GEORGIA DOT RESEARCH PROJECT RP 11-21

FINAL REPORT

HOW CAN INNOVATIVE PROJECT DELIVERY SYSTEMS IMPROVE THE OVERALL EFFICIENCY OF GDOT IN TRANSPORTATION PROJECT DELIVERY?

Georgia Department of Transportation

OFFICE OF RESEARCH

GDOT Research Project No. RP 11-21

Final Report

HOW CAN INNOVATIVE PROJECT DELIVERY SYSTEMS IMPROVE THE OVERALL EFFICIENCY OF GDOT IN TRANSPORTATION PROJECT DELIVERY?

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Contract with

Georgia Department of Transportation

April 2013

1. Report No.: FHWA-GA-13-1121	2. Government Accession No.:	3. Recipient's Catalog No.:
4. Title and Subtitle: How Can Innovative Project Delivery Systems Improve the Overall Efficiency of GDOT in Transportation Project Delivery?	5. Report Date: April 2013 6. Performing Organization Code:	
7. Author(s): Baabak Ashuri, Ph.D., DBIA, CCP Kia Mostaan David Hannon, PE	8. Performing Organ. Report No.:	
9. Performing Organization Name and Address: Georgia Institute of Technology 790, Atlantic Drive, Atlanta, GA 30332	10. Work Unit No.: 11. Contract or Grant No.: 0010737 (RP 11-21)	
12. Sponsoring Agency Name and Address: Georgia Department of Transportation Office of Research 15 Kennedy Drive Forest Park, GA 30297-2534	13. Type of Report and Period Covered: Final; October 2011 - April 2013 14. Sponsoring Agency Code:	
15. Supplementary Notes:		

16. Abstract:

The USDOT and Federal Highway Administration (FHWA) recommend the smart use of innovative project delivery systems, such as design-build, to improve efficiency and effectiveness of developing transportation projects. Although design-build provides state DOTs with accelerated delivery and innovations in design and construction, there is still a need to accelerate delivery of design-build projects and achieve higher level of efficiency. To fully utilize the entire potential benefits of the design-build project delivery system, state DOTs are required to overcome significant challenges in various critical areas of the project development process including project delivery system selection, procurement, environmental analysis and permitting, right-of-way (ROW) acquisition, utilities coordination and relocation, alternative technical concepts (ATCs), and design oversight, design acceptance, and quality management. The overall objective of this research project is to develop a guidebook for the Georgia DOT (GDOT) to identify major challenges in the critical areas of the project development process, determine opportunities to overcome these challenges, and describe potential best practices to enhance the efficiency of project development process for highway design-build projects. The findings of design-build review and scanning process, and the results of interviewing design-build programs in 7 state DOTs helped the research team identify various issues related to efficient delivery of design-build projects in the seven critical areas. The primary findings of this study are categorized under these critical areas. Each area begins with clear description of the new dynamics of design-build and follows with critical challenges and issues to enhance the efficiency of delivery processes. These challenges relate to a variety of legal and statutory barriers or issues that can delay the project delivery schedule, increase the project delivery cost, and hinder flexibility of the design-build team to implement innovative design and construction solutions. Furthermore, the analysis for each area presents efficiency enhancement opportunities as a set of propositions that recommend appropriate strategies for implementation. Examples of actual design-build projects are provided along with references from project RFQs/RFPs, design-build guides and manuals, and professional and academic literature for further clarification of challenges that can happen during development of design-build projects and strategies to overcome the challenges.

17. Key Words: Innovative Project Delivery Systems, Design-Build, NEPA, Procurement, Permitting, Utilities, Alternative Technical Concepts, Right-of-Way, Design Management, Quality Assurance/Quality Control		18. Distribution Statement:	
19. Security Classification (of this report): Unclassified	20. Security Classification (of this page): Unclassified	21. Number of Pages: 589	22. Price:

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LIST OF ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ACC	Alternative Configuration Concepts
ARE	Additional Requested Elements
ASDB	Adjusted Score Design-Build Bid Process
ATC	Alternative Technical Concepts
BAFO	Best and Final Offer
CDOT	Colorado Department of Transportation
CM at Risk	Construction Manager-at-Risk
CM/GC	Construction Manager/General Contractor
DBIA	Design-Build Institute of America
DOT	Department of Transportation
EDC	Every Day Counts
FDOT	Florida Department of Transportation
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
GDOT	Georgia Department of Transportation
ITP	Instructions to Proposers
ITS	Intelligent Transportation System
LOI	Letters of Interest
LOS	Level of Service
MOT	Maintenance of Traffic
NEPA	National Environmental Policy Act
PD&E	Project Development and Environment
PDP	Plan Development Process

PEB	Proposal Evaluation Board
PET	Price Evaluation Team
PM-IPD	Project Manager - Innovative Project Delivery
QA	Quality Assurance
QC	Quality Control
RFP	Request for Proposals
RFQ	Request for Qualifications
ROW	Right-of-Way
SAFETEALU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SEIR	State Environmental Impact Report
SEP	Special Experimental Project
SO	Selection Official
SOQ	Statement of Qualifications
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TEA	Transportation Equity Act
TET	Technical Evaluation Teams
TIFIA	Transportation Infrastructure Finance and Innovation Act
TRC	Technical Review Committee
UA/O	Utility Agency/Owner
VDOT	Virginia Department of Transportation
VE	Value Engineering
VECP	Value Engineering Change Proposal

ACKNOWLEDGMENTS

The research reported herein was sponsored by the Georgia Department of Transportation through Research Project Number 11-21. Mr. Darryl D. VanMeter, State Innovative Program Delivery Engineer, and Mr. Mike Dover, Assistant Innovative Program Delivery Engineer, provided invaluable assistance and insight that were critical to the completion of this research. Mr. Robert Lewis and Mr. David Hannon from HNTB shared their knowledge and experience on the application of the design-build project delivery system throughout the course of this project.

Mr. Nabil Haddad, Mr. Jordan Rudel, Matthew Pacheco, and Mr. Kevin Sullivan of Colorado Department of Transportation, Mr. Alan Autry, Mr. Duane Brautigam, Mr. Thomas Bane, and Mr. Jim Spalla of Florida Department of Transportation, Mr. Christian Youngs and Ms. Sheila Upton of Michigan Department of Transportation, Mr. Rodger Rochelle and Ms. Teresa Bruton of North Carolina Department of Transportation, Ms. Michelle Page, Mr. Philip Ellsworth, Mr. Richard Manser, Mr. Brandon Weston, Mr. Dave Schwartz, and Mr. James Olschewski of Utah Department of Transportation, Mr. Shailendra Patel, Mr. James Cromwell, Mr. Les Griggs, and Mr. Mattew Raynolds of Virginia Department of Transportation, and Mr. Derek Case and Ms. Christina Martinez of Washington State Department of Transportation kindly participated in the structured interviews and helped the research team better understated the state of practice in using design-build project delivery system for transportation projects. Finally, we would like to thank Ms. Supriya Kamatkar, Mr. David Jared, and Ms. Georgene Geary of the office of Office of Research at the Georgia Department of Transportation who have helped us throughout the progress of this research project. Especially, Ms. Kamatkar's oversight and administrative support has been critical in the success of this research project. The following Georgia Tech graduate research assistants contributed to various components of this report: Mr. Jian Lu, and Mr. Mohammad Ilbeigi.

The assistance and support from these individuals and organizations is gratefully acknowledged. The opinions and conclusions expressed herein are those of the authors and do not represent the

opinions, conclusions, policies, standards or specifications of the Georgia Department of Transportation or of other cooperating organizations.

CHAPTER 1

EXECUTIVE SUMMARY

1.1 Study Purpose

The United States Department of Transportation (USDOT) and state DOTs across the nation are under increased pressure to keep up with the rapidly rising demand to improve transportation capacities and deliver infrastructure projects. The investment in infrastructure projects and improvements in the transportation system are vital to economic growth and competitiveness of the U.S. However, the ability of transportation agencies to provide adequate time and resources for infrastructure project delivery is limited. Furthermore, the delivery of large transportation projects involves a myriad of processes and requires a high level of coordination among all stakeholders. The amount of time and resources required to advance major transportation projects is significant. Delivery of projects can be delayed for several reasons, such as inefficient decision-making processes, time-consuming permit and approval processes, and shortage of experienced staff and funding. As a result, the USDOT and state DOTs across the nation are unable to keep up with the rapidly rising demand for transportation infrastructure by relying on their traditional project delivery system. Therefore, there have been significant efforts at the national and state levels to utilize innovative project delivery systems to expedite project delivery.

The USDOT and Federal Highway Administration (FHWA) recommend the smart use of innovative project delivery systems, such as design-build, to improve efficiency and effectiveness of developing transportation projects. Although design-build provides state DOTs with accelerated delivery and innovations in design and construction, still there is a need to accelerate delivery of design-build projects and achieve higher level of efficiency. To fully utilize the entire potential benefits of the design-build project delivery system, state DOTs are required to overcome the challenges in various critical areas, such as design-build project selection, procurement process, environmental analysis and permitting, right-of-way (ROW) acquisition, utilities relocation, alternative technical concepts (ATCs), design oversight, design acceptance, and quality management. The major problem is to identify opportunities in critical areas of the project development process to overcome the challenges and improve efficiency of the design-build project delivery system. State DOTs should identify and analyze opportunities for efficiency enhancement and utilize best practices to optimize existing processes of design-build project delivery. This research project is aimed at fulfilling the need for studying challenges in developing design-build projects and identifying opportunities to enhance the efficiency and effectiveness of existing processes for delivering design-build projects.

1.2 Brief Statement of Primary Findings

The primary findings of this research are explained in this section under three categories.

1.2.1 State of Practice of Design-Build in State DOTs across the United States

A comprehensive review of academic and professional literature was conducted, in order to analyze and document the emerging trends in using the design-build project delivery system. A scanning process was conducted on state DOT websites regarding documented state of practice related to design-build. The results of the scanning process indicated that considerable number of state DOTs have developed guidelines and manuals and established appropriate processes for implementing the design-build project delivery system. Further, it was identified that several state DOTs are in the process of improving their design-build practices and promoting the use of design-build in their respective states. This scanning process led to the conclusion that, there are significant efforts toward optimizing current processes for effective and efficient development of design-build projects. The scanning process involved several state DOTs, such as Florida, Colorado, Michigan, North Carolina, Virginia, Utah, and Washington that are the most progressive in utilizing design-build. It was found out that state DOTs, which are at the forefront of utilizing the design-build project delivery system are constantly improving their processes to accelerate delivery of design-build projects, utilize innovation in design and construction, and improve collaboration among all project stakeholders.

1.2.2 State of Practice of Design-Build in Michigan, North Carolina, Utah, and Washington State DOTs

Following the nation-wide scanning process, several structured interviews were conducted with representatives from four state DOTs, Michigan, North Carolina, Utah, and Washington, to further enhance understanding regarding optimizing delivery of design-build projects. The interviewed state DOTs acknowledged the need for accelerating delivery of design-build projects and enhancing efficiency of their respective departments to improve the development process of design-build projects. The interviewed state DOTs recognized the need for improvements in critical areas of the project development process and shared their views regarding challenges and opportunities in each area. They highlighted importance of utilizing transparent decision-making processes for selection of design-build projects. Further, they indicated the need for competitive and transparent procurement processes for selection of the most qualified design-build team for the project. State DOTs participating in this review, expressed major need for collaboration and communication with local, state, and federal stakeholders as well as communication and coordination with private entities involved in environmental analysis and permitting, ROW acquisition, and utilities relocation. They also shared major concerns related to design oversight, design acceptance and quality management in design-build projects.

1.2.3 Challenges and Opportunities for Efficiency Enhancement in Critical Areas of Design-Build Project Delivery

Challenges and opportunities for efficiency enhancement in critical areas of design-build project delivery were identified as major deliverable of this research project. These challenges and opportunities are identified, analyzed, and discussed in the following seven critical areas:

- Project delivery system selection
- Procurement
- Environmental analysis and permitting
- ROW acquisition
- Utilities coordination and relocation
- Alternative technical concepts (ATCs)
- Design oversight, design acceptance, and quality assurance/quality control

The primary findings of this study are categorized under these critical areas. Each area begins with clear descriptions considering dynamics of design-build followed by critical challenges and issues in design-build. These challenges relate to a variety of legal and statutory barriers or issues that can delay the project delivery schedule, increase the project delivery cost, and hinder flexibility of the design-build team to implement innovative design and construction solutions. Furthermore, the analysis for each area involves efficiency enhancement opportunities as a set of propositions that recommend certain strategies for implementation. Examples of actual design-build projects are provided along with references from project RFQs/RFPs, design-build guides and manuals, and professional and academic literature for further clarification of challenges that can happen during development of design-build projects and strategies to overcome the challenges. The analysis further involves follow-up interviews with design-build programs and other technical professionals in various offices including contract management, design, environmental, right-of-way (ROW), and utilities. The results of this analysis along with follow-up interviews in seven critical areas are presented below:

Table 1.1
Challenges Related to Project Delivery System Selection
Has your state DOT experienced these challenges?

Challenges	State DOT: Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Assessment of the Appropriateness of the Design-Build Project Delivery System for a Project							
Legal (statutory), internal (funding, resources, and leadership), and external (market-place conditions) barriers for utilizing design-build project delivery system	No	No	No	No	No	No	No
Difficulty in identification and evaluation of major factors that drive the selection of design-build projects	No	No	No	No	No	No	No
Lack of standard processes for selecting the project delivery system	No	No	Yes	Yes	No	Yes	No
Risk Identification							
Lack of a standard approach for identifying project risks and developing risk registers for design-build projects	No	No	Yes	Yes	No	Yes	No
Coordination and communication problems among subject matter experts from several offices and technical areas for risk identification	No	No	No	No	No	No	No
Risk Assessment and Allocation							
Lack of standard risk assessment processes for qualitative and quantitative risk analysis	No	No	Yes	Yes	No	Yes	No
Lack of standard risk allocation models for avoiding, mitigating, transferring, or sharing risks that were traditionally managed by state DOTs	No	Yes	Yes	Yes	No	Yes	No

Table 1.2
Opportunities to Enhance Efficiency of Project Delivery System Selection
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Assessment of the Appropriateness of the Design-Build Project Delivery System for a Project**							
	State DOTs should develop, maintain, use, and update a standard design-build selection tool that systematically evaluates the appropriateness of design-build for transportation projects.	Standard practice	Not considered	Not considered	Not considered	Standard practice	Not considered	Not considered
	Risk Identification							
	State DOTs should develop, maintain, use, and refine a proper risk identification tool for design-build projects.	Standard practice	Standard practice	Utilized on a few projects /Considered for Future Use	Not considered	Standard practice	Not considered	Standard practice
	Risk Assessment and Allocation							
	State DOTs should develop, maintain, use, and refine proper risk assessment methods for design-build projects.	Standard practice	Standard practice	Utilized on a few projects /Considered for Future Use	Not considered	Standard practice	Not considered	Standard practice
	State DOTs should develop, maintain, use, and refine proper risk allocation matrices for design-build projects.	Standard practice	Standard practice	Utilized on a few projects /Considered for Future Use	Not considered	Standard practice	Not considered	Standard practice

Table 1.3
Challenges Related to Procurement of Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Proposal Evaluation (basis of award)**							
	Limitations of evaluating design-build proposals based on price consideration only (limitations of low-bid as the basis of award)	No	No	No	No	No	No	No
	Difficulty in the evaluation of design-build proposals based on price and technical considerations (difficulty of implementing best-value as the basis of award)	No	No	No	No	Yes	Yes	No
	Possibility of litigations and bid protests in best-value design-build projects	No	No	No	No	Yes	Yes	No
	Proposer Evaluation (single-phase vs. two-phase procurement process)							
	Inherent limitations of the single-phase selection approach for evaluating design-build proposers	No	No	No	No	No	No	No
	Industry concerns related to preparing design-build proposals that require extensive technical proposals as part of a single-phase procurement process	Yes	Yes	No	Yes	Yes	Yes	Yes
	Extensive time and resource requirements to prepare and evaluate RFQs/RFPs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Possibility of litigations and bid protests in two-phase design-build projects	No	Yes	No	No	No	Yes	No
	Selection of Procurement Methods							
	Lack of a consensus in definitions and the actual practice of various procurement methods among state DOTs	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 1.4
Opportunities to Enhance Efficiency of Procurement of Design-Build Projects
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Proposal Evaluation (basis of award)**							
	State DOTs should balance the need between innovation and technicality offered by best-value procurement and efficiency and transparency that can be gained through low-bid procurement.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	Proposer Evaluation (single-phase vs. two-phase procurement process)							
	State DOTs should balance the need between qualified bidders and competitive proposals offered by two-phase selection and expedited procurement and reduced resource requirements offered by single-phase selection.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	Selection of Procurement Methods							
	State DOTs should develop and use standard contract templates for RFQ and RFP processes.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should use consensus evaluation instead of individual evaluations, and pass/fail and adjectival scoring instead of point scoring for the assessment of design-build proposals.	Utilized on a few projects /Considered for Future Use	Not considered	Utilized on a few projects	Utilized on a few projects /Considered for Future Use	Utilized on a few projects /Considered for Future Use	Utilized on a few projects /Considered for Future Use	Utilized on a few projects
	State DOTs should consider shortlisting 3-5 bidders and paying stipends to unsuccessful bidders, in order to enhance the chance of receiving high-quality proposals in the competitive bid environment.	Standard practice	Utilized on a few projects*	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should consider paying stipends to non-winning teams and should clearly describe their approach towards acquiring the ownership right of proposers in the RFP.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice

*FDOT has changed their standard practice from shortlisting 3-5 teams to a long list without any limit on the number of participating design-build teams. However, the qualified teams will carry the qualifications score to the proposal evaluation phase.

Table 1.5
Challenges Related to Environmental Analysis and Permitting on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Identification of Environmental Resources and Coordination with Environmental Agencies**							
	Regulatory concerns with incomplete design in design-build projects	Yes	-	Yes	No	Yes	Yes	Yes
	State DOT relationships with regulatory agencies	Yes	-	Yes	Yes	No	No	Yes
	Improper identification of resources	Yes	-	Yes	Yes	No	Yes	Yes
	Impact of Environmental Permitting on project schedule	No	-	No	Yes	No	No	Yes
	NEPA and Quantification and Mitigation of Environmental Impacts							
	Conventional prescriptiveness constraints of NEPA	Yes	-	No	No	Yes	No	Yes
	Mitigation of NEPA impacts while not limiting innovation	Yes	-	No	No	Yes	No	No
	Permit agency concerns about pressure from design-build teams	No	-	Yes	Yes	No	No	Yes
	Post-Award Environmental Management in Design-Build Contracts							
	Re-evaluation of the NEPA document triggered by proposed design changes	Yes	-	No	Yes	No	Yes	Yes
	Permit modification triggered by proposed design changes	Yes	-	Yes	No	No	No	Yes

Table 1.6
Opportunities to Enhance Efficiency of Environmental Analysis and Permitting on Design-Build Projects
Has your state DOT utilized these opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Identification of Environmental Resources and Coordination with Environmental Agencies**							
	State DOTs should partner with, fund positions, or co-habitat with regulatory agencies	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should examine alternative solutions during the concept phase by clearing additional areas for each environmental special study to allow for innovation	Standard practice	-	Standard practice	Standard practice	Utilized on a few projects	Standard practice	Standard practice
	State DOTs should be flexible to utilize several strategies for acquiring environmental permits	Standard practice	-	Standard practice	Not considered	Not considered	Not considered	Standard practice
	NEPA and Quantification and Mitigation of Environmental Impacts							
	State DOTs should add flexibility to the NEPA document and special studies by identifying alternative mitigation strategies, maximum impacts, and performance mitigation measures	Standard practice	-	Standard practice	Standard practice	Utilized on a few projects	Standard practice	Standard practice
	State DOTs should establish programmatic agreements with federal and environmental agencies to streamline the environmental planning and permitting process and to provide flexibility in the NEPA document	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Utilized on a few projects
	State DOTs should acquire time-consuming and high-risk permits early on and leave non-critical permits to be attained by the design-build team	Not considered	-	Standard practice	Not considered	Standard practice	Not considered	Standard practice
	State DOTs should consider advertising and awarding projects prior to the completion of NEPA to expedite project schedule	Considered for future use	-	Not considered	Utilized on a few projects	Not considered	Not considered	Utilized on a few projects

Table 1.6 (cont'd)

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Opportunities	**Post-Award Environmental Management in Design-Build Contracts**							
	State DOTs should consider allowing the design-build team to accept the risk of NEPA re-evaluations (schedule and cost risks) by requiring the design-build team to complete the re-evaluation or to provide required documentation for NEPA re-evaluation.	Standard practice	-	Not considered	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should consider allowing the design-build team to accept the risk of obtaining or modifying environmental permits (schedule and cost risks) by requiring the design-build team to complete the permit application and/or modification or to provide required documentation for the permit modification.	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should consider providing incentives to the design-build team to encourage reduction in the environmental impacts of the project.	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should require the design-build team to have an environmental management plan and an environmental compliance manager to oversee the environmental impacts of the project and ensure compliance with permit requirements.	Standard practice	-	Not considered	Not considered	Standard practice	Standard practice	Standard practice

Table 1.7
Challenges Related to ROW Acquisition on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Identification of ROW Impacts and Determination of a ROW Acquisition Strategy for Design-Build Projects**							
	Identification of ROW impacts based on incomplete design plans	No	No	Yes	No	Yes	No	-
	Management of third party ROW needs	No	Yes	Yes	No	Yes	No	-
	Execution of ROW Acquisition Tasks							
	ROW acquisition as the critical path to a project's schedule	No	No	Yes	No	Yes	Yes	-
	Management of ROW acquisitions for a large number of parcels	No	No	No	No	Yes	Yes	-

Table 1.8
Opportunities to Enhance Efficiency of ROW Acquisition on Design-Build Projects
Has your state DOT utilized these opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Identification of ROW Impacts and Determination of a ROW Acquisition Strategy for Design-Build Projects**							
	State DOTs should coordinate project ROW needs with utilities, environmental mitigation requirements, tolling infrastructure, and other project needs that may affect ROW	Standard practice	Standard practice	Standard practice	Not considered	Standard practice	Standard practice	-
	State DOTs should identify project goals and select a ROW acquisition strategy that helps achieve them	Not considered	Not considered	Considered for future use	Utilized on a few projects	Standard practice	Utilized on a few projects	-
	Execution of ROW Acquisition Tasks							
	State DOTs should utilize effective ROW management tools	Not considered	Utilized on a few projects	Standard practice	Not considered	Standard practice	Standard practice	-
	State DOTs should utilize advance acquisitions	Utilized on a few projects	Standard practice	Utilized on a few projects	Utilized on a few projects	Standard practice	Utilized on a few projects	-
	State DOTs should maintain ownership of ROW acquisition	Standard practice	Standard practice	Standard practice	Utilized on a few projects	Standard practice	Utilized on a few projects	-
	State DOTs should transfer responsibility for ROW acquisition to the design-build team	Not considered	Not considered	Considered for future use	Standard practice	Standard practice	Standard practice	-

Table 1.9
Challenges Related To Utilities Coordination and Relocation on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Identification of Utilities**							
	Insufficient or inaccurate identification of utility locations	Yes	Yes	No	Yes	Yes	-	-
	Disputes on determination of utility compensable property rights	No	Yes	No	No	No	-	-
	Coordination of Utilities							
	Reluctance of utility owner to work with design-build teams	No	Yes	No	No	Yes	-	-
	Deficiency in addressing utility impacts on environmental resources and ROW needs	No	Yes	No	No	Yes	-	-
	Relocation of Utilities							
	Unclear determination of responsibility for utility relocations	No	Yes	No	No	Yes	-	-
	Uncontrollable impact of utility relocations on the project schedule	No	Yes	No	No	Yes	-	-
	Unfamiliarity of design-build teams with utility relocation work	No	Yes	No	No	No	-	-

Table 1.10
Opportunities to Enhance Efficiency of Utilities Coordination and Relocation on Design-Build Projects
Has your state DOT utilized these opportunities on design-build projects?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Opportunities	**Identification of Utilities**							
	State DOTs should conduct utility engineering and subsurface utility engineering activities early in the project development process	Utilized on a few projects	Standard practice	Considered for future use	Standard practice	Standard practice	-	-
	Coordination of Utilities							
	State DOTs should consider obtaining Memorandums of Understanding (MOUs) or Master Utility Agreements (MUAs) with utilities as major pre-bid utility coordination tasks	Not considered	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should consider including utility coordination in design-build contracts	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should partner with utility owners and encourage design-build teams to partner with utility owners to create solutions that minimize or avoid relocations	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should coordinate anticipated utility relocations with other project disciplines, especially ROW and environmental planning and permitting	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should ensure that contract language is clear to design-build teams on their required role in utility coordination	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	Relocation of Utilities							
	State DOTs should consider including utility relocations in the design-build contract	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should consider providing incentivizes to utility owners to expedite relocations by reimbursing them for normally non-reimbursable relocations	Not considered	Not considered	Not considered	Not considered	Standard practice	-	-

Table 1.11
Challenges Related to Utilizing Alternative Technical Concepts (ATCs) on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Evaluation and Use of ATCs**							
	Difficulty in maintaining confidentiality and fairness (unbiased evaluation) among the bidders	No	No	No	No	No	-	No
	Determination of an “equal or better” design solution in comparison to base design	Yes	Yes	Yes	Yes	Yes	-	Yes
	Excessive resource requirements of the ATC review process	Yes	Yes	Yes	Yes	Yes	-	Yes
	Significant impacts on NEPA permits, ROW, utilities, and other critical areas	No	No	No	No	No	-	No
	Conflicts with Title 23 CFR 636.209(b) (supplement not substitute base proposals)	No	No	No	No	No	-	No

Table 1.12
Opportunities to Enhance Efficiency of Alternative Technical Concepts (ATCs) on Design-Build Projects
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Evaluation and Use of ATCs**							
	State DOTs should provide a standard process to receive, evaluate, and approve ATCs for design-build projects that benefit from innovation.	Standard Practice	Standard Practice	Utilized on a few projects /Considered for Future Use	Utilized on a few projects /Considered for Future Use	Standard Practice	-	Standard Practice
	State DOTs should maintain confidentiality during the ATC review process and hold one-on-one meetings with design-build teams.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	-	Standard Practice
	State DOTs should consider ATCs as a learning device and an educational tool to engage state engineers in the process.	Considered for future use	Considered for future use	Considered for future use	Not Considered	Considered for future use	-	Not Considered

Table 1.13
Challenges Related to Design Oversight, Design Acceptance, and Quality Management on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Design Oversight and Design Acceptance**							
	Loss of Control over Design	No	No	Yes	No	No	Yes	Yes
	Prescriptive design solutions and enforcement of unnecessarily strict design oversight by state DOTs	No	No	Yes	No	Yes	Yes	No
	Limited number of professional design specialists in state DOTs to expedite the process of design oversight and design acceptance	No	Yes	No	Yes	Yes	Yes	Yes
	Fear of shrinking public engineering workforce despite the design-build project delivery system	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Difficulty in stipulating the process for design oversight and design acceptance	Yes	No	Yes	Yes	Yes	No	No
	Fear of jeopardizing quality or sacrificing quality for profit in design-build projects	No	No	No	No	No	No	No
	Quality Assurance/Quality Control (QA/QC)							
	Difficulty in identifying a proper QA/QC plan for a design-build project	Yes	No	Yes	Yes	Yes	No	No
	Difficulty in identifying critical roles and responsibilities for performing major QA/QC tasks	Yes	No	Yes	Yes	Yes	Yes	Yes
	Time-consuming reviews after contract award that hinder innovation and expedited delivery	No	No	Yes	No	No	No	No

Table 1.14
Opportunities to Enhance Efficiency of Design Oversight, Design Acceptance, and Quality Management on Design-Build Projects
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Opportunities	**Design Oversight and Design Acceptance**							
	State DOTs should facilitate the required cultural shift regarding design oversight and design acceptance of design-build projects and provide opportunities for state DOT engineers to think of design-build projects as learning experience and not a threat.	Standard Practice	Standard Practice	Considered for future use	Standard Practice	Standard Practice	Standard Practice	-
	Whenever appropriate, state DOTs should co-locate the project design team and state DOT engineers to facilitate coordination and communication and improve the flow of information on large and complex projects.	Utilized on a few projects	Utilized on a few projects	Not considered	Utilized on a few projects	Utilized on a few projects	Utilized on a few projects	Utilized on a few projects
	State DOTs should either explicitly stipulate what their expectations are from the design-build team regarding design management or solicit design management plan from the design-build team.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice
	Quality Assurance/Quality Control (QA/QC)							
	State DOTs should consider transferring QA/QC responsibilities to the design-build team and retain quality acceptance and independent assurance responsibilities for the state DOT.	Standard Practice	Standard Practice	Standard Practice	Utilized on a few projects/ Considered for future use	Utilized on a few projects/ Considered for future use	Standard Practice	Standard Practice
	State DOTs should either stipulate required quality management plan in the project RFP or solicit proper quality management plan from the design-build team.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice
	Whenever appropriate, state DOTs should take advantage of informal or over-the-shoulder design review while requiring design-build teams to submit milestone design developments for formal review.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice

1.3 Application and Implementation

The challenges and opportunities identified in seven critical areas can help DOTs in efficient and effective implementation of design-build. More specifically, proper identification of challenges and opportunities for efficiency enhancement in critical areas of the design-build project development process can help the state DOT achieve higher level of efficiency. The results of follow-up interviews along with examples of actual design-build projects, further confirm that there are various challenges to design-build project delivery that can be managed through efficiency enhancement opportunities. State DOTs with mature design-build programs can consider utilization of proposed opportunities as part of their ongoing efforts to accelerate delivery of design-build projects, utilize resources more efficiently and optimize their design-build practices.

1.4 Potential Best Practices for Implementation Consideration by GDOT

1.4.1 Potential Best Practices for "Project Delivery System Selection"

GDOT should continue using, maintaining, and updating the standard design-build selection tool that systematically evaluates the appropriateness of design-build for transportation projects.

Several State DOTs have developed and utilized a systematic decision support tool that is capable of capturing the design-build dynamics and reflecting the project outcomes. This project delivery selection tool is able to incorporate several influential criteria in assessing the appropriateness of design-build for the project. The tool should be continuously refined and updated based on feedbacks provided by experts who implement the tool and document lessons learned in design-build projects.

The following state DOTs have implemented this potential best practice:

- Colorado – CDOT utilizes a risk-based process to determine if there is a dominant or obvious choice of project delivery system among the three available choices (design-bid-build, design-build, and CM/GC). Using this process, project delivery system is selected based on specific project attributes and characteristics. Specifically, in this process, the appropriateness of each project delivery system is evaluated based on a series of primary evaluation factors, an initial risk assessment, and three secondary evaluation factors. The outcome of this process is a Project Delivery Decision Report that describes the decision about the project delivery system in details.
- Utah – UDOT uses a comprehensive process for selecting a proper innovative project delivery system for a project. This process evaluates the benefits and risks of design-bid-build, design-build, and construction manager-general contractor (CM/GC) using seven influential factors that have critical impact on the project outcomes.

- Georgia – The Georgia DOT has developed a systematic tool for the assessment of appropriateness of design-build for a project. This tool is based on a systematic approach intended to help GDOT perform the critical task of evaluating the appropriateness of design-build project delivery system for a transportation project.

1.4.2 Potential Best Practices for "Procurement of Design-Build Projects"

GDOT should balance the need between innovation and technicality offered by best-value procurement and efficiency and transparency that can be gained through low-bid procurement.

State DOTs have realized several significant benefits through availability of various procurement methods for design-build projects since they have the ability to decide based on the project-specific goals and objectives. State DOTs should consider low-bid procurement as a powerful and transparent procurement method for certain design-build projects. Low-bid procurement has two fundamental advantages over best-value procurement in awarding design-build contracts: (a) offering the highest level of transparency in the selection process; and (b) expediting the process of contract award. Further, state DOTs can benefit from the advantages of best-value procurement and consider an appropriate level of innovation and technicality in contract award. Use of best-value procurement provides state DOTs with the flexibility to choose the proposal that brings the highest degree of innovation and technicality to the project (i.e., added value).

