GEORGIA DOT RESEARCH PROJECT 15-12

FINAL REPORT

Deploying SHRP2 Renewal 10 Guidebook for Project Management Strategies for Complex Projects in the Georgia Department of Transportation

OFFICE OF INNOVATIVE PROGRAM DELIVERY

&

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GDOT Research Project No. 15-12

Final Report

DEPLOYING SHRP2 RENEWAL 10 GUIDEBOOK FOR PROJECT MANAGEMENT STRATEGIES FOR COMPLEX PROJECTS IN THE GEORGIA DEPARTMENT OF TRANSPORTATION

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16. Abstract:

The Georgia Department of Transportation (GDOT) was selected by the Federal Highway Administration (FHWA) for the Strategic Highway Research Program 2 (SHRP2) Lead Adopter Incentive Implementation Assistance Grant to deploy the Renewal 10 (R10) Guidebook for Project Management Strategies for Complex Projects. The overarching objective of this research is to help Georgia Department of Transportation (GDOT) maximize its benefits form the successful utilization of the R10 product and enhance its current project delivery process and development plan for its complex projects. GDOT projects are increasingly becoming more complex. More than any time in the GDOT's history, the agency is relying on innovative project delivery systems, such as design-build (DB) and public-private partnership (P3), to deliver complex projects. In this research, several components of the R10 research product are rigorously evaluated considering the GDOT Office of Innovative Delivery to enhance its design-build manual. Complexity mapping, 5-dimensional project management methods, and several tools are incorporated into the design-build manual to facilitate managing complexity in GDOT design-build and P3 projects. This is an implementation research project and the final deliverable, the updated design-build manual, is developed in partnership with the Office of Innovative Delivery.

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EXECUTIVE SUMMARY

The Georgia Department of Transportation (GDOT) was selected by the Federal Highway Administration (FHWA) for the Strategic Highway Research Program 2 (SHRP2) Lead Adopter Incentive Implementation Assistance Grant to deploy the Renewal 10 (R10) Guidebook for Project Management Strategies for Complex Projects. The overarching objective of this research is to help Georgia Department of Transportation (GDOT) maximize its benefits form the successful utilization of the R10 product and enhance its current project delivery process and development plan for its complex projects. GDOT projects are increasingly becoming more complex. More than any time in the GDOT's history, the agency is relying on innovative project delivery systems, such as design-build (DB) and public-private partnership (P3), to deliver complex projects. In this research, several components of the R10 research product are rigorously evaluated considering the GDOT Office of Innovative Delivery to enhance its design-build manual. Complexity mapping, 5-dimensional project management methods, and several tools are incorporated into the design-build manual to facilitate managing complexity in GDOT design-build and P3 projects. This is an implementation research project and the final deliverable, the updated design-build manual, is developed in partnership with the Office of Innovative Delivery.

CHAPTER 1

INTRODUCTION

1.1. WHAT IS STRATEGIC HIGHWAY RESEARCH PROGRAM (SHRP)?

The Strategic Highway Research Program (SHRP) is a five-year, $150 million research program that focuses on some of the biggest, most expensive problems facing highway agencies in the United States and around the world (Damian 1991). The history of the SHRP program was described in Damian (1991) as the following:

> "The program was authorized by the U.S. Congress in the 1987 highway bill. It was first proposed in 1984 by the Strategic Transportation Research Study (STRS) — Highway Committee, which was administered by the Transportation Research Board. Chaired by Thomas B. Larson, who is currently the U.S. Federal Highway Administrator, the STRS committee examined the focus and structure of U.S. highway research programs."

At a time when the situation of deterioration of the U.S. transportation and public works systems was widespread and severe in the public spotlight, the SHRP was proposed to offer innovative technologies as a groundbreaking solution. The Strategic Transportation Research Study (STRS) committee proposed the SHRP as a highway research program that would concentrate on a short list of high-payoff research and development (R&D) items to deal with the deteriorating conditions of the nation's highways and to improve their performance, durability, safety, and

efficiency (Michael 1998). The STRS committee proposed that the SHRP should focus on 4 major technical research areas as identified by Damian (1991):

"• Improved performance of asphalt materials;

• Improved concrete and the protection of reinforced concrete structures;

• Efficient methods of highway maintenance, including control of snow and ice (Highway Operations); and

• Long-term durability of pavements."

1.2. WHAT IS THE SECOND STRATEGIC HIGHWAY RESEARCH PROGRAM (SHRP2)?

According to the SHRP 2 Report S2-R10-RW-1, the development of SHRP2 was stimulated by the progress in research and technology, such as advanced materials, communications technology, new data collection technologies, and human factor sciences. The utilization of these technologies offer new opportunities to improve safety and reliability of highway systems. However, the main challenge for highway agencies is to find appropriate tools and strategies for implementing the identified technologies over a short period of time. The need for an effective implementation plan is the main reason behind the development of the SHRP2 program. The SHRP2 program was designed as an intense, large-scale research program that integrates multiple fields of research and technology and focuses on a high-impact problem to respond to the implementation need of highway agencies. Such a multidisciplinary program is substantially different from the traditional research program that is broad, mission-oriented, and discipline-based.

Damian (1991) summarizes the goal of the SHRP2 program as the following: “The need for SHRP2 was identified in TRB Special Report 260: Strategic Highway Research: Saving Lives, Reducing Congestion, Improving Quality of Life, published in 2001 and based on a study sponsored by Congress through the Transportation Equity Act for the 21st Century (TEA-21).”

The main difference between the SHRP2 and its older program, the SHRP, is its main focus on time-constrained, management-driven program designed to complement existing highway research programs. Shane et al. (2014) described the 4 major areas that the SHRP2 emphasized on compared with those of the original SHRP as the following:

“• Safety: to prevent or reduce the severity of highway crashes by understanding driver behavior;

• Renewal: to address the aging infrastructure through rapid design and construction methods that cause minimal disruptions and produce lasting facilities;

• Reliability: to reduce congestion through incident reduction, management, response, and mitigation;

• Capacity: to integrate mobility, economic, environmental, and community needs in the planning and designing of new transportation capacity.”

The full authorization of the SHRP2 program was described in Damian (1991) as the following:

“SHRP 2 was authorized in August 2005 as part of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). The program is managed by the Transportation Research Board (TRB) on behalf of the National Research Council (NRC). SHRP 2 is conducted under a memorandum of understanding among the American Association of State Highway and Transportation Officials

(AASHTO), the Federal Highway Administration (FHWA), and the National Academy of Sciences, parent organization of TRB and NRC."

To help State DOTs better deploy the SHRP2 products, the FHWA promoted a program called Implementation Assistance Program (IAP) that facilitates the adoption of SHRP2 solutions nationwide. In the first round of the IAP in 2013, R10 "project management strategies for complex projects" was selected as one of the innovative solutions with great potential to enhance the state of practice in project management. The final product of R10 is a new project management guidebook that expands the conventional three-dimensional project management to five-dimensional project management. The research also provides a set of methods and tools that can be utilized by State DOTs to deal with complexity in managing projects.

1.3. FIVE-DIMENSIONAL APPROACH FOR PROJECT MANAGEMENT

Infrastructure projects are becoming larger and more complex. The increasing complexity makes the management of maintenance and replacement projects challenging in the renewal program. The SHRP2 R10 project focused on enhancing our understanding of complex projects and identifying appropriate strategies to better manage the project from the complexity analysis.

The SHRP2 R10 research project proposed a framework to analyze the complexity of the project in 5 areas (or dimensions): cost, schedule, technical, context, and finance. The concept of five-dimensional approach for project management of complex projects was proposed before the R 10 project but it has been extensively developed, outlined, and clearly mapped for acceptance and integration within the R10 project.

- **Cost**

The definition of cost dimension was described in the SHRP2-S2-R10-RW-1 as the following:

> "The cost dimension essentially quantifies the scope of the project in dollar terms. This dimension focuses on factors that affect cost growth, control, risk, and related issues and addresses how to plan for these management tasks during the preliminary stages and throughout the project construction."

