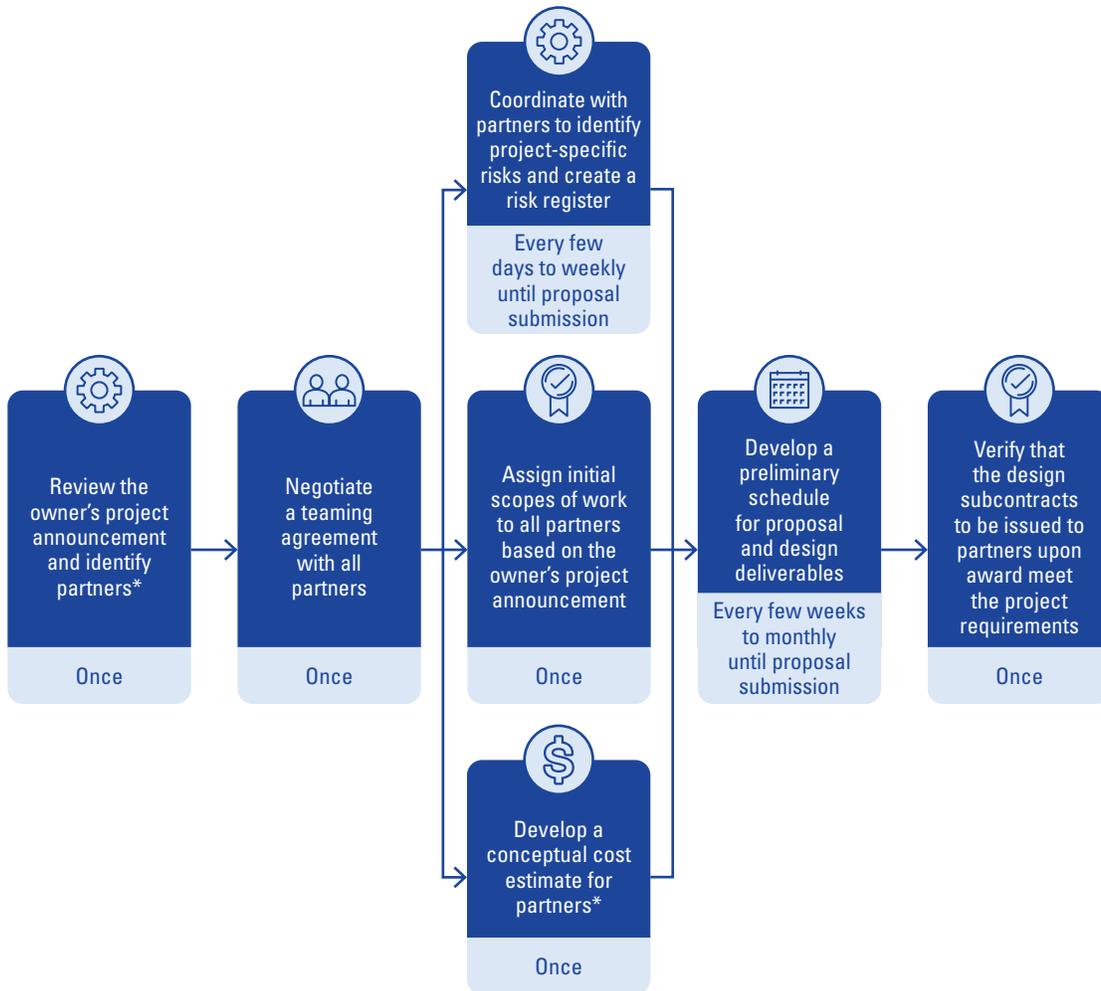
The design integration manager is pivotal in coordinating and supervising a diverse team of designers, contractors, specialty consultants, vendors, and material suppliers.

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Additionally, the design integration manager identifies and assesses potential risks through a risk register and evaluates the design's reliability in terms of the potential for scope growth or reduction. Both risk and the reliability of the design may impact the design-builder's ability to meet the project's requirements. Assessing risk includes brainstorming potential scenarios that could cause delays, cost overruns, quality issues, or performance shortcomings. While the design-builder can assume some or all the risks related to geotechnical concerns, utility relocations, and permitting, the design integration manager ensures that risks are properly addressed, allocated, and communicated among the partners.