The following state DOTs have implemented this potential best practice:

- Colorado – CDOT is authorized to use low-bid and adjusted score best-value procurement, and any other method the Chief Engineer determines appropriate for design-build projects.
- Florida – FDOT has the authority to use a variety of procurement methods, such as low-bid, adjusted score best-value, design-build hybrid, best-value maximum price, and design-build with options for design-build projects.

- Michigan – MDOT has the authority to use a variety of procurement methods, such as low-bid, best-value, fixed-cost variable scope, and project specific qualification, for design-build projects.
- North Carolina – NCDOT has the authority to use low-bid and best-value procurement for design-build projects. The best-value procurement in NCDOT involves two-phase RFQ and RFP processes.
- Utah – UDOT has the authority to use low-bid, best-value, and fixed-price best-design for design-build projects depending on the specific goals and objectives of the project. The best-value procurement in UDOT involves two-phase RFQ and RFP processes.
- Virginia – VDOT has the authority to use low-bid, best-value, and fixed-price procurement on design-build projects. The best-value procurement in VDOT usually involves two-phase RFQ and RFP processes.
- Washington – WSDOT has the authority to use low-bid and best-value procurement on design-build projects. The best-value procurement in WSDOT usually involves two-phase RFQ and RFP processes.

GDOT should use consensus evaluation instead of individual evaluations, and pass/fail and adjectival scoring instead of point scoring for the assessment of design-build proposals.

State DOTs have realized significant benefits through utilizing consensus evaluation, and pass/fail and adjectival scoring for assessment of design-build proposals. Consensus rating encourages discussion among the evaluation committee members. The final rating will be based on inputs from all members of the evaluation committee and will reflect interactions and discussions among the members. Consensus rating provides an easy-to-comprehend assessment for the design-build team and reduces the chance of bid protests or lawsuits.

The following state DOTs have implemented this opportunity or considered it for implementation:

- Colorado – CDOT uses adjectival and point scoring in evaluation of technical proposals. CDOT has utilized average of individual scores and consensus evaluation for best-value determination of design-build proposals on some design-build projects.
- Michigan – MDOT has utilized pass/fail scoring and consensus-based evaluation for responsiveness evaluation on a few design-build projects.
- North Carolina – NCDOT uses consensus rating for evaluation of technical proposals. NCDOT requires the technical review committee to submit an overall consensus technical proposal score in various categories.
- Utah – UDOT uses pass/fail scoring and consensus evaluation in responsiveness evaluation and best-value determination of design-build proposals.
- Virginia – VDOT uses consensus evaluation and group discussions to assign scores to technical proposals in various categories. VDOT also uses pass/fail evaluations to determine proposal responsiveness.
- Washington – WSDOT has utilized adjectival scoring and consensus evaluation to determine responsiveness of design-build proposals on some projects.

1.4.3 Potential Best Practices for "Environmental Planning and Permitting"

GDOT should add flexibility to the NEPA document and special studies by identifying alternative mitigation strategies, maximum impacts, and performance mitigation measures. State DOTs have realized several significant benefits through considering flexibility in environmental analysis and permitting. There have fewer reevaluations of the NEPA or state environmental planning documents. Additionally, less upfront work has been required to develop project plans to clear NEPA or state environmental planning documents since these documents can be developed utilizing less detailed designs. Design-build teams also prefer this strategy since flexibility in NEPA allows them to entertain new design ideas and propose cost-effective solutions for the project.

State DOTs that have implemented this potential best practice are the following:

- Colorado – CDOT defines maximum anticipated impacts in their "Base Design" which defines the project limits in the environmental planning document.
- Michigan – MDOT documents all potentially affected resources and possible impacts but does not document a design solution. MDOT also works to ensure that the NEPA document clears areas outside of the anticipated construction footprint that will be needed by the design-build team.
- North Carolina – North Carolina clears a wide corridor to allow for flexibility in final design regardless of the project delivery method (design-build or design-bid-build).
- Virginia – clears an environmental footprint much wider than anticipated to be required by the design-build team; anticipated impacts are documented with the flexibility that the design-builder can alter impacts.
- Washington – clears an anticipated corridor by describing and quantifying anticipated approaches to the final design.

GDOT should consider allowing the design-build team to accept the risk of NEPA re-evaluations (schedule and cost risks) by requiring the design-build team to complete the re-evaluation or to provide required documentation for NEPA re-evaluation.

State DOTs and design-build teams have realized benefits by requiring the design-build team to update or provide documentation to update the NEPA document. State DOTs benefit by not expending resources to update special studies and/or prepare the NEPA reevaluation. Design-build teams benefit as they are able to better control the project schedule as they are not waiting on the State DOT to update special studies and/or prepare the NEPA reevaluation.

State DOTs that have implemented this potential best practice are the following:

- Colorado – design-build team updates special studies and Colorado DOT writes the reevaluation.
- North Carolina – design-build team prepares all special study updates and writes the reevaluation; North Carolina reviews and submits these documents to FHWA.
- Virginia – design-build team prepares all special study updates and Virginia DOT writes the reevaluation, performs additional coordination with regulatory agencies as required, and submits the reevaluation to FHWA.
- Washington – design-build team prepares all special study updates and WSDOT writes the reevaluation and submits to FHWA.

1.4.4 Potential Best Practices for "Right of Way Acquisition"

GDOT should continue to coordinate project ROW needs with utilities, environmental mitigation requirements, tolling infrastructure, and other project needs that may affect ROW.

State DOTs have realized benefits of early coordination with utilities, environmental mitigation requirements, tolling infrastructure, and other project needs that may affect required ROW. Identifying these needs during the project's concept development has allowed State DOTs to avoid delays and change orders due to additional ROW requirements being identified after a design-build contract has been awarded.

State DOTs that have implemented this potential best practice are the following:

- Colorado - coordinates ROW requirements closely with utility relocations and environmental mitigation efforts.
- Utah – coordinates upfront with utility owners to identify needs to mitigate this risk. Utah also obtains and coordinates permits and the NEPA process prior to award of design-build contracts to ensure adequate ROW is acquired.

- Virginia – performs early coordination with utilities and identifies an anticipated ROW footprint. This footprint also takes into consideration all mitigation and environmental permit requirements.

GDOT should select a ROW acquisition strategy that helps GDOT achieve project-specific goals.

State DOTs have several options (depending on State laws) to acquire ROW on design-build projects. These options are:

- Acquire the ROW using internal resources in advance of advertising and awarding the design-build contract
- Acquire the ROW using internal resources after award of the design-build contract
- Require the design-build team to acquire the ROW needed for the project

Each option has benefits and risks that must be considered with the goals of the project. Projects with expedited delivery as the primary goal often have the ROW acquired in advance to expedite the project to construction, while projects that have a ROW footprint that is likely to change, may wait until after the design-build contract is awarded to acquire the ROW.

Utah DOT has implemented this potential best practice as the following:

- Utah – conducts a risk analysis on all design-build projects and selects the ROW acquisition method that best accomplishes project goals and reduces project risks.

All other State DOTs that were interviewed either acquire all ROW prior to advertising or awarding a design-build contract, or require the design-build team to acquire all ROW.

1.4.5 Potential Best Practices for “Utility Coordination and Relocation”

GDOT should continue to ensure that contract language is clear to design-build teams on their required role in utility coordination and relocations.

Design-build projects are generally more successful when the State DOT and design-build team both understand the work the design-build team is contractually obligated to perform. Clear contract requirements allow the design-build team to accurately scope and bid these requirements. Utility coordination and relocation requirements are often excluded from the scopes of design-bid-build contracts and design-build teams may be unfamiliar with performing this type of work. Clear contract requirements can help to mitigate this challenge so that all bidding design-build teams understand what is required vs. only those design-build teams with experience in these areas.

The following state DOTs have implemented this potential best practice:

- Washington – explicitly states design-build team requirements with respect to utility coordination and relocation and lists out those requirements.
- New York – provides a table in the contract that identifies all utilities located on the project, the location of each utility, the planned adjustment or relocation that has been previously coordinated, and who will be performing the relocation (State DOT, utility owner, or design-build team).
- Minnesota – explicitly states all utility coordination and relocation requirements in the contract. The contract also states the work that the design-build team is not responsible for, which aids the design-build team in limiting their risks and likely reduces the contingencies in their bids.

1.4.6 Potential Best Practices for "Alternative Technical Concepts (ATCs) in Design-Build Projects"

GDOT should consider ATCs as a learning device and an educational tool to engage state engineers in the process.

State DOTs have realized significant benefits through considering ATCs as a learning opportunity and an educational tool. The ATC submission and review process enables state DOT engineers to discuss innovative solutions with design-build teams. The meetings during the ATC process can be considered as a learning experience for engineers of the state DOT. Engineers and designers of the state DOT have the opportunity to discuss new ideas with proposers. The design-build team is at best position to make new design solutions to work since they are at risk for the successful implementation of new ideas. Being exposed to these new ideas can result in new ways of thinking and new ways of doing business that facilitate the deployment of innovation. In other words, ATCs are unique learning experiences that can be utilized by the engineers of the state DOT in similar situations. Interviews with Colorado, Florida, and Utah state DOTs highlighted the educational benefits of ATCs for engineers of the state DOT.

The following state DOTs have implemented this potential best practice:

- Colorado – CDOT encourages design-build teams to recommend alternatives as ACCs (alternative to basic configuration) and ATCs (alternatives to technical requirements). CDOT has used ATCs and ACCs on several projects and believes that the proposed alternatives can result in significant innovations with the potential to be used on future projects.
- Florida – FDOT believes that ATCs provide the design-build team with additional flexibility to test innovative ideas on design-build projects. The office of design in FDOT has initiated "invitation for innovation" to further involve the DOT engineers in

development and implementation of innovative solutions in highway design and construction.

- Michigan – MDOT has utilized ATCs on some design-build projects and considers it as an innovative tool with the potential to be used on future projects.
- Utah – UDOT considers ATCs as beneficial tools for engaging DOT engineers in innovation. For instance, the Diverging Diamond Interchange at Pioneer Crossing and I-15 is an example of an innovative solution that can be considered for future use in design-build and design-bid-build projects.

1.4.7 Potential Best Practices for "Design Oversight, Design Acceptance, and Quality Assurance/Quality Control (QA/QC) in Design-Build Projects"

GDOT should facilitate the required cultural shift regarding design oversight and design acceptance of design-build projects and provide opportunities for state DOT engineers to think of design-build projects as learning experience and not a threat.

State DOTs have realized several significant benefits through facilitating the cultural shift so that state DOT engineers and employees understand that design development is contractually allocated to the design-build team and design management is one of the new roles that the design-build team should play. By enabling the cultural shift to the design-build environment where the state DOT personnel control the process rather than the product, the state DOT can facilitate the formation of a learning culture inside the Department. As a result, the engineers and personnel of the state DOT involved in different phases of the project development would think of each design-build project as a learning experience and not a threat to their positions. Each design-build project can provide invaluable opportunity for the state DOT engineers to learn from their peers on the private sector. The following state DOTs have implemented this opportunity:

- Colorado – CDOT has been able to overcome challenges regarding design oversight and design acceptance by facilitating the cultural shift toward a more administrative role for the state DOT. CDOT believes by making the required cultural shift and maintaining administrative role, the design-build team has more flexibility in developing and implementing innovative ideas, which are great learning experiences, on design-build projects.

- Florida – FDOT has made the cultural shift a long time ago and design-build has become the standard way of doing business for FDOT. By establishing trust between the state DOT and design-build teams, FDOT is able to maintain control over design, preserve quality on design-build projects and at the same time, transfer the responsibility of design to the design-build team.
- Utah – UDOT prefers to have an administrative role and at times partner with the design-build team to achieve an acceptable design solution. Despite some design challenges in accelerated design-build projects, UDOT has made the required cultural shifts and is utilizing design-build more frequently.

Whenever appropriate, GDOT should take advantage of informal or over-the-shoulder design review while requiring design-build teams to submit milestone design developments for formal review.

State DOTs have realized significant benefits through utilizing expedited informal (over-the-shoulder) or milestone formal design reviews. Informal and verbal reviews while design activities are under progress are more suited to the fast-track environment of design-build projects. The state DOT should focus more on reviewing the QA/QC processes rather than precisely checking every individual component of design. This strategy is especially more efficient in projects that QA/QC activities are transferred to the design-build team and independent consultants. The state DOT should also offer their comments on preliminary or final design submittals in a timely manner. Through interviews with several state DOTs and review of design-build solicitation documents, the research team has identified that most state DOTs spend 7 to 21 calendar days to review design submittals. To efficiently implement design reviews, the state DOT should also develop a review plan prior to contract award and require the design-build team to accept the review plan contents. The following state DOTs have implemented or considered this potential best practice:

- Colorado – CDOT recommends informal and over-the-shoulder reviews prior to official design submittals to expedite the review for faster design acceptance. CDOT also requires 60% and 100% milestone submittals for formal reviews.
- Florida – FDOT takes advantage of efficient reviews. These reviews are usually conducted prior to formal review and help the design-build team achieve performance requirements of the contract. Intensive and time-consuming reviews require extensive time and effort. FDOT avoids time-consuming design reviews to the extent possible and requires design-build teams to submit milestone review schedules.
- North Carolina – NCDOT utilizes informal and over-the-shoulder reviews and also formal 25% and 100% design reviews.
- Utah – UDOT utilizes over-the-shoulder reviews during design development since it enables them to expedite design reviews, especially when the designer, contractor, reviewers are present at the project location. UDOT also requires the design-build teams to submit 50% and 90% design packages according to the pre-established schedule.
- Virginia – VDOT utilizes informal reviews prior to formal design submittals. VDOT usually requires preliminary and final (100%) design submittals for formal reviews.
- Washington – WSDOT utilizes informal and over-the-shoulder reviews and also requires 30%, 60%, and 100% milestone submittals for formal reviews.

CHAPTER 2

INTRODUCTION

In the United States, the needs for expanding and repairing the nation's network of roads, bridges, and tunnels have been constantly escalating over the past decades (ASCE 2013; USDOT 2013). According to the Report Card for America's Infrastructure (ASCE 2013), 32% of America's major roads are in poor or mediocre condition and 42% of the nation's major urban highways are congested. As a result, motorists pay $67 billion a year or $324 per motorist in additional repairs and operation costs. Further, Americans wasted 1.9 billion gallons of gasoline in traffic (an average of 34 hours in 2010), at a cost of $101 billion per year (ASCE 2013). The U.S. Department of Transportation (U.S. DOT) and state DOTs across the nation are unable to keep up with the rapidly rising demand for transportation infrastructure by relying on their traditional project delivery system. A variety of issues, such as changing economic conditions, delayed federal transportation reauthorization bills, and declining value of fuel taxes, have affected the ability of transportation agencies to provide adequate budget to expedite delivery for building new capacity and performing necessary maintenance on existing infrastructure (USDOT 2013; Rall et al. 2010).

The delivery of large transportation projects involves a myriad of processes and requires a high level of coordination among all stakeholders. According to the Federal Highway Administration (FHWA), project delivery refers to the implementation of a project, from its inception to the close-out of construction, with responsibilities that include: estimating and controlling costs; ensuring the fulfillment of environmental and federal requirements; obtaining adequate financing; and the overall management of various parties involved in bringing the project to a successful completion (FHWA, IPD 2013).

The amount of time and resources required to advance a project through the project development process (i.e. from the initial planning stages to the completion of construction) is significant. According to the Government Accountability Office (GAO), while the time required varies with the size of the project, its complexity, and the public interest in the project, some projects may take as few as 3 years or as many as 20 years or more to complete (RSG 2007). One of the main reasons for longer than usual project delivery time is that at different stages, projects are pending actions, approvals or inputs from a number of federal, state, and local stakeholders. Hence, projects take long to complete because there can be many major steps requiring actions, approvals or input from a number of federal, state, and other stakeholders. In addition, several issues that are internal to transportation agencies, such as project priorities, staffing, funding, and communication can affect the project development process and cause delays (Mallett and Luther 2011). Conventional project delivery requires separating the design and construction processes and performing in-house design by the agency. However, involvement of the private sector in development of transportation projects can lead to accelerated project delivery and cost savings for the state DOT. There is an opportunity to enhance project delivery by utilizing innovations of the private sector in planning, financing, design, construction, operation, and maintenance of transportation facilities.

There is a growing challenge between the speed of delivering new transportation capacities and the rapidly rising demand for transportation infrastructure. The Federal Highway Administration (FHWA), state DOTs, and other stakeholders have recognized that the slow pace of project delivery leads to increased costs, inefficient resource allocation, risks to overall economic vitality, and quality of life. Therefore, there have been significant efforts at the national and state levels to utilize innovative project delivery systems to expedite project delivery.

2.1 Development of Innovative Project Delivery Systems

The FHWA has been allowing state DOTs to utilize innovative project delivery systems since the introduction of the special experimental project No. 14 (SEP-14) – “Innovative Contracting” in 1990. According to the Design-Build Institute of America (DBIA), as of 2013, 45 State DOTs across the U.S. are authorized to use design-build and several are experimenting with construction manager general contractor (CM/GC) project delivery systems (DBIA 2013). Since the “Design-Build Contracting: Final Rule” became effective on January 9, 2003, the contracting practices by state DOTs have evolved. Innovative practices for project delivery help state DOTs expedite delivery of projects and overcome the challenges of traditional project delivery. However, delivery of projects by innovative approaches is not without hurdles. State DOTs with mature design-build programs have encountered various issues and challenges that can hinder and delay delivery of design-build projects. State DOTs with mature design-build programs constantly look for appropriate ways to optimize their current processes for project delivery. These State DOTs need to identify best practices and opportunities in various areas of project delivery and develop strategies that can help them deliver design-build projects more efficiently.

The U.S. DOT and the FHWA encourage state DOTs to utilize innovative practices and opportunities to enhance the efficiency in delivery of transportation projects. In 2010, the FHWA formed the Every Day Counts (EDC) initiative with particular focus on deployment of innovation aimed to improve the process of transportation project delivery with the emphasis on the following key goals (EDC 2012a):

- Shortening project delivery
- Enhancing the safety of U.S. roadways
- Protecting the environment

Shortening project delivery and accelerating project delivery is a major component of the EDC initiative, designed to help the U.S. DOT and state DOTs deliver projects sooner so that the public can enjoy the projects' benefits (EDC 2012a). To achieve the objectives identified in the EDC initiative regarding accelerated project delivery, the EDC initiative specifically recommends implementing the following innovative practices (EDC 2012a):

- Shortening project delivery toolkit: A toolkit that includes ideas for using flexibilities in the law and not duplicating efforts in the planning and environmental review process.
- Accelerated project delivery methods: Innovative contracting practices that should become the standard way of doing business.

On July 6, 2012, the Moving Ahead for Progress in the 21st Century Act (MAP-21) was signed into law by President Obama. MAP-21 is the first long-term highway authorization enacted since 2005 and represents a milestone for the U.S. economy since it funds surface transportation programs at over $105 billion for fiscal years (FY) 2013 and 2014 (FHWA 2012c). MAP-21 is supposed to guide the growth and development of the country's vital transportation infrastructure by transforming the framework for investments. MAP-21 has specific focus on accelerated project delivery. More specifically, Title I (C) of Division A, is dedicated to accelerated project delivery in federal-aid highway programs. Regarding this critical issue, the law states the following (H. R. 4348—123, Division A, Title I, Subtitle C, 2012):

> "*… (1) it is in the national interest for the U.S. DOT, State DOTs, transit agencies, and all other recipients of Federal transportation funds–*
>
> > *(A) to accelerate project delivery and reduce costs*
> >
> > *(B) to ensure that the planning, design, engineering, construction, and financing of transportation projects is done in an efficient and effective manner, promoting accountability for public investments and encouraging greater private sector involvement in project financing and delivery while enhancing safety and protecting the environment…*"

It can be noticed that accelerated project delivery, and efficient and effective process for developing transportation projects are critical components in EDC and MAP-21. Several provisions of MAP-21 are designed to reduce project delivery time and costs while protecting the environment (FHWA 2012c). The main reason for the great deal of focus on accelerated project delivery is long completion time for transportation projects. There is a growing challenge between the speed of delivering new transportation capacities and the rapidly rising demand for transportation infrastructure. Regarding this critical issue, MAP-21 states the following (H. R. 4348—123, Division A, Title I, Subtitle C, 2012):

> "… *(2) delay in the delivery of transportation projects increases project costs, harms the economy of the United States, and impedes the travel of the people of the United States and the shipment of goods for the conduct of commerce*…"

The main objective of Subtitle C of MAP-21 is to devise solutions for the existing challenges in delivery of transportation projects. These improvements are designed to enhance economic growth and increase resource utilization in a timely manner, while protecting the environment. To better implement these improvements, the U.S. DOT, in particular the FHWA, is suggested to identify innovative solutions and better ways to deliver transportation projects. Followed by enactment of MAP-21, the FHWA endorsed a second wave of innovative solutions to state, local, and regional agencies as well as to the design and construction industries through EDC 2. Two of the innovative solutions of EDC 2, the design-build and the construction manager general contractor (CM/GC) project delivery systems, focus on expediting the delivery of transportation projects, a critical component of MAP-21.

The U.S. DOT and FHWA recommend the smart use of innovative project delivery systems, such as design-build, to improve efficiency and effectiveness of developing transportation projects. However, state DOTs are challenged with several issues to expedite the delivery of design-build projects, in order to fully utilize the entire potential benefits of design-build project delivery system. Delivery of design-build projects is a complex process that involves challenges in various critical areas, such as design-build project selection, procurement process, environmental analysis and permitting, right-of-way (ROW) acquisition, utilities relocation, alternative technical concepts (ATCs), design oversight, design acceptance, and quality management. The critical issue for state DOTs is to identify opportunities in each area to overcome the challenges and improve efficiency of design-build project delivery. The major problem is to identify and understand critical barriers and bottlenecks in major phases of developing design-build projects, such as processes for design-build project selection, procurement, environmental analysis and permitting, utilities relocation, ROW acquisition, design oversight, design acceptance, and quality management. Enhancing the understanding of state DOTs in these areas is required to optimize existing processes of design-build project delivery. Best practices and innovative solutions to expedite project delivery should be identified and analyzed by state DOTs, in order to enhance the efficiency and effectiveness of project development using the design-build project delivery system. Studying challenges in developing design-build projects and identifying opportunities to enhance the efficiency and effectiveness of existing processes for delivering design-build projects are the subjects of this research project.

2.2 Research Objectives

The overarching objective of this research is to develop a guidebook for the Georgia DOT (GDOT) to expedite the delivery of design-build projects, enhance the efficiency of the department, and achieve higher levels of performance and compliance with transparency, legal, and statutory expectations. Specific objectives of this research are:

a) Identify challenges in critical areas of the project development process (from planning to close-out) that can delay project delivery schedule, increase project delivery cost, or hinder innovation and integration in project delivery
b) Propose opportunities for efficiency enhancement and document solutions in each critical area to overcome the challenges of design-build project delivery
c) Develop a best-practices guidebook for GDOT to show how the effective adoption of efficiency enhancement opportunities can help GDOT overcome the challenges and expedite the delivery of design-build projects

2.3 Overview of the Research Process

To achieve the research objectives, comprehensive literature review and content analysis and structured interviews were chosen as the research method. Specific research tasks are designed in order to achieve the research objectives as follows:

- Conduct a comprehensive literature review regarding the design-build project delivery system
- Review the current practice of design-build project delivery system in state DOTs across the U.S.
- Scan and interview design-build programs in 4 State DOTs: Michigan, North Carolina, Utah, and Washington State
- Perform content analysis of design-build project documents (i.e. request for qualifications (RFQs), request for proposals (RFPs), interim reports, and project reviews) to identify innovative solutions to expedite project delivery
- Identify challenges and opportunities to enhance efficiency of the state DOT in delivery of design-build projects in the following seven critical areas:
    - Design-build project selection
    - Procurement
    - Environmental analysis and permitting
    - ROW acquisition
    - Utilities coordination and relocation
    - Alternative technical concepts (ATCs)
    - Design oversight, design acceptance, and quality assurance/quality control
- Perform follow-up interviews with design-build programs in 4 State DOTs (i.e. Michigan, North Carolina, Utah, and Washington State) to validate the challenges and opportunities

The findings and products of these research tasks are presented in the following order: Chapter 3 provides a review of innovative project delivery systems in the U.S. Chapter 4 presents the findings of in-depth study of design-build programs in 4 state DOTs (i.e. Michigan, North Carolina, Utah, and Washington). The seven critical areas of the project development process are presented in Chapter 5 to Chapter 12 with efficiency enhancement opportunities as a set of propositions under each area of consideration. Finally, Chapter 12 presents the conclusions of this research.

2.4 Significance of this Research

This research builds upon the goals and objectives defined in Moving Ahead for Progress in the 21st Century Act (MAP-21) and the Every Day Counts (EDC) initiatives to expedite the delivery of transportation projects and efficiently use the resources for the public benefit. The design-build project delivery system when selected appropriately can provide state DOTs with a time- and cost-efficient alternative for delivery of transportation project. The MAP-21 legislation and the EDC initiatives both recommend the use of alternatives to the traditional design-bid-build project delivery system for accelerated project delivery. Furthermore, the legislation and the FHWA recommend that state DOTs should "develop and advance" the use of best practices to accelerate project delivery and deliver their projects more efficiently. Several state DOTs, such as the Georgia Department of Transportation (GDOT), have used design-build to expedite project delivery and facilitate innovation in their respective states. While design-build is a relatively new concept for some state DOTs, those DOTs with mature design-build programs, such as GDOT, have been seeking new ways to optimize their business processes to enhance the efficiency of their design-build programs.

Considering the challenges and issues of design-build project delivery, this research is concerned with improving the overall efficiency of state DOTs in transportation project delivery. Enhancing the efficiency of design-build project delivery will enable state DOTs to: (1) improve the decision-making process for design-build project selection; (2) accelerate lengthy and inefficient environmental analysis and permitting processes; (3) establish appropriate processes for procurement of qualified design-build teams; (4) accelerate ROW acquisition and reduce property acquisition costs; (5) improve utilities coordination and accelerate their relocation; (6) establish appropriate processes for consideration of innovative ideas and alternative solutions for design and construction; and (7) improve design oversight, design acceptance, and quality management practices in design-build projects.

CHAPTER 3

REVIEW OF TRADITIONAL AND INNOVATIVE PROJECT DELIVERY SYSTEMS

In this chapter, a review of traditional and innovative project delivery systems that are in use by state DOTs across the U.S. is presented. The thorough review is intended to describe the organization structure of different project delivery systems and relations and contractual obligations of different contract parties in delivery of projects. The review includes the traditional design-bid-build, CM/GC, design-build and variations of design-build project delivery systems.

3.1 Traditional Project Delivery

The traditional design-bid-build project delivery system, involves competitively bid construction contracts that are based on complete and prescriptive contract documents prepared by the owners' architects and engineers and/or design consultants (AGC 2011). Design-bid-build projects by nature are delivered through a sequential approach that starts with planning and scope development, which later form the final project design, and continues with design development and finalization along with permit acquisition and several other responsibilities. In design-bid-build, the state DOT assigns the responsibility of design and construction to separate parties as shown in Figure 3.1 below.

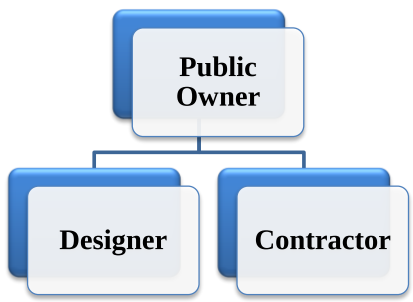


Figure 3.1

Organizational Structure of Design-Bid-Build

The state DOT and the designer are responsible for the accuracy and the validity of the project design. The procurement of the contractor in this project delivery system is mainly based on the total construction cost. Since most of the required responsibilities in design-bid-build project delivery should happen in sequence, delivery of these projects is associated with longer overall schedule and possible changes in total project costs, not to mention claims and disputes resulting from change orders and design errors and omissions. State DOTs, the FHWA, the federal government, and other stakeholders have recognized that the slow pace of project delivery leads to increased costs, inefficient resource allocation and risks to overall economic vitality and quality of life. Conventional approaches to project delivery have proven to be insufficient in dealing with the emerging challenges to streamlined project delivery. Since state DOTs have significant backlogs of needed projects but little financial means to advance them to the next step, innovative project delivery has become an active tool for state DOTs that can mitigate the effects of construction cost increase, which is escalating at rates higher than those of the inflation.

3.2 Innovative Project Delivery

In the mid-1800s many states adopted the “low-bid” requirements to protect tax payers from improper practices by agencies. The “low-bid” requirements on public projects also ensured that the public money was invested at the best possible way. In 1938, the Federal Aid Highway Act set the stage for the interstate highway system and required the use of “competitive bidding process” for construction and major reconstruction projects. The 1968 Federal Aid Highway Act required that construction contracts be awarded competitively to the contractor which submits the lowest responsive bid. The mandate to award the contracts only on the basis of “lowest responsive bid” was set forth in 23 U.S.C. 112 of the 1968 Federal Aid Highway Act. In 1990, the FHWA established the Special Experimental Project Number 14 (SEP-14) – Innovative Contracting. This act allowed state DOTs to test and evaluate a variety of approved innovative project delivery systems, such as design-build and CM/GC. In 1998, the Transportation Equity Act for the 21st Century (TEA-21) became the new authorization legislation for the nation's surface transportation programs. Included in TEA-21 was Section 1307 (c), which required FHWA to develop and issue regulations describing the approval criteria and procedures of the agency. The “Design-Build Contracting: Final Rule” was published in the federal register on December 10, 2002 and became effective on January 9, 2003. As for the CM/GC project delivery system, there is no current statutory authority in effect.

Since 1990, a number of transportation agencies (as owners, sponsors, or contracting agencies of highway projects) have been experimenting with a wide range of innovative project delivery systems aimed at lowering cost and time to develop highway construction and rehabilitation projects, while maintaining or improving the quality of delivered projects. By placing increasing functional responsibilities (e.g., design, financing, operations, and maintenance) under a single contract, innovative project delivery systems can take several forms that differ in the degree to which the private sector assumes responsibility along with the associated risks. Figure 3.2

summarizes innovative project deliveries into 5 project delivery systems, construction manager/general contractor (CM/GC), design-build, design-build-operate-maintain, design-build-finance, and design-build-finance-operate-maintain.

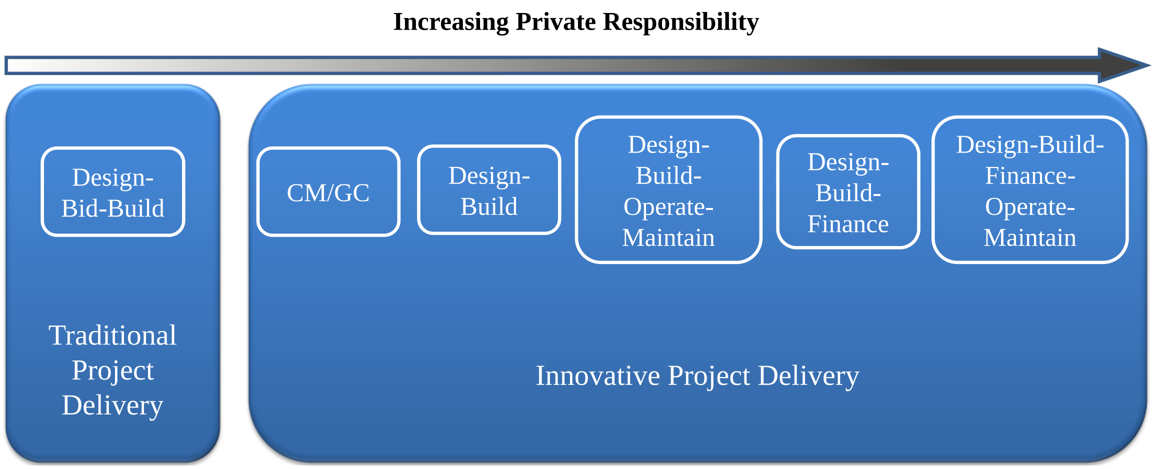


Figure 3.2

Continuum of Private Sector Involvement in Project Delivery Systems

3.2.1 Construction Manager/General Contractor Project Delivery System

The CM/GC project delivery system allows a public owner to engage a general contractor as the construction manager during the preconstruction phase to provide preconstruction services, such as design, constructability, pricing, and scheduling input (FHWA, IPD 2013). Since the construction manager (CM), who will later become the general contractor (GC), is responsible for the performance of all construction-related activities, this project delivery system is also known as CM at-risk. As shown in Figure 3.3, the organization structure of CM/GC is similar to the traditional design-bid-build project delivery system where the public owner signs two separate contracts with a designer and a contractor, respectively.