In a real project, the following 3 categories are recommended to be considered as significant factors impacting the cost of the project. First, uncertainty and contingency costs reflect the risk characteristic of the highway project. In a good contract document, several clauses are used to specify the cost related to risk allocation. Contingency is a part of cost specified in the contract to deal with potential uncertainty in future. It is a method to allocate the risk between the contractor and the State DOT. Second, there are several costs in the preliminary stage of the project that needs to be considered, such as right-of-way (ROW), land acquisition, and design costs. Third, in the construction phase, several costs are essential for the progress of projects, such as materials cost and the money which are used to provide incentives to contractors.

- **Schedule**

Schedule is one the three objectives on traditional project management. On one hand, schedule represents time management. Several time control technics have been developed to help project managers plan and monitor the project progress. On the other hand, schedule closely relates to cost because the delay in the project always results in extra costs and payment. This close interaction was described in the SHRP2-S2-R10-RW-1 as the following:

> "The project schedule is closely associated with the cost dimension. This dimension is affected by and directly affects the cost of the overall project, depending on management and decision making during the venture. The schedule dimension looks at variables, such as the overall time and deadline, risk, milestones, control, and problems associated with managing and planning for issues that arise before and during construction. The advent of new technology is also pertinent because it may affect the management of the project schedule."

- **Technical Dimension**

Several areas are considered in the assessment of the technical dimension of a project. First, the organizational structure defines the management technic that the project team utilizes in the execution of the project. Second, the formation and the language of the contract reflects the technic to specify the responsibility and right for all stakeholders and the technic to solve the dispute when any conflicts happen. Third, the advanced technology applied in the project, such as visual and laser technology in construction safety, represents one of main characteristic of the technical dimension. The definition of technical dimension was described in the SHRP2-S2-R10-RW-1 as the following:

> "Issues identified for this dimension include design requirements, scope of the project, quality of construction, and the organizational structure of the owner undertaking the project. This area also includes items such as contract language and structure and the implementation of new technology for effective management of the project."

- **Context Dimension**

Context dimension is mainly considered from three aspects. First, it represents relationships among stakeholders. The project organizational structure defines relationships between the contractor and the State DOT that affect how stakeholders work together towards the project objectives and how conflicts will be solved when there is a dispute. Second, context dimension covers project-related factors, such as social equity, demographics, public services, land use, growth inducement, land acquisition, right of way (ROW) acquisition, economics, marketing, and cultural aspects. Even though these factors do not directly produce the product of transportation project, they have significant impact on it. Third, complementary to the second category, project-specific factors that directly produce the project, such as material, equipment and labor, are considered in the assessment of the context dimension of the project. The availability of these resources should be considered before and during the project. The definition of context dimension was described in the SHRP2-S2-R10-RW-1 as the following:

> "The context dimension refers to all of the external factors that have an impact on the project and can be some of the most difficult factors to predict and plan for before and during construction. Context includes stakeholders, environmental issues, legal and legislative requirements, local issues, and project-specific factors."

- **Financing Dimension**

For highway project, public financing from Federal and State funding are two of the most important money resource. If we understand cost dimension as "how to spend money," the financing dimension becomes more important because it answers to the question of "where does the money come from." The definition of financing dimension was described in the SHRP2-S2-R10-RW-1 as the following:

"It is no longer sufficient to merely know the project cost. The owner must know how it will be paid for and integrate that knowledge into the project's scope of work. The mechanics of the financing can have a direct impact on the project's design, the speed of delivery, and the ability to achieve contextual requirements. One of the first steps in complex-project management is to identify available financing and the constraints inherent to the debt-servicing process."

Complexity map is a visual tool to identify and understand the dimension(s) with the most complexity. A complexity map can help analyze the complexity of a project in the 5 dimensions identified above. Steps in developing a complexity map are:

i. Consider factors that impact each dimension.

ii. Score each dimension on a scale of 0-100 (normal project is score at 50).

iii. Plot the project complexity.

Figure 1-1 shows a score card as a template for the 5-dimesnion complexity assessment.

Cost Dimension Complexity	**Scale**			
	Minimal		Average	High
	0	25	50	75
	100			
Schedule Dimension Complexity	**Scale**			
	Minimal		Average	High
	0	25	50	75
	100			
Technical Dimension Complexity	**Scale**			
	Minimal		Average	High
	0	25	50	75
	100			
Context Dimension Complexity	**Scale**			
	Minimal		Average	High
	0	25	50	75
	100			
Financing Dimension Complexity	**Scale**			
	Minimal		Average	High
	0	25	50	75
	100			

Figure 1-1. Score Card of 5DPM

Figure 1-2 shows a radar chart that is used to illustrate the results of the 5-diemnsional complexity assessment. The radar chart is a graphical method of displaying 5-dimensional data in the form of a two-dimensional chart represented on axes starting from the same point.

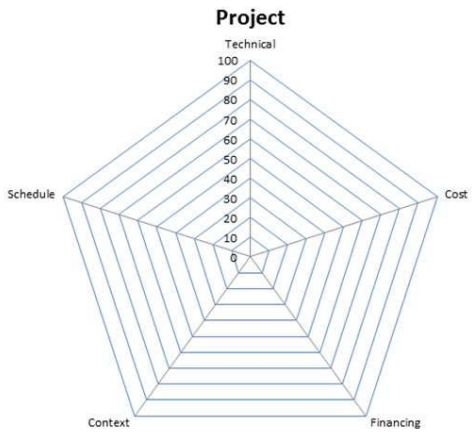

Figure 1-2. A Sample Complexity Map

The 5DPM complexity map helps the project team understand the project complexity and assists the project manager in resource allocation and tool selection. Project complexity map is a useful tool for organizational leaders to assign internal team members, develop effective procurement plans, advocate for project needs to state legislators and policy makers, and allocate financial resources in the most effective manner. With the different component in each project, the results of complexity assessment call for a distinct project management style and approach.

1.4. FIVE-DIMENSION PROJECT MANAGEMENT (5DPM)

Complexity mapping provides a useful visualization technique to represent the project complexity in five important dimensions. This conceptualization process forms the basis to decide appropriate project management methods that can facilitate dealing with complexity in the execution of the project. The following 5 methods are recommended in the R10 to manage complex projects:

- **Method 1: Define critical project success factors**

Method 1 aims to identify critical project success factors for complex projects. This is the first method that should be implemented because it lays the foundation for other procedures.

- **Method 2: Assemble project team**

Assembling the project team includes two tasks: choosing appropriate people to form the project team and empowering each people with the needed authority.

- **Method 3: Select project arrangements**

This method focuses on the allocation of the administrative resources (procurement and contracting for services). It is intended to determine the most suitable resources to the project based on the critical success factor.

- **Method 4: Prepare early cost model and finance plan**

This method is based on the outcome of complexity assessment on cost and financing dimensions, and therefore, it not only considers how to spend the money, but also discusses the sources of the funding and the different limitations imposed by various funding.

- **Method 5: Develop project action plans**

From the guide, this method emphasizes on the importance of considering all the project stakeholders, including legislators and community representatives before any action is made.

The following figure gives an overview of the process for using five methods. All the methods are applied in the preliminary stage of the project. Even though five methods are not displayed in the same box but they are integrated as a comprehensive process and related with each other.