The design integration manager also focuses on developing a preliminary schedule for proposal deliverables and reviews and negotiating the cost estimate. A milestone schedule of design deliverables should be prepared to track progress, and the design integration manager monitors whether the design-build team is meeting the anticipated milestone dates. Developing a schedule of deliverables before the other tasks of the pursuit phase begin can enhance project success.

During the pursuit phase, multiple task force groups are initiated, each focusing on a specific work scope mentioned in the project's procurement documents. The design integration manager is responsible for facilitating communication and collaboration among these groups. Throughout the pursuit phase, the design integration manager spends the majority of the time interfacing between the design and cost estimating teams.




 Review the greensheet estimate and coordinate between the designers and estimators
 Daily throughout the pursuit phase


 Identify innovative ideas and potential alternative technical concepts
 Daily throughout the pursuit phase

** Phrasing has been modified slightly from [The Design-Builder's Guide to Design Management](#) to reflect the unique characteristics of the highway sector*

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

Additional Task: Review the Greensheet Estimate and Coordinate between the Designers and Estimators

Daily throughout the pursuit phase

A key task for the design integration manager that is specific to highway sector projects is to develop the greensheet estimate and ensure coordination between the designers and estimators while logging associated costs and savings.

Knowledge	Skills	Abilities	Other Characteristics
<ul style="list-style-type: none"> • Document management procedures • The design process and stages of design • Local market conditions (e.g., competition, labor availability, quality of trade partners) • Construction work sequencing • Construction means and methods • Discipline-specific experience • Discipline-specific knowledge 	<ul style="list-style-type: none"> • 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 • Reading and understanding design drawings • Forecasting cost and schedule impacts • Prioritizing work • Determining client and stakeholder expectations • Integrating design and construction • Coordinating design and construction services • Estimating costs 	<ul style="list-style-type: none"> • Establishing and maintaining relationships • Collaborating with partners • Focusing on and remembering details • Collecting, analyzing, and interpreting information 	<ul style="list-style-type: none"> • Focused • Trustworthy • Adaptable • Accountable • Respectful • Competent

The design integration manager plays a crucial role in the coordination between the designers and cost estimators, interfacing between the design manager and the chief estimator and allocating time in the project schedule for the specific responsibilities of each team. Allocating a sufficient amount of time for key tasks is crucial for developing a workable project timeline, and therefore the design integration manager should carefully split the time needed for developing the design and the estimate. Typically, time is evenly divided among the design and estimating teams to perform their responsibilities, but the specific division can depend on the project's needs. The greensheet estimate is reviewed early in the pursuit phase and will be reviewed continuously throughout the project. This estimate is used to validate the engineer's estimate, serves as a basis for driving meeting agendas, and strategizes ways to approach ATCs, focus task force groups, minimize scope, and devise means and methods that align with the project's technical provisions.

The design integration manager initially conducts a high-level quantity takeoff, identifying the primary scope of work and the quantities required, verifying the unit prices, and ensuring that the price obtained matches the owner's price estimate. Throughout the project, the design integration manager coordinates with the design and estimating teams to ensure that both teams are in alignment regarding design clarifications and any potential design changes. This task of transferring information between both teams is an iterative process that will occur throughout the project. To this end, the design integration manager needs to understand the design and be ready to obtain information from the designers and estimators.

Additional Task: Identify Innovative Ideas and Potential Alternative Technical Concepts

Daily throughout the pursuit phase

A key task for the design integration manager that is specific to highway sector projects is to identify innovative ideas and potential ATCs.

Knowledge	Skills	Abilities	Other Characteristics
<ul style="list-style-type: none"> • Document management procedures • Construction work sequencing • Construction means and methods • Understanding of the agency and its standard specifications 	<ul style="list-style-type: none"> • 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 • Reading and understanding design drawings • Determining client and stakeholder expectations • Solving design, construction, and system-wide problems • Integrating design and construction • Coordinating design and construction services • Using design and management tools 	<ul style="list-style-type: none"> • Collaborating with partners • Devising innovative solutions • Focusing on and remembering details • Collecting, analyzing, and interpreting information 	<ul style="list-style-type: none"> • Focused • Trustworthy • Adaptable • Decisive • Experienced in several areas

The design integration manager encourages team members to propose innovative ideas in the form of ATCs. In the highway sector, recognizing ATCs is highly encouraged because they provide cost-effective solutions that align with the proposal's requirements. ATCs need to be submitted during the pursuit phase, and in the post-award phase the selected design-builder may initiate changes to the procurement documents based on these approved concepts.