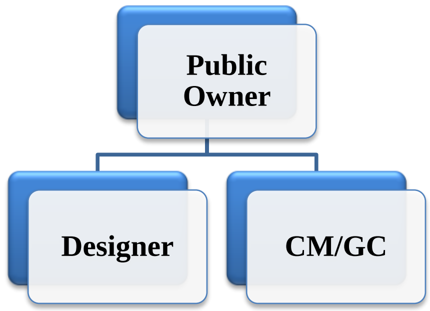


Figure 3.3

Organizational Structure of CM/GC

The CM/GC process is broken down into two phases. The first phase, the design phase, allows the CM/GC to work with the designer and the project owner to identify risks, provide costs projections and refine the project schedule. As the design nears completion, if the owner and the construction manager are able to negotiate a “guaranteed maximum price” (GMP) for the construction of the project based on the defined scope and schedule, they sign a construction contract and the construction manager then becomes the general contractor. CM/GC allows state DOTs to remain active in the design process while assigning risks to the parties most able to mitigate them.

Table 3.1 summarizes the responsibilities in the CM/GC project delivery system.

Table 3.1

CM/GC Roles and Responsibilities

	Own	**Design**	**Build**	**O&M**	**Financial Responsibility**
CM/GC	Public	Public	Private	Public	Public

There are advantages to using the CM/GC project delivery system. Since contractor has valuable proven experience doing the actual construction, they can offer innovations and best practices as the owner’s consultant in the design process to reduce costs and schedule risks of the project. Early contractor involvement in the design process allows the owner to consider employment of innovations and best practices, assist in the design process, and make informed decisions regarding the project cost and schedule. Furthermore, public owners can understand the risk and explore risk mitigation options with feedback provided by the contractor. The contractors can also provide constructability reviews for the designer to produce better designs that reduce issues in construction and prevent change orders that can lead to future claims, disputes and cost or schedule overruns.

3.2.2 Design-Build Project Delivery System

Design-build is a relatively new project delivery system that is growingly applied or considered by state DOTs. Procurement consists of selecting a design-build contractor that is responsible for both design and construction (FHWA, IPD 2013). As shown in Figure 3.4, the public owner only signs a single contract with the design-build team who is responsible for the both design and construction activities.

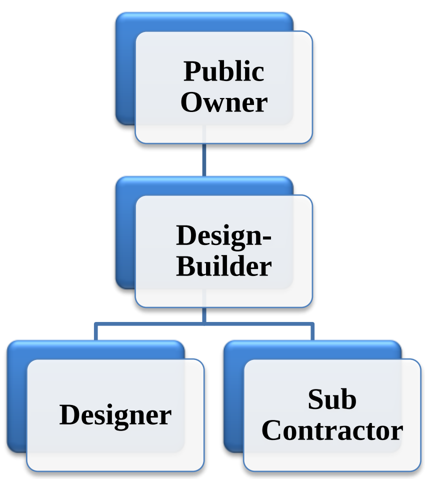


Figure 3.4

Organizational Structure of Design-Build

In the design-build process, state DOT identifies what it wants to be constructed, accepts proposals, and selects the design-build team to assume the risk and responsibility for design and construction tasks. The design-build team is involved early in the design process, so the designer can tailor plans to design-build team's capabilities from the onset. This provides the design-build team with increased flexibility to be innovative, along with greater responsibility and risk for the majority of the design work and all construction activities. On the other hand, the owner takes the responsibility for financing, operating, and maintaining the project. Table 3.2 summarizes the allocation of responsibilities in a typical design-build contract.

Table 3.2

Design-Build Roles and Responsibilities

	Own	**Design**	**Build**	**O&M**	**Financial Responsibility**
Design-Build	Public	Private	Private	Public	Public

Design-build shortens the project duration, in several ways. The design-build team has flexibility in selecting design, materials, and construction methods based on available equipment, workforce, and other resources. The design-build team also works closely with the designer to share their expertise, in order to reduce the risk of design errors and the need for redesign, which can add to the project cost and can delay the project. Allowing the design-build team to tailor the project design and applying appropriate innovative solutions provide flexibility for the design-build team to manage and compensate for cost increases in one area through efficiencies in another. Trust and teamwork between the designer and the contractor allows for greater collaboration and innovation, and accelerated project delivery, and often results in improved project quality. It is shown that through design-build, the state DOT can reduce project duration sometimes by 1 to 2 years (FHWA, IPD 2013).

Design-build provides opportunities for significant cost savings and safety improvement. For example, shortened project durations reduce labor costs and safety risk associated with the maintenance of traffic or work zones. As of May 2012, there are only three State DOTs (Oklahoma, Nebraska, and Iowa) that have not received legislative approval to use the design-build project delivery system for transportation projects (DBIA 2013). Figure 3.5 illustrates the current design-build state laws for transportation projects.

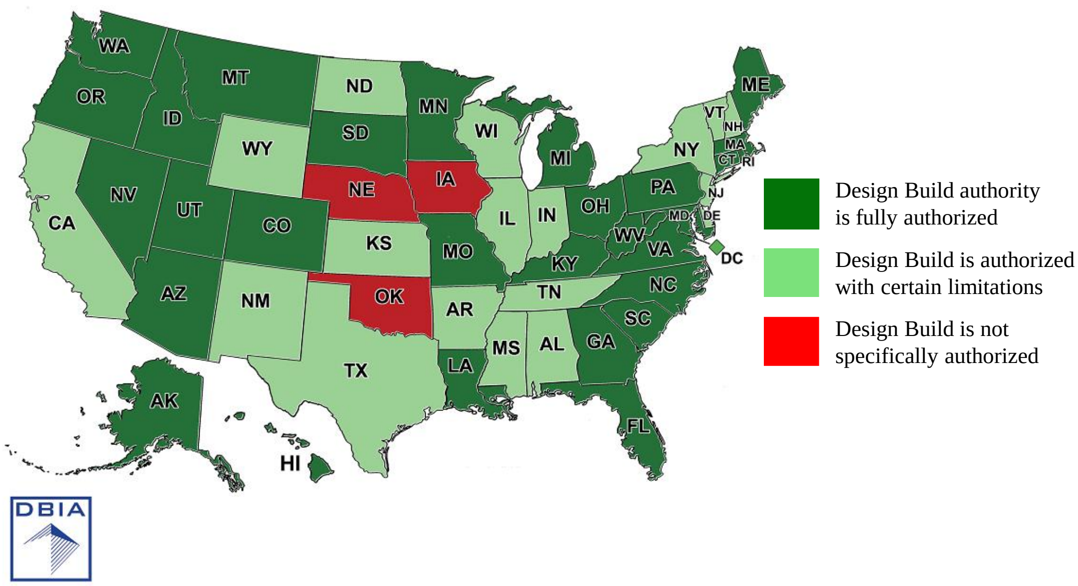


Figure 3.5

Design-Build State Laws for Transportation Projects in 2012

(Copyright of DBIA 2013)

With the primary designer and the contractor working as a team, scheduling considerations can be addressed up front, often leading to more efficient project implementation. The design-build team has the ability to compress the project delivery schedule by creating an overlap between design and construction activities or starting the construction process before the design is finalized. This is a major advantage of design-build compared with the traditional design-bid-build project delivery system where design and construction phases must be undertaken in sequence. Two studies involving over 600 design-build projects in the private sector showed a 30% increase in project delivery speed and 6% reduction in unit cost compared to Design Bid Build projects (Gransberg and Barton 2007). This time-saving advantage makes design-build project delivery system the prime candidate for projects where fast-track implementation is a priority (Touran et al 2011). Design-build has proven to be a successful Project Delivery System for implementing transportation projects. The FHWA's 2006 Report to Congress, titled: “Design-Build Effectiveness Study” concluded that design-build can reduce the project delivery duration (by as much as 14%) and may produce project savings while maintaining the same level of quality as the traditional design-bid-build project delivery system. Nevertheless, several state DOTs were still facing regulatory barriers to the adoption of design-build project delivery system.

3.2.3 Design-Build-Operate-Maintain Project Delivery System

Design-build-operate-maintain is a project delivery system that combines the design and construction responsibilities of the design-build project delivery system with operations and maintenance (FHWA, IPD 2013). Procurement consists of selecting a design-build contractor that is responsible for design, construction, operation, and maintenance of the project. As shown in Figure 3.6, the public owner only signs a single contract with the design-build team who is responsible for all design and construction and long-term operation and maintenance activities.

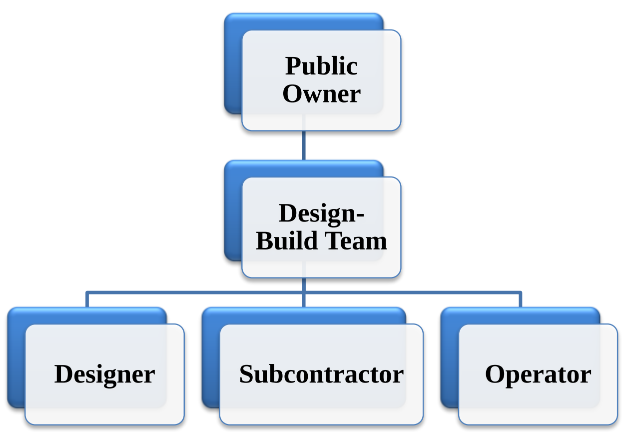


Figure 3.6

Organizational Structure of Design-Build-Operate-Maintain

In the design-build-operate-maintain process, the state DOT identifies what it wants to be constructed, defines how it would like to see the facility being operated and maintained (e.g., level of service and acceptable performance), accepts proposals, and selects the design-build team to assume the risk and responsibility for not only design and construction service but also long-term operation and maintenance activities. The design-build team, who is also responsible for operations and maintenance, is involved early in the design process in order to provide an opportunity for the designer to tailor plans to the capability of the design-build team from the operations and maintenance standpoint. Therefore, the design-build-operate-maintain team should consider the long-term operations and maintenance requirements during the process of design and construction. The major difference between design-build and design-build-operate-maintain is the consideration of long-term performance requirements. New objectives will be introduced in the design-build-operate-maintain project delivery system, for instance, enhancing the long-term performance of the constructed facility and reducing the total life cycle cost of designing, building, and operating the facility. The design-build-operate-maintain-team has also the flexibility to be innovative, along with the greater responsibility and risk for the majority of the design and construction activities and all the operation and maintenance responsibilities. The owner, however, still keeps the responsibility for financing the project. Table 3.3 summarizes the allocation of responsibilities in a typical design-build-operate-maintain contract.

Table 3.3

Roles and Responsibilities in Design-Build-Operate-Maintain

	Own	**Design**	**Build**	**Operate & Maintain**	**Finance**
Design-Build	Public	Private	Private	Private	Public

3.2.4 Design-Build-Finance Project Delivery System

In design-build-finance, one contract is awarded for design, construction, and full or partial financing of a facility (FHWA, IPD 2013). As shown in Figure 3.7, organization structure is similar to that of design-build with additional short-term financing functionality.

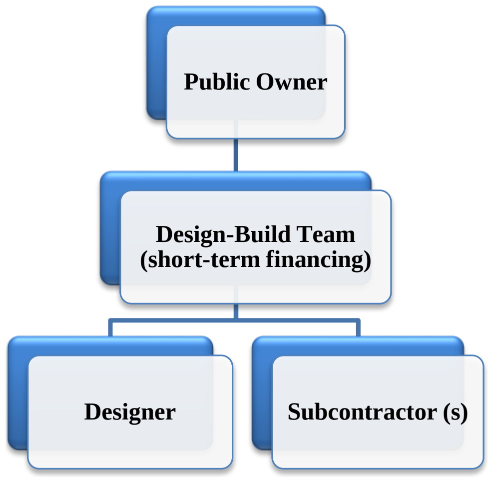


Figure 3.7

Organizational Structure of Design-Build-Finance

In design-build-finance, the responsibility for long-term maintenance and operations of the facility remain with the public owner. This approach takes advantage of the efficiencies of design-build, while allowing the public owner to completely or partially defer financing during the construction phase of the project. Table 3.4 summarizes the allocation of responsibilities in a typical design-build-finance contract.

Table 3.4

Roles and Responsibilities in Design-Build-Finance

	Own	Design	Build	Operate & Maintain	Finance
Design-Build	Public	Private	Private	Public	Public/Private

Design-build-finance can be motivated by the owner's cash flow constraints or the owner's desire to defer payment for the project. In case of cash flow constraints, the public owner identifies what level of funding is available for the project at the time the procurement is released, and requires the design-build team to finance any development cost in excess of that amount over a specified period of time. In case of the desire to defer payment, the public owner issues a procurement asking the design-build team to provide the cost for developing the project today, with the payment of that amount promised at a later time. The design-build team may use different approaches to finance the cost of project development. In some cases, the design-build team provides self-financing to cover design and construction costs until the public owner is able to repay them. In the other approaches, the design-build team finances the costs through existing commercial credit lines or uses a combination of self-financing and borrowing. Whenever there is a need for substantially large financing amount over a long period of time, the design-build team may arrange project-specific financing tools.

The benefits of design-build-finance are similar to those of design-build, in that the public owner can capitalize on the efficiencies of having the design-build team undertake both design and construction activities. In design-build-finance, short-term financing of all or a portion of the project is assumed by the private sector. This allows the public owner to advance the construction of the project prior to assembling all the funding required for the project. The design-build-finance model is particularly beneficial when there is a short-term gap in financing that can be overcome by the design-build team. Therefore, the public owner can expedite project delivery despite its short-term shortage in financing capacity.

3.2.5 Design-Build-Finance-Operate-Maintain Project Delivery System

In design-build-finance-operate-maintain, one contract is awarded for design, construction, operation, maintenance, and full or partial financing of a facility (FHWA, IPD 2013). As shown in Figure 3.8, the organization structure is similar to that of design-build-operate-maintain with additional financing (short-term or long-term) functionality.

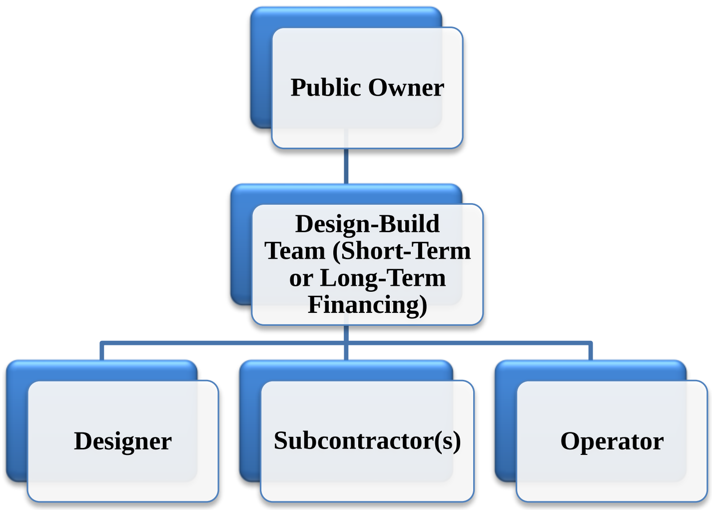


Figure 3.8

Organizational Structure of Design-Build-Finance-Operate-Maintain

Similar to the design-build-operate-maintain project delivery system, in the design-build-finance-operate-maintain project delivery system, the design-build team is responsible for long-term operations and maintenance of the facility. This approach takes advantage of the efficiencies of design-build-operate-maintain, while allowing the public owner to completely or partially defer financing of the project. The public sector takes advantage of the financial resource of the design-build team to finance the project. Financing can be complete or partial and short-term or long-term. Therefore, design-build-finance-operate-maintain project delivery system attempts to combine the advantages of both design-build-operate-maintain and design-build-finance project delivery systems.

Table 3.5 summarizes the allocation of responsibilities in a typical design-build-finance-operate-maintain contract.

Table 3.5

Roles and Responsibilities in Design-Build-Finance-Operate-Maintain

	Own	**Design**	**Build**	**Operate & Maintain**	**Finance**
Design-Build	Public	Private	Private	Private	Public/Private

CHAPTER 4

STATE OF PRACTICE OF DESIGN BUILD IN MICHIGAN, NORTH CAROLINA, UTAH, AND WASHINGTON STATE DEPARTMENTS OF TRANSPORTATION

The research team conducted structured interviews with the representatives from four state DOTs that are the forefront of using Design-build for transportation projects. These four state DOTs are Michigan DOT (MDOT), North Carolina DOT (NCDOT), Utah DOT (UDOT), and Washington State DOT (WSDOT). This process helped research team better understated state of practice in using design-build project delivery system for transportation projects and gain further understanding of the experiences and opinions of key participants in design-build projects. Prior to the interview with the representative from each State DOT, the research team prepared a questionnaire (shown in Appendix I) that included a series of questions concerning the state of practice of design-build in the respective State DOTs as well as a series of questions directly related to the topic of this research project. The findings of this in-depth study are presented in this chapter.

4.1 State of Practice of Design-Build in Michigan DOT

4.1.1 Background

Michigan State does not have specific legislation that authorizes the use of the design-build and the construction manager/general contractor (CM/GC) project delivery systems. since the Michigan DOT (MDOT) has no guidelines on the design-build project delivery system, the use design-build project delivery system is governed by FHWA guidelines in Title 23, CFR 636– Design-build Contracting. The use of design-build project delivery system by the Michigan DOT is based on the individual needs and merits of the project, and is subject to approval by the Michigan Transportation Commission (Transportation Design-Build Users Group 2009).

4.1.2 Innovative Project Delivery Systems in MDOT

Based on the goals, funding, and risks associated with the project, MDOT has different options for project delivery. Below, we explain the project delivery systems that are approved or proposed but not yet approved by MDOT.

4.1.3 Approved Innovative Project Delivery Systems

The following project delivery systems are approved and are being used by MDOT:

- Design-Build: Design-build project delivery system is a project delivery method that combines two usually separate services into a single contract. With design-build project delivery system, MDOT executes a single contract for both architectural/engineering services and construction. The Design-build entity may be a single firm, consortium, joint venture, or other organization assembled for a particular project.
- Design-Build-Finance: Design-build-finance augments a typical Design-build project by transferring the financing of the project to the Design-build private sector partners. In this approach, projects can be partly or wholly financed by the private sector partner and are compensated by MDOT at a future point as defined in the design-build-finance contract.

In 2008, MDOT awarded 2 pilot design-build-finance projects. The design-build team is required to provide the funding for the projects throughout construction. MDOT began making relatively small payments when the projects reached substantial completion with a balloon payment for the balance of the contract being made more than two years after the completion of the project. These Design-build Finance projects were completed in 2009, well ahead of the intended 2012 timeline.

If a design-build-finance project delivery system is desired, MDOT should have extensive early coordination with the financial and contracting industries to verify if the project could be financially viable. Additionally, if federal funds are intended to be used, FHWA must be in agreement to the funding concepts. MDOT states the following advantages and disadvantages for design-build-finance project delivery systems:

- Advantages in addition to design-build:
    - Potential cost savings by constructing the project early through the annual inflation of construction costs
    - Reduce maintenance costs and increase safety benefits due to the road, structure, or facility being constructed in an earlier fiscal year than originally planned
    - Job creation and economic stimulus due to a project being constructed in an earlier fiscal year than originally planned
    - Provides the ability to build a project needing improvements in an earlier year
    - Design-build Finance does not impact MDOT's ability to bond
    - Depending on the payment structure, a Design-build team has a vested interest in completing a project quickly if payments are tied to project completion

- Disadvantages in addition to Design-build:
    - Design-build Finance may limit the number of Design-build teams that can pursue a project
    - The financial market is constantly changing; potential Design-build Finance projects may be viable today but not in the near future; this unknown factor makes a programmatic approach to utilizing Design-build Finance difficult
    - Potential cost increases due to the Design-build team financing the contract for a period of time
    - Design-build Finance projects may take projects from a future fiscal year into a current year - this can leave a gap in the future program causing an undesired economic impact to designers and contractors

The following project delivery systems are proposed but not yet approved by MDOT:

- Design-Build Finance Operate and/or Maintain: Design-build-finance operate (or maintain) (DBFOM) projects, commonly known as public-private-partnerships (PPPs or P3s) and public private ventures (PPVs), transfer specific design, construction, financial, operational, and maintenance responsibilities to the private sector partner for a specific period of time. The P3 contractual agreement between MDOT and the private partner clearly defines the limits of the responsibilities between both parties.

- Construction Manager At-Risk: The department in a construction management at risk (CM@Risk) project has a direct contract with an architectural/engineering (A/E) firm and a separate contract with a construction company. The construction company is the construction manager (CM) for the project. The A/E firm designs the project, and the A/E firm and the CM are contractually required to work together during the design phase in order to create a project that is potentially less expensive and is quicker and easier to construct.

Nationally, CM@Risk procurements have been used on a very limited number of transportation projects and minimal information is available on the success of these projects. Until additional information is available, recommendations for use at MDOT will not be provided. If MDOT identifies a candidate for a CM@Risk transportation project, contact the Engineer of Design to discuss the potential benefits and drawbacks. CM@Risk is considered an experimental method by FHWA and their SEP-14 program must be followed to receive approval for using federal funds on the project.

4.1.4 Design-Build Project Delivery System in MDOT

MDOT does not have a specific manual or guideline for innovative project delivery systems. The information in this section is gathered from design-build RFPs and memorandums of understanding and strictly web-based material.

The implementation of the design-build project delivery system in MDOT is through the following steps:

1. Initial project selection
2. Contact the engineer of design
3. Initial scope verification and risk analysis
4. Determination of procurement methods
5. RFQ process (for two-step procurement only)
6. RFP development and preliminary engineering activities
7. Advertisement and award
8. Design and construction activities

Design-build project delivery is typically tailored for large construction projects (greater than $10 million) but can be utilized on smaller projects. MDOT states the following advantages and disadvantages for the design-build project delivery system:

Advantages of design-build:

- Risk primarily owned by design-build team, except for designated "at risk" items
- May shorten completion time by overlapping design and construction
- Much earlier obligation of federal funds
- Stipend payment allows for the department to keep ideas received from unsuccessful proposers
- Construction can begin before all design details are final
- Greater innovation in selecting design, materials, and construction methods
- Reduced claims due to design errors
- Accelerated response time and dispute resolution through a team effort
- Single point of contact for quality, cost, and schedule from design through construction
- Ability to use two-step and/or Best Value project award selection criteria which evaluates the qualifications of the Design-build team
- Reduced or eliminated conflicts arising from a difference in design and actual conditions
- Can use various procurement options that are beneficial to the needs of the project (i.e., short-listing, Low Bid, Best Value Selections, etc.)

Disadvantages of design-build:

- High learning curve because Design-build changes stakeholders' roles
- Difficult to anticipate staffing needs due to the piece-meal design submittals

- Large time commitment is needed from MDOT PM and other key stakeholders
- Parties are more familiar with traditional methods
- Bidding process more expensive for Design-build teams
- Coordination is more challenging due to faster pace
- Low Bid projects without a short-listing process tend to yield a project that utilizes minimum standards
- Small dollar Design-build projects tend to have higher costs
- Heavy reliance on consultants

In addition, MDOT considers the following project types as preferred and undesirable candidates for design-build:

Proffered candidates for design-build:

- Projects that need to be “fast-tracked” or expedited
- Projects that allow for innovation in the design and construction efforts
- Projects with funding deadlines where traditional Design-Bid-Build delivery may not be able to achieve these dates
- Projects where traditional delivery processes cannot meet the project demands
- Emergency projects
- Projects with a clearly defined scope, design basis, and performance requirements
- Projects with low possibility for significant change during all phases of work
- Projects with low risk of unforeseen conditions

- ITS projects involving software development or integration and/or rapidly changing technologies
- Projects with a complete National Environmental Policy Act (NEPA) process
- Projects with limited utility relocation
- Projects that require minimal or no right-of-way acquisition; FHWA approval is needed if all anticipated right-of-way is not acquired at the time of fund obligation
- Projects greater than $10 million
- Projects that can utilize Best Value procurement or other methods tailored to benefit the specific needs of a project
- New alignments, widening, reconstruction, and rehabilitation projects with a clear scope of work

Undesirable candidates for design-build:

- Projects with complicating issues, such as utility conflicts, right-of-way acquisition, hazardous materials, wetland and environmental concerns, or other unresolved issues
- Major bridge rehabilitation/repair projects with significant unknowns
- Urban construction/reconstruction with major utilities, major subsoil, right-of-way, or other major unknowns
- Rehabilitation projects of movable bridges
- Significant and/or undefined third party requirements
- Stand-alone sewer pump station projects
- Areas of work without established standards and specifications, or indefinable outcome-based performance standards

According to design-build project data provided by MDOT webpage, MDOT has procured 12 design-build projects since 2009. Figure 4.1 illustrates the distribution of the number of design-build projects procured since 2009.

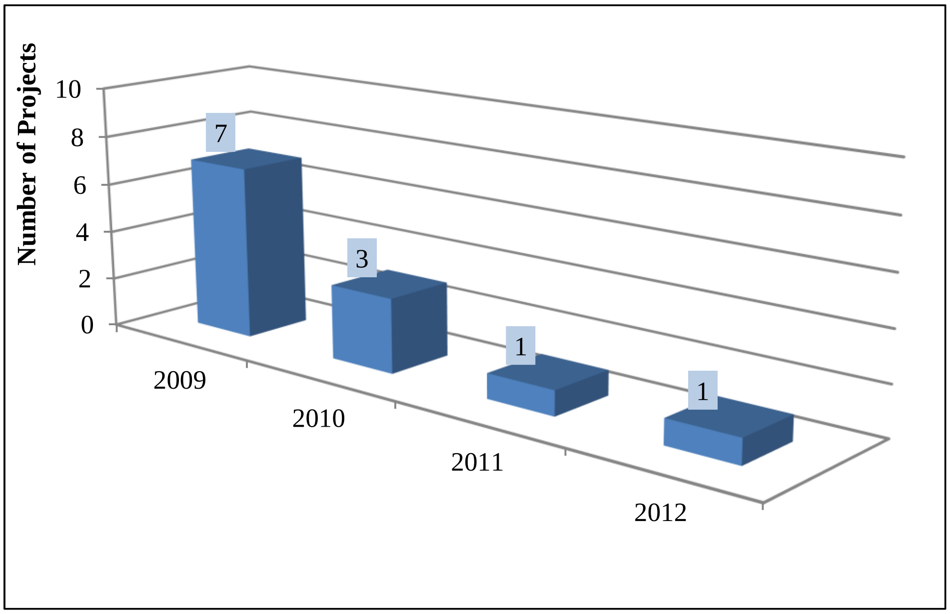


Figure 4.1

Number of Design-build Projects Procured by MDOT Since 2009

Figure 4.2 illustrates the value of Design-build projects procured every year since 2009.

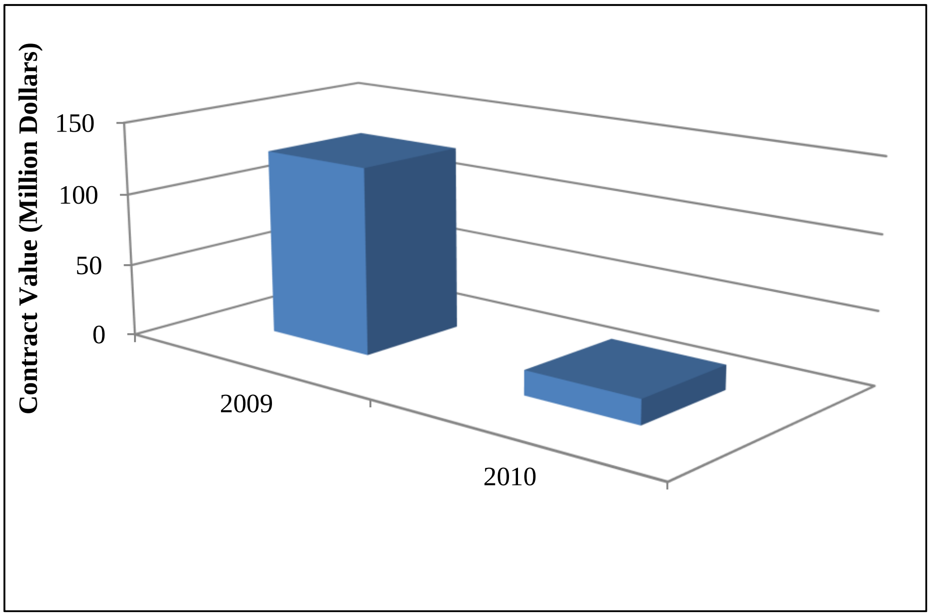


Figure 4.2

Contract Value ($ Million) of Design-build Projects Procured Since 2009

MDOT has the authority to use a variety of procurement methods for design-build projects. We explain the procurement options used by MDOT using the information that we have gathered from various resources and project RFPs. Procurement methods for the design-build project delivery systems that are used by MDOT are the following:

4.1.4.1 Best-Value

Best-value procurement method involves selection of a contractor on the basis of price and other key factors to obtain the best overall value for the project. The goal is to balance cost with technical factors to achieve long-term performance and value of construction for the public. As of December 2010, MDOT has procured 5 projects using best-value procurement.