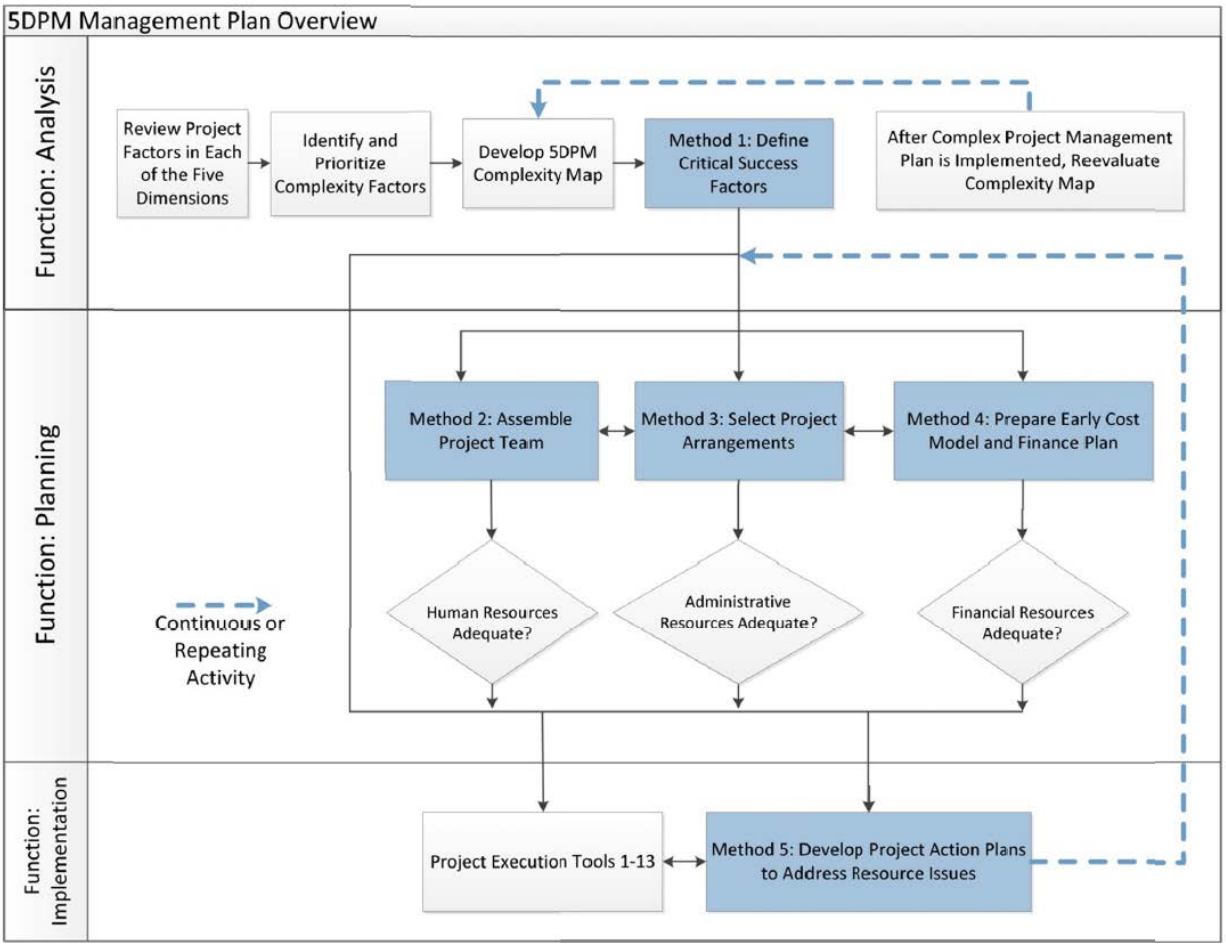

Figure 1-3. Overview of the Process for Using the Five Project Planning and Analysis Methods from SHRP2-S2-R10-RW-2 (2015)

Five methods comprehensively cover the span of three functions in the preliminary stage of the project. Method 1, defining critical success factors, provides analysis that forms the basis for further action. Methods 2, 3, 4 are used to facilitate planning functions. Method 2 focuses on the selection of human resource and method 3 further considers how to arrange them in an appropriate manner. Method 4 is about another aspect of the project: cost and funding. After these four methods are utilized a plan of action is outlined in method 5 to implement the identified project management methods.

The 5 methods facilitate thinking about the complexity of the project and planning for managing complexity at a conceptual level. The R10 identifies 13 tools that are selected based on the analysis of five methods for each project. These tools are practical and aim to facilitate implementing the plan for managing complex projects

1.5. THIRTEEN PROJECT MANAGEMENT TOOLS

Thirteen project management tools are identified in the R10 project to facilitate the management of complex projects in different areas.

Tool 1: Incentivize critical project outcomes

Incentives and disincentives are useful measures to encourage project designers and contractors to meet project goals. The R10 summarizes several different types of incentives ranging from traditional schedule, cost, and safety incentives to performance incentives for factors, such as social issues, environmental issues, public involvement, and traffic mobility.

Tool 2: Develop dispute resolution plans

For complex projects, the number of potential dispute points is far more than simple projects, and therefore development of a thoughtful dispute resolution plans can be crucial to project success.

Tool 3: Perform comprehensive risk analysis

It is suggested to implement risk analysis and mitigation plans at the early stage of the project. Risk analysis should not only focus on the cost and schedule issues, but also on context and financing issues, such as those related to utilities and capital bill allocation.

Tool 4: Identify critical permit issues

The results of analysis on the five-dimension project management methods reveal critical permit issues that should be treated with cautious. It is significant to consider potential regulatory issues with responsible agencies to minimize the impact resulted from the permit conflict.

Tool 5: Evaluate applications of off-site fabrication

The pre-fabrication is mentioned as a tool recommended for contractors because it could minimize the road closures, disruption to local business, traffic delays, detour lengths, and public inconvenience.

Tool 6: Determine involvement in ROW and utilities

Determination of involvement in ROW and utilities should be based on critical project success factors identified in method 1. ROW and utilities are significant areas in project success and if they are not managed properly the problem can lead to schedule delay or cost increase. State DOT personnel should be responsible to facilitate ROW acquisition and utilities relocation processed. It is recommended that State DOTs and highway contractors should actively attend utility coordination meetings. Recommendations are also provided to State DOT officials to better coordinate with the related public agencies and private-sector participants to enhance the efficiency of the overall process.

Tool 7: Determine work packages and sequence

Determining the sequence and content of work packages is a schedule control tool. Work packages should be evaluated considering available funding sources, contactor capabilities, and stakeholder concerns about project impacts.

Tool 8: Design to budget

Designing to budget is the measure to make sure that the project will be completed within resource constraints, especially the funding mechanism with a specified time frame. Compared to routine projects where the scope of work is quantified around the design loads, complex projects are required to use this tool to limit the scope of work to the available fund. The application of design to budget requires the project management team to consider not only the cost plan but also the funding sources at the early stage of the project.

Tool 9: Co-locate team

A number of case studies conducted on complex projects showed that colocation is a good strategy to make the whole team to work closely with each other to aim for the same set of objectives for the project.

Tool 10: Establish flexible design criteria

This tool is especially recommended for designers who are encouraged to work with major material suppliers and vendors in the project life cycle to make the design more flexible.

Tool 11: Evaluate flexible financing

When considering the funding sources, there are several funding choices ranging from various Federal funds to State and local funds. Several alternative funding sources are also available for complex project, such as tolling and other revenue-generation approaches that should be considered to develop flexible financing plan for the project.

Tool 12: Develop finance expenditure model

The finance expenditure model is developed based on the project cash inflow and outflow analysis. There should be a balance between the two cash flows and balance shortfalls could be detected from the model.

Tool 13: Establish public involvement plans

In the process of determining the design options and project delivery methods, stakeholders' needs and concerns should be considered. Public outreach is a critical step in preliminary analysis.