It is recommended that the design-builder review the owner's track record regarding ATC approval and discuss with the team whether to pursue each idea in this context. ATCs can be developed for various aspects of the project, including but not limited to maintenance of traffic, roadway alignment, pavement design, bridge superstructure type, interchange reconfiguration, and construction phasing. It is vital when proposing an ATC that a high level of confidentiality be maintained to protect ideas and ensure a level playing field with competitors.



CHAPTER 5: POST-AWARD PHASE



Description of Phase

The post-award phase commences when the design-build team negotiates and executes a contract agreement with the owner and concludes upon the issuance of contracts to all partners. The post-award phase is a short phase that can last a few weeks to a month depending on the project. The tasks of the design integration manager during the post-award phase align with those in *The Design-Builder's Guide to Design Management*.

The Role of the Design Integration Manager

During the post-award phase, the design integration manager issues the contract agreements among the partners. The design integration manager then oversees the initial design development within the task force groups to ensure compliance with the project's requirements and specifications. Working closely with the task force groups and the owner, the design integration manager facilitates the alignment of the initial basis of the design proposed by the design-build team with the owner's requirements. Drawing upon the project information provided in the procurement documents and the proposal, the design integration manager coordinates efforts to develop a comprehensive plan for project advancement.

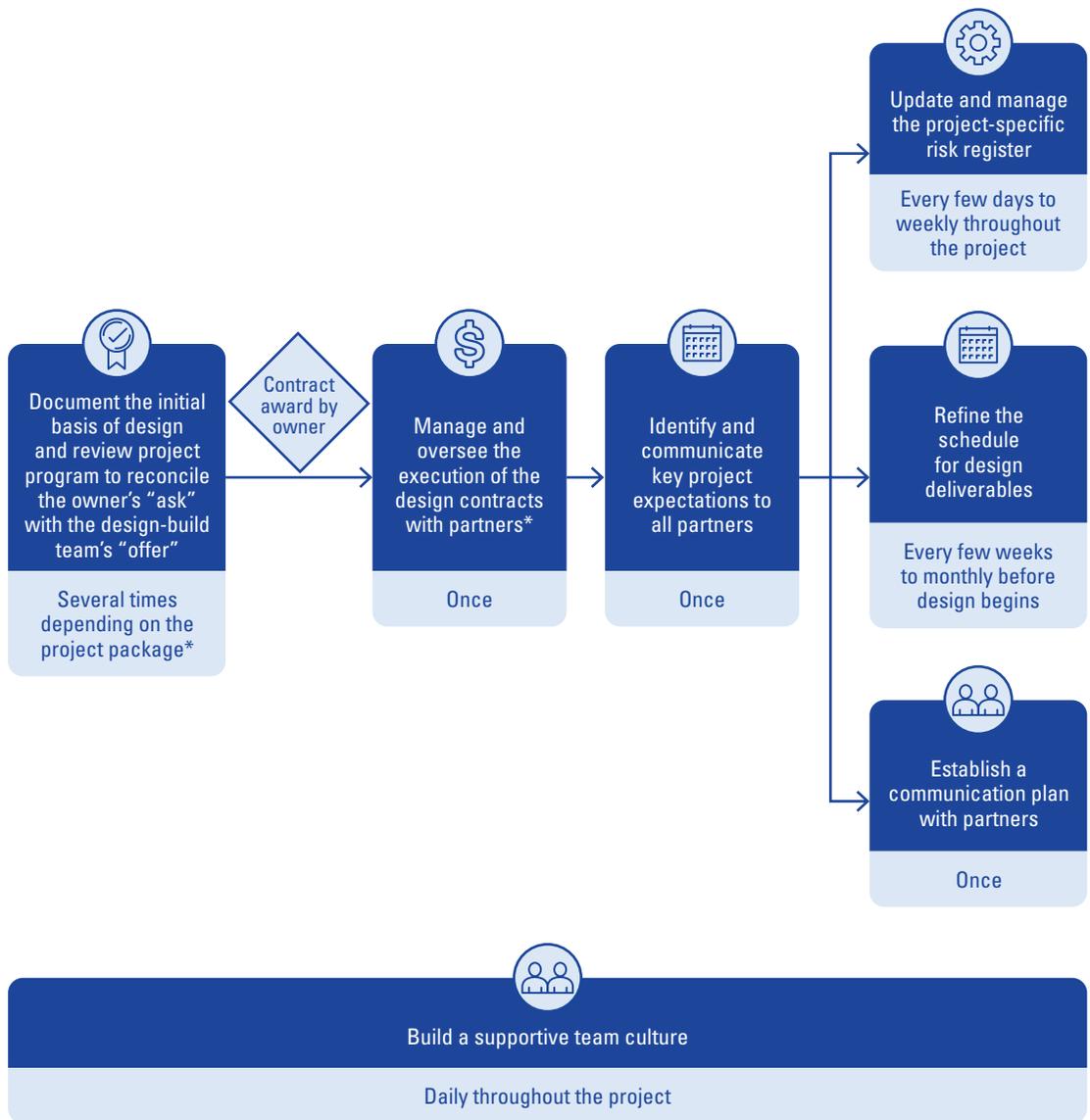
The design integration manager continues to analyze and refine the risk register established during the pursuit phase. This task involves expanding the scope of the initial design deliverables prepared during the proposal phase by incorporating additional relevant subtasks and updating any information received from the owner or task force groups. Additionally, the design integration manager continues to identify potential value engineering opportunities. Care should be taken to explore value engineering opportunities because they may be identified and advanced at any point during the project if they are found to be beneficial to the project's goals.