In best-value procurement of design-build teams, MDOT considers the following critical issues:

- The technical scoring is combined with the weighted scores for the bids. The bid scores are determined by assigning a score to the lowest bid and then each subsequent bid receives a score calculated on the percent that bid is compared to the Low Bid.
    - The Central Selection Review Team reviews and approves all scoring criteria
    - The bid price must account for a minimum of 25% of the score
    - Bid Prices above 80% of the scoring should be considered for Low Bid procurement
    - May be a one or two step selection process
    - One step – RFP only
    - Two step – RFQ with a shortlist of 3-5 Design-build teams and RFP
- Advantages:
    - Depending on what technical evaluation is used in combination with price, the department could see improvements in project quality and schedule savings
    - More opportunity for innovation
    - Allows for the project schedule, quality, and/or other parameters to be competitively bid
    - May achieve higher quality by open competition with contractors that may provide a higher price but more qualifications or expertise
    - May result in lower life cycle costs
- Disadvantages:
    - Learning curve for the department and its industry partners
    - Can be administratively burdensome for both MDOT and contractors
    - Takes additional time to process

- Requires additional staff time and a different level of training to evaluate Best Value proposals
- Preparing a Best Value proposal will likely require a high level of effort which may discourage smaller or Design-build contractors with limited resources for bidding
- Potential for a higher initial cost – especially for the designers with no stipend available
- Subjectivity of the evaluation process may result in protests

- Preferred Project Candidates:
    - Projects with opportunity for proposing different aesthetic designs or innovations
    - Projects that are highly complex or unique and would receive benefit from an alternative form of procurement
    - Projects with high public involvement
    - Projects where MDOT is unfamiliar with construction techniques
    - Projects that require specialized equipment, knowledge of construction, or exclusive technology
    - Projects with several maintaining traffic options and complexities
    - Projects where design innovations are optimum

- Undesirable project qualities:
    - Projects without unique design issues
    - Projects with a clearly defined scope with no opportunities for innovation

4.1.4.2 Low Bid

In low-bid procurement of design-build teams, MDOT considers the following critical issues:

- Award contract to the lowest qualified bid
    - May be a one or two step selection process
    - One step – RFP only
    - Two step – RFQ used to prequalify proposing Design-build teams and RFP
    - Two step process is used when there is no prequalification available for the proposed scope of work
    - Used when price or budget for the proposed work is the most important factor in delivering the project
- Advantages:
    - Lowest cost to MDOT
    - Less effort to prepare bid
    - Easier review time of proposals
- Disadvantages:
    - No opportunity for innovation
    - Tend to yield a project that utilizes minimum standards
- Desirable project qualities:
    - Projects without unique design issues
    - Projects with a clearly defined scope with no opportunities for innovation
    - Projects with low risk of unforeseen conditions
- Undesirable project qualities:
    - Projects with opportunity for proposing different aesthetic designs or innovations

  - Projects that are highly complex or unique and would receive benefit from an alternative form of procurement
  - Projects with high public involvement
  - Projects where MDOT is unfamiliar with construction techniques
  - Projects that require specialized equipment, knowledge of construction, or exclusive technology

4.1.4.3 Project Specific Qualification

Project Specific Qualification is a selection method in which contractors are required to meet Project Specific Qualifications in order to be eligible to bid on a project. MDOT has typically used the Project Specific Qualification procurement method on Intelligent Transportation Systems (ITS) and new traffic barrier installations. In project specific qualification procurement of design-build teams, MDOT considers the following critical issues:

- When additional or unique expertise is required beyond MDOT's normal prequalification process
- May be a one or two step selection process
  - One step – contractors supply qualification information either just before or at the same time as the bids are provided. The selection team reviews the qualifications and determines who is eligible to have their bids opened. Eligible bids are opened and the lowest responsive bid is selected. Ineligible bids are returned unopened to the contractors.
  - Two step – RFQ is used to shortlist 3-5 Design-build teams and RFP based on lowest responsive bid
  - Two step process is used when there is no prequalification available for the proposed scope of work (Two Step Low Bid)

- Advantages:
  - Improved project quality for unique elements
  - Better documentation of MDOT needs in description and evaluation of qualifications
  - Improved competition from contractors well-qualified to do the work
  - Costs that better reflect unique projects
  - Contractors that may not understand how to bid the project correctly are unable to participate
- Disadvantages:
  - More MDOT experienced resources needed to establish and evaluate qualifications
  - More cost to contractors to submit additional information
  - Additional monitoring of projects to assure key contractor personnel are working on projects
  - Longer period between design and award is needed to review and approve qualifications
- Desirable project qualities:
  - Projects with no existing department pre-qualifications
  - Projects with new or unique elements not previously used by MDOT
  - Projects with unusual requirements
  - Projects with aesthetic treatments that need to be evaluated
- Undesirable project qualities:
  - Expedited contract award
  - When standard contractor pre-qualifications are sufficient

4.1.4.4 Alternate Bid

Alternate bid is a selection method where the contractor can bid on equivalent designs of competing alternates. In alternate bid procurement method, MDOT considers the following critical issues:

- Allows competition on pavement types or other transportation features
- Alternates must provide approximately equal life cycle costs
- Can be incorporated into Low Bid or Best Value selection procurements
    - Low-Bid – if two pay items in a low bid selection (concrete pavement vs. HMA pavement) or two approaches to meeting a goal (bridge replacement)
    - Best-Value – if the contractor also provides approaches to alternate items and a value is established in the scoring of the approaches. Alternate bid is not used as an independent procurement method and instead incorporated as a way to add value to a Low-Bid or Best-Value procurement
- Advantages:
    - Allows for innovation if the contractor is allowed to propose design options
    - Allows MDOT to define two different alternatives
    - Allows competition between products with different maintenance and service life expectations
- Disadvantages:
    - May increase risks of protests if bid documents are not clear for instructions regarding the alternates
    - May reduce the number of capable bidders if alternates are outside the average contractor's capabilities
    - Life-cycle costing to determine Low Bid can be difficult to determine

    - Requires development of plans and specifications for each alternate increasing MDOT's upfront costs and increases the potential for conflicting details, specifications, and quantities

- Desirable project qualities:
    - Bridges (steel vs. concrete)
    - Pavement replacement (hot mix asphalt vs. concrete)
    - Work items or projects that have competing designs that are simple to design
    - Projects with potential for numerous bidders with cost savings opportunities to justify the increase in plan and specification development
- Undesirable project qualities:
    - Projects with no obvious alternatives
    - Projects where alternatives are not desirable
- MDOT has used alternative bidding for pavement

4.1.4.5 Fixed Cost Variable Scope

Fixed Cost Variable Scope is a selection method where the contractor proposes to complete items of work within an established budget. Each item of work is assigned a value for evaluation purposes. The contractor with the best value for the established budget is awarded the contract at the budget price. In fixed cost variable scope procurement method, MDOT considers the following critical issues:

- Projects with an established budget where the Design-build team can vary the scope of the work
- Work items are assigned a value for evaluation purposes and the contractor who bids the most work items for the established budget is awarded the contract

- Bids are still included in case multiple contractors bid the same number of work items. The lowest bid is awarded the contract in this case.
- May be a one or two step selection process
  - One step – RFP only and all prequalified contractors are eligible to participate
  - Two step – RFQ used to shortlist 3-5 Design-build teams and RFP; additional qualification elements may be added to the RFP but this can cause confusion to the bid process
- Advantages:
  - Project will not exceed budget
  - Potential to have more work completed than originally anticipated
- Disadvantages:
  - Takes more time to evaluate proposals
  - Assigning values to portions of the work can be difficult and time consuming
  - Possible challenge if selection criteria are not clearly defined and defendable
  - Potential for unused design if design plans provided to the contractor cover more than be constructed for the budget
- Desirable project qualities:
  - Projects that can be split into definable elements for bidding
  - ITS devices or any contract with a set quantity and unit price
  - Capital Preventive Maintenance work
  - Resurfacing projects
  - Projects with desired scope or limits of work with estimates that exceed the budget
  - Innovation opportunities to allow for more work to be completed when bid upon
- Undesirable project qualities:
  - Projects where work cannot be split up or left out

    - Projects where the budget is unlikely to allow for a majority of the work to be completed and bid on
- MDOT was test piloting 1 project for Fixed Price Variable Scope as of December 2010.

4.1.4.5 Best and Final Offer

Best and Final Offer is a Design-build selection method where proposals are first submitted by the Design-build team. Following the review with proposers, MDOT will call for the Best and Final Offers (BAFOs). The Design-build team would submit their best prices and/or technical responses in reply to the department's request. In effect, this step levels the playing field by allowing finalists an opportunity to provide their BAFO after interviews have been conducted. In best and final offer evaluation, MDOT considers the following critical issues:

- Prices and deliverables are negotiated based on submittals and interviews
- Should only be used on projects in excess of $100 million
- Negotiations must be fair and well-supported
- Multi-phase process:
    - Offers or proposals submitted by Design-build teams
    - Proposals are reviewed by MDOT
    - Design-build teams are interviewed
    - Best and Final Offer is requested
    - Design-build teams submit best prices and technical responses
    - Awards is based on a combination of price and technical proposal scoring
- Advantages:
    - May drive down costs
    - May increase understanding of work and allow for more innovation
    - Allows Design-build teams to re-evaluate proposals and refine their bid and technical proposal

- Disadvantages:
    - Difficult to determine how many discussions/interviews are needed
    - Need lengthy period (3 to 6 months) of negotiation for final offer which delays the award
    - Negotiators must have authority for project and budget decisions; therefore, high level resources are needed
- Desirable project qualities:
    - Projects with well-established budgets
    - Projects with opportunities for innovation and varying approaches
- Undesirable project qualities:
    - Small projects
    - Projects with a quick delivery date
- MDOT has not used this procurement method to date. Full involvement from upper MDOT management in selection of the project and negotiations would be required to move forward with a Best and Final Offer procurement.

4.2 State of Practice of Design-Build in North Carolina DOT

4.2.1 Background

The use of design-build project delivery system in North Carolina began in 1998 under the Senate Bill 1366, which allowed the North Carolina DOT (NCDOT) to use design-build project delivery system on up to three projects each year. For a project to be eligible, NCDOT had to determine that the projects needed an expedited delivery method that normal design and construction procedures could not provide. The Secretary of Transportation was required to report the nature and scope of the project for approval that Design-build project to the Joint Legislative Transportation Oversight Committee and to the Joint Legislative Commission on Governmental Operations. These committees had to approve that the project was in the public's best interest prior to being eligible for award.

In 2002, the use of design-build project delivery system was expanded to allow the use on up to 10 projects for the fiscal year 2002-2003 and up to 25 projects from fiscal year 2003-2004 to fiscal year 2008-2009 under House Bill 1518. The law specifically allowed the use of design-build project delivery system on projects of any award amount, but did include a requirement that NCDOT attempt to structure and size the project to allow an equal opportunity for North Carolina based contractors and engineering firms to compete on the project. This law also amended the reporting requirement to include only those projects in excess of $100 million.

In 2007, the sunset in fiscal year 2008-2009 for the use of design-build project delivery system on up to 25 projects was removed and the reporting requirements were amended to reduce the requirement to any project in excess of $50 million under the House Bill 610. The approval requirement by the Joint Legislative Transportation Oversight Committee and the Joint Legislative Commission on Governmental Operations was also removed for the reported projects.

In 2011, the law was amended to remove the limit on the number of projects allowed to be delivered through design-build project delivery system each year under House Bill 200. Design-build project delivery system may currently be used in North Carolina to deliver any project that must be expedited and where it is not in the public's interest to comply with normal design and construction contracting measures.

4.2.2 Design-Build Project Delivery System in NCDOT

According to the North Carolina DOT "Design-Build Policy and Procedures", NCDOT can use different forms of design-build delivery as outlined below (NCDOT Design-Build Policy and Procedures 2011):

Design-Build: In the design-build project delivery system, the responsibility of design and construction services are transferred to the design-build team. The selected design-build team has to perform the required preconstruction, construction, construction engineering, inspection requirements and testing requirements for the project in accordance with standard North Carolina Department of Transportation (NCDOT) criteria, specifications and contract administration practices.

Express Design-Build: In the express design-build project delivery system, NCDOT advertises RFQs and evaluates submitted SOQs. The RFQ process results in a shortlist of qualified design-build teams. The shortlisted teams will then submit price proposals to perform the work. However, express design-build can only be used on projects with the following criteria:

- "*Projects with limited opportunity for innovation; and*
- *Projects with a narrow scope of work (e.g., small bridge replacements or spot safety improvements)*"

Modified Design-Build: In the modified design-build project delivery system, NCDOT or a third party agent performs partial project design. The RFP will state that NCDOT is responsible for the validity of design information. NCDOT will then evaluate SOQs and shortlist proposers. Procurement of design-build proposals is usually through the best-value procurement method.

Nested Design-Build: In the nested design-build project delivery system, a contractor performs partial design utilizing a subcontractor design firm. The selection is based only on the proposed price (low-bid). NCDOTY will not solicit technical proposals for nested design-build projects.

4.2.2.1 Design-Build Project Selection

According to the North Carolina DOT "Design-Build Policy and Procedures", design-build projects may be considered if they fall within at least one of the following broad categories:

- "*Projects where design and construction need to be expedited for the public good or to capitalize on advanced or specific funding opportunities;*
- *Emergency Projects;*
- *Projects with complex constructability or traffic phasing issues;*
- *Projects offering opportunities for innovation; and*
- *Unusual projects that do not lend themselves to normal design-bid-build procedures.*"

The type of the project may also be an integral factor in its selection as a design-build project. The following types of projects are particularly suitable to the design-build process:

- "*New location projects;*
- *Large interstate widening or rehabilitation projects;*
- *Projects with heavy traffic volume; and*
- *Large or unique bridge projects.*"

Selection of design-build projects requires a qualitative and quantitative comparison of critical factors that affect the delivery of the project. To evaluate the qualitative factors, NCDOT uses a selection matrix that compares different project delivery systems using several factors, such as: opportunity for innovation, constructability, safety, environmental permitting, right-of-way acquisition, utilities, traffic management, public/business perception, and risk. The quantitative analysis requires the evaluation of the project cost and schedule. Furthermore, NCDOT considers the role of third parties, such as: permitting, utilities, and right-of-way relocations, in final decision to choose design-build as the project delivery system for the project. NCDOT may require the design-build team to mitigate these third parties by providing right-of-way acquisition services, relocation of utilities, railroad coordination, and permit application services.

According to design-build project data provided by NCDOT webpage, NCDOT has procured 63 design-build projects since 2001. Figure 4.3 illustrates the distribution of the number of design-build projects procured since 2001.

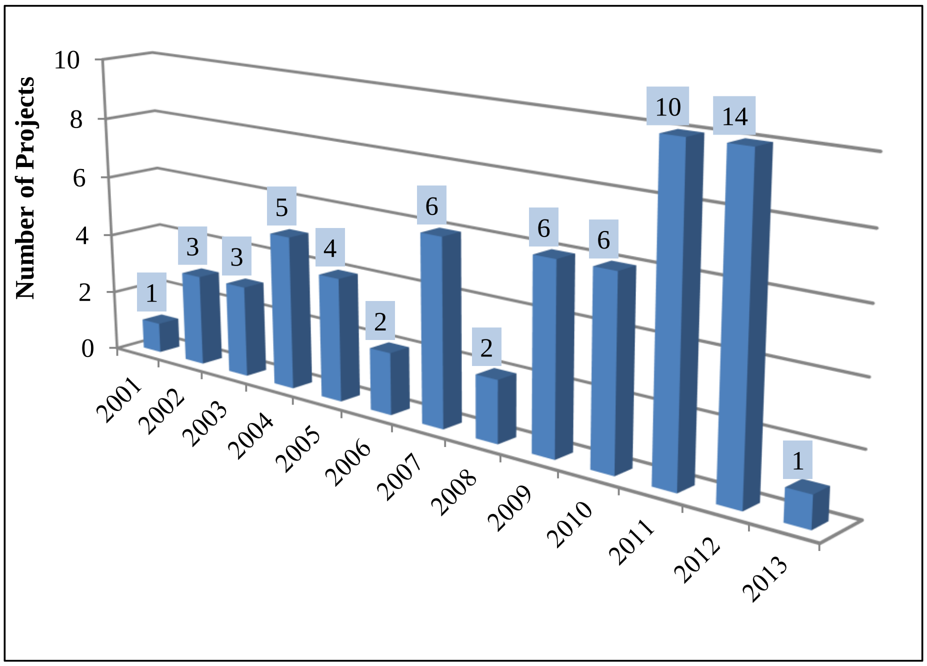


Figure 4.3

Number of Design-build Projects Procured Since 2001

Figure 4.4 illustrates the value of design-build projects procured every year since 2001.

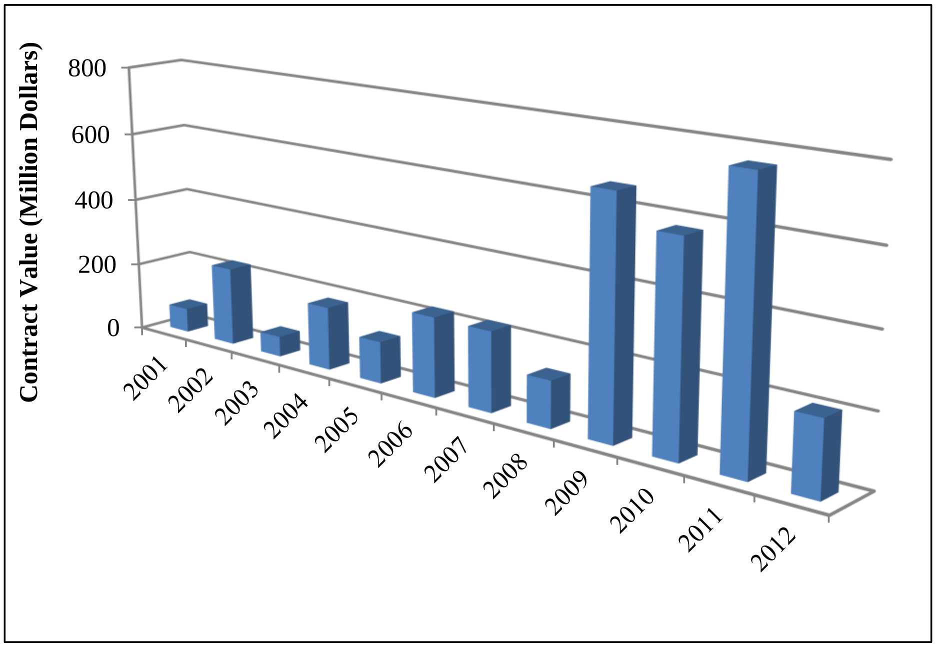


Figure 4.4

Contract Value ($ Million) of Design-build Projects Procured Since 2001

4.2.3 Procurement Methods for Design-Build Projects

NCDOT uses a two-phase selection process for procurement of design-build projects. The first step of this two-phase process results in a shortlist of qualified design-build teams. NCDOT Design-Build Policy and Procedures (2011) describes evaluation and selection of the design-build team as the following:

> "*Design-build teams are evaluated and selected through what is commonly referred to as a 'two-step' process. This process includes shortlisting that, in essence, pre-qualifies design-build teams on a project specific basis. The short-listed design-build teams then compete for the project on a Best Value basis that accounts for both cost and a technical score (quality). For express design-build projects, the same first step is used for a quality based selection of short-listed*

design-build teams; however, the second step is made on a competitive Low Bid basis. The evaluation and selection process will be clearly outlined in the RFP."

The standard process of design-build team evaluation and selection by the NCDOT board of transportation has the following steps:

1. Selection of Technical Review Committee
2. Advertisement through newspapers, website, Purchase Directory and notification to all prequalified bidders
3. Submission of Statements of Qualifications
4. Shortlisting of Design-build Teams
5. Issuance of the Request for Proposals
6. Submission of Technical Proposals and Price Proposals
7. Evaluation of Technical Proposals
8. Opening of Price Proposals
9. Determination of the "Best-Value" Design-build Team
10. Recommendation for Action by the Secretary of Transportation

The first step of design-build procurement in NCDOT is selection of the technical review committee, which is composed of at least five DOT employees. The Director of Transportation Program Management has the authority to choose the committee members on a project-specific basis. The committee members should have significant NCDOT experience and a thorough understanding of DOT procedures. These members will represent major areas of the project design, construction, and/or operation. The committee is responsible for two important tasks: (1) evaluating the Statements of Qualifications (SOQs) for the purpose of shortlisting and, as applicable, (2) the Technical Proposals for the purpose of determining a committee consensus Technical Score for the Technical Proposals submitted by the short-listed Teams.

Advertisement of design-build projects generally includes the following requirements:

- Advertisement for Professional Services

- Request for Qualifications (RFQ)
- Project Synopsis
- Timeline of the project
- Stipend availability

The technical review committee determines the shortlist of qualified design-build teams according to the evaluation criteria stipulated in the RFQs. A minimum of two prospective teams will be short-listed. All prospective teams, regardless of short-list status, will be offered the opportunity for a debriefing with the Department regarding the relative merits of their Statements of Qualifications.

The qualified design-build teams will be able to submit price and technical proposals according to the RFP requirements. Each design-build team will have the opportunity to address any questions they may have about the project, the RFP requirements, or the selection process. The contents of the RFP vary on a project specific basis, but at the minimum, it should address the following items:

- "*Date and Time of Price Proposal Opening*
- *Payment Details*
- *Evaluation Criteria*
- *Team Selection Process*
- *Technical Proposal Submittal Requirements*
- *Price Proposal Submittal Requirements*
- *Disadvantaged business enterprise (DBE) or Minority/Women Business (MB/WB) Goals and Reporting Requirements*
- *Design and Other Preconstruction Services Required*
- *Design References*
- *Submittal Requirements*
- *Permits (as applicable)*

- *Construction Services Required*
- *Construction Engineering and Inspection Services Required*
- *Third Party Involvement or Restrictions*
- *Information or Services to be Provided by the Department*
- *Professional Insurance and Bonding*
- *Supplemental Special Provisions*
- *Itemized Proposal Form and Signature Sheets*" (NCDOT Design-Build Policy and Procedures 2011)

Followed by the submission of technical and price proposals, the review committee will evaluate design-build proposals. The evaluation of proposals is made based on the evaluation criteria set forth in the project RFP. The evaluation criteria may include, but may not be limited to: design-build team's demonstrated capabilities, design features, schedule, innovation, long term maintenance considerations, traffic control, safety, quality control, utilization of disadvantaged business enterprises or minority/women businesses, natural environment responsibility, oral interview, and/or project guarantees. Proposals that are determined as responsive will be afforded the opportunity for a debriefing with the Department regarding the relative merits of their Technical Proposal and Presentation.

NCDOT will determine the best-value design-build proposals based on a pre-determined algorithm that combines the total technical score with the price proposal. The best-value procurement method used by NCDOT considers both the qualities of the technical proposal with the bid price. The transportation program management and the design-build executive committee will determine the quality credit percentage that will be assigned for each project. The quality percentage can range from 15% to 30% depending on the complexity and size of the project. However, for modified design-build projects or projects with little opportunity for innovation or flexibility, NCDOT may decide a maximum quality credit percentage below 15%. On the other hand, in extraordinary situations, such as technically specialized projects or emergency projects, the maximum quality credit may be as high as 50%. The contract RFP will usually include a table to be used by the state contract officer to assign quality credit to each technical proposal. The example below in Table 4.1 shows a sample to be used for a maximum quality credit percentage of 25%.

Table 4.1

Sample Quality Credit for Technical Proposals

Total Technical Score	Quality Credit (%)	Consensus Technical Score	Quality Credit (%)
100	25.00	84	11.67
99	24.17	83	10.83
98	23.33	82	10.00
97	22.50	81	9.17
96	21.67	80	8.33
95	20.83	79	7.50
94	20.00	78	6.67
93	19.17	77	5.83
92	18.33	76	5.00
91	17.50	75	4.17
90	16.67	74	3.33
89	15.83	73	2.50
88	15.00	72	1.67
87	14.17	71	0..83
86	13.33	70 or below	0.00
85	12.50		

The procurement of design-build projects can include a best and final offer if necessary. NCDOT will recommend the proposal with the lowest adjusted-price to the Secretary of Transportation. The cost of the contract will be the amount received as the Price Proposal for that Team.

4.3 State of Practice of Design-Build in Utah DOT

4.3.1 Background

The 2002 Winter Olympics in Salt Lake City and the federal support was the major initiative for innovative contracting in the Utah DOT (UDOT). The state legislature authorized the use of the design-build project delivery system for the I-15 reconstruction project. The $1.6 billion I-15 reconstruction project started in 1997 and was successfully delivered by 2002. The decision to use design-build for this project was motivated by two factors. The first was the strong public support for completing the project as soon as possible to minimize the period of severe traffic congestion resulting from the diversion of more than half of the traffic from I-15 during the construction period. The second factor was the need to have the project completed before the 2002 Winter Olympics in Salt Lake City. It was generally accepted that use of the design-build contracting methodology was the only way to satisfy these goals.

The Utah legislature has enabled formation of Utah Administrative Codes through titles 63G and 72 (Utah Administrative Rulemaking Act). These Administrative Rules authorize UDOT to use the design-build and CM/GC project delivery systems. UDOT may use design-build project delivery system for any number of projects with any amount. In fact, there was never a cap on the number/maximum budget for design-build projects. UDOT has formed an innovative contracting division with the authority to manage and oversee design-build and CM/GC contracts. The main objective of the innovative contracting group is to identify alternative delivery methods to be used in the development and delivery of transportation projects that allow for innovative contracting methods outside of the traditional design-bid-build delivery method. The innovative delivery methods include CM/GC and low-bid or best-value design-build.

UDOT uses a comprehensive process for selecting a proper innovative project delivery system for a project. This process evaluates the benefits and risks of design-bid-build, design-build, and CM/GC regarding seven influential factors:

- Design and constructability
- Cost
- Public impact
- Project schedule
- Risk (identify, eliminate or manage)
- Innovations in cost, schedule, public impact, and technology
- Environmental stewardship

When reviewing the design and constructability elements, UDOT determines whether a well-defined scope is available or if there are several scenarios that will need to be worked through during the design process. This is one of the leading criteria in choosing:

- Whether a project remains a Design-Bid-Build and is fully designed by UDOT wherein the ultimate design decisions remain with UDOT;
- Whether the project needs contractor participation and input to determine the most efficient design and approach, resulting in a CM/GC project delivery method; or
- Whether the project is sufficiently outlined that UDOT is willing to hand the final design over to a design-build team.

UDOT uses a comprehensive process for delivery of design-build projects that starts with selection of design-build as the project delivery system for the project. Figure 4.5 below presents the design-build development process used by UDOT.

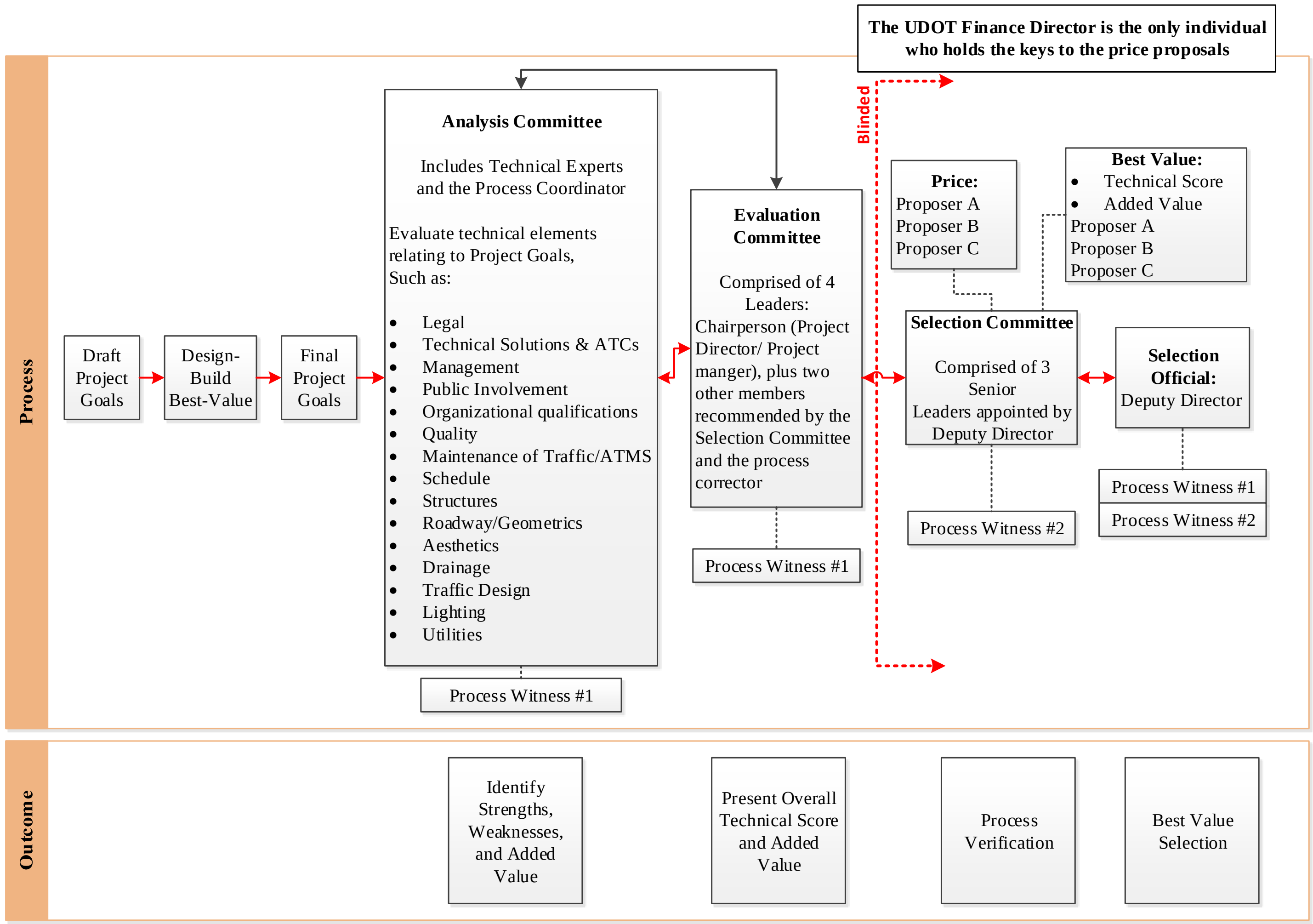


Figure 4.5

Development of Design-Build Projects in UDOT

Adopted from Utah DOT Best Value Design-Build Selection Manual of Instruction (UDOT 2011b)

4.3.2 Design-Build Project Statistics

According to design-build project data provided by UDOT webpage, UDOT has procured 21 design-build projects since 2008. Figure 4.6 illustrates the distribution of the number of design-build project procured since 2008.

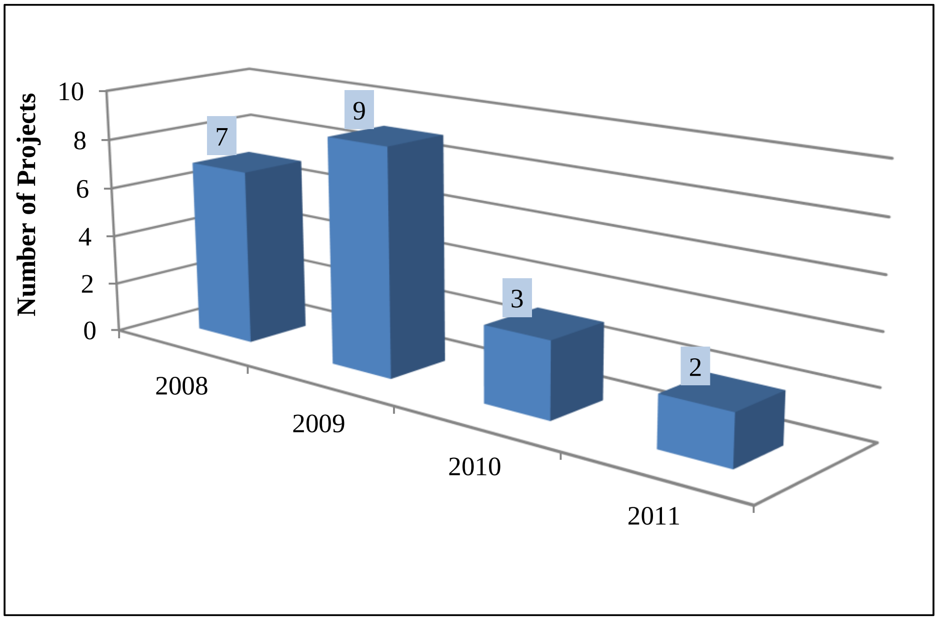


Figure 4.6

Number of Design-build Projects Procured Since 2008

Figure 4.7 illustrates the value of Design-build projects procured every year since 2008.

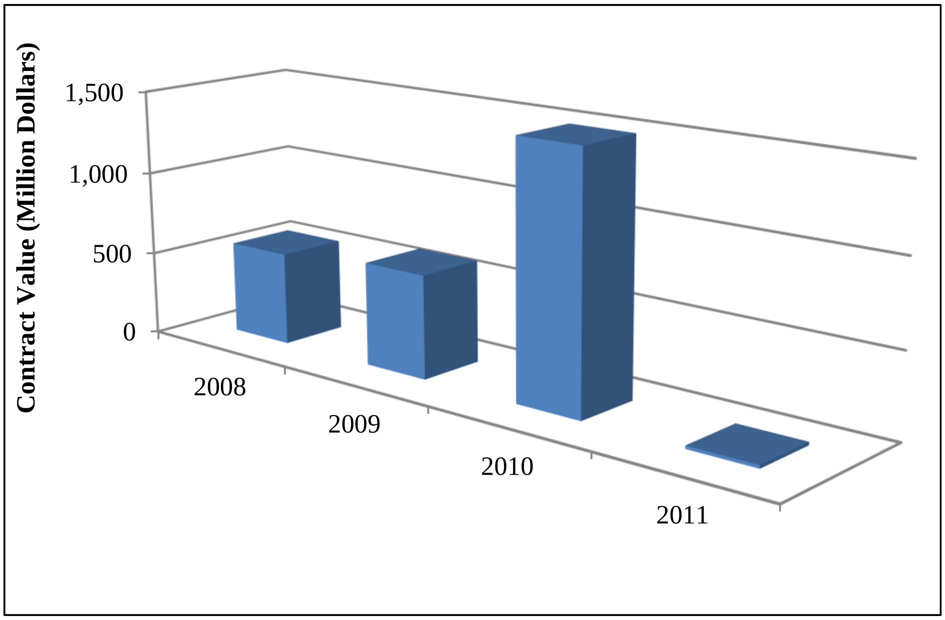


Figure 4.7

Contract Value ($ Million) of Design-build Projects Procured Since 2008

4.3.3 Procurement Methods for Design-Build Projects

UDOT is authorized to use various procurement methods as long as the contract award is competitive and price is a major component of the scope of the work. Depending on the specific goals and objectives, UDOT may use the following procurement methods for design-build projects (Utah Administrative Code, Rule 916-3):

- Best-Value: Any selection process in which proposals contain both price and qualitative components
- Low-Bid: Award to the responsible proposer offering the lowest priced responsive proposal
- Fixed-Price Best-Design: Award to the responsible proposer whose proposal is evaluated as providing the best value to UDOT

The contract award in best-value procurement method is based upon a combination of price and qualitative considerations (technical merit and other factors). The best-value procurement method used by UDOT is a two-step process. The Two-Phase selection procedure consists of a Request for Qualifications (RFQ) followed by a Request for Proposal (RFP). In fact, Utah administrative code R916-2 urges UDOT to prequalify design-build contractors prior to procurement. UDOT can use a variety of criteria to determine the best-value proposal. The proposal evaluation process for best-value determination has two steps: a price evaluation and a technical evaluation.