CHAPTER 2

APPLICATION OF SHRP2-R10 IN GEORGIA DOT

In this chapter, we focus on how Georgia DOT implements the strategies for managing complex projects. GDOT was among the lead adopters of incentive implementation assistance grant to deploy R10 guide for project management strategies for complex projects. Two of the most successful innovative delivery projects that implement the SHRP2 R10 are:

- Northwest Corridor (NWC) I-75/I-575 Managed Lanes (November 2013)
- I-285/SR-400 Interchange Reconstruction and CD Lanes (January 2015)

The State Innovative Delivery Engineer, Mr. Darryl VanMeter summarizes the benefits of implementing the R10 product in his presentation at the R10 peer exchange meeting in Iowa on May 4, 2016, in the following 5 areas:

- "Facilitate an open dialogue among agency participants to map project complexity
- Define effective project planning methods
- Identify project execution tools to achieve what matters the most for the project
- Optimize project expenditure plan at the program level
- Conduct maturity self-assessment for implementing 5DPM project planning methods and execution tools in a complex project"

2.1. COMPLEXITY MAPPING

Complexity mapping has been an effective method to assess megaproject issues at GDOT. The Office of Innovative Delivery has used complexity mapping as an effective visual means to display the project issues in an intuitive way to the project management team. For instance, complexity mapping was conducted on I-285/SR-400 interchange reconstruction project (Gransberg 2016). The results of 5-diemnsioanl assessment are shown in Figure 4.

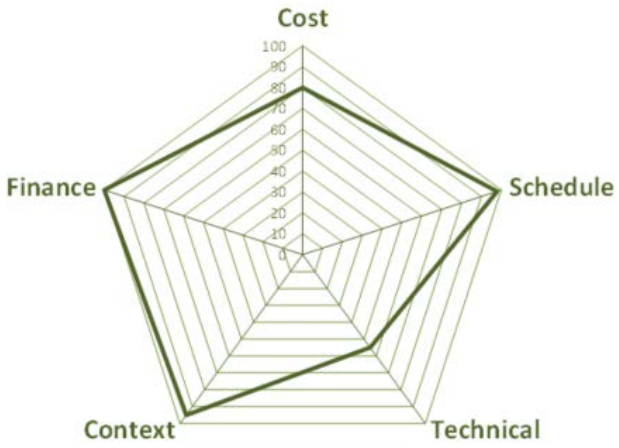

Figure 2-1. Complexity Map of I-285/SR-400 Megaproject

The following issues and challenges were identified for the megaproject in each of the 5 complexity dimensions as summarized in Table 2-1.

Table 2-1. Identified Critical Issues and Challenges for the I-285/SR-400 Megaproject Summarized in Five Dimensions

Complexity	Identified Issues and Challenges

Dimension	
Cost	• Price fluctuations due to ever-changing market conditions
Schedule	• Risk of proposing a design & construction plan that fails to meet agency needs • Schedule-driven delivery (The agency was working on a hard deadline to select the developer by the December 10, 2015 Board meeting)
Technical	• Design and scope of work require significant use of Alternative Technical Concepts (ATCs) • Quality control/quality assurance (QC/QA) arrangements that require shift in business as usual for the agency
Context	• Proximity to major hospitals and emergency responders • Major utility conflicts during the construction phase
Financing	• Desire not to utilize the GARVEE bond program by the agency • Major financing gap during the construction phase

Based on these identified issues and challenges, GDOT further adopted appropriate methods and tools to manage the project.

2.2. METHODS AND TOOLS

All of the five methods have been applied in this project by GDOT.

Five methods identified in the 5DPM management plan were utilized in developing an efficient management plan for I-285/SR-400 Megaproject. In the first step, method 1 was utilized to identify critical success factors in each of the five complexity dimensions of the project. The identified factors are summarized in the following table:

Complexity Dimension	Critical Success Factors
Cost	Having a proposal come within the estimate (at or below)
Schedule	Being substantially open to traffic by December of 2019
Technical	Not exceeding the approved environmental impacts
Context	Local acceptance through effective communication to the stakeholders on what to expect and when (real-time information)
Financing	One developer having a proposal that meets GDOT's financial goal (budget) and get to financial close

Table 2-2. Success Factors for Five Dimensions

Based on the SHRP2-R10 guide book, Method 2 emphasizes the significance of selecting appropriate people to form the project team. Moreover, authority should be empowered to right people to make sure they could execute responsibilities effectively. With this instruction, GDOT

allowed the project managers to be accessible to funding sources to make sure managers have full authority on project financial needs.

Using the project arrangements approach recommended in Method 3, GDOT chose to create a public involvement plan and cooperate with a public relation (PR) company. Also, under the current delivery model, GDOT uses a staff augmentation delivery model to help the agency develop design-build projects. GDOT holds a contract with a program management consultant (PMC) to help the Office of Innovative Delivery in various tasks related to procurement, project management, and construction administration. GDOT also holds a contract with a general engineering consultant (GEC) firm to develop design during the preliminary engineering phase and provide design reviews throughout the detailed design development phase.

Moving beyond the I-285/SR-400 Megaproject and building on the proven approach, GDOT has expanded the current augmentation model to allow for stronger owner with limited staff as the selected PMC assumes some traditional GDOT roles, responsibilities, and authorities. Under the new delivery model, program-level contracts will be held for programmatic PMC, GEC, and construction engineering & inspection (CEI) services and depending on the size and complexity of the design-build project, a separate GEC contract may be made for each design-build project in the program. New approach, while federally compliant, would be more independent, accountable with PMC serving as “mini-DOT.” PMC acts as the owner’s representative, to extent allowable and desirable (GDOT will retain key authorities). PMC accomplishes work activities that previously have only been done by GDOT staff. PMC’s detailed roles and responsibilities are developed and coordinated with other Offices. Close ties from PMC Subject Matter Experts and GDOT Offices are anticipated.

Method 4 was utilized by GDOT in setting project- level expenditure plan. Estimated expenditures for the project must be quantified over time. The project manager assigned by the Office of Innovative Delivery created an estimated expenditures model for the project in different phases of development over time. Expenditures were categorized as costs related to different aspects of a design-build project:

- Preliminary engineering (PE)
- Right-of-Way (ROW)
- Construction

Moving beyond the I-285/SR-400 megaproject, GDOT has developed a program-level expenditure model to enhance opportunities to introduce flexibility in cash flow expenditures across several projects in the program.

Finally, GDOT used method 5 to develop an action plan for management of the I-285/SR-400 megaproject. Table 2-3 describes the action plan and the tools that were used by GDOT to achieve successful results in different dimensions of project complexity.

Table 2-3. Tool Selection Based on Analysis on Five Dimensions

Complexity	***Success Factor***	**Action Plan**	***Tools Used***

Dimension			
Finance-Public	*Budget Compliance and Financial Close*	Monitor costs vs. expenditures Create a master tracking plan	*Tool 8: Design to budget*
Finance-Private	*Selection of a developer with a proposal that meets financial goal (budget)*	Engage with industry and modify the RFP in accordance with industry feedback	*Tool 1: Incentivize critical project outcomes,* *Tool 3: Comprehensive risk analysis*
Context	*Local Acceptance using real-time information*	Develop a plan to maintain access to hospitals	*Tool 10: Flexible design,* *Tool 13: Public involvement Plans,* *Tool 7: Determine Work packages and Sequencing*

CHAPTER 3

UPDATING THE GDOT DESIGN-BUILD (DB) MANUAL

3.1. OBJECTIVE

The main goal of this research project is to facilitate the implementation of the SHP2 R10 product to enhance the management of complex projects in the GDOT. To achieve this goal, the research team worked with the Office of Innovative Delivery and updated the GDOT design-build manual as the main source of project management guide for complex projects at GDOT. Recommendations are included in several places throughout the GDOT's design-build manual (http://www.dot.ga.gov/PartnerSmart/DesignManuals/DesignBuild/001-GDOT_Design-Build_Manual.pdf) as described in the following sections.

3.2. UPDATING GDOT DESIGN-BUILD MANUAL CHAPTER 2, SECTION 2.1 PROJECT DEVELOPMENT

Most of the methods and tools in SHRP2 are recommended to be applied in the early stage of a project. Chapter 2 of the GDOT design-build manual provides instructions on pre-advertisement activities that need to be completed before the project moves to the procurement phase. Table 2.1 summarizes several activities that need to be completed during the pre-advertisement phase of a project. Based on recommendations provided by the SHRP2 R-10 product, several areas can be considered for enhancement as summarized below.