Throughout the post-award phase, the design integration manager is also responsible for establishing a comprehensive communication plan among the task force groups. Task force meetings are encouraged to ensure ongoing communication between the owner and the design-builder throughout the project's design and construction phases. These meetings advance project reviews, incorporate innovative solutions to potential design issues, and ensure that the project is on track. Regularly scheduled design task force meetings, typically held once a week, play a central role in monitoring the project's progress. These meetings go beyond design updates to encompass plan submittal reviews that determine the design's trajectory. Proper management of the task force groups leads to efficient project progress and effective design approval procedures. Co-location further enhances active collaboration within the process.

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Drawing upon the project information provided in the procurement documents and the proposal, the design integration manager coordinates efforts to develop a comprehensive plan for project advancement.

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** Phrasing has been modified slightly from [The Design-Builder's Guide to Design Management](#) to reflect the unique characteristics of the highway sector*

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

CHAPTER 6: PRE-CONSTRUCTION PHASE



Description of Phase

The pre-construction phase in the highway sector encompasses the early design and detailed design phases from *The Design-Builder's Guide to Design Management*. During this phase, the design-build team collaborates closely with the owner to formulate a design concept and develop a preliminary design that aligns with the project's requirements and specifications. Later in this phase, as construction documents are prepared, the construction team starts to play a more active role in conjunction with the design team. The tasks of the design integration manager during the pre-construction phase align with those in *The Design-Builder's Guide to Design Management* apart from two additional tasks: monitoring construction quantity and scope growth and conducting constructability reviews.

The Role of the Design Integration Manager

During the pre-construction phase, the design integration manager works with the design manager to help monitor costs and prevent scope creep as designs are being developed. If there are any discrepancies between the cost estimates based on the design and the estimated budget for the contract, the design integration manager collaborates with the design manager to resolve any issues. The design integration manager also ensures that the alternative technical concepts (ATCs) that were developed during the pursuit phase are addressed and identifies any potential opportunities for value engineering.