- Price Evaluation: Pricing Evaluation by the Selection Committee will be conducted only after they have completed the technical ratings.
- Technical Evaluation: Technical proposals will be rated in accordance with the guidelines provided in UDOT guidelines for Best Value Evaluation of RFPs.

The written Technical Proposal will be evaluated on the Pass/Fail and technical factors identified in the RFPs; the Price Proposal will be evaluated on the pricing factors identified in the RFPs. The Department's Selection Committee will determine the Pass/Fail status and overall technical rating of each Proposal before reviewing the time submittal requirements and Price Proposal. The Selection Committee will then review the Price Proposal and prepare a recommendation to the Selection Official indicating which Proposal represents the best-value to the Department. The Selection Official will assess the Selection Committee's recommendation and make a determination as to which Proposer represents the best-value. Each Proposal within approximately 10% of the lowest Base Build Price Proposal will be compared for possible best-value selection. Based on the technical evaluations and Price Proposals (based on similar options), the Selection Committee will determine which of those technical proposals provides the best-value and make the selection.

For instance, the Best Value determination (i.e., Best Value Formula) for the I-15 South Layton Interchange (approximately $100 Million) project is:

> "*Base Build price (within the limits of construction funding) + Option Proposal price(s) (within the limits of construction funding) + Time (Proposer's number of days for the substantial completion dates required in Part 2 of the RFP) + Time*

> *(Proposer's number of days for the Southbound Ramp Rental required in ITP Appendix B of the RFP) + Technical merit.*"

In best-value procurement of design-build contracts, UDOT also considers paying stipends to non-winning design-build teams. With regards to stipends, UDOT best-value manual of instruction states the following:

> "*UDOT will pay a stipend to all design/build teams submitting a responsive, non-successful Final Proposal. The cost of preparing a responsive Final Proposal can be prohibitive and an incentive is considered an appropriate way the owner pays for a portion of the development cost. The value of the stipend is typically in the range of 0.01 percent of the project's construction cost for very large projects to 0.2 percent of the project's construction for smaller projects. In no case is this amount large enough to compensate the competing teams for the cost of participating in the overall selection process and preparing a technical and cost proposal.*"

By stipend acceptance, UDOT owns all ideas and can share with the selected proposer the ideas of unsuccessful proposers, who have accepted the stipend. UDOT has also used the low-bid procurement method on design-build projects that have relatively simple scope and are worth less than approximately $25 million. With regard to low-bid procurement, UDOT low-bid evaluation and selection manual states the following:

> "*The Department will award the Project to the Proposer with a responsive Proposal and the lowest Proposal Price, unless all Proposals are rejected, or the Department otherwise elects not to award the Contract. In order to complete the project in the limited timeframe and meet high quality standards, the Design-builder has been given maximum possible flexibility to plan, design, construct and control the project. The RFP contains broad performance specifications which*

offer proposers the opportunity to choose materials, means and methods, and innovative ideas meeting those requirements; while having to price the work competitively to win the project."

Low-bid procurement of design-build projects in UDOT starts with responsiveness evaluation of proposals submitted by design-build teams. The responsiveness determination is made on a Pass/Fail basis by evaluating technical proposals against evolution criteria stipulated in the project RFP. Followed by responsiveness evaluation, price proposals are opened via the UDOT Electronic Bid System (EBS) and the contract is awarded to the lowest responsive and responsible bidder.

UDOT has used the fixed-price best value approach on one project so far. The interview with UDOT officials highlighted the following information with regard to the Utah County Corridor Expansion (I-15 CORE) project:

"*This project is the only project that UDOT procured by Fixed Price Best Value. The shortlisting for this project was an extensive process that started in January 2009 and ended in December 2009. UDOT announced the budget for this project as $1.1 Billion. The expansion project involves 25 miles of I-15 main line and several bridges and interchanges. However, during the 30% design phase by UDOT technical analysts, it was realized that with the mentioned budget, UDOT could only proceed with the construction of 50% of the track length. UDOT management decided to award the contract to the proposer that could build the higher percentage of the project compared to others by the mentioned budget. The project manager and a team of experts from UDOT spent 4 hours weekly with each proposer for 18 weeks to align the proposer*[s'] *design and objectives with the goals and objectives of the project mentioned in RFPs. This process resulted in 3 proposals that were able to build the whole 25 miles with the initial budget. This extremely intensive, time consuming and costly process resulted in 3 proposals* *with high added value to UDOT. The contracting community was appreciative and cooperative during this delicate process.*"

4.3.4 National Environmental Policy Act

Considering the NEPA process, UDOT proceeds with the Code of Federal Regulations Part 636 design-build project delivery system. The NEPA process requires definition of major project features. In the design-bid-build process, UDOT conducts the studies, prepares the documents, and applies for the appropriate clearances. Following this procedure ensures that the clearances are received and general mitigation requirements are known before the project proceeds. The role of the Department does not change when using the design-build project delivery system. FHWA has defined the approval of the environmental document environmental assessment/ environmental impact statement (EA/EIS) to be the formal approval for design-build project delivery system.

In the preliminary design phase, UDOT defines the general project location and design concepts. The general description includes, but is not limited to, preliminary engineering and other activities and analyses, such as environmental assessments, topographic surveys, metes and bounds surveys, geotechnical investigations, hydrologic analysis, hydraulic analysis, utility engineering, traffic studies, financial plans, revenue estimates, hazardous materials assessments, general estimates of the types and quantities of materials, and other work needed to establish parameters for the final design. Prior to completion of the NEPA review process, any such preliminary engineering and other activities and analyses must not materially affect the objective consideration of alternatives in the NEPA review process.

4.4 Washington State DOT

4.4.1 Background

The Washington State DOT (WSDOT) was authorized to use design-build project delivery system in 2001 under two state legislations namely RCW 47.20.780 – 785. At that time, the requirements mandated the use of design-build project delivery system for projects over $10 Million. The law has enabled the use of best-value as a procurement method for design-build projects. The law has not mandated, but encouraged WSDOT on the use of best-value procurement method for design-build projects. Any other design-build project delivery system and procurement method not authorized under RCW 47.20 requires a formal request through legislative channels by WSDOT. The design-build competitive bidding legislation for WSDOT states the following (RCW 47.20.780):

> "*Design-build — Competitive bidding*
>
> *The department of transportation shall develop a process for awarding competitively bid highway construction contracts for projects over ten million dollars that may be constructed using a design-build procedure. As used in this section and RCW 47.20.785, "design-build procedure" means a method of contracting under which the department of transportation contracts with another party for the party to both design and build the structures, facilities, and other items specified in the contract.*
>
> *The process developed by the department must, at a minimum, include the scope of services required under the design-build procedure, contractor prequalification requirements, criteria for evaluating technical information and project costs, contractor selection criteria, and issue resolution procedures*." [2007 c 152 § 1; 2001 c 226 § 2.]

However, in most cases for the 21 design-build projects, the best-value proposer has also been the lowest bidder. In 2006, the state legislature authorized WSDOT to perform design-build project delivery system on 10 pilot projects between $2 and $10 Million.

The design-build guidebook of the Washington State DOT defines the design-build project delivery system as the following:

> "*The design-build is a method of project delivery in which WSDOT executes a single contract with one entity (the Design-build Team) for design and construction services to provide a finished product. In general, this means the Department's role in the project will focus much more describing performance than on how to get that performance. It is particularly important that WSDOT staff be able to define the basic objectives of the Design-build project very early in the process. This includes physical components, operational requirements, performance expectations, and public service. It is necessary to describe the project in such a way that the Design-build Team has enough information to deliver the intended project.*" (WSDOT Design-Build Guidebook 2004b)

The selection of design-build projects for WSDOT is performed by following a decision-making process. This process requires assessing the project benefits and risks followed by determining design-build as the project delivery system for the project. Hence, WSDOT has developed a project selection procedure for selecting design-build as the project delivery system for the project (WSDOT Design-Build Project Delivery, Guidance Statement 2006):

1. "*The project engineer develops a schedule of milestones for the project.*
2. *The project engineer completes a cost risk assessment or uses the department Cost Estimating Validation Process (CEVP®).*
3. *The project engineer completes a Design-build risk matrix for the project.*

4. *The project engineer circulates the schedule and risk matrix to the appropriate specialty groups (environmental, geotechnical, etc.) for review and comment.*
5. *The Region's representatives from the Design-build Policy Team present the recommendations to the Region Administrator.*
6. *The Region Administrator reviews and makes a recommendation to the Assistant Secretary for Engineering and Regional Operations*.
7. *The Assistant Secretary for Engineering and Regional Operations reviews the recommendation and either concurs or rejects.*
8. *The project engineer clearly defines what processes and procedures are to be followed when proposing Design-build as the project delivery method for a project.*"

The final decision to use the design-build project delivery system on a project is based on an investigation of the following areas (WSDOT Design-Build Project Delivery, Guidance Statement 2006):

- "*Perform a thorough analysis of the Risk Matrix to determine whether risk elements assigned to the Design-build Team can be properly developed prior to issuance of the RFP. This will be used to determine how far the preliminary design has to be carried (to address owner-held risk elements) before the RFP is released*
- *Identify the desired outcomes for using design-build (innovation, traffic control challenges, project time, etc.)*
- *Identify potential benefits to be gained from design-build project delivery system. List the most important benefits first and provide further detail*"

This information is presented to the Secretary of Transportation who makes the final decision to proceed with a design-build contract for the selected project.

4.4.2 Design-Build Project Statistics

According to design-build project data provided by WSDOT webpage, WSDOT has procured 22 design-build projects since 2001. Figure 4.8 illustrates the distribution of the number of design-build project procured since 2001.

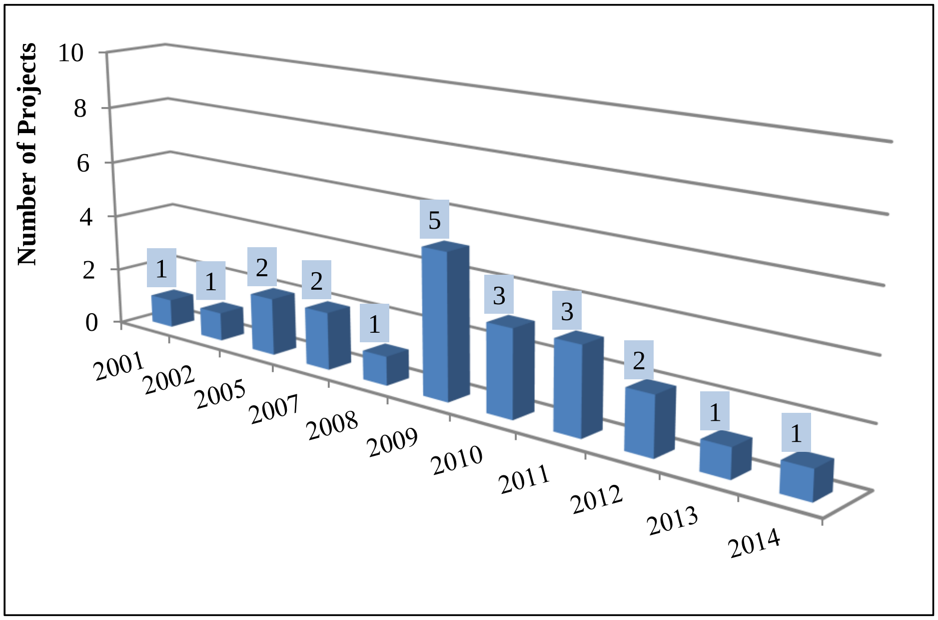


Figure 4.8

Number of Design-build Projects Procured Since 2008

Figure 4.9 illustrates the value of Design-build projects procured every year since 2008.

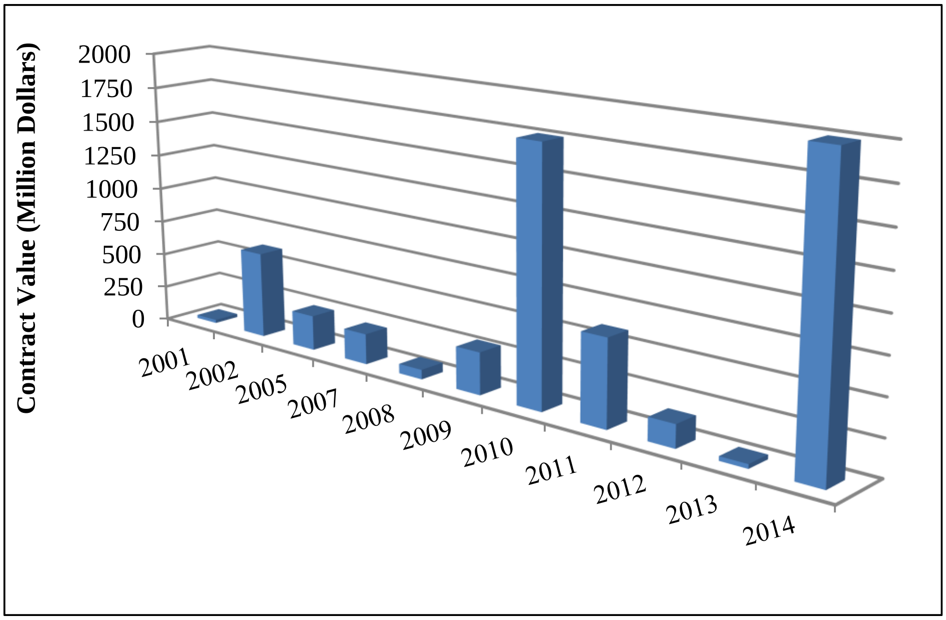


Figure 4.9

Contract Value ($ Million) of Design-build Projects Procured Since 2008

4.4.3 Procurement Methods for Design-Build Projects

WSDOT is not limited on the procurement method option for design-build projects. Currently WSDOT is using a two-phase best-value procurement method for design-build projects. The two-phase best-value selection procedure consists of a Request for Qualifications (RFQ) followed by a Request for Proposal (RFP). The RFQ focuses on the DB team's understanding of the project and their qualifications. The RFP Package contains the defined Contract Provision components as well as the selection process requirements and scoring criteria. The RFP also contains the technical requirements for design and construction of the project and the contract terms. The RFP should define the project end goals but not be prescriptive in how to meet the defined goals.

The RFQ and RFP Packages contain a number of inter-related documents that completely describe the project, the technical requirements for designing and constructing the project, the methods for selecting the Design-build Team, and the means to administer the contract. The various components are combined into a document resembling WSDOT's current bid proposal package.

4.4.3.1 Request for Qualification (RFQ)

The Request for Qualifications (RFQ) is used in the qualification step of the two-phase selection process. The RFQ asks interested proposing teams (Proposers) to submit a well-defined package outlining historical information related to capabilities, experience and past performances on specific issues pertinent to the project, project team organization, key project team members, QC/QA approach, individual and team history and current safety record.

To help ensure that all necessary information is included in the SOQ, it is necessary that WSDOT includes the evaluation criteria in the RFQ. These criteria should be specific enough to ensure that it is clear to all involved what the design-build team's required technical expertise/values are for a given project. A clear, well defined RFQ will help to ensure that the most qualified design-build teams prepare the Final Proposals. The following criteria should be included in the SOQ evaluation:

- "*Individual experience of team members with design-build project delivery system*
- *Corporate experience with design-build project delivery system*
- *History of the proposed team working together*
- *Specialized design capability for the key project elements*
- *Specialized construction capability for the key project elements*
- *Experience with complex construction staging, traffic control, site conditions*
- *Safety record (tie to Northwest L&I index)*
- *Staff available (Project Manager, Design Manager, Construction Superintendent, etc.)*
- *Quality performance*
- *QA/QC organization*

- *Bonding record or proof of bonding ability*
- *Past performance on awarded contracts (completion, liquidated damages, quality, claims, fines, schedule)*
- *Financial capacity*
- *Experience with formal partnering activities*
- *Experience in similar types of work*
- *History of performance (unsubstantiated claims, fines, suits, quality, accuracy, schedule)*
- *Understanding local environment*
- *Resource capacity and availability*
- *Scheduling and control systems to track and manage project*
- *Specialized expertise that reduces risk and assures quality of work*" (WSDOT Design-Build Guidebook 2004b)

The goal of the RFQ process is to select the three to five shortlisted proposers based on their experience in specific areas that are important for the project and their understanding of the project. The shortlisted teams will be asked to compete in the second phase of the two-phase procurement process. It is in the best interest of WSDOT and public to keep the number of shortlisted teams within 3 to 5 teams. Since the costs for proposal development are high, it is in the best interest of WSDOT to keep the number of shortlisted teams at the minimum. Unless the submitted RFQ's are likely to produce significantly different, final results the number of firms short listed should be minimized.

4.4.3.2 Request for Proposal (RFP)

The RFP Package contains all required information that is to be submitted as part of the final proposal packages developed by design-build teams. The RFP package will contain the following:

- "*General Proposal Requirements – Instructions to the Proposers on how to respond to the RFP and formulate the Final Proposal.*
- *Technical Proposal Requirements and Evaluation Criteria – Includes specific consent of the Final Proposal and how each of the requested details will be evaluated.*
- *Project Scope of Work – Project description and other technical criteria associated with the design and some of the construction related work.*
- *Revisions to Standard Specifications – Revises the Standard WSDOT Specifications for DB contracting. These are standard changes and are relevant to all DB projects.*
- *Special Provisions – Modifications to Standard Specifications that are project specific. These should not conflict with the Revisions to Standard Specifications.*
- *Risk/Responsibility Allocation Chart – Graphic illustration of the allocation of risks associated with the project and whether those risks lie with WSDOT or the proposing DB teams.*
- *Project Specific Materials – Defines project requirements and provides gathered data. May include maps, traffic forecasts, technical reports, design details, and environmental documentation.*
- *Typical Bid Proposal Documents – Bid documents, Bonding Requirements, Contract Form, Prevailing Wage Information, and Federal Aid Provisions.*
- *The RFP should outline the desired outcome and specific requirements of the project and Final Proposal submittal.*" (WSDOT Design-Build Guidebook 2004b)

4.4.3.3 Design-build Team Selection

The evaluation of the Technical Proposal is the most important and significant exercise the Department will undertake in the design-build project delivery system process. The proposals evaluators must be well trained to minimize scoring discrepancies. It is recommended that evaluators use a non-numbered scale to judge each criterion with judgment positions identified. The positions could relate to aspects as simple as unacceptable (non-responsive), acceptable (meets criteria), and exceptional (exceeds criteria). Best-value determination of the winning design-build proposal is based on the highest technical and price score. The equation adopted for the WSDOT Design-build selection process is a simple division of the technical score by the proposed price. The technical score is then adjusted by a factor to create an order of magnitude similar to the price.

Total Score = (Technical Score x 1,000,000)/Bid price ($)

For example, with a $10 million project and a 1000-point system, 1,000,000 would multiply the technical score to get to a useful whole number final score (WSDOT Design-Build Guidebook 2004b).

CHAPTER 5

PROJECT DELIVERY SYSTEM SELECTION

The choice of the project delivery system for a project is one of the most critical decisions that is made early on during the project planning phase and has significant impacts on the outcome of the project. Design-build is not the right project delivery system for every project. Each project has a unique set of goals and requirements that should be carefully analyzed and evaluated prior to proceeding with a specific project delivery system. Successful delivery of the project and achieving expected project goals depend on selecting a proper project delivery system that clearly defines contractual responsibilities for design and construction components of the project (Walweski et al 2001; AGC 2004; AGC 2011). The state DOT needs to carefully evaluate the appropriateness of design-build for the project and ensure that combining design and construction phases is beneficial for the successful delivery of the project (FHWA 2006a; AASHTO 2008; Nejat et al. 2009).

Proper assessment of design-build for a project involves careful consideration of benefits, challenges and motivations regarding the use of design-build for the project. When deciding about the appropriateness of design-build project delivery system for a transportation project, state DOTs should also carefully review the potential project risks and identify appropriate allocation and mitigation measures that should be adopted, in order to facilitate the smooth implementation of the design-build project delivery system. In this chapter, we discuss the need for a systematic approach for assessing appropriateness of design-build for a project considering these critical issues and present examples from the project delivery systems literature as well as the current state of practice in state DOTs across the U.S. A proper project delivery selection approach consists of three major components: A module to assess the appropriateness of design-build for the project, a risk identification module, and a risk assessment and allocation module.

5.1 Assessment of the Appropriateness of the Design-Build Project Delivery System for a Project

Several critical factors, such as unique characteristics of the project, project risks, specific project goals, and the owner's institutional objectives and its organizational capabilities, can affect the outcome of the project. The interactions among these factors complicate the process of evaluating the suitability of the design-build project delivery system for a project. State DOTs need a systematic and transparent approach to take into account these factors for evaluating the appropriateness of the design-build project delivery system for the project. There is a body of knowledge in project delivery systems that can be used to identify best practices for the assessment of suitability of design-build project delivery system for transportation projects. However, this assessment is a challenging process since owners have to consider several critical factors for selection of the appropriate project delivery system. Further, owners have to establish proper selection approaches to overcome various legal and statutory barriers and establish transparent decision-making processes to respond to public concerns.

5.1.1 Challenges of the assessment of the design-build project delivery system

5.1.1.1 Legal (statutory), internal (funding, resources, and leadership), and external (market-place conditions) barriers for utilizing design-build project delivery system

State DOTs may face several external barriers and issues that hinder the implementation of design-build. More specially, there are certain critical requirements for implementing the design-build project delivery system. These requirements include a variety of issues, such as legal and statutory challenges, organizational barriers, and market conditions. Using the design-build project delivery system is subject to legal and statutory requirements and without legislative support, design-build may not be used on transportation projects. It is also critical to have the support of the leadership of the agency, dedicated funding for the project, and necessary resources for procurement of the project. Furthermore, the marketplace conditions and the capacities of contracting community have an important role when considering the design-build project delivery system for a project. We concluded that without fulfilling these requirements, design-build is not a viable solution for a project. Thus, these requirements should be considered in decisions regarding the use of design-build for a transportation project. These requirements can be categorized into the following five groups (Ashuri and Kashani 2012):

1. Legal and statutory requirements: Whether the current regulation allows the state DOT to use design-build project delivery system to develop the project (considering the project characteristics, such as type and size);
2. Agency resources and experience: Whether the state DOT has available human resources and access to design-build consultants to deliver the project;
3. Project funding resources: Whether the state DOT has available funding in the foreseeable future to deliver the project using the design-build project delivery system ;
4. Leadership support: Whether leadership of the state DOT supports the utilization of design-build project delivery system for the project considering issues such as public endorsement; and
5. Design-build marketplace conditions: Whether state DOT has potential access to qualified design-build teams outside the state to deliver the project.

These issues represent major challenges for state DOTs that must be fully considered before any detailed assessment is even conducted to evaluate design-build for a project.

5.1.1.2 Difficulty in identification and evaluation of major factors that drive the selection of design-build projects

Several studies were conducted to determine what motivates owners to consider design-build project delivery system as an innovative project delivery system for the development of projects. Since state DOTs select design-build as an alternative to the conventional design-bid-build project delivery system, it is appropriate to identify the factors that motivate state DOTs to select design-build project delivery system for transportation projects. This identification can be used as an important part of constructing a systematic approach to evaluate the appropriateness of design-build project delivery system for a transportation project.

We performed a domestic scan of existing practices in State DOTs, to identify what have motivated State DOTs to select design-build project delivery system for their projects. The major source of information for State DOT scanning was official State DOT websites. The research team studied design-build Guidelines and Manuals of State DOTs, design-build RFQ and RFP Templates, and any other relevant documents that were available to the public through official State DOT websites. The research team conducted rigorous content analysis on these sources to identify main factors motivating State DOTs to consider design-build project delivery system. The information collected through the content analysis is used to rank these motivating factors considering the frequency of their appearances in different manuals of State DOTs. It is interesting to find out that 18 State DOTs – which are authorized to use design-build – do not provide any explicit objective and/or motivation for selecting design-build project delivery system in their online materials available at State DOT websites. 29 State DOTs present useful information in their online sources regarding the Department's objectives for applying design-build project delivery system. Figure 5.1 shows the results of content analysis, which identifies the main factors that motivate these 29 State DOTs to select design-build project delivery system for a transportation project.

It can be seen that all 29 State DOTs identified "Expedite Delivery" as the main motivation for selecting design-build project delivery system. "Facilitate Innovation" and "Reduce Cost" are considered as the next two important motivating factors within these 29 State DOTs. Other motivating factors, in order, are "Enhance Quality", "Deliver Projects Not Suitable for Design-Bid-Build", "Manage Technical Complexity", "Maximize Available Funds", "Manage Project Risk", and "Overcome Environmental Challenges".

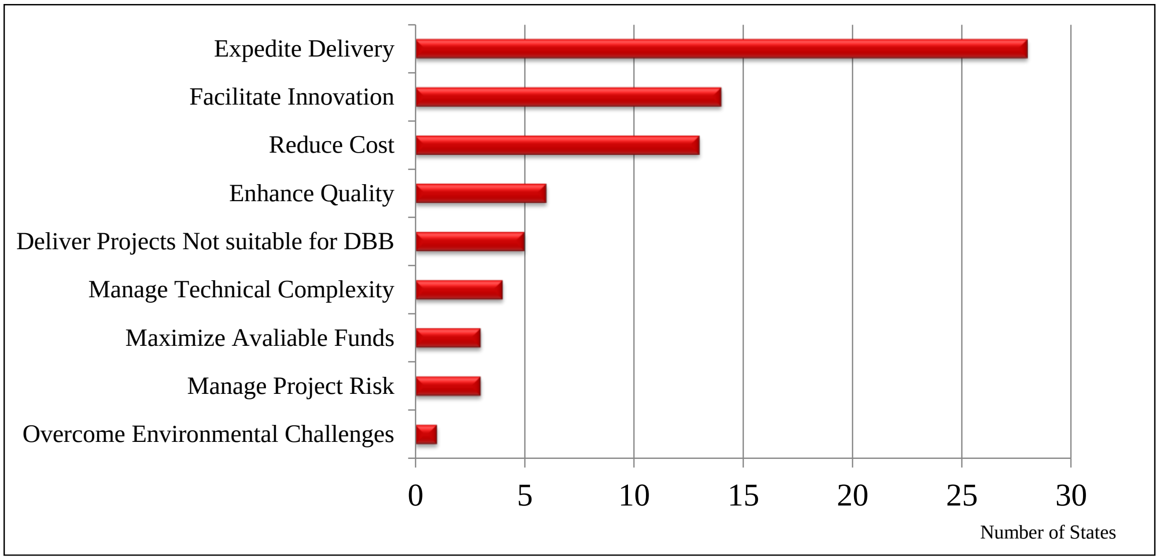


Figure 5.1

Main Factors That Motivate State DOTs to Select Design-Build Project Delivery System

(Source: 29 State DOTs' Design-Build Guidelines and Manuals)

We conducted a thorough literature review and identified main factors that have been deemed significant for considering design-build project delivery system for a transportation project. There is a growing body of knowledge that focuses on the selection of appropriate project delivery system in different industry sectors. Nevertheless, the research efforts focusing on selecting design-build project delivery system for a transportation project have been relatively limited so far. The existing literature recommends the presence of specific primary factors that should be considered in the selection of design-build as an alternative to other project delivery systems. The summary of the literature review on design-build project delivery system is provided in Table 5.1. As it can be observed, Time and Cost factors are generally considered as the major factors in the selection decision for design-build project delivery system. Issues related to Innovation, Quality and Scope are among the most important factors in the design-build selection. Other important factors in selecting design-build project delivery system for a project are: Experience, Early Involvement, Best Value Selection, Single Point of Responsibility, Claim Reduction, Project risk, and Flexibility.

Table 5.1
Summary of the Selection Factors for Design-Build Projects

Design Build Selection Factors	Vessay (1991)	Potter & Sanvido (1994)	Songer & Molenaar (1997)	Alhazmi & McCaffer (2000)	Chan et al. (2001)	Oyetunji & Anderson (2001)	Tookey et al. (2001)	Warne & Beard (2005)	Mahdi & Alreshaid (2005)	Mafakheri et al. (2007)	Chan (2007)	del Puerto et al. (2008)	Touran et al. (2011)	Love et al. (2012)	Molenaar et al. (2012)
Time	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cost	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Quality		✓		✓	✓		✓	✓	✓	✓	✓	✓		✓	
Complexity	✓	✓	✓		✓	✓			✓	✓			✓	✓	✓
Risk Management	✓			✓	✓	✓		✓		✓	✓		✓	✓	✓
Flexibility				✓	✓	✓			✓		✓			✓	
Owner's Experience & Competency	✓				✓	✓			✓	✓			✓		✓
Innovation			✓	✓		✓						✓			✓
Size		✓	✓						✓	✓			✓		
Project Teams' Experience & Competency	✓				✓			✓	✓						✓
Scope	✓	✓			✓	✓									
Claims Management			✓						✓				✓		
Safety and Security				✓				✓					✓		
Level of Design									✓						✓
Best Value Selection												✓			
Regulatory Requirements								✓	✓	✓			✓		
Single Point of Responsibility					✓	✓	✓		✓		✓	✓		✓	
Early Involvement						✓									

A range of factors have been identified in the literature that can influence the decision of whether design-build should be selected for the project. The assessment of these many factors is challenging for state DOTs. The proper assessment of these factors is required by the state DOT before proceeding with design-build for the project. However, because of the complexity of influential factors and existence of interrelations among them, identification and evaluation of these factors by the state DOT has several challenges. Each influential factor is composed of several other variables that may be correlated (Touran et al. 2009; VDOT 2011b). For instance, time can represent project delivery schedule, construction duration, or procurement duration. Similarly, various aspects of other factors should be considered by state DOTs when choosing the appropriate project delivery system for a project. Furthermore, quantification of some variables, such as innovation, quality, and flexibility may be a difficult task (Touran et al. 2009; VDOT 2011b). Evaluation of the added value to innovation, quality, flexibility, and similar factors by utilizing design-build on a project further complicates the decision-making process. Considering these challenges, there is a pressing need for state DOTs to choose the most appropriate set of selection factors for consideration in their decision-making process.

5.1.1.3 Lack of standard processes for selecting the project delivery system

The identification and evaluation of selection factors should result in determining a set of critical selection factors that can be used by the state DOT for evaluating appropriateness of design-build for a project. The review of literature showed us that there have been several methods proposed for selection of the appropriate project delivery system for a project. Gordon (1994) emphasized on the importance of selecting the appropriate project delivery system for the project and argued that a careful selection of project delivery system results in cost savings and a smooth construction process. Gordon (1994) proposed a flowchart-based project delivery system selection approach that considers parameters, such as time constraints, preconstruction service needs, risk aversion, and availability of appropriate contractors. The process starts with the analysis of the project, and owner and market drivers in the stated order. An appropriate project delivery system is selected based on the outcome of this analysis, allocation of project risks, and a commodity-versus-service analysis (Figure 5.2).