3.2.1. Complexity Mapping through Using 5 Dimension Project Management (5DPM)

This update introduces the concept of 5DPM into the GDOT design-build manual. The required steps for developing a complexity map and the related benefits are added to the manual as the following:

> "Project managers of complex projects, both large and small, must ultimately optimize the available resources (time and money) with the technical performance needs of the project (design) while operating under both known and unknown constraints (context), all the while accommodating the requirements of new financing partners and funding models (financing). Project complexity should be assessed in 5 key dimensions:
>
> 1) Cost: The cost dimension essentially quantifies the scope of the project in dollar terms. This dimension focuses on factors that affect cost growth, control, risk, and related issues and addresses how to plan for these management tasks during the preliminary stages and throughout project construction. Cost dimension factors are:
>
>   - Contingency usage
>   - Risk analysis
>   - Estimate formation
>   - Owner resource cost allocation
>   - Cost control
>   - Optimization's impact on project cost
>   - Incentive usage
>   - Material cost issues
>   - User costs/benefits
>   - Payment restrictions

2) Schedule: The project schedule is closely associated with the Cost Dimension. This dimension is affected by and directly affects the cost of the overall project, depending on the management and decision-making during the venture. The Schedule Dimension looks at variables such as the overall time/deadline, risk, milestones, control, and problems associated with managing and planning for issues that arise before and during construction. Schedule dimension factors are:

    - Timeline requirement
    - Risk analysis
    - Milestones
    - Schedule control
    - Optimization's impact on project schedule
    - Resource availability
    - Scheduling system/software
    - Work breakdown structure
    - Earned value analysis

3) Technical: The technical aspects of the project include all of the typical engineering requirements. Issues identified for this dimension include design requirements, scope of the project, quality of construction, and the organizational structure of the owner undertaking the project. This area also includes items such as contract language and structure and the implementation of new technology for effective management of the project. Technical dimension factors are:

    - Scope of the project
    - Owner's internal structure
    - Prequalification of bidders
    - Warranties

- Disputes
- Delivery methods
- Contract formation
- Design method
- Reviews/Analysis
- Existing conditions
- Construction quality
- Safety/Health
- Optimization impact on construction quality
- Typical climate
- Technology usage

4) Context: The context dimension refers to all of the external factors that have an impact on project development and progress. These factors can be some of the most difficult to predict and plan for before and during construction. Context dimension factors are:

    - Public
    - Marketing
    - Political
    - Cultural impacts
    - Owner
    - Local workforce
    - Jurisdictions
    - Utility coordination
    - Designer(s)
    - Railroad coordination
    - Maintaining capacity
    - Resource availability

5) Financing: The financing dimension relates to the need for understanding the fact that the manner in which the project is funded has an impact on the final scope of work. The owner must know how it will be paid for and integrate that knowledge into the project's scope of work. The mechanics of the financing can have a direct impact on the project design, the speed with which it can be delivered, and the ability to achieve contextual requirements. One of the first steps in complex-project management is to identify available financing and the constraints inherent to the debt servicing process. Financing dimension factors are:

    - Legislative process
    - Vehicle miles traveled fees
    - Uniformity restrictions
    - Cordon/Congestion pricing
    - Transition to alternate financing sources
    - Monetization of existing assets
    - Project manager financial training
    - Franchising
    - Federal funding
    - Carbon credit sales

Complexity map is a visual tool to identify and understand the dimension(s) with the most complexity. A complexity map can help describe a project in terms of the five dimensions of 5 Dimension Project Management (5DPM). Steps in developing a complexity map are:

i. Consider factors that impact each dimension.

ii. Score each dimension on a scale of 0-100 (normal project is 50).

iii. Plot the project complexity.

Cost Dimension Complexity	**Scale**			
	Minimal		Average	High
	0	25	50	75 100
Schedule Dimension Complexity	**Scale**			
	Minimal		Average	High
	0	25	50	75 100
Technical Dimension Complexity	**Scale**			
	Minimal		Average	High
	0	25	50	75 100
Context Dimension Complexity	**Scale**			
	Minimal		Average	High
	0	25	50	75 100
Financing Dimension Complexity	**Scale**			
	Minimal		Average	High
	0	25	50	75 100

Figure 3-1. Score Card of 5DPM

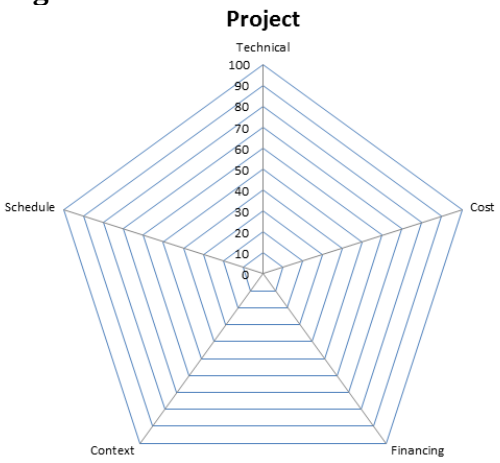

Figure 3-2. A Sample Complexity Map

The 5DPM complexity map helps the project team understand their project complexity and helps in resource allocation and tool selection. Project complexity maps are useful tools for organizational leaders to assign internal team members, develop effective procurement plans, advocate for project needs to state legislators and policy makers, and allocate financial resources in the most effective manner. Uses of Complexity Mapping are:

- Discussing critical project issues at early stage of project planning and project definition
- Shared understanding of complexity dimensions that are driving the project
- Rational resource allocation to maximize potential for project success
- Tracking project performance over time

The process of mapping the complexity of the project should happen several times during the stage of project development as the complexity or source of complexity changes. As projects progress, the dynamics of the project change, particularly with complex projects. It is helpful to remap the complexity of the project several times throughout project duration to see where changes are occurring. This may help you to shift the resources for the project. Project managers should use an automated spreadsheet tool that was developed as one of the products of the SHRP 2 research project R10[1] to systematically evaluate the complexity of their projects."

3.2.2. Define Critical Success Factors

The first recommended project management method in the SHRP2 R10 is related to defining critical success factors. This method is a helpful project management technique to establish a common set of objectives among all stakeholders involved in the project. This method emphasizes on the importance of early involvement of different stakeholders in the project. The following description was added to Table 2.1 to show how to identify and evaluate the success factors for the project:

"It is important to gather information from all groups of people that will influence the outcome of the project. This will ensure that everyone involved with the project will have

[1] Shane, Jennifer, Kelly Strong, Douglas Gransberg, and David Jeong. Guide to Project Management Strategies for Complex Projects. No. SHRP 2 Report S2-R10-RW-2. 2015.

a clear understanding of what needs to be accomplished to have a successful project. Agreement on critical success factors facilitates further planning on resource utilization and action items.

The updated part in DB manual is developed as follows:

- Measurable
- Justifiable
- Balances long- and short-term issues
- Addressed internal and external issues
- Integrated with multiple sources of complexity

Critical success factors can be imposed from several different individuals, organizations, community stakeholders, or project requirements. Once the project complexity map is understood, measurable project outcomes can be developed in each of the dimensions as well as the supporting documentation to track the project and who is responsible for each of the action items. There may be 1 or 2 success factors under each of the dimensions of complexity. The number of success factors should be relatively low, probably in the range of seven to 10 factors. If project success comes to include everything desired by everyone, the success factors will not serve to guide project decisions and actions. This is one of the most important aspects of managing complex projects successfully because it sets the basis for decision-making throughout the project life cycle.

Critical success factors can vary widely by project; however, the inputs to define critical project success factors require the project management team to:

- Identify the legislative and political directives;
- Gather input from agency and project leaders;
- Estimate project resource requirements and determine if they are currently available;
- Assess community needs and influence over project feasibility; and

-
- Ascertain project characteristics.