This phase also involves close collaboration between the lead design team and the design integration manager to ensure that the design aligns with the project's requirements and complies with applicable codes. In this regard, the design integration manager is looking to optimize the design while meeting the project requirements. The design integration manager also acts as the main point of coordination and interaction, particularly during the distribution of the release for construction (RFC) documents, addressing questions and facilitating design changes as needed and logging associated costs and savings; this process is also known as an up-down analysis. In this phase, the final basis of design is approved by the owner and documented. Note that there may be multiple bases of design for the owner to approve depending on how the project is packaged.

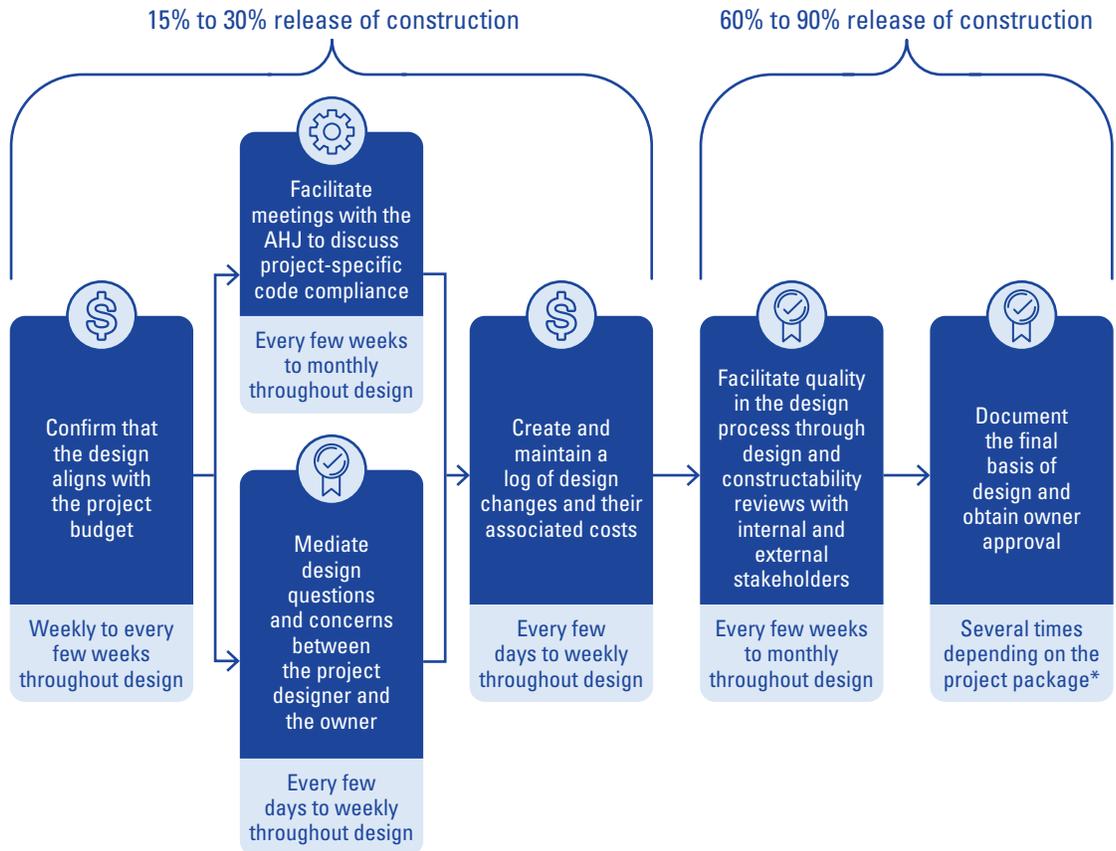
Additionally, the design integration manager assists the design-build team in developing phasing operations and a maintenance of traffic (MOT) plan for the project. Managing the MOT includes planning the phasing, which requires meticulous coordination of traffic flow to ensure safety and minimize congestion.

The design integration manager facilitates various design, constructability, and third-party coordination reviews to ensure quality as the design progresses. It is also important to maintain quality in the design through thorough quality assurance checks before finalizing any design element. These reviews can help focus the team on constructability and interdisciplinary coordination in order to minimize conflicts, errors, and potential issues that may arise during construction.

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During this phase, the design-build team collaborates closely with the owner to formulate a design concept and develop a preliminary design that aligns with the project's requirements and specifications.