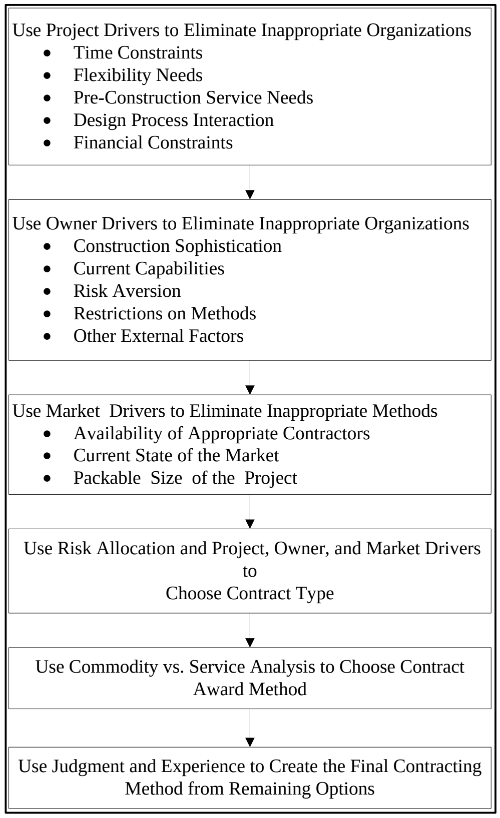


Figure 5.2

Project Delivery System Selection Flowchart

(Adopted from Gordon 1994)

Molenaar and Songer (1998) introduced a formalized selection model for public-sector design-build projects. The core of this model is a regression-based predictive equation built based on 122 retrospective case studies. Projects are selected based on the anticipated project success that can be achieved if design-build project delivery system is used.

Alhazmi and McCaffer (2000) presented an analytical model for selecting the most appropriate project delivery system. This model, which is called the Project Procurement System Selection

Model (PPSSM), integrates the Analytical Hierarchy Process (AHP) and Parker's judging alternative technique of value engineering into a multi-criteria, multi-screening system. A survey of public-sector owners was conducted in order to evaluate the effectiveness and efficiency of PPSSM in facilitating the selection of appropriate project delivery system. The flowchart shown in Figure 5.3 illustrates the model proposed by Alhazmi and McCaffer (2000).

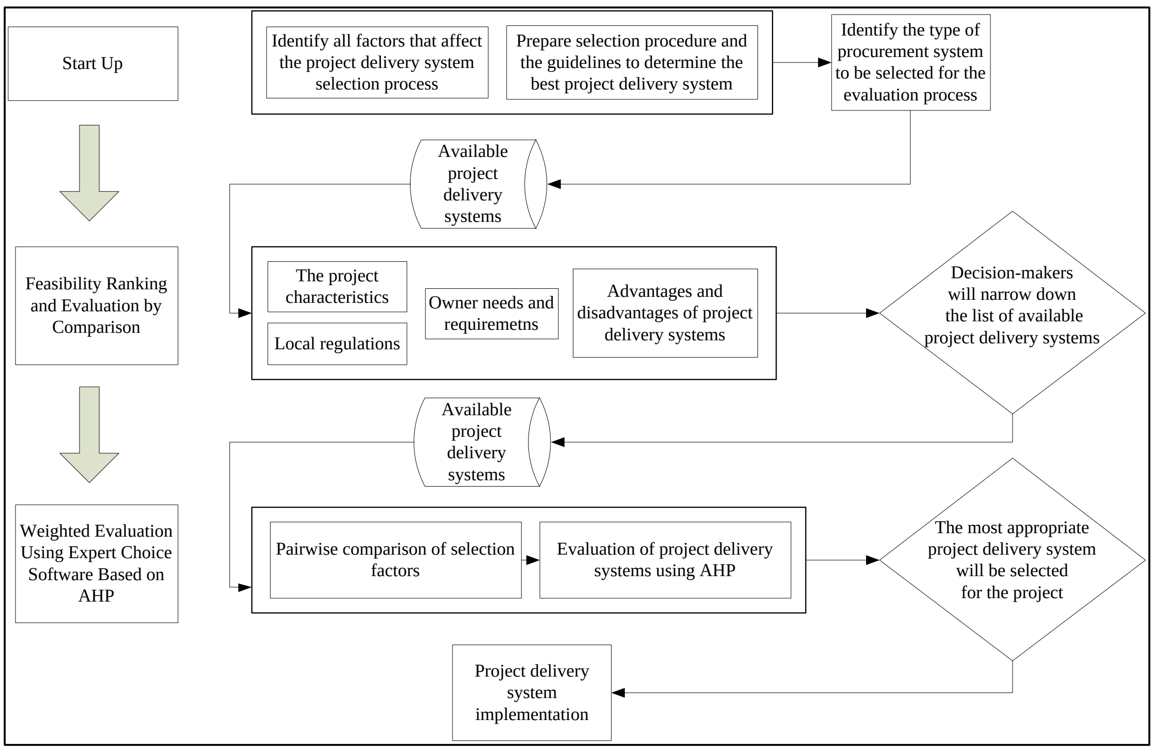


Figure 5.3

Project Procurement System Selection Model Developed by Alhazmi and McCaffer (2000)

As part of a research sponsored by the Construction Industry Institute (CII), Oyetunji and Anderson (2001) developed a structured procedure to assist owners in selecting appropriate project delivery system for a project. This procedure focuses on owner's goals and objectives for the project as well as the environment in which the project is executed. It can be used in order to identify an appropriate project delivery system for any given project based on the anticipated effect of a relevant set of factors in a pairwise (PW) comparison of project delivery systems. Figure 5.4 illustrates the project delivery system selection procedure proposed by Oyetunji and Anderson (2001).

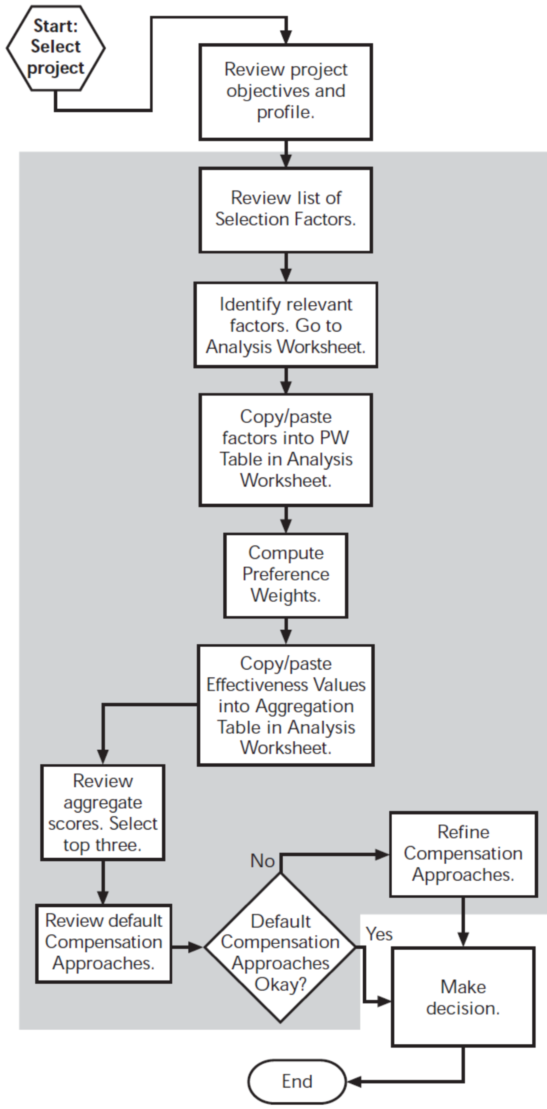


Figure 5.4

Project Delivery System Selection Procedure Proposed by Oyetunji and Anderson (2001)[1]

[1] The project delivery system selection procedure utilizes a relevant set of factors for pairwise (PW) comparison of project delivery systems.

Mahdi and Alreshaid (2005) examined the compatibility of various project delivery systems with specific types of owners and projects. They presented a multi-criteria decision-making model using the analytical hierarchy process that assists owners in selecting the proper project delivery system for their projects. The authors identified thirty-four factors that were categorized into seven areas, owner characteristics, project characteristics, design characteristics, regulatory constraints, contractor characteristics, risks, and claims and disputes. The decision makers can assign different weights to these seven areas when deciding the most appropriate project delivery system.

Loulakis (2005) presented a matrix for project delivery system evaluation and selection. Selection factors are analyzed and categorized under three major criteria: project goals, owner characteristics, and marketplace condition. Findings of previous research efforts on comparing different project delivery systems, such as design-bid-build and design-build, were taken into account to rank and prioritize different selection factors in this matrix.

Oyetunji and Anderson (2006) developed a decision support tool for identifying the optimal project delivery system for capital industrial and general building projects. Their approach utilized a multi-criteria decision analysis approach known as Simple Multi-Attribute Rating Technique with swing weights (SMARTS) to evaluate project delivery system alternatives.

Ng and Cheung (2007) emphasized the importance of selecting an appropriate project delivery system for an infrastructure project and presented a conceptual framework of the Virtual project delivery system Adviser for Infrastructure Facilities (VPDSA-IF). The selection factors used in their analysis include: project speed, cost certainty, flexibility, responsibility, complexity, quality level, risk allocation/avoidance, and price completion. Figure 5.5 presents the conceptual framework proposed by Ng and Cheung (2007) for project delivery system selection.

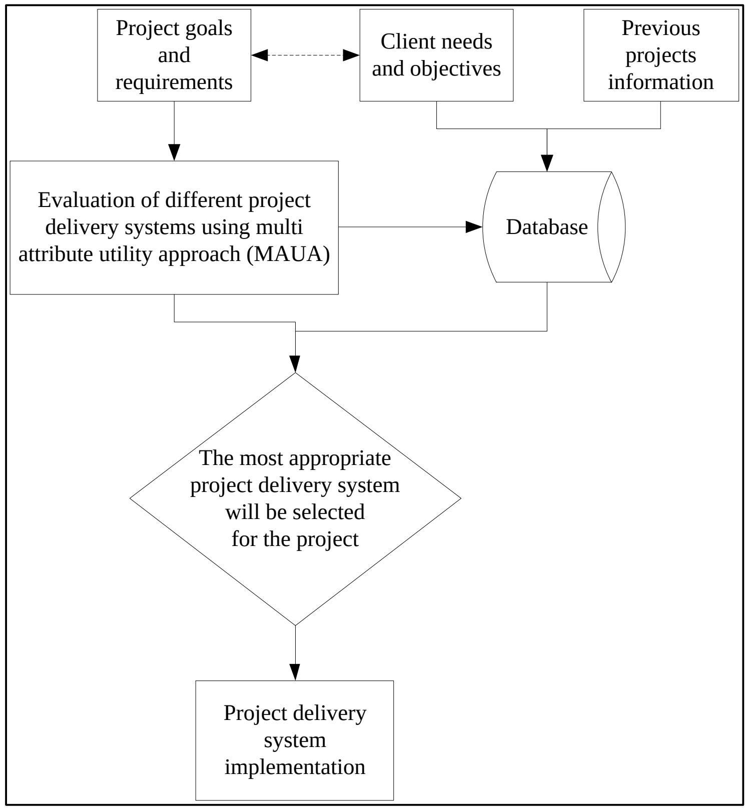


Figure 5.5

Multi-criteria Project Procurement System Selection Model Developed by Ng and Cheung (2007)

Ibbs and Chih (2011) conducted an extensive review of project delivery system selection approaches. They identified four groups of project delivery system selection methods, namely, guidance (i.e., decision charts and guidelines), multi-attribute analysis (i.e., multi-attribute utility theory and analytical hierarchical process), knowledge- and experience-based (i.e., case-based reasoning), and mix-method approaches. Based on this categorization, they presented the formalized project delivery system selection process illustrated in Figure 5.6.

Love at al. (2012) developed a process that helps project stakeholders evaluate their goals and objectives to select the project delivery system that generates better value for money. The proposed project delivery system selection process utilizes qualitative and quantitative stages and is comprised of six steps as shown in Figure 5.6. The outcome of the six-step process is a recommendation that is grounded in detailed evaluation of project goals, constraints, and the characteristics of authorized project delivery systems.

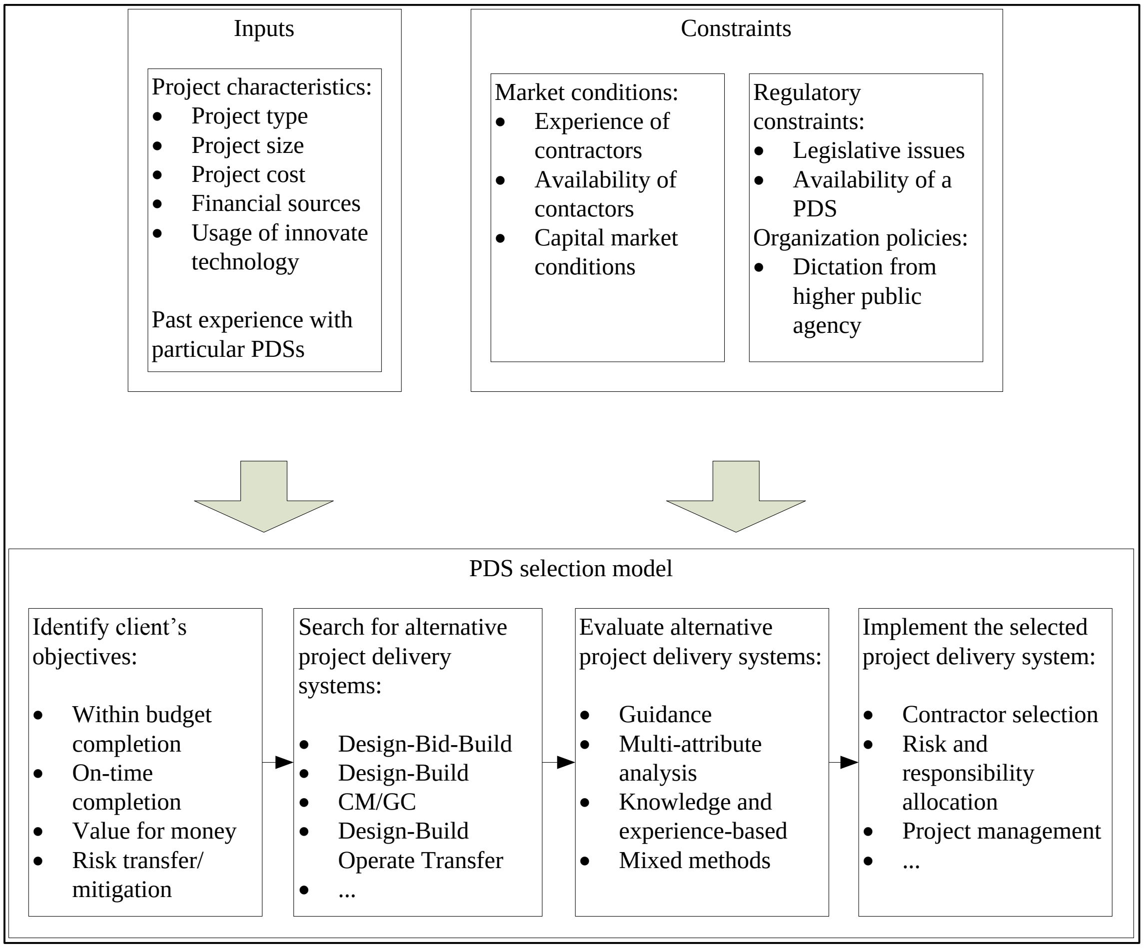


Figure 5.6

Conceptual Project Delivery System (PDS) Selection Process

Developed by Ibbs and Chih (2011)[2]

Molenaar et al. (2012) developed a decision support tool called the Project Delivery Selection Matrix (PDSM) to assist transportation agencies in selecting an appropriate project delivery system. The tool uses a risk-based selection approach to select a project delivery system from three choices: Design-Bid-Build, Design-Build, and CM/GC. The evaluation uses specific project attributes and

[2] In this figure "…" refers to etc.

characteristics and evaluate the appropriateness of each project delivery system based on a series of primary evaluation factors (Delivery Schedule, Project Complexity and Innovation, Level of Design, and Cost), an initial risk assessment, and three secondary evaluation factors (Owner's Staff Experience/Availability, Level of Oversight and Control, Competition, and Contractor Experience). Figure 5.7 illustrates a flowchart that describes the project delivery system selection process proposed by Molenaar et al. (2012).

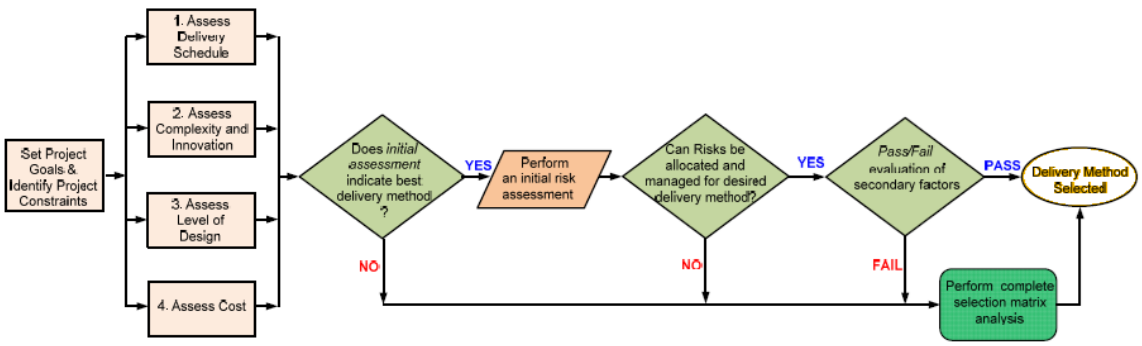


Figure 5.7

Flowchart Describing the project delivery system Selection Process Proposed by The University of Colorado (2012)

Choosing an appropriate project delivery system for a project is a complex decision-making problem (Touran et al. 2011). Despite the need for such an approach, researchers and stakeholders in the construction industry have not yet established a successful method for the systematic assessment of the appropriateness of design-build for highway projects. Development and implementation of systematic processes for selecting the project delivery system is not without challenges. One of the major barriers in the smooth implementation of a systematic decision-making process is the presence of subjectivity and opinion-based decision-making process in most state DOTs (Touran et al. 2009; VDOT 2011b). Since the assessment of appropriateness of the project delivery system is done by subject matter experts, differences in opinions may cause problems in reaching group consensus. Decision-making can get more challenging, especially when qualitative factors, which are difficult to quantify in terms of added value, are involved in the evaluation process. Furthermore, in some situations, projects are selected for political reasons or urgent funding availability and not because they meet the design-build criteria. We propose the following opportunity to enhance the efficiency of the state DOT in selection of design-build projects.

5.1.2 Opportunity for efficiency enhancement of the assessment of the design-build project delivery system for a project

5.1.2.1 Opportunity for efficiency enhancement: State DOTs should develop, maintain, use, and update a standard design-build selection tool that systematically evaluates the appropriateness of design-build for transportation projects.

State DOTs should develop and utilize a systematic decision support tool that is capable of capturing the design-build dynamics and reflecting the project outcomes. This tool should be able to incorporate several influential criteria in assessing the appropriateness of design-build for the project. The tool should be continuously refined and updated based on feedbacks provided by experts who implement the tool and document lessons learned in design-build projects. According to a survey conducted by Anderson and Damnjanovic (2008), just a few state DOTs, such as Colorado and Utah DOTs, have developed a systematic approach that determines the appropriateness of design-build for their projects:

Colorado DOT (CDOT)

CDOT has recently started to use a formal approach to select project delivery system for highway project. This “risk-based” process provides CDOT staff and project team members with generic forms that can be used to determine if there is a dominant or obvious choice of project delivery system among the three available choices (CDOT 2011): Design-Bid-Build, Design-Build, and

Construction Manager/General Contractor (CM/GC). Using this process, project delivery system is selected based on specific project attributes and characteristics. Specifically, in this process, the appropriateness of each project delivery system is evaluated based on a series of primary evaluation factors, an initial risk assessment, and three secondary evaluation factors. The outcome of this process is a Project Delivery Decision Report that describes the decision about the project delivery system in details. The process consists of the following activities (CDOT 2011):

A. Describe the project and set the project goals: The process begins by collecting and organizing information on the characteristics of project. A project description form, which at least includes the items below, can be used for the purpose of defining the project characteristics:

    - Project name
    - Location
    - Estimated budget
    - Estimated project delivery period
    - Required delivery date (if applicable)
    - Source(s) of project funding
    - Project corridor
    - Major features of work – pavement, bridge, sound barriers, etc.
    - Major schedule milestones
    - Major project stakeholders
    - Major challenges (e.g., challenges with acquiring right of way, utilities, and/or environmental approvals, challenges during construction phase)
    - Main identified sources of risk
    - Safety issues
    - Sustainable design and construction requirements

It should be noted that other items can be added if the evaluators believe that they may influence the Project Delivery System decision. Next, specific project goals should be identified. These project goals must be clearly understood as a foundation for the selection of appropriate Project Delivery System. These goals should remain consistent over the life of the project.

B. Assess the three primary factors that most often determine the selection of the appropriate Project Delivery System; these primary factors are: Delivery Schedule, Complexity and Innovation, and Level of Design at the time of the project delivery procurement. For each candidate Project Delivery System, the evaluators should discuss the opportunities and obstacles related to each factor, and document the discussion on these factors.

1. Delivery Schedule: Delivery schedule is the overall project schedule from scoping through design, construction and opening to the public. Assessment of delivery schedule is concerned with the time required to secure the funding required for the project and get the project started. Delivery schedule assessment also considers the importance of project completion schedule.

2. Complexity and Innovation: Assessment is concerned with the applicability of new designs or processes to resolve complex and technical issues.

3. Level of Design: Assessment focuses on the percentage of design completion at the time of Project Delivery System selection.

An example of the form, which can be used for the analysis opportunities and obstacles as well as the evaluation summary form, is shown in Figure 5.8 and Figure 5.9 shows a sample of the opportunities and obstacles checklists that are used in conjunction with the evaluation.

C. Perform an initial risk assessment if the assessment of three primary factors indicates there is a clear choice of the Project Delivery System.

4. Initial risk assessment: Risk is an uncertain event or condition that can negatively impact the project outcome. Risk allocation is the assignment of unknown events or conditions to

the party that can best manage them. CDOT uses three sets of risk assessment checklists, which are provided to assist in an initial risk assessment relative to the selection of the Project Delivery System for transportation projects:

1. Typical transportation project risks categorized in major areas including site conditions and investigations, utilities, railroads, drainage/water quality best management practices, environmental, and third party involvement
2. General project risks checklist as shown in Figure 5.10
3. Opportunities/challenges checklist (relative to Design-Bid-Build, Design-Build and CM at Risk Project Delivery Systems)

The initial assessment of project risks is aimed at determining if the project risks can be appropriately managed under the Project Delivery System in question.

D. Perform a brief pass/fail analysis of the secondary factors to ensure that they are not relevant to the decision. These secondary factors are as the following:

5. Cost: Assessment is focused on the financial process related to meeting budget restrictions, early and precise cost estimation, and control of project costs.

6. Staff Experience/Availability: Assessment is concerned with the owner staff experience and availability as it relates to the Project Delivery Systems in question.

7. Level of Oversight and Control: Assessment is concerned with the amount of agency staff required to monitor the design or construction, and amount of agency control over the delivery process.

8. Competition and Contractor Experience: Assessment is focused on the level of competition, experience and availability of qualified contractors in the marketplace and their capacity for delivering the project.

E. If steps B, C and D do not result in clear determination of the appropriate Project Delivery System, perform a more rigorous evaluation of all eight factors against the three potential Project Delivery Systems i.e., Design Bid Build, Design-Build and CM/GC.

DESIGN-BID-BUILD	
Requires time to perform sequential design and procurement, but if design time is available has the shortest procurement time after the design is complete.	
Opportunities	**Obstacles**
▪	▪ ....
▪	▪ ....
▪	▪ ....

DESIGN-BUILD	
Can get project under construction (and meet funding obligations) before completing design. Parallel process of design and construction can accelerate project delivery schedule; however, procurement time can be lengthy due to the need for an accurate RFP.	
Opportunities	**Obstacles**
▪	▪ ....
▪	▪ ....
▪	▪ ....

CM/GC	
Quickly gets contractor under contract and under construction to meet funding obligations before completing design. Parallel process of development of contract requirements, design, procurements, and construction can accelerate project schedule, but schedule can be slowed down by CM/GC design process and Guaranteed Maximum Price (GMP)negotiations and contracting.	
Opportunities	**Obstacles**
▪	▪ ....
▪	▪ ....
▪	▪ ....

Delivery Schedule Summary

	DBB	DB	CM/GC
1. Delivery Schedule			

Key: **+ +** Most appropriate delivery method **+** Appropriate delivery method
– Least appropriate delivery method **X** Fatal Flaw (discontinue evaluation of this method)
NA Factor not applicable or not relevant to the selection of project delivery

Notes and Comments: ....
....
....
....

Figure 5.8

Example of the Forms That Can be Used for Project Delivery System Selection Analysis

Opportunities and Obstacles (Top) & Evaluation Summary (Bottom) (Copyright of CDOT 2011)

DESIGN-BID-BUILD	
Opportunities	**Challenges**
❒ Schedule is more predictable and more manageable ❒ Milestones can be easier to define ❒ Projects can more easily be "shelved" ❒ Shortest procurement period ❒ Elements of design can be advanced prior to permitting, construction, etc. ❒ Time to communicate/discuss design with stakeholders	❒ Requires time to perform a linear design-bid-construction process ❒ Design and construction schedules can be unrealistic due to lack industry input ❒ Errors in design lead to change orders and schedule delays ❒ Low bid selection may lead to potential delays and other adverse outcomes.

DESIGN-BUILD	
Opportunities	**Challenges**
❒ Potential to accelerate schedule through parallel design-build process ❒ Shifting schedule risk to DB team ❒ Encumbers construction funds more quickly ❒ Industry input into design and schedule ❒ Fewer chances for disputes between agency and design-builders ❒ More efficient procurement of long-lead items ❒ Ability to start construction before entire design, ROW, etc. is complete (i.e., phased design) ❒ Allows innovation in resource loading and scheduling by DB team	❒ Request for proposal development and procurement can be intensive ❒ Undefined events or conditions found after procurement, but during design can impact schedule and cost ❒ Time required to define technical requirements and expectations through RFP development can be intensive ❒ Time required to gain acceptance of quality program ❒ Requires agency and stakeholder commitments to an expeditious review of design

CM/GC	
Opportunities	**Challenges**
❒ Ability to start construction before entire design, ROW, etc. is complete (i.e., phased design) ❒ More efficient procurement of long-lead items ❒ Early identification and resolution of design and construction issues (e.g., utility, ROW, and earthwork) ❒ Can provide a shorter procurement schedule than DB ❒ Team involvement for schedule optimization ❒ Continuous constructability review and VE ❒ Maintenance of Traffic improves with contractor inputs ❒ Contractor input for phasing, constructability and traffic control may reduce overall schedule	❒ Potential for not reaching GMP and substantially delaying schedule ❒ GMP negotiation can delay the schedule ❒ Designer-contractor-agency disagreements can add delays ❒ Strong agency management is required to control schedule

Figure 5.9

A Sample of the Opportunities and Obstacles Checklists (Concerned with Schedule) that Are Used in Conjunction with the Evaluation (Copyright of CDOT 2011)

Environmental Risks	External Risks
❐ Delay in review of environmental documentation ❐ Challenge in appropriate environmental documentation ❐ Defined and non-defined hazardous waste ❐ Environmental regulation changes ❐ Environmental impact statement (EIS) required ❐ NEPA/ 404 Merger Process required ❐ Environmental analysis on new alignments required	❐ Stakeholders request late changes ❐ Influential stakeholders request additional needs to serve their own commercial purposes ❐ Local communities pose objections ❐ Community relations ❐ Conformance with regulations/guidelines/ design criteria ❐ Intergovernmental agreements and jurisdiction
Third-Party Risks	**Geotechnical and Hazmat Risks**
❐ Unforeseen delays due to utility owner and third-party ❐ Encounter unexpected utilities during construction ❐ Cost sharing with utilities not as planned ❐ Utility integration with project not as planned ❐ Third-party delays during construction ❐ Coordination with other projects ❐ Coordination with other government agencies	❐ Unexpected geotechnical issues ❐ Surveys late and/or in error ❐ Hazardous waste site analysis incomplete or in error ❐ Inadequate geotechnical investigations ❐ Adverse groundwater conditions ❐ Other general geotechnical risks
Right-of-Way/ Real Estate Risks	**Design Risks**
❐ Railroad involvement ❐ Objections to ROW appraisal take more time and/or money ❐ Excessive relocation or demolition ❐ Acquisition ROW problems ❐ Difficult or additional condemnation ❐ Accelerating pace of development in project corridor ❐ Additional ROW purchase due to alignment change	❐ Design is incomplete/ Design exceptions ❐ Scope definition is poor or incomplete ❐ Project purpose and need are poorly defined ❐ Communication breakdown with project team ❐ Pressure to delivery project on an accelerated schedule ❐ Constructability of design issues ❐ Project complexity (scope, schedule, objectives, cost, and deliverables are not clearly understood)
Organizational Risks	**Construction Risks**
❐ Inexperienced staff assigned ❐ Losing critical staff at crucial point of the project ❐ Functional units not available or overloaded ❐ No control over staff priorities ❐ Lack of coordination/ communication ❐ Local agency issues ❐ Internal red tape causes delay getting approvals, decisions ❐ Too many projects/ new priority project inserted into program	❐ Pressure to delivery project on an accelerated schedule. ❐ Inaccurate contract time estimates ❐ Construction QC/QA issues ❐ Unclear contract documents ❐ Problem with construction sequencing/ staging/ phasing ❐ Maintenance of Traffic/ Work Zone Traffic Control

Figure 5.10

General Project Risk Checklist that includes the Items to Consider when Assessing Risk

(Copyright of CDOT 2011)

CDOT has used the systematic selection process to determine the appropriate project delivery system on 7 projects since its development. In each of these projects, CDOT has performed a rigorous evaluation of benefits and challenges to using design-bid-build, design-build and CM/GC project delivery systems. The evaluation in every project is done on the primary and secondary factors with slight modifications on each project. With regard to the use of this systematic evaluation process, CDOT states that:

> "*The systematic evaluation process provides a formal approach for CDOT highway project delivery selection. CDOT staff and project team members can use the documents provided by Innovative Contracting Advisory Committee as generic forms. By using these forms, a brief project delivery selection report can be generated for each individual project. The primary objectives of this document are:*
>
> - *Present a structured approach to assist CDOT in making project delivery decisions*
> - *Assist CDOT in determining if there is a dominant or obvious choice of project delivery methods*
> - *Provide documentation of the project delivery decision in the form of a project delivery decision report*" (CDOT 2011)

Utah DOT (UDOT)

The goal of the innovative contracting group is to identify alternative delivery methods for the Regions to use in the development and delivery of UDOT projects that allow for innovative contracting methods outside of the traditional Design-Bid-Build delivery method. Historically, these delivery methods have included Construction Manager/General Contractor (CM/GC) and low-bid or best-value design-build. UDOT uses a comprehensive process for selecting a proper innovative project delivery system for a project. This process evaluates the benefits and risks of design-bid-build, design-build, and construction manager-general contractor (CM/GC) using seven influential factors (UDOT 2011c):

1) Design and constructability

2) Cost
3) Public impact
4) Project schedule
5) Risk (identify, eliminate or manage)
6) Innovations in cost, schedule, public impact, and technology
7) Environmental stewardship

The project delivery system that provides the highest benefits and lowest risks with regard to these influential factors is selected for the project. The UDOT project delivery system selection manual describes the review of each influential factor as the following (UDOT 2011c):

1) Design and constructability: Project design and constructability is the major leading criterion in choosing whether a project remains design-bid-build or is delivered through design-build. If UDOT determines that the project will benefit from contractor input and participation, then CM/GC can be chosen for the project. Further, if UDOT is willing to hand the final design to the design-build team, then design-build can be chosen for the project.
2) Cost: Project cost is a significant factor in selection of the project delivery system for the project. In design-bid-build, UDOT is primarily responsible for design risks, such as errors, omissions, and change orders, which can result in material cost overruns and project delays. In CM/GC, the contactor input can result in significant cost savings in major items of the work, such as maintenance of traffic (MOT), utilities, and construction items. In design-build, the transfer of project risks, such as design, ROW, and utilities to the design-build team can result in bid inflation; on the other hand expedited project delivery can result in significant cost savings for UDOT.
3) Public impact: It is important to evaluate the impacts of the project delivery system on the public with regard to project delivery schedule, project cost, design errors and omissions,

and traffic impacts. For instance, CM/GC and design-build allow UDOT to expedite the delivery of projects and minimize impacts to the traveling public or design-bid-build allows for selection of the lowest bidder based on a well-established project development process.