In summary, this activity establishes higher-order critical project success factors than those typically formalized in a project mission statement or project charter, although they obviously should be related. The critical success factors form the basis for the complex-project management plan that must include specifics on responsibilities, schedules, actions, and interdependencies. One of the outcomes of the plan should be identification of resources to achieve success."

3.2.3. Perform Comprehensive Risk Analysis

Managing complex projects represents significant challenges to an agency. Several issues (or risks) should be identified and managed throughout the project development process. Therefore, the SHRP2 R10 guide recommends deploying a risk management process as an integrated part of project management plan. Performing risk analysis was added as one of the major activities in Table 2.1 as the following:

"Implementation of risk analysis and mitigation plans at early stages of the project is critical to project success. Risk analysis must include clear and concise assignment of responsibilities and designated resources. Risk analysis must also include not only traditional cost and schedule issues but also context and financing issues, such as those related to railroads, utilities, U.S. DOT Section 4(f), the National Environmental Policy Act (NEPA), appropriations, capital bill allocation (use it or lose it funding), and the effect of delays on private equity viability.

Steps in performing comprehensive risk analysis are:

1) Assemble a project team with broad representation and expertise. Incorporate individuals with local knowledge, as well as those with organizational knowledge.

Consider dedicated time for developing risk management plans. Consider using an outside facilitator.

2) Have the team brainstorm potential risk factors.

3) Have the team rank each potential risk factor by considering both likelihood and severity of the risk and the impact it will have on achieving project outcomes. Include discussions of both potentially negative and positive risks.

4) Develop mitigation strategies for each critical risk factor. Assign responsibility for tracking risk to a specific team member.

5) Identify project partners and other stakeholders that will have any impact on the issue or that can be influenced by the issue. The objective is to make sure the team is not trading one risk for another.

6) Allocate resources needed to support mitigation strategies. Also, consider contract language, incentives, and partnership agreements that reduce resistance to the mitigation strategy.

7) Have the project team meet frequently to update the risk management plan.

8) Integrate risk management decisions into cost estimates, project schedules, design scopes, the communication plan, and so forth.

The adequacy of risk management will be improved by following this advice:

- Start the process early.
- Include all major project team members in the process (owner, designer, financier, and builder).

- Continually monitor the plan and update as needed.
- Have a two-way communication and information-sharing system that promotes consistent scanning for new and emerging risks.

CRAFT© (Comprehensive Risk Assessment for Transportation) software – currently in use at GDOT Office of Program Delivery – can be utilized as a tool for performing systematic risk analysis. Risk analysis outcomes will be used to develop aggressive mitigation plans including the possibility of re‐allocating contingency within project segments or phases to prevent delays or cost increases. Early involvement from contractor groups or construction specialty review boards can be effective for input on means, methods, and material supply issues.

Risk analysis helps identify what can stop the project (constraint) versus what can slow the project down (resource limitation). Once the constraints have been identified throughout the project development and management process, they can be characterized. There are two different characterizations: speed bumps and roadblocks. Speed Bumps can be managed through creative approaches to resource limitations such as innovative financing, alternative delivery or procurement, or teaming arrangements, whereas roadblocks cannot be overcome with additional resources and require structural change. Roadblocks and speed bumps may be risks that need to be developed in a risk register or risk model as appropriate. Managing the roadblocks and speed bumps is really risk management. The key to overcome risk factors is innovation. Thinking outside the box should be the culture in the environment for managing complex design-build projects."

3.2.4. Prepare Early Cost Model and Finance Plan

Funding and financing are different for complex projects. There are several sources of funding, including alternative funding sources that are typically utilized in complex projects. Also, expenditure flows are not simple for complex projects depending on assumptions and scenarios that a project manager needs to make about the project development. Funding and financing of complex projects are subject to significant uncertainties that should be taken into account in the pre-advertisement phase of the project. The SHRP2 R10 guide recommends creating a cost model and developing a finance plan for complex projects early on during the project planning phase. Cost model and finance plan are better developed as a single integrated model to show where the money is coming from and where it is going to be spent. The section related to costing plans in Table 2.1 was updated as the following:

> "Understanding the financial model, where the funding is coming from, the sources of expenditures and the limitations placed on design and context flexibility imposed by available funding, is important to project success. The early cost model and finance plan should be prepared early in project development for complex projects. One reason is because complex design-build projects are often large in terms of dollars. Complex design build projects also typically seem to have funding coming from a number of different sources. Beginning to realize and track this early is important.
>
> Given that multiple funding sources, both public and private, are increasingly common on large, complex, design-build projects, funding and financing frequently drive the schedule and cost estimate. Therefore, the cost model and financing plan should be developed very early in the process. Preparing the cost model and finance plan is often done concurrently with assembling the project team and selecting project arrangements.

Not only does the project manager need to know who is on the team and how they are on the team, he or she also needs to know how they will be paid or if they are bringing funding to the project.

With complex design-build projects, the financial resources may drive the design solution rather than the other way around. The two key questions are: how much can we afford to build and when will the financial resources arrive. Therefore, getting a handle on financial requirements at an early point is critical

All currently available financial sources need to be evaluated. These sources should have a high degree of certainty. The next step is to compare the available amount of funding from the secured sources to the expected cost and scope of the project. If the available resources are sufficient, the project team can incorporate the expected cash flows from the financial sources into the procurement plan and develop a relatively straight-forward cost model using standard project management tools, such as resource-loaded critical path method (CPM) schedules, earned-value analysis, or cash-balance-linked project draw schedules. However, if available financial resources are insufficient, the project team must look for additional external financial sources or adjust the project scope or develop a phased approach to fit available funding.

The cost model will be built on a number of assumptions regarding the technical, financial, and schedule requirements of each major feature of work. Quantifying cost and time allows the project manager to benchmark the assumptions made early in the process and, then, manage the project to realize those assumptions. This act as a project control tool during early stages of the project and creates a baseline against which progress can be measured. Quantifying costs and time also acts to retard scope creep."

3.2.5. Identify Critical Environmental Permits

Complex projects are subject to significant uncertainty related to environmental issues. It is critical to identify environmental resources and plan early to acquire necessary environmental permits. The SHRP2 R10 guide recommends several strategies to facilitate the acquisition of environmental permits for complex projects. These recommendations were added to Table 2.1 as the following:

> "Permitting issues need to be addressed as early as possible. Development of timelines for environmental, U.S. DOT Section 4(f), and other critical regulatory reviews is critical for successful projects, very early in the project life cycle. Flexible response mechanisms for permit issues, as well as flexible planning and design for minimal impact from permit issues, must be developed for complex project success, especially when uncertainty is high (e.g., geotechnical and subsurface conditions, State Historic Preservation Office (SHPO) sites). Information from the complexity evaluation and mapping process, as well as definition of critical success factors, provide insight into critical permit issues that may have a potential negative impact on cost, schedule, technical scope, context, or financing. Also, permit issues may be identified in risk analysis. Steps in dealing with critical permit issues are:
>
> 1) From the complexity mapping process, identify the critical permit issues that must be resolved before design can be completed and construction can begin: To be effective, identifying critical permit issues should be implemented in the very early stages of planning, preferably before alignments have been finalized and irreversible design decisions have been made.

2) Discuss potential major regulatory issues with responsible agencies and utilize flexible designs to minimize the impact of potential points of conflict with permitting agencies (e.g., be responsive to their concerns): Critical permit issues need to be evaluated as soon as possible in the development of the process. If permits cannot be obtained immediately, it is recommended that the design is flexible enough to be changed if necessary.

3) Make early contact with regulatory agencies responsible for permits to communicate and coordinate submittal and approval schedules. Investigate the potential for phased permitting, simultaneous reviews, fast tracking, etc.: Talking to the regulatory agencies should begin as soon as possible to let them know that the Department will be needing a permit for the project soon.