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Monitor construction quantities and scope growth
Every few weeks to monthly throughout design
- 

Perform a constructability review
Every few weeks throughout the project
- 

Set goals for meetings, then plan and organize effective meetings
Every few days to weekly throughout design
- 

Oversee the progress of the design schedule
Weekly to every few weeks throughout design
- 

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

* Phrasing has been modified slightly from [The Design-Builder's Guide to Design Management](#) to reflect the unique characteristics of the highway sector

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

Additional Task: Monitor Construction Quantities and Scope Growth

Every few weeks to monthly throughout design

A key task for the design integration manager that is specific to highway sector projects is to consistently monitor construction quantities and scope growth.

Knowledge	Skills	Abilities	Other Characteristics
<ul style="list-style-type: none"> • Document management procedures • The change order process • Sources of risk and risk management practices • Discipline-specific knowledge • Discipline-specific experience 	<ul style="list-style-type: none"> • Organizing information and record keeping • Forecasting cost and schedule impacts • Using design and management tools 	<ul style="list-style-type: none"> • Focusing on and remembering details 	<ul style="list-style-type: none"> • Accountable • Trustworthy

The design integration manager works closely with the construction manager and other team members to ensure that the project's scope aligns with the confirmed scope agreed upon with the owner. The design integration manager consults with the design team if any deviations or issues in meeting the scope become evident.

Additional Task: Perform a Constructability Review

Every few weeks throughout the project

A key task for the design integration manager that is specific to highway sector projects is to conduct constructability reviews.

Knowledge	Skills	Abilities	Other Characteristics
<ul style="list-style-type: none"> • The design process and stages of design • Construction means and methods • Document management procedures • Contractual terms and conditions • Construction work sequencing • Discipline-specific experience • Discipline-specific knowledge • Professional engineering license 	<ul style="list-style-type: none"> • Listening • Negotiating with partners and stakeholders • Resolving conflict among people on the project team • Compromising and finding equitable solutions • Integrating design and construction • Coordinating design and construction services • Using design and management tools • Conducting constructability reviews 	<ul style="list-style-type: none"> • Collaborating with partners • Speaking comfortably in a group situation 	<ul style="list-style-type: none"> • Adaptable • Self-motivated • Accountable • Creative • Respectful • Competent • Experienced in several areas

Constructability reviews are conducted at project milestones as part of a continuous pre-construction process. A constructability review involves assessing the design for construction realities and should involve key stakeholders such as the construction manager, design manager, and design integration manager. The primary objective of a constructability review is to ensure efficient and effective construction by aligning the design with construction requirements. The review also evaluates the design's alignment with the scope of work, means, and methods described in work plans and identifies potential conflicts.



CHAPTER 7: CONSTRUCTION PHASE



Description of Phase

The construction phase includes obtaining the necessary approvals and permits not obtained in previous phases, procuring materials and equipment, and executing the construction work. The design-build team must collaborate closely with the owner and other stakeholders to ensure that the project is constructed according to the specified requirements and to everyone's satisfaction. Construction can commence as soon as the release for construction (RFC) documents are prepared during the pre-construction phase. For example, construction can begin as early as when 30% of the design is complete if permits require extended lead times, or it can begin when the design is nearer completion; each project will differ in this regard. The tasks of the design integration manager during the construction phase align with those in *The Design-Builder's Guide to Design Management*.

The Role of the Design Integration Manager

The design integration manager continues to have a role during the construction phase by acting as a bridge between the design team and the construction team to maintain alignment and keep the project on schedule. The design integration manager also acknowledges and documents key decisions related to design throughout the construction process. These decisions may be prompted by field conflict resolutions, inspection requests, or innovative ideas that were previously discussed. The design integration manager should continue contributing to value engineering and innovation efforts to optimize solutions, reduce costs, and expedite the project schedule.