4) Project schedule: Project schedule is an important criterion for project delivery system selection. Design-bid-build projects usually go through a sequential design, bid, and construction process that does not allow overlapping project phases. CM/GC and design-build allow fast-tracking (overlapping design and construction) that can result in significant time savings for UDOT. The major difference is that in design-build, the design-build team becomes primarily responsible for design while in CM/GC the contractor has to coordinate with the designer to make design decisions. On the other hand, the procurement process for design-build projects can be time-consuming for UDOT.

5) Risk (identify, eliminate, or manage): UDOT performs an in-depth review of project risks prior to selecting the project delivery system. The main objective is to choose the project delivery system in accordance with mitigating, transferring, and sharing project risks. Regarding project risks UDOT states the following: "*With a design-bid-build project, there is very little risk for the contractor as they are allowed change orders for items outside the original design. A CM/GC project engages UDOT, a contractor, and a designer in a joint effort to identify and manage risk together, minimizing overall impact to either party. Design-build on the other hand, assigns the risk to the party who is in the best position to control and/or manage the risk*."

6) Innovation: UDOT reviews innovations in cost, schedule, public impact, and technology when selecting the project delivery system for the project. Regarding the effects of innovation, UDOT states the following: "*A CM/GC project allows UDOT to determine which risks and/or increases to cost and schedule are to the greatest benefit of the project and the traveling public. The CM/GC project delivery allows UDOT and the contractor to share innovative ideas and the risks associated with them. The third option is to allow a*

Design-Build team to propose the innovations allowed within the requirements of a Request for Proposals (RFP). Design-build project delivery system puts nearly all of the innovation and risk on the design-build team, who then benefits from competitive bid advantages during selection and potential profit increases during the project due to innovative efficiencies."

7) Environmental stewardship: UDOT prefers to complete environmental clearances in traditional design-bid-build projects prior to contract award. In CM/GC projects, UDOT allows for contactor input to facilitate the environmental analysis and permitting while in design-build projects, UDOT identifies and addresses all environmental work in the RFP.

The process for selection of the appropriate project delivery system for UDOT continues with evaluation of benefits and risks of each project delivery system considering all 7 selection evaluation criteria. Table 5.2 presents the project delivery system evaluation guide used by UDOT (UDOT 2011c).

Table 5.2
Project Delivery System Evaluation Guide (Copyright of Utah DOT)

Criteria	CM/GC	Design-build	Design Bid Build
Project Types	• Owner wants to maintain design control • Owner wants contractor input in design • Projects with owner directed technology • Better for early procurement	• Good on projects with limited UDOT resources • Owner wants contractor input in design	• Simple project designs

1. Design and Constructability	**Benefits**
	• UDOT controls design
	• Scope is variable
	• Less detail required to communicate design
	• Contractor participation is expected to
	  ○ Reduce and share risk
	  ○ Improve alternative analysis
	  ○ Highest reduction in change orders
	  ○ Improve constructability
	  ○ Reduce errors
	  ○ Reduce overruns
		Benefits
		• Less detail required to communicate design
		• Contractor participation is expected to
		  ○ Transfer risks to contractor
		  ○ Reduce change orders
		  ○ Improve constructability
		  ○ Reduce errors
		  ○ Reduce overruns
			Benefits
			• Complete design
			• Process familiar to community
			• Right of Way known
			• Utilities identified and relocated

	Risks • May increase design time to evaluate contractor suggestions • May need to create a biddable package if price is unacceptable • Right of Way may delay some construction	**Risks** • Scope needs to be well defined • UDOT does not control design • Consultant works for Contractor and oversight is increased • Right of Way may delay some construction	**Risks** • Scope is fixed • Design is independent of contractor experience and abilities • Alternative designs may be limited and have no production estimate
2. Cost	**Benefit** • Innovations provide owner cost savings • Risk reduction to lower contingency funding and improve production rates • Reduced change orders • Reduced schedule	**Benefit** • Low bid favored in selection • Reduced schedule	**Benefit** • Low bid
	Risk • UDOT pays for contractor involvement in design	**Risk** • UDOT pays for risk transferred to contractor • UDOT pays for RFP development and stipends • Unknown conditions, ROW, and Utilities may drive up cost • UDOT pays for contractor involvement in design	**Risk** • Errors, omissions, and unknowns will drive up cost through change orders
3. Public	**Benefit** • Reduced delivery time • Reduced errors and omissions	**Benefit** • Reduced delivery time • Reduced errors and omissions	**Benefit** • Low cost selection • Proven delivery method

Table 5.2 (cont'd)

Criteria	CM/GC	Design-build	Design Bid Build
4. Project Schedule	**Benefits** • Compressed schedule by early procurement • Long lead items • Pre-casting • Crossover construction • Shorter construction time • Plan Utility & Right of Way effort • Maintenance of traffic improves with contractor inputs	**Benefits** • Less time in design and construction • Design is tailored to contractor's abilities • Construction can begin before design is complete	**Benefits** • Proven record of performance for construction schedule
	Risks • Unable to negotiate on price and design is sent out for bid	**Risks** • Considerable time and effort in RFP • Limited Department review times	**Risks** • Errors in design result in change orders and delay project completion • Low bid selection results in schedule delays when contractor's ideal projections do not occur
5. Risk (Identify Eliminate or Manage)	**Benefits** • Contractor will help identify and manage risk • ROW after design reduces errors and rework • Utilities and ROW managed during design using the same consultant which results in less chance of error and rework	**Benefits** • Contractor will help identify and accept ownership of some risk • Risk transfer to the Contractor	**Benefits** • Utilities and ROW managed during design using the same consultant which results in less chance of error and rework
	Risk • Opportunity to increase cost on non-proposal items • Lacks motivation to manage small quantity costs • Sole source contract	**Risk** • Increased proposal costs may limit bidders • Higher risk for projects with R/W and Utilities • Contractor may avoid risk. • Contractor may drive consultant to reduce cost at risk to quality • No cost savings return to UDOT	**Risk** • Contractor may avoid risk • Motivated to make up for low bid in change orders
6. Innovation Cost Schedule Public Impact Technology	**Benefits** • The best method for owner directed innovations • UDOT can select innovation independent of contractor experience or abilities • Contractor participation moderates the risk of new technology • Contractor participation encourages innovation • Owner benefits from innovation savings	**Benefits** • Contractor participation is expected to encourage innovation	**Benefits** None identified
	Risks • UDOT selected innovation may fail or increase cost and schedule	**Risks** • Innovation is limited to contractor abilities and comfort zone • Contractor benefits from innovation savings	**Risks** • Innovation may be considered a risk and limited to what benefits the contractor • Contractor benefits from innovations savings
7. Environmental Stewardship	• Contractor is able to influence the approach	• Design oversight is required	• UDOT's task

Georgia DOT (GDOT)

The Georgia DOT has developed a systematic tool for the assessment of appropriateness of design-build for a project. This tool was developed by the Georgia Institute of Technology in collaboration with the GDOT Office of Innovative Program Delivery. This tool is based on a systematic approach intended to help GDOT perform the following critical tasks (Ashuri and Kashani 2012):

1. Evaluate the appropriateness of design-build project delivery system for a transportation project;
2. Conduct initial risk identification and risk assessment and develop initial risk allocation matrices for transportation design-build projects; and
3. Evaluate the appropriateness of procurement methods for transportation design-build projects

The entire systematic approach is automated in a Microsoft Excel Visual Basic for Application (VBA) tool named "GDOT's Next-Gen DB Assessment Tool" that are specifically developed for GDOT (Figure 5.11). These tools are currently used in the Office of Innovative Program Delivery for the assessment of design-build project delivery system for GDOT transportation projects.

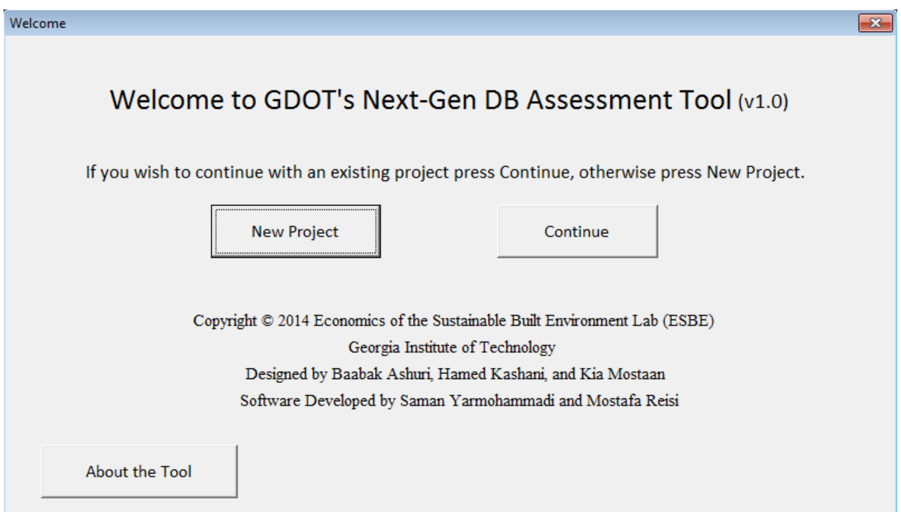


Figure 5.11

Snapshot of GDOT's Next-Gen DB Assessment Tool Welcome Screen

The design-build suitability assessment process involves several steps starting with identifying the strategic goals of the Georgia DOT. The strategic goals of GDOT must be clearly understood and identified as a foundation for the selection of appropriate project delivery system. The process then continues with defining project-related inputs, such as project characteristics and specific project goals. Project characteristics are used to create a brief description of the project. Project specific goals must be clearly understood and identified as a foundation for the selection of appropriate project delivery system. Prior to proceeding to the project delivery system evaluation steps, GDOT performs an analysis of deal-breaker issues to see whether design-build can be used for the project. If any deal-breaker issue exists, the project cannot be considered for the design-build project delivery system.

The process of the systematic design-build selection approach is described in the flowchart presented in Figure 5.12.

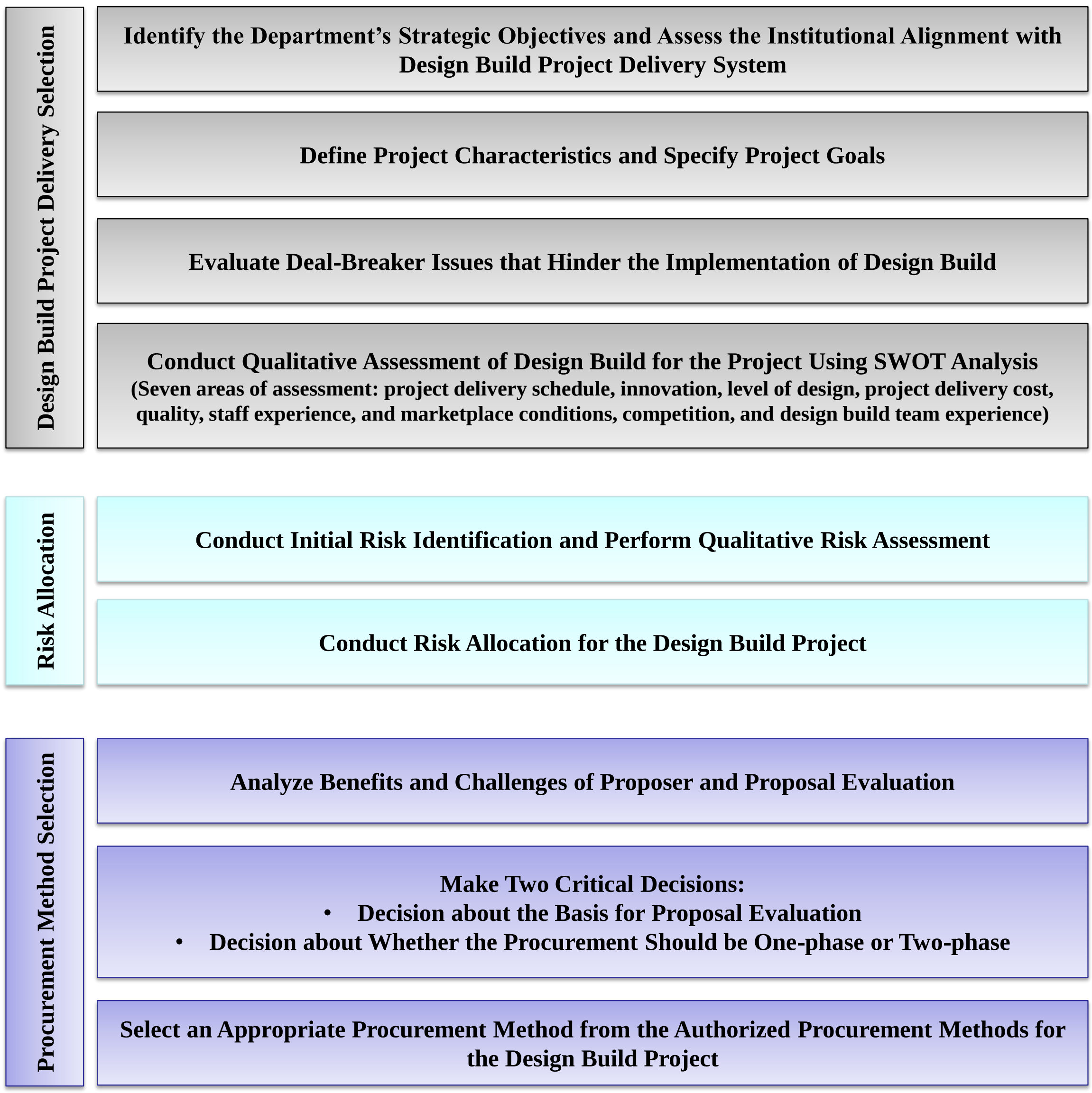


Figure 5.12

An overview of the Proposed Systematic Approach

GDOT's Next-Gen DB Assessment Tool starts with defining the project characteristics (snapshots presented in Figure 5.13).

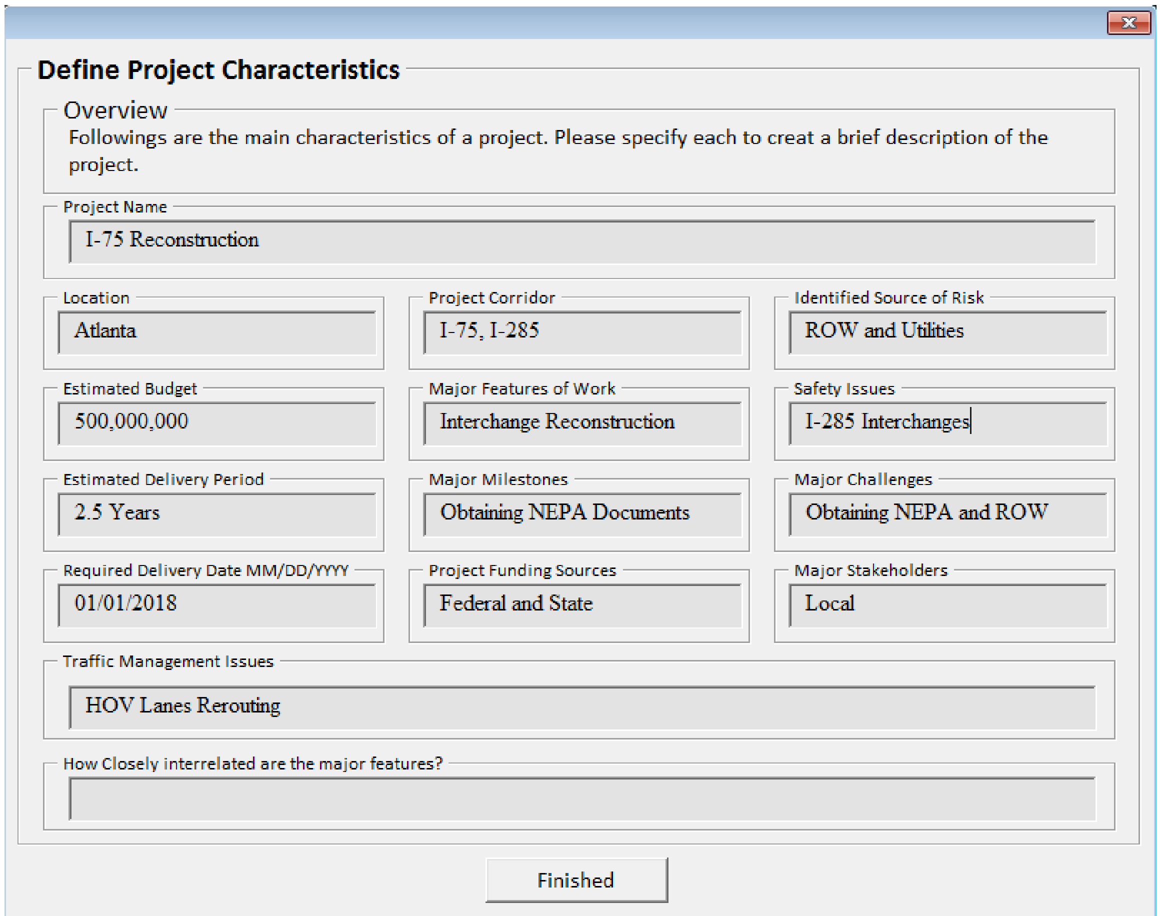


Figure 5.13

Snapshot of the GDOT's Next-Gen DB Assessment Tool for Defining Project Characteristics

The evaluation process continues with SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis, which is used by GDOT to determine the appropriateness of design-build project delivery system for a transportation project with respect to specific factors. SWOT analysis addresses the following issues:

- Strengths: Characteristics of the design-build project delivery system that give it an advantage with respect to the issue under consideration;

- Weaknesses (or Limitations): Characteristics of the design-build project delivery system that create disadvantages with respect to the issue under consideration;
- Opportunities: Chances to improve performance (e.g. achieve the Department's project goals; greater benefits; higher efficiencies) if it decides to go with design-build project delivery system;
- Threats: Elements that could result in threats for the department if it decides to go with design-build project delivery system.

The following factors are considered in the SWOT analysis outlined in the GDOT design-build selection tool:

a) Project Delivery Schedule
b) Innovation
c) Level of Design
d) Project Delivery Cost
e) Quality
f) Staff Experience
g) Marketplace Conditions, Competition and Design-Build Team Experience

The evaluation process involves a generic SWOT analysis template that can be used to assess the appropriateness of design-build project delivery system. GDOT uses a scoring system, in order to facilitate an objective and clear evaluation of the suitability of design-build project delivery system. In this scoring system, Strengths and Weakness are scored on a 1-10 scale with Strengths receiving a positive score and Weaknesses a negative score. Opportunities and Threats are scored on a 1-5 scale with Opportunities receiving a positive score and Threats a negative score.

Figure 5.14 presents snapshot of the SWOT analysis section of the "GDOT's Next-Gen DB Assessment Tool" in the area of project delivery schedule.

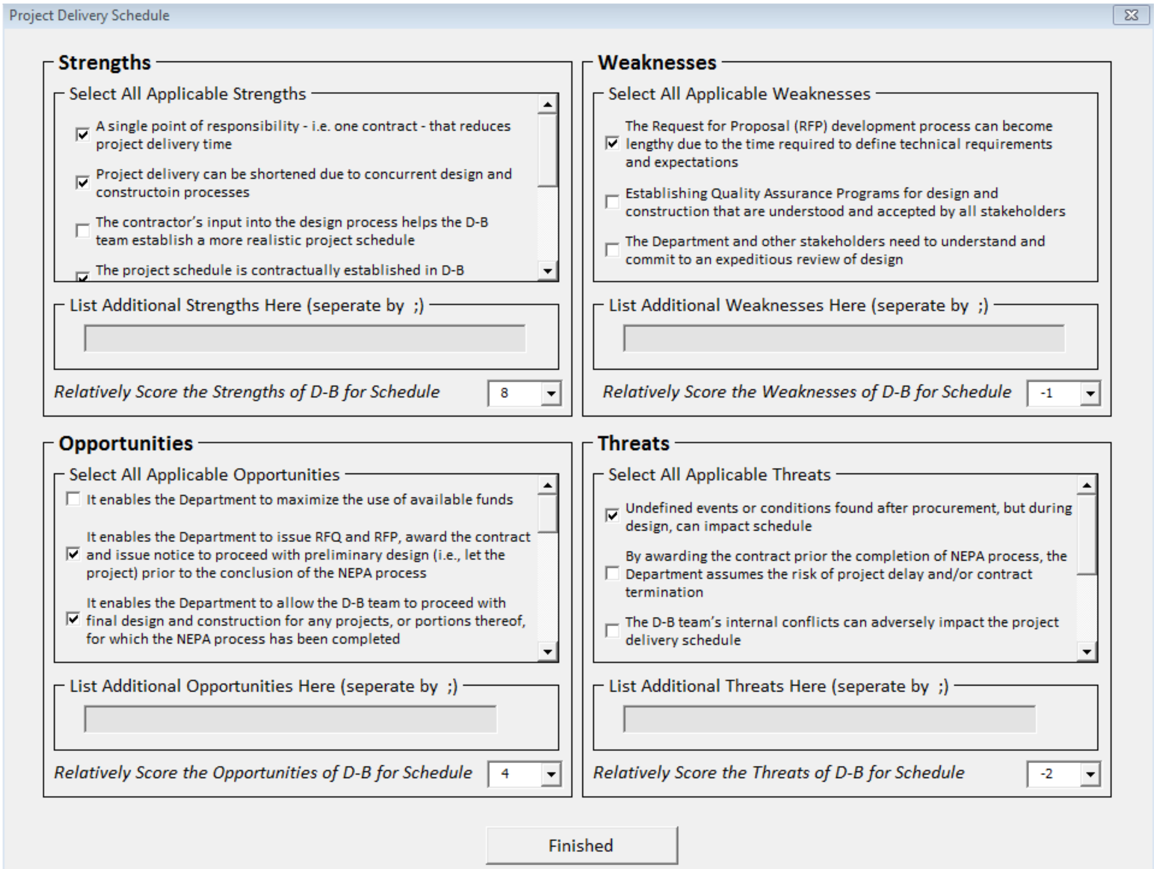


Figure 5.14

Snapshot of the GDOT's Next-Gen DB Assessment Tool for SWOT analysis

The appropriateness of design-build project delivery system is evaluated independently for each of the seven areas. The proposed assessment method is based on both qualitative and quantitative evaluation processes. The qualitative assessment is based on SWOT analysis for each area. The purpose of the qualitative assessment is to provide a systematic framework for studying different aspects of the project that may impact the decision of the state DOT to choose (or not to choose) design-build considering specific concerns of the project. A template of main strengths, weaknesses, opportunities, and threats is presented for each area. This template provides a beginning point for the assessment. The developed tool is flexible and is specifically designed to provide easy interaction with the assessment process. If appropriate, the decision-maker can refine the language in these templates and further add other statements for further assessment. The outcome of the qualitative assessment will be documented, in order to justify why design-build has or has not been a good candidate for the project. Qualitative assessment outlines important points that form the basis of the state DOT's decision to choose (or not to choose) design-build for the project. The qualitative assessment is powerful to communicate specific concerns of the project with all stakeholders including the public. The framework for the qualitative assessment provides a transparent approach for evaluating cons and pros of choosing design-build for the project.

The purpose of quantitative assessment is to summarize the results of qualitative assessment into a numerical score that relatively ranks the appropriateness of design-build for the project. The quantitative assessment is based on a simple rating system that assigns a score to each SWOT area. This score can take any value between +20 (meaning that the dynamics of the design-build project delivery system best addresses the concerns of GDOT in the SWOT area) and -10 (meaning that the dynamics of the design-build project delivery system least addresses the concerns of GDOT in the SWOT area). The score of each SWOT area is then normalized to facilitate its interpretation and its application in the quantification of the total score (i.e., the raw score is linearly transformed from the range of -10 to 20 into the range of 0 to 100). Finally, a weighting system is used to combine the normalized scores of the seven SWOT areas into a total score that represents the total appropriateness of the design-build project delivery system for the project. Weights are selected by the decision-maker to determine the relative significance of each SWOT area in the overall process of the assessment of design-build project delivery system. The overall score of this quantitative assessment is a value between 0 and 100.

A snapshot of the weighting section for calculation of the final score is presented in Figure 5.15.

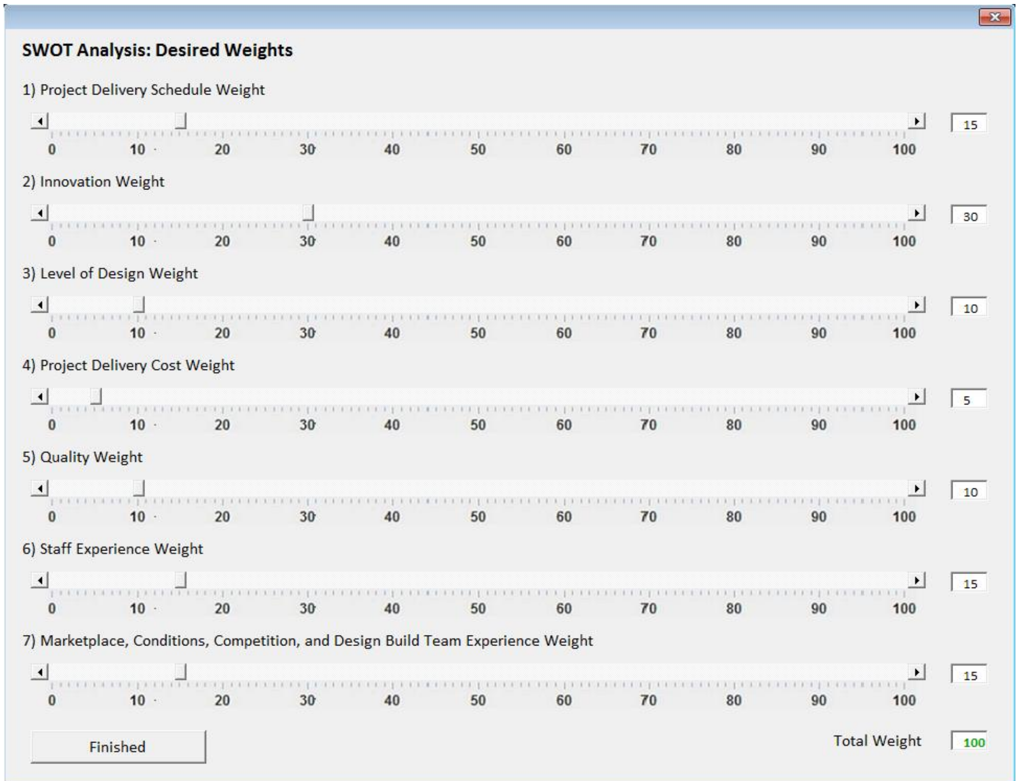


Figure 5.15

Snapshots of GDOT's Next-Gen DB Assessment Tool for Weighting

The overall score, which is the outcome of quantitative assessment, is used to identify how appropriate design-build is for the project. Figure 5.16 presents snapshots of score calculation for 7 areas and also the final score for a sample project.

Final Scores	Project Delivery Schedule Weight	93.33
	Innovation Weight	90
	Level of Design Weight	90
	Project Delivery Cost Weight	80
	Quality Weight	40
	Staff Experience Weight	63.33
	Marketplace, Conditions, Competition, and Design Build Team Experience Weight	63.33
	Total Score	58

Figure 5.16

Snapshots of GDOT's Next-Gen DB Assessment Tool for Final Score Calculation

Figure 5.17 shows five categories based on the range of the overall score that determines how appropriate design-build is for the transportation project. The GDOT's Next-Gen DB Assessment Tool summarizes and presents the results of the analysis in this table format that determines the level of appropriateness of the design-build for the project.

Design Build Suitability Assessment	Appropriateness of Design Build Project Delivery System for the Project	Range of the Overall Score
	Excellent Design Build candidate; Design Build risks have been properly assigned and mitigated	80-100
	Good Design Build candidate; Some mitigation measures should be considered to ensure successful delivery	60-80
	Mediocre Design Build candidate; Design Build Project Delivery System is risky or another Project Delivery System may be more suitable	50-60
	Poor Design Build candidate; Another Project Delivery System may be more suitable	40-50
	Not suitable for Design Build Project Delivery System	Below 40

Figure 5.17

Snapshots of GDOT's Next-Gen DB Assessment Tool for Range of Scores for Determining Appropriateness of Design-Build for a Project

5.2 Risk Identification

When deciding about the appropriateness of design-build project delivery system for a transportation project, state DOTs should also carefully review potential project risks and identify appropriate allocation and mitigation measures that should be adopted, in order to facilitate the smooth implementation of design-build project delivery system. There is a well-established literature regarding risk management that recommends several processes for risk identification in highway project delivery. Risk identification should begin early in the project development phase and evolve as the project moves through different phases. There are several types of risk that can affect the outcomes of the design-build project. The project management team should carefully identify major project risks with the assistance of subject matter experts from different offices involved in the design-build project delivery. Several major risk factors have been identified in the transportation risk management literature that can also be considered for design-build projects (WSDOT 2004b, 2010; FHWA 2006b; Caltrans 2007):

- Scope and goals
    - Issues associated with scope changes or additional scope driven by internal considerations
- Environmental issues
    - Risks associated with environmental impacts, studies, permits, approvals, and reevaluations
- Design
    - Potential changes to design criteria and specifications, errors and omissions, and design management
- Right-of-way (ROW)
    - Issues associated with identifying, coordinating, and securing the project ROW, and uncertainties in future real estate costs

- Utilities, railroad, and third parties
    - Issues associated with identifying and maintaining communication and coordination for successful reallocation
- Contracting and procurement
    - Changes in project delivery system, issues related to contract language, delays in advertisement, bid and award, market conditions, and changes in procurement method
- Construction
    - Project construction risks, issues related to quality assurance/quality control, construction permitting issues, differing site conditions, etc.
- Financial/Economic
    - Availability of funding, labor disruptions, financing costs, and uncertainty about material price escalation
- Governmental/Management/Policy
    - Issues associated with multi-level federal, state, and local participation and sponsorship, and changes in leadership, political policy and legislation
- Force majeure
    - Risk of natural disasters, social disasters, and lawsuits against the project

Each design-build project is unique and has its own specific risk factors. The above list provides an initial risk template that can help state DOTs begin risk identification. The main challenge for the state DOT is to develop a systematic approach to determine whether any of these possible risk factors is applicable to the project under consideration. Also, the state DOT needs a formal approach to identify any other risk factor that may be applicable for the design-build project.

5.2.1 Challenges of risk identification

5.2.1.1 Lack of a standard approach for identifying project risks and developing risk registers for design-build projects

The risk identification process will depend on the level of complexity of the project. On complex, high-cost projects that are by nature uncertain, risk identification will vary depending on risk management skills of the project team members (FHWA 2006b; Molenaar et al. 2010b). Effective risk identification requires careful examination of the project development process and reduction of project elements to the highest possible level of details so that experts can understand the significance of any risk and identify its causes. However, the review of risk management literature in highway construction and survey of state DOTs show that there is a lack of proper risk identification processes for highway projects. We performed a domestic scan of state DOTs and identified that Colorado, Florida, Montana, and Washington states have developed proper risk identification processes for highway projects.

Most state DOTs still rely on traditional project examination and expert judgment methods to identify project risks. Furthermore, the lack of proper historical data that would help state DOTs develop structured risk databases, hinders risk identification efforts. For instance, Hansen (2013) identifies the pitfalls in data dissemination and collection as a major challenge for identifying project risks, as the following: "*Concern for confidentiality will create challenges for sharing this* [project related] *information with external researchers. The best way to ensure the high quality of research within government agencies is to make important components of the data available to external researchers. This external access is necessary not only to allow for replication of results, but also to nurture innovative modeling and measurement*". The lack of a systematic risk identification process results in poor risk identification and misjudgment that can lead to project failure.