4) Ensure that submittal packages are coordinated, complete, and timely: The task of obtaining the permits should be assigned to a specific person so that there is one point of contact."

3.2.6. Determine Involvement in Right-of-Way (ROW) and Utilities

Project managers often need to deal with complex issues related to ROW and utilities that represent major challenges in the development of complex projects. These issues are particularly challenging as they deal with the concerns of the third parties and the project team has often little or no control over the schedule of these third parties. The SHRP2 R10 guide recommends several steps in determining the optimal level of involvement in ROW and utilities process that were added in Table 2.1 as the following:

"It is worth noting that even when contractual responsibilities for coordinating ROW and utilities are assigned to the design-build team, it is the owner agency and general public

that ultimately suffer if ROW and utility (including railroads) issues are not integrated into the overall project. Determination of the required involvement in ROW and utilities should be based on the critical project success factors. Paying additional design staff to assist railroads and utilities with design reviews or planning can be an option for project success. To the extent possible, it is important to incorporate ROW, railroads, and utilities as project partners (rather than adversaries) and to develop win - win solutions to issues involving potential delay or cost increases.

The interaction of these constraints will result in schedule delays if not managed properly. In other words, the involvement of utilities and ROW holders may have some flexibility in staffing, incentives, early coordination, and so forth that can minimize potential schedule impacts. Involvement of utilities and ROW holders can help manage schedule impacts, which are created by cost and technical constraints. Steps in determining involvement in ROW and utilities are:

1) From the complexity analysis and the comprehensive risk analysis, identify potential negative project impacts from poorly integrated ROW, utility, or railroad conflicts.

2) Discuss major information and integration needs with ROW, utilities, and railroads.

Hold early discussions with individuals who are empowered to commit the organizations to action.

3) Recognize potential organizational or goal conflicts and discuss mutually beneficial options openly (i.e., look at issues from the other party's viewpoint).

4) Allocate project resources (staff, money, support software, etc.) to the ROW, utility, or railroad as needed to facilitate integration into overall project objectives and success.

5) Assign a team member specific responsibility to track communication and integration progress with each ROW, utility, or railroad partner."

3.2.7. Co-Locate Team

The SHRP2 R10 research found out that co-location has been used as an effective strategy in complex projects, in order to expedite decision making process about the key features of the project. The recommended co-location practice was added to Table 2.1 as the following:

"Before the start of the project, the advantages and disadvantages of project team colocation must be discussed. Some compromise may be necessary, but having the whole team together most of the time may increase the odds of achieving critical project success factors. Particularly on multijurisdictional (e.g., bi-state) projects, placing a dedicated, empowered, representative project team in a common location may be critical to project success. The co-location strategy for the design-build team may be considered in later project stages.

Team co-location is used because the technical complexity of the project makes it necessary (and justifies the cost of colocation) to maintain close communication between the owner, designers, and builder to guarantee that cost and schedule constraints are met. Therefore, colocation is recommended for complex design-build projects when technical complexity warrants the increased cost of colocation in return for improved cost and schedule controls. Steps in establishing a co-location strategy are:

1) Identify the possible need for colocation and evaluate costs and benefits.

2) If colocation is warranted, identify which project team members should be included in the colocation.

3) Identify viable physical locations for colocation and arrange for necessary technology upgrades (e.g., voice or data lines, audio/visual, satellite, high-speed Internet) and space build-out (e.g., offices, conference rooms, storage).

4) Develop contractual agreements on payment for space improvements, lease payment, terms and duration of colocation, and other administrative details."

3.2.8. Establish Public Involvement Plans

The success of any complex projects depends heavily on effectively engaging the public and establishing an effective partnership with the local communities. The SHRP2 R10 provided several recommendations that were added to Table 2.1 as the following:

"Stakeholder needs and concerns are frequently the driver in developing design options and project delivery methods on complex design-build projects. Extensive public outreach is required for project success, particularly for complex design-build projects. Public involvement early in the planning phase can be important in mitigating public disruption (such as with self‐detour planning) and dissatisfaction. Open, timely communication and a commitment to promises are the best response to public concerns or inquiries. Public relations specialists can be retained to serve as points of contact. Neighborhood meetings with open agendas and mechanisms should be held to solicit feedback. Public communication plans must also be developed very early in the planning process and continued until the completion of construction.

If context uncertainty or complexity creates a potential impact on cost and schedule factors, the use of public involvement plans should be considered to manage the process of external communication and management of expectations. In addition, if innovative

financing is used, public involvement plans can be useful in educating the public as to the new methods employed on the project.

It is important to assign a person or group that will take responsibility for executing public information plan. In this case, it is especially important that there is a single main point of contact for the public. While an entire team of agency personnel, consultants, contractors, etc. may be attending the community meetings to answer questions, it is important that the public has a limited number of people to contact with questions or concerns. If the public is given too many people to contact with various topics, they may become confused about whom to contact for which concerns. But if there is only one point of contact, that person can answer questions or direct the public to the correct person if they wish to speak with someone directly.

Steps in developing a public information plan are:

1) Identify key public stakeholders (from comprehensive risk analysis) and road users affected by the project.

2) Set up communication and information-sharing systems (e.g., public meetings, websites, newsletters, web cams, 411 phone links, mobile alerts, dynamic message boards).

3) Gather information on specific public stakeholder concerns and relay information to the project team (e.g., designers, builders, consultants).

4) Report back. The key to successful public involvement plans is frequent, targeted communication that is responsive to the concerns of public stakeholders. Be sure to design follow-up communications to address concerns raised in Step 3 or a rationale

(such as budget constraints, funding limits) to explain why public concerns cannot be addressed."

3.2.9. Develop Dispute Resolution Plans

It is not uncommon to see disputes in complex projects. Developing dispute resolution plans lays a good foundation to smoothly resolve the conflict. The goal of a dispute resolution plan should be to identify and manage conflicts proactively before they have a negative impact on project cost and schedule. The SHRP2 R10 provided several recommendations for developing dispute resolution plans that were added to Table 2.1 as the following:

"It is important to have dispute resolution plans in place at the very beginning of the project development process to ensure that project development issues that arise can be identified easily and resolved in a timely manner. Dispute resolution plans may be needed to negotiate for neighborhood and community groups, U.S. DOT Section 4(f) signatories, and other indirect stakeholders on any design-build project. The key to any effective dispute resolution plan is to have decision makers who are empowered to bind their organizations to agreements, involved in the process. Another key to effective dispute resolution is to create a project culture that respects disagreements, in that it is safe to discuss conflicts openly with the goal of quick resolution in the best interests of the project. Preparing a memorandum of agreement that all local jurisdictions are signatory to and elaborates the process for resolving disputes without increasing cost or schedule risk is a good practical idea.

It is best to have dispute resolution plans in place before there is even a chance for any issues to arise on the project. Dispute resolution methods must be established for each

major project partner or stakeholder as soon as they are identified and invited (or contracted) to participate in the project. To the extent possible, dispute resolution methods should be agreed upon prior to the partner's formal engagement or involvement in the project and prior to signing any contracts. If considering new or innovative design solutions, cooperation with designers and city and local review agencies on flexible approval processes in advance is important. Mechanistic designs and nonstandard protocols can be effective solutions in resolving conflicts or disagreements.

The goal of a dispute resolution plan should be to identify and manage conflicts proactively before they have a negative impact on cost, schedule, or risk. Steps to develop dispute resolution plans are:

1) Identify key decision makers with each major project partner or stakeholder.

2) To the degree possible, have each partner or stakeholder organization provide written empowerment to their project representative.

3) Establish a hierarchy of disputes and a time frame for moving disputes to the next level of the hierarchy if they remain unresolved.

4) Establish a multi-partner communication protocol for sharing potential dispute issues early.

5) Clearly identify a project leader who is responsible for managing disputes and following up on resolution agreements.