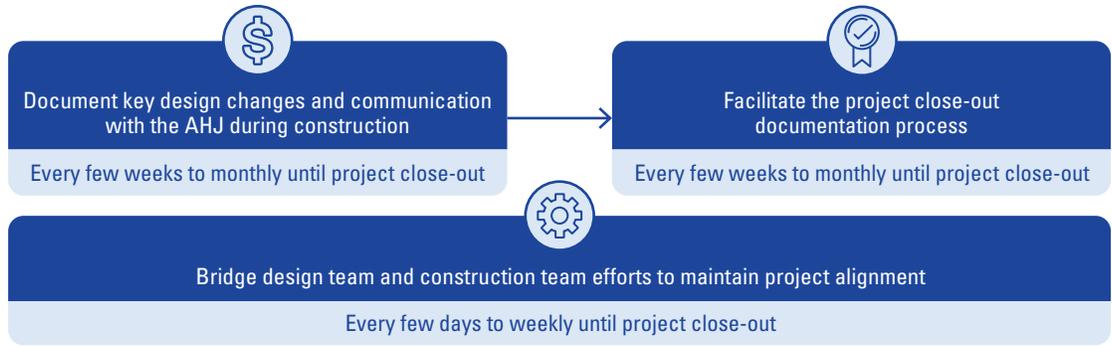
In acting as a bridge between the design and construction teams, the design integration manager handles requests for information (RFIs). If an issue is encountered during construction, the RFI is the first step in translating the issue into a notice of design change (NDC) or field design change (FDC), depending on the issue. The design integration manager negotiates with the design manager to determine who should bear responsibility for the communication and cost associated with an FDC.

Lastly, the design integration manager ensures effective coordination between the design and construction teams during the closeout documentation process, including the preparation and turnover of punch lists, record drawings, warranties, operations and maintenance information, and any commissioning requirements.

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The design integration manager continues to have a role during the construction phase by acting as a bridge between the design team and the construction team to maintain alignment and keep the project on schedule.

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

GLOSSARY



A

Agreement

The executed portion of the contract between the owner (e.g., department of transportation [DOT]) and the successful design-build team.

Alternative technical concept (ATC)

Any innovative deviation from the base technical concept that may result in either improved best value or a shorter project duration while preserving or increasing the quality or functionality of the project. ATCs are often used to reduce costs.

D

Design services during construction (DSDC)

The design services required during the construction phase. Services may include, but are not limited to, construction engineering services, consultation in the field, advice, visits to the work site, and review and approval of all shop plans and construction drawings received from the builder.

E

Engineering services during construction (ESDC)

The engineering services required during the construction phase, with the prior approval of the owner (e.g., DOT). Services may include providing an overview of the design intent or interpreting the plans and specifications.

F

Field design change (FDC)

A change typically initiated in the field to improve constructability, address differing field conditions, increase cost-effectiveness, or address errors or ambiguities in the plans.

I

Issue resolution report (IRR)

A written report prepared by participants involved in an issue to describe a resolution to the problem. The term used for this type of report may vary from project to project and from owner to owner.

N

Notice of design change (NDC)

Document recording a design change initiated by a designer to maintain the design's quality, correct errors, or implement an owner-directed change.

R

Release for construction (RFC)

Documentation that is prepared by the design-build team, is in compliance with the executed contract, and is used by the design-build team to begin construction on a project. Any FDC or NDC made by the design-build team after the owner issues a designated date of acceptance of the RFC documents shall be reviewed by the owner.

Right-of-way (ROW)

The total land area acquired for the construction of a roadway.

Risk register

A tool that documents the following items: the risks identified by the design-build team, the assessment of the root causes of each risk, the affected elements in the project, an analysis of the likelihood of each risk, the type of impact of each risk, the criteria used to assess the risks, and the overall risk rating for the project.

T

Task force group

A group organized around a specific discipline (e.g., utilities, civil engineering, structural engineering) or topic (e.g., safety, permits, quality control/quality assurance) that meets regularly during design development to ensure that all participants are aligned with the project objectives and to facilitate open communication, feedback, and collaboration. The group may include either the owner and the design-builder or the designer and the design-builder.

Technical proposal

A document encompassing the design-builder's response to an RFP. The document contains a detailed description and methodology of the design builder's approach to the project and provides an in-depth response to the design, construction, management, cost, and schedule requirements of the RFP.

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.

In highway design-build projects, the role of the design integration manager spans four distinct phases:



PURSUIT PHASE



POST-AWARD PHASE



PRE-CONSTRUCTION PHASE



CONSTRUCTION PHASE



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