6) Identify potential third-party facilitators who can be called upon if needed."

3.3. UPDATING GDOT DESIGN-BUILD MANUAL CHAPTER 2, SECTION 2.3, DESIGN-BUILD COST ESTIMATE

Flexibility is the key in developing a proper cost estimate and financing plan for complex projects as there are several sources of funding that should be identified and evaluated in these projects.

3.3.1. Identify and Evaluate Flexible Financing

The SHRP2 R10 provided several recommendations for developing a flexible financing plan for complex projects as the following:

> "If the cost, schedule, scope and context represent relatively fixed and constrained factors, use of flexible financing may be the only option to advance the project. Use of flexible financing is recommended on complex design-build projects when few viable technical alternatives exist, contextual constraints are significant, and cost or schedule requires the need to move forward (i.e., the problems will only get worse if the project is put on hold).
>
> Flexible financing contemplates the hunt for alternative sources of project funding outside the traditional state and federal-aid highway funding. It includes public options like Grant Anticipation Revenue Vehicle (GARVEE) bonds, infrastructure banks, and general obligation bonds. It also covers identifying new sources of public funding such as contributions from municipalities that would benefit from the complex project's capacity. Finally, the identification of private capital can be considered.
>
> Several alternative funding sources are available, including the following:
>
> - Grant Anticipation Revenue Vehicle (GARVEE) bonds
> - Hybrid forms of contracting such as public-private partnerships (P3s)

- Project phasing to leverage different sources of financing
- Tolling and other revenue-generation approaches (e.g., congestion pricing, HOT lanes)
- Monetization of assets and service options, such as franchising

Steps in evaluating flexible financing are:

1) Identify total expected project cost (planning, design, and construction). These numbers should come from a comprehensive cost model that has been built specifically for this purpose.

2) Identify available funds from typical sources (state program, federal aid) and any time constraints that are associated with each.

3) Analyze any funding gaps.

4) Identify potential funding sources for gap financing including debt and private equity, within state regulatory authority if possible.

5) If gap financing is inadequate for project funding, consider adding revenue-generating options, such as congestion pricing, tolling, franchising, and so forth.

3.4. UPDATING GDOT DESIGN-BUILD MANUAL CHAPTER 2, SECTION 2.4, DESIGN-BUILD SCHEDULE

Keeping complex projects on budget is a challenging task for project managers that strive to limit the scope of work to the available funds.

3.4.1. Design to Budget

The SHRP2 R10 provided several recommendations for designing a complex project on budget as the following:

> "Routine projects initially quantify their scope of work around the design loads. Complex projects often must limit the scope of work to the available funds. Often design-build projects have tight budgets that cannot be increased. Designing to the budget can ensure that the GDOT does not exceed the budget. Designing to budget is based on the assumption that funding is constrained and the cost of the project must remain within the available funding. This may require re-design, breaking the project into phases, or both and suggests the need for strict cost control. Technical requirements will be made complex by the need to design current (funded) phases of the project to align with future phases that will be completed pending identification of funds. There may also be increased need for design exceptions. Steps in designing to budget are:
>
> 1) Identify available funding and other cost and schedule constraints that affect design options, including project phasing, initial project scope, and restrictions on various sources of funding.
>
> 2) Establish maximum budget and schedule and develop design options intended to remain within those maximum values.
>
> 3) Confirm cost and schedule values early in the design process and update frequently to ensure that design and scope remain within the constraints. Look at alternative project delivery, early contractor involvement, or use of preconstruction service consultants to help achieve project success.

4) Use a tracking log for design exceptions required to maintain project cost and schedule and begin the approval process for design exceptions early. Communicate all requests for design exceptions early and track them.

5) Clearly communicate cost and schedule constraints and financing limitations to external stakeholder groups so that expectations for project outcomes or viability of other design options are managed appropriately."

3.4.2. Establish Flexible Design Criteria

Except for strictly meeting the budget, the design is encouraged to be flexible for complex projects. The SHRP2 R10 provided several recommendations for establishing flexible design criteria as the following:

"This shift requires designers to be innovative and is facilitated by the use of colocation of the design team with the owner and construction team, as well as the use of flexible design criteria. Sometimes on complex design-build projects the GDOT may need to establish flexible design criteria so the project can be designed using innovative design techniques.

Establishment of flexible design criteria is closely related to project cost, schedule, and quality performance (e.g., designing to a budget) as well as critical permit issues. Agencies rarely can allow design professionals unconstrained latitude to design whatever they would like. However, over-constraining the design process may have a negative impact on project success criteria by summarily eliminating solutions to design problems that might support success toward critical project objectives. Flexible design criteria can minimize potential ROW, utility, and U.S. DOT Section 4(f) conflicts. Flexible designs

can be achieved through use of design exceptions, need-based review and approval processes, performance specifications, and mechanistic designs. Use of flexible design criteria is recommended on complex design-build projects when technical complexity and constraints in other dimensions makes use of standard designs and specifications impractical.

Steps in establishing flexible design criteria are:

1) Identify design constraints and potential conflicts (ROW, utility locations, historic neighborhoods, environmentally sensitive areas, etc.) that can be mitigated through alternative or innovative design approaches.

2) Catalog design exceptions required under each design option.

3) Articulate the rationale for design exceptions (use of performance specifications, mitigation of environmental impact, alleviation of ROW issues, etc.).

4) Set up a tracking and monitoring system to manage documentation, request, approval, and implementation of each design exception."

3.5. UPDATING GDOT DESIGN-BUILD MANUAL CHAPTER 2, SECTION 5.2, DESIGN-BUILD TEAM

Teaming is the key success factor of any complex project. Several issues should be considered in managing a high-performance team. Required skill sets should be properly identified and project leadership should be established, in order to successfully execute a complex project.

3.6.1. Assemble Project Team

The SHRP2 R10 provided several recommendations for assembling an appropriate project team as the following:

> "The design-build team is the driver of the project. It is expected that the design-build team selects appropriate people at the appropriate time based on project needs and nature of project complexity as rational resource selection and allocation of human resources for the project are critical in delivering a complex project successfully. This comes down to making sure that the right people are involved with the project. This includes people with skills that address the complexities of the project. This also includes getting buy-in from potential team members to ensure that they are supportive of the approach to delivering the complex project. Not only is having the right people important, but so is giving them the authority needed to effectively execute their responsibilities.
>
> To assemble the project team, gap analysis is recommended a method that project needs are identified in terms of skills, knowledge, responsibility, and authority and compared to in-house resources and capabilities. There are four main steps in this process:
>
> 1) Identify skills required on the project;
>
> 2) Assess internal skills and availability;
>
> 3) Assign responsibility, authority, and leadership roles; and
>
> 4) Determine external sources for additional required skills.
>
> A successful project needs a strong team leader—someone who is able to quickly make important decisions when needed. Typically, on complex design-build projects, there

need to be people in leadership roles who have the authority to do things outside of what might be typical of a project leader on normal projects. The team leader might be given the responsibility/authority to determine what additional skills or knowledge is needed on the project and to hire individuals to fill the gaps."

CHAPTER 4

CONCLUSIONS

This research helps Georgia Department of Transportation (GDOT) maximize its benefits form the successful utilization of the R10 product and enhance its current project delivery process and development plan for its complex projects. GDOT projects are increasingly becoming more complex. More than any time in the GDOT's history, the agency is relying on innovative project delivery systems, such as design-build (DB) and public-private partnership (P3), to deliver complex projects. In this research, several components of the R10 research product are rigorously evaluated considering the GDOT Office of Innovative Delivery to enhance its design-build manual. Complexity mapping, 5-diemnsioanl project management methods, and several tools are incorporated into the design-build manual to facilitate managing complexity in GDOT design-build and P3 projects. This is an implementation research project and the final deliverable, the updated design-build manual, is developed in partnership with the Office of Innovative Delivery.

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