5.2.1.2 Coordination and communication problems among subject matter experts from several offices and technical areas for risk identification

Risk identification requires active involvement of subject matter experts from several offices and technical areas. These experts provide the project manager with insight in various critical areas, such as design, environmental, ROW, utilities, third-parties and railroad, and construction. The major challenge is to elicit information from experts in various technical areas and encourage them to have active participation in risk identification workshops during the course of the project development. The project management team may face significant challenges in maintaining appropriate coordination and communication among these offices and units. Effective coordination and communication help the responsible parties develop and maintain a sense of ownership of and responsibility for the risks and associated risk response actions (CalTrans 2007; WSDOT 2013b). Some state DOTs also face shortage of staff experienced in risk identification. Furthermore, state DOTs may face various risks on local projects that require a different layer of coordination and communication with regional offices of the state DOT. Active involvement of experts from regional and local offices is required for appropriate risk identification processes. The major problem is to create a risk identification platform for the design-build project that can be accessed by multiple offices and technical areas. This risk identification framework should allow each office to identify specific project risks related to its work. This risk platform should also provide access for the entire project team to the identified risks in all areas.

5.2.2 Opportunity for efficiency enhancement of risk identification

5.2.2.1 Opportunity for efficiency enhancement: State DOTs should develop, maintain, use, and refine a proper risk identification tool for design-build projects.

State DOTs should develop a customizable risk identification tool and should perform a comprehensive risk assessment on design-build projects. The risk identification tool helps state

DOTs identify common risk factors found in most design-build projects. The risk identification tool can be used as a template to begin risk assessment for design-build projects. Understanding project risks enables project teams to make better decisions regarding the process of project development and delivery. Risk identification is an iterative process since new risk may evolve or become known as the project progresses during its life cycle. Therefore, risk identification should occur through all phases of project development including planning, design, and construction (Montana DOT 2012; PMI 2012). General guidelines for the development of a proper risk identification tool are available in risk management plans developed by the FHWA and the Project Management Body of Knowledge (PMBOK). The literature of risk management identifies several effective techniques for proper risk identification as the following:

- Project examination (Molenaar et al. 2005; CalTrans 2007; AASHTO 2008; WSDOT 2013b; PMI 2012): Project examination involves the review of project characteristics, stakeholders, physical surroundings, and community.
- Document examination (Molenaar et al. 2005; AASHTO 2008; WSDOT 2013b; PMI2012): Document review is a critical aspect of risk identification. These documents include studying available design, historic data, test data, project management plans, and lessons learned databases.
- Personal experience and insight (Molenaar et al. 2005; CalTrans 2007; AASHTO 2008; WSDOT 2013b; PMI 2012): As supplements to project and document examination, techniques, such as brainstorming among the design-build team members and interviewing subject matter experts are useful for proper risk identification.

State DOTs should develop a risk breakdown structure (RBS) to organize the identified project risks into several relevant categories. RBS is an organized hierarchical representation of the identified project risks arranged by several risk categories. RBS enables state DOTs to develop an organized risk register, which is updated as the project progresses through its lifecycle (PMI 2012). Continuous utilization and update of the risk registrar enables state DOTs to improve the efficiency of risk identification for design-build projects. The Washington State DOT has one of the best practices in risk identification for design-build projects.

Washington State DOT (WSDOT)

WSDOT has developed the project risk management guidebook that provides a consistent methodology to perform risk analysis for design-build projects. This guide describes inputs and outputs of risk analysis and identifies data and information requirements for performing risk assessment. In WSDOT, risk identification typically begins with a simple risk assessment workshop organized by the project team. WSDOT's risk identification process is an iterative process that requires continuous updating of project risks since new risks may become known throughout the project's lifecycle and previously identified risks may no longer pose a threat to the project. Thus, the project management team is required to conduct frequent reviews of project risks and the progress made in addressing them, in order to indicate where additional actions and resources may be needed (WSDOT 2013a). The WSDOT "Project Risk Management" handbook describes the risk identification process as the following (WSDOT 2013a):

Risk Identification

Risk identification in WSDOT is an iterative process that occurs throughout the following four phases of the project development process:

1. Planning
2. Scoping
3. Design/Plans, Specifications and Estimate (Engineer's Estimate)
4. Construction

The important issue is that during project development, the project risk profile can evolve as previously identified risks change and/or new risks are identified.

Risk identification in WSDOT consists of three important steps that are explained below:

1. **Risk Identification Inputs**

The major inputs for risk identification are project goals and characteristics that should be clearly understood by project team members. More specifically, it is important to define the project scope and establish project schedule and cost estimate during different phases of project development process to keep risk identification inputs regularly updated.

2. **Risk Identification Tools and Techniques**

The main objective of the project team is to identify risks that can affect the project objectives. WSDOT recommends using common risk identification techniques, such as "Document Reviews" and "Information Gathering", which are explained in opportunity 1.2.2.1 as well as the WSDOT "Project Risk Management" handbook.

3. **Risk Identification Outputs**

According to the WSDOT "Project Risk Management Handbook" (2010), the output of risk identification process is a preliminary "risk register" which documents the following information:

(1) "*Identification # for each risk identified: A unique number is assigned to each risk for tracking purposes. If available, this can be done utilizing an established Risk Breakdown Structure (RBS); the WSDOT RBS is provided in the appendix of WSDOT "Project Risk Management" handbook.*

(2) Date and phase of project development when risk was identified: Document the date the risk was identified and [the] project development phase (planning, scoping, design/PS&E, construction).

(3) Name of Risk (does the risk pose a threat or present an opportunity?): Each identified risk should have an appropriate name, for example "NEPA Delay" or "Reduction in Condemnation"; the nature of the risk with respect to project objectives (threat or opportunity) should also be documented. This can be done using the Risk Breakdown Structure (RBS) for naming conventions.

*(4) Detailed Description of Risk Event: The detailed description of the identified risk; the description must be provide information that is **S**pecific, **M**easurable, **A**ttributable (a cause is indicated), **R**elevant, and **T**ime bound (SMART). The description must be clear enough and thorough enough so that others reading about the description of the risk will understand what it means.*

(5) Risk Trigger: Each identified risk must include the risk trigger(s). Risks rarely just suddenly occur; usually, there is some warning of imminent threat or opportunity. These warning signs should be clearly described and information about the risk trigger should be documented. For example, "NEPA Approval Date" may be considered a risk trigger on a project that has a risk of a legal challenge, or other as appropriate.

(6) Risk Type: Does the identified risk affect project schedule, cost, or both?

(7) Potential Responses to Identified Risk: Document, if known, possible response actions to the identified risk –can the identified threat be avoided, transferred, mitigated or is it to be accepted? Can the identified opportunity be exploited, shared or enhanced?" (WSDOT 2013b)

Figure 5.18 presents a sample risk identification template by WSDOT that can be used by project teams for risk identification.

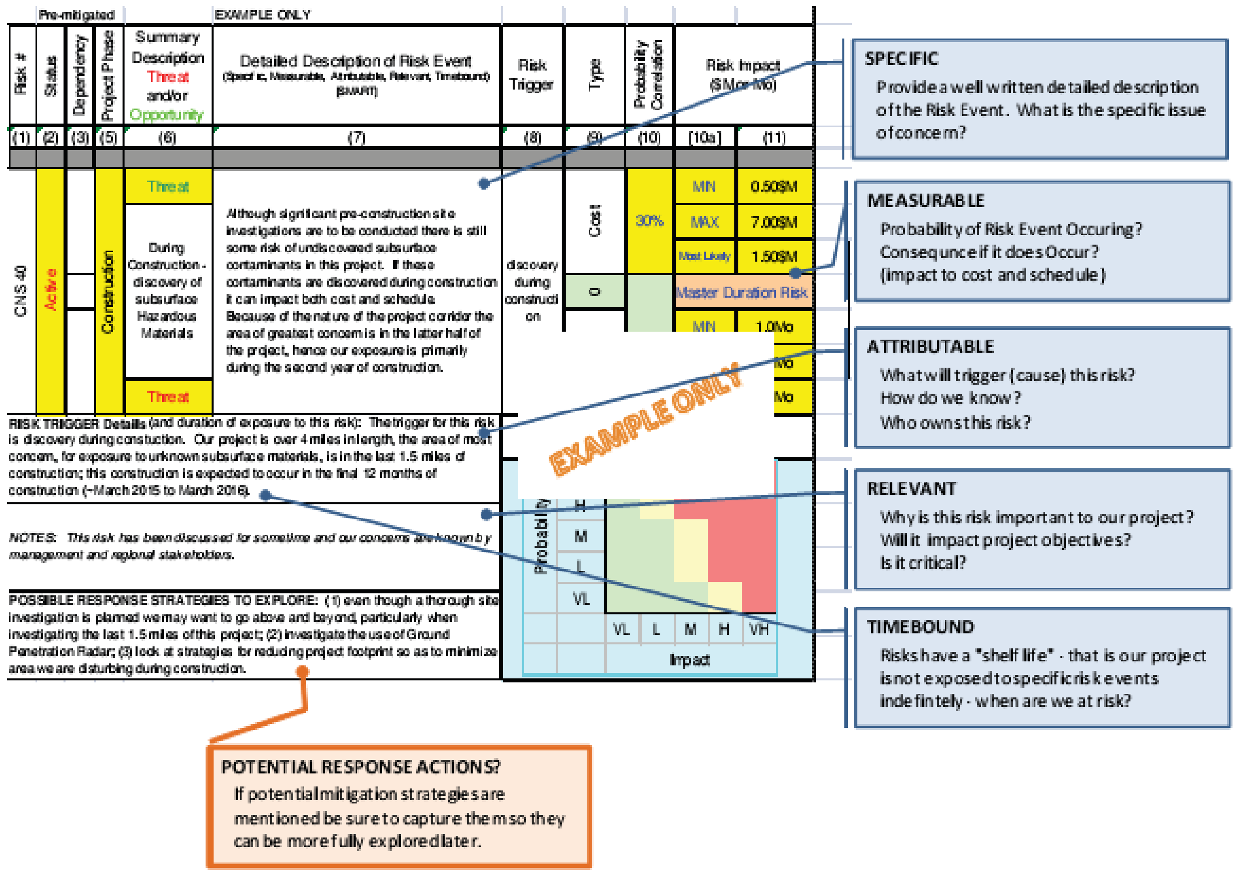


Figure 5.18

Sample risk Identification Draft used by WSDOT

(Copyright of WSDOT 2013b)

5.3 Risk Assessment and Allocation

Once the identified project risks are classified, a high-level risk assessment and allocation should be conducted in order to develop an understanding of each project risk. The objective of risk assessment and allocation is to determine the impact of the identified project risks on the project outcomes and find appropriate and cost-effective risk treatment strategies to mitigate and manage each risk item. Initial risk assessment and allocation provide inputs to decisions on whether the project risks can be effectively managed if the design-build project delivery system is selected for the project. The results of risk assessment and risk allocation plans can be the basis of establishing proper risk clauses in design-build contracts. Furthermore, risk assessment enables the state DOT to gain better understanding of risk outcomes and potential consequences in terms of various measures such as cost, schedule, and quality.

Risk analysis in construction projects is often ignored or is limited to subjective assessment that establishes contingency for the project (Mak and Picken 2000). The main challenge is to develop a systematic approach for appropriate assessment of risks that can affect the project cost, schedule, and quality. The lack of proper risk assessment processes and risk allocation tools negatively impact project outcomes. For instance, Flyvbjerg et al. (2002) identified that 90% of large-scale transportation projects experience cost growth, an indirect result of poor risk management. Various risks, such design- and environmental-related issues can affect the project schedule and cost. We performed a domestic scan of state DOTs and identified that currently Washington and California DOTs have developed proper risk assessment and allocation processes for transportation projects. It is critical that state DOTs develop risk management processes that can be used on transportation projects for proper analysis and allocation of risks.

5.3.1 Challenges of risk assessment and allocation

5.3.1.1 Lack of standard risk assessment processes for qualitative and quantitative risk analysis

The FHWA guide for risk assessment and allocation for highway construction management identifies risk assessment as "The process of quantifying the risk events documented in the preceding identification stage" (FHWA 2006b). Two important aspects of risk are evaluated in risk assessment: (a) the likelihood of the risk occurring; and (b) the severity of the respective consequence(s). There are two general risk assessment methods, qualitative and quantitative. While qualitative risk assessment helps the project management team evaluate the project risks on their worst-case effects and their relative likelihood of occurrence, quantitative risk assessment is best for estimating the numerical and statistical nature of the risk exposure (FHWA 2006b). The literature of risk management identifies several qualitative and quantitative methods that are explained in details in section 1.3.2.1 as an opportunity for efficiency enhancement.

Several studies and reports, such as "FHWA Risk Assessment and Allocation Guide" (2006b), "NCHRP Report 658: Guidebook on Risk Analysis Tools and Management Practices to Control Transportation Project Costs" (2010b) and "SHRP2 Report No. R09" (2011) provide best practices and appropriate procedures for risk management in highway projects. However, the process of qualitative and quantitative risk assessment has several challenges. Qualitative risk assessment requires the involvement of experts for subjective, verbal, or adjectival assessment of project risks. Similarly, quantitative risk assessment requires the involvement of experts that are familiar with mathematical and statistical risk analysis methods. In addition, both qualitative and quantitative risk analysis require regular updates as the project risk register changes and newer risks are identified.

Studies show that vast majority of construction industry utilizes traditional risk analysis methods that are based on deterministic approaches (Mak and Picken 2000; Senesi et al. 2012). The major limitation of deterministic risk analysis methods is their limited capacity to incorporate uncertainty in analysis of project risks (Senesi 2012). State DOTs lack a systematic approach for risk assessment and procedures for updating and monitoring risks during the project development process. Furthermore, state DOTs may face challenges from the lack of organizational understating regarding qualitative and quantitative risk analysis methods. The other organizational barriers, such as the lack of leadership support and the lack of accountability for implementation (Senesi et al. 2012), may hinder the development and the utilization of effective risk assessment tools. It is imperative that state DOTs raise the awareness towards qualitative and quantitative risk analysis in different layers of the agency to facilitate the execution of risk assessment. Proper risk assessment is required for risk allocation since allocation strategies are based on assessment of project risks.

5.3.1.2 Lack of standard risk allocation models for avoiding, mitigating, transferring, or sharing risks that were traditionally managed by state DOTs

Following identification and assessment of the project risks, the project management team should determine which party of the design-build contract (the owner or the design-build team) is best suited to manage the project risks. The project management team should focus on the project risks in each identified risk category and should devise proper risk allocation strategies (avoiding, mitigating, transferring, or sharing) based on the assessed risk priorities. Proper risk allocation enables the state DOT to handle project risks systematically and assign required project management resources to effectively manage the risk (FHWA 2006b; Caltrans 2007; WSDOT 2013b). It is worth noting that risk management for design-build projects is different from risk management for design-bid-build projects. Effective risk allocation is critical for design-build projects considering major differences between the two project delivery systems. Several risk factors that have been traditionally managed by the state DOT become the responsibility of the design-build team. For instance, risks of design errors and omissions, compliance of design with environmental permits, and local agency impacts are usually transferred to design-build teams.

Flexibility in transferring and sharing some project risks can be utilized for the design-build project. Although this flexibility can be beneficial for the state DOT, it should not result in transferring all risks to the design-build team, which may cause potential project failure, disputes, and higher price proposals (Molenaar et al. 2005).

State DOTs deal with different types of risk on each design-build project. Each project risk may lead to different kinds of negative outcomes. Effective risk allocation should be based on the assessed likelihood and the severity of the identified project risk. Also, the state DOT should consider the fact that the design-build team adds the risk premium to the bid price in case the state DOT decides to transfer the project risk to the design-build team (Molenaar et al. 2005; FHWA 2006b). Hence, effective risk allocation is a complex process for the state DOT that requires cost-benefit analysis for finding the right balance for riks allocation.

The most common risk allocation tool widely used by state DOTs is risk allocation matrices (FHWA 2006b). Risk allocation matrices are developed by compiling the project risks from the risk breakdown structure and using the information from risk assessment regarding the importance of each risk category. Risk allocation matrices are useful communication tools to clearly highlight the responsibilities of different parties in the design-build contract. The development of proper risk allocation matrices requires a significant level of expertise in design-build, particularly in the areas that the project risks are transferred to the design-build team. State DOTs face challenges to develop proper risk allocation matrices specifically designed for significant design-build project risks, such as legal, governmental, market-related, environmental, financial, etc. (Caltrans 2007; WSDOT 2013b).

5.3.2 Opportunity for efficiency enhancement of risk assessment and allocation

5.3.2.1 Opportunity for efficiency enhancement: State DOTs should develop, maintain, use, and refine proper risk assessment methods for design-build projects.

State DOTs should develop, utilize, and refine proper risk assessment methods to determine the impact of the identified risks on the project outcomes. Both qualitative and quantitative risk assessment methods should be utilized to determine the impact of the identified risks. Qualitative risk assessment ranks the identified risks according to their potential effects and likelihood. The risk analysis literature identifies two qualitative risk assessment techniques that can be used by state DOTs to evaluate the project risks:

- Risk assessment table (WSDOT 2013b; FHWA 2006b): Risk assessment tables prioritize risks according to a ranking system or a score determined by experts.
- Risk assessment diagram/matrix (WSDOT 2013b; FHWA 2006b): Risk assessment diagram/matrix (heat map) is a two dimensioned diagram/matrix that classifies risks into categories based on the combined effects of their frequency and severity (the project risks can be classified according to different color codes, such as green for low risk, yellow for medium risk, and red for high risk). Figure 5.19 presents a sample risk heat map that can be used for risk assessment by state DOTs.

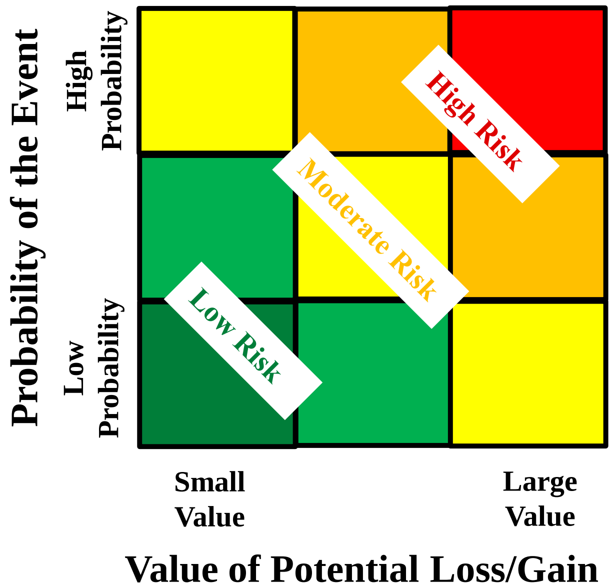


Figure 5.19

Sample Risk Heat Map

Both of these risk assessment techniques require adjectival rating and expert judgment. Quantitative risk assessment quantifies the impact of different project risks on project cost and schedule. These methods range from simple, empirical methods to computationally complex, statistical methods. Effective quantitative risk assessment techniques that can be used by state DOTs are the following (FHWA 2006b):

- Traditional methods: Traditional risk analysis methods are empirically developed procedures that focus on developing cost contingencies for projects. Project contingency is determined by multiplying the estimated cost of each element by its respective risk occurrence probability.
- Analytical methods: Analytical methods (or second-moment methods) concentrate on analytical probability methods to determine the mean and standard deviation of the risk effect on the project cost. These methods are difficult to apply for schedule risk analysis.
- Simulation (or Monte Carlo simulation) methods: Simulation models are computerized probabilistic calculations that use random number generators to draw samples from

probability distributions. The objective of the simulation is to find the effect of multiple uncertainties on a value quantity of interest, such as the total project cost or total project duration.

PMI (2012) recommends using qualitative and quantitative risk assessment but indicates that qualitative risk assessment is a cost-effective and rapid means of establishing risk response plans. Qualitative risk assessment lays out the foundation for quantitative risk assessment (if required). State DOTs should critically examine the risk assessment methods and use the most appropriate technique for analyzing the identified risks for the project.

5.3.2.2 Opportunity for efficiency enhancement: State DOTs should develop, maintain, use, and refine proper risk allocation matrices for design-build projects.

State DOTs should develop proper templates for risk allocation matrices as a starting point for effective risk allocation. State DOTs should utilize these templates on design-build projects and should refine these matrices as new information becomes available. The new information may indicate addition of new risks to the project or changes in the level of importance of the risks. State DOTs should also revise the risk allocation matrices according to lessons learned on past design-build projects. The risk management literature in highway project delivery as well as the design-build literature (Molenaar et al. 2005; FHWA 2006b; AASHTO 2008) recommends several issues that should be considered for effective risk allocation for design-build projects:

- Allocate risks in alignment with project goals: The state DOT should consider the project goals in allocating the project risks to the responsible parties. Each project has a unique set of goals and every attempt should be made to motivate the responsible parties to regularly monitor the project risks and apply the required preventive measures to achieve the project goals.
- Allocate risks to the party best able to manage the risks: The state DOT should allocate the project risk to the party that is less vulnerable to the risk exposure and has the highest degree

of control over the risk. The vulnerability and the ability to control the project risk depend on the type of the risk and level of experience of the responsible party in managing the risk.

- Share risks when appropriate to accomplish project goals: The state DOT should avoid placing too much risk on the design-build team and should balance between transferring and sharing the project risks. Transferring uncontrollable risk to the design-build team can cause a high risk premium and hence, can raise the bid price. In certain risk areas, such as ROW acquisition and utilities relocation, the state DOT may decide to share the risks with the design-build teams to avoid placing too much burden on the design-build team, as well as expediting the project delivery.

The Washington State DOT provides best practices for risk assessment and risk allocation matrices developed for design-build projects.

Washington State DOT (WSDOT)

The risk assessment process used by WSDOT involves qualitative risk assessment for attributable risks and quantitative risk assessment for measurable risks. For qualitative risk assessment, WSDOT uses a probability impact matrix that classifies different risks by color codes based on their impact and probability of occurrence. Risks with high impact and high probability of occurrence fall in the red zone. Probability impact matrix provides a convenient and efficient way to identify, describe, and characterize project risks. For quantitative risk assessment, WSDOT uses Monte Carlo simulation to generate a probability distribution of project cost and schedule based on uncertainty and risk effects. The qualitative and quantitative risk assessment may be conducted several times throughout the project development.

The proposed systematic approach focuses on risk identification, qualitative risk assessment, and risk allocation and provides an initial template for the high-level risk allocation that can be used by the project manager to identify and assess project risks, and assign the identified risk to the party that can best handle it. These risk templates can help WSDOT determine whether the project risks can be effectively managed if the design-build project delivery system is selected for the project.

The WSDOT “Project Risk Management” handbook describes the risk assessment and allocation process as the following:

Qualitative Risk Assessment

The WSDOT “Project Risk Management Handbook” (2013b) defines qualitative risk assessment as the following: “*...assessment of the impact and likelihood of the identified risks and development of prioritized lists of these risks for further analysis or direct mitigation. The team assesses each identified risk for its probability of occurrence and its impact on project objectives*”. The WSDOT “Project Management Online Guide” (2013a) recommends that project teams may seek assistance from subject matter experts in various technical areas to properly assess and characterize the project risks.

How to perform Qualitative Risk Analysis

The project teams can begin characterizing project risks in terms of probability of occurrence and risk consequences if it occurs. WSDOT recommends that project teams consider the following steps for qualitative risk assessment (WSDOT 2013b):

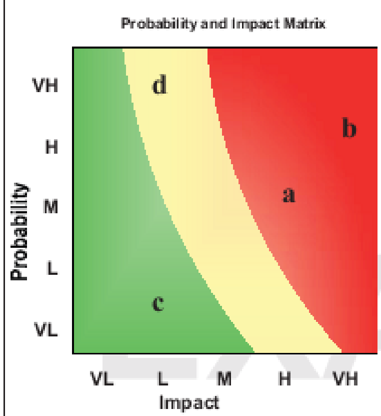
1) “*Gather the project team and appropriate persons to discuss project risk. Establish which of the qualitative risk matrices you intend to use, define the terms you plan to use (Very High, High, Medium, Low…. Etc.).*
2) *Review the risk information from the risk identification step.*
3) *Discuss the risk with the group.*
4) *Evaluate the likelihood of the risk occurring by asking the group “How likely is it that this risk will occur?” Record the result that the group agrees on.*
5) *Evaluate the consequences if the risk does occur by asking the group “What will be the impacts if this risk does occur?” Record the result that the group agrees on.*

6) *Prioritize the risks based on the results of the qualitative analysis. If it is desirable, the risks can also be grouped by category (i.e. Environmental, Structures/Geotech) and ranked within each category.*"

Figure 5.20 presents a sample qualitative risk assessment template.

Qualitative Risk List

count	T/O	RBS #	Risk Title	Probability	Impact
a	T	ENV 30.1	Permits and Permit Appeals	Medium	High
b	T	UTL 20.1	Unidentified Utility Conflicts	High	Very High
c	T	STG 20.4	Change to Substructure Assumptions	Very Low	Low
d	T	ROW 40.1	Managed Access challenge	Very High	Low



Probability (Likelihood)	Synonyms		[1]Approximate %
Very high	Almost certain	Very Sure	≥ 90%
High	Likely	Pretty Sure	80%
Medium	Possible	Maybe	50%
Low	Unlikely	Seldom	20%
Very Low	Rare	Improbable	≤ 10%
Consequence (Impact)	**Synonyms**		**[1]Approximate % of Phase (PE, RN, CN)**
Very high	Very Critical	Very Strong	≥ 10%
High	Critical	Strong	8%
Medium	Moderate	Average	4%
Low	Slight	Mild	2%
Very Low	Very Little	Very Mild	≤ 1%

[1]Suggested percentages; project teams may adjust if they desire.

Figure 5.20

Sample Qualitative Risk Assessment TEMPLATE used by WSDOT

(WSDOT Project Risk Management Handbook 2013b)

Quantitative Risk Analysis

The WSDOT "Project Risk Management Handbook" (2013b) defines quantitative risk assessment as the following: "Quantitative risk analysis involves numerically estimating the probability that a project will meet its cost and time objectives. Quantitative analysis is based on a simultaneous evaluation of the impacts of all identified and quantified risks." The Office of Strategic Analysis and Estimating offers several tools for quantitative risk assessment. WSDOT recommends using well-established risk assessment processes, summarized below in Table 5.3, as required by Executive Order 1053.00 December 10, 2008.

Table 5.3 Requirements for Levels of Risk Based Estimating

(WSDOT Project Risk Management Handbook 2013b)

Project Size ($)	**Required Process** (project managers can use a higher level process if desired)
Less than $10 M	Qualitative Spreadsheet in the Project Management Online Guide[1]
$10 M to $25 M	In-formal workshop using the Self-Modeling Spreadsheet[1,3]
$25 M to $100 M	Cost Risk Assessment (CRA) Workshop[1,2]
Greater than $100 M	Cost Estimate Validation Process (CEVP®) Workshop[2]
[1] In some cases, it is acceptable to combine the Value Engineering Study and Risk Based Estimating Workshop. [2] Projects $25 Million and over should use the self-modeling spreadsheet in the scoping phase risk based estimating process, followed up by the more formal CRA or CEVP® process during the design phase. [3] An informal workshop is comprised of the project team (or key project team members), other participants may be included as the project manager/project team deem necessary.	

How to perform Quantitative Risk Analysis

Followed by risk identification and qualitative risk assessment, project teams can proceed with quantitative risk assessment. WSDOT basically uses the following techniques for quantitative risk analysis:

- "*Gather and Represent Data through the following methods:*
    - *Interviews – can be formal or informal settings, such as smaller group meetings and/or larger formal workshops.*
    - *Subject Matter Expert Input – participating collaboratively with the project team and cost-risk team […] in interviews or contribute opinions in other ways such as surveys (questionnaires).*

   - *Represent data in terms of probability and impact, impacts can be represented using discrete distributions or continuous distributions.*
- *Quantitative Risk Analysis and Modeling*
   - *Project simulation using Monte Carlo technique to generate a probability distribution of project cost and schedule based on uncertainty and risk effects.*" (WSDOT Project Risk Management Handbook 2013b)

Quantitative Risk Analysis Outputs

The outputs of quantitative risk assessment include the following:

- Prioritized list of quantified risks: Those risks that have the most significant impact (threats or opportunities) to project objectives. (tornado diagrams, expected values, decision trees)
- Probabilistic analysis of the project: Estimated cost and completion dates and associated confidence levels.
- Informal Workshop (Meeting): For smaller projects, an informal workshop comprised of the project team and/or key project team members, and other participants (such as specialty groups involved with critical items) may suffice.

These outputs should be incorporated in the risk register since it is a critical component of the project management plan. Regarding the use of quantitative risk assessment, WSDOT states the following:

> "*Quantitative analyses can be conducted several times throughout project development; trends can be identified, mitigation strategies can be implemented and monitored, the risk profile of a project evolves and changes as the project is developed and knowledge is gained as design changes occur. Risk management is ongoing and iterative, periodically workshop members can regroup to evaluate the project and associated uncertainty and risks, workshops typically occur for a project every 12 to 24 months or at key project milestones. Project risks and*

> *mitigation efforts should be discussed at regular project meetings, make changes as appropriate and following those changes[,] re-run the risk model. Value is gained when action is taken to respond to risks resulting in a cost and schedule savings to the project*." (WSDOT Project Risk Management Handbook 2013b)

Risk Allocation

Following identification and analysis of project risks, project managers and project teams must take action in response to the identified project risks, focusing on risks of most significance, in order to shift the odds in favor of project success. Risk allocation in design-build projects involves assigning responsibility for each of these risks either to WSDOT or to the design-build team. WSDOT utilizes risk allocation matrix throughout development and implementation of the project to allocate the responsibility of project risks. WSDOT indicates that "This matrix will not only govern which party is responsible for a given risk, but it will also help the project team determine how far to advance each technical element within the preliminary design during development of the RFP". Regarding the use of risk allocation matrices in design-build projects the WSDOT "Design-Build Guidebook" (2004) states the following:

> "*This allocation matrix will need to be tailored to each individual project. The allocation of risk on this matrix was determined through discussions within WSDOT, as well as with the construction and consulting industry. This risk allocation matrix is not intended to be all-inclusive. The project team will have to carefully review all elements that could impact the specific project and tailor the matrix to fit the project. The matrix should be open for review throughout the entire RFP development process.*"

Figure 5.21 presents a sample risk allocation matrix from WSDOT “Design-Build Guidebook” for allocation of design related risks. As it can be seen, various design-related risks that are usually managed by the state DOT are transferred to the design-build team.

	Design-Bid-Build				Design-Build Process		
	Owner	Shared	Contractor	Change	Owner	Shared	Design Builder
Risks							
Design Issues							
Definition of Scope	X				X		
Project Definition	X				X		
Establishing Performance Requirement	X				X		
Preliminary Survey/Base Map	X				X		
Geotech Investigation - Initial Borings Based on Preliminary Design	X				X		
Geotech Investigation - Initial Borings Based on Proposal	X			→			X
Establish/Define Initial Subsurface Conditions	X				X		
Initial Project Geotechnical Analysis/Report Based on Preliminary Design	X				X		
Proposal Specific Geotechnical Analysis/Report	X			→			X
Plan Conformance With Regulations/Guidelines/RFP	X			→			X
Plan Accuracy	X			→			X
Design Criteria	X				X		
Conformance to Design Criteria	X			→			X
Design Review Process	X			→			X
Design QC	X			→			X
Design QA	X			→			X
Owner Review Time	X				X		
Changes in Scope	X				X		
Constructability of Design	X			→			X
Contaminated Materials	X				X		

Figure 5.21

An Example Risk Allocation Matrix

(Adopted from WSDOT Design-Build Guidebook WSDOT (2004b))

Georgia DOT

The Georgia DOT has developed a systematic tool for the assessment of appropriateness of design-build for a project. This systematic tool can be used for initial risk identification, assessment and allocation for transportation design-build projects. Project risks are identified in 10 categories that are listed below. The risk analysis module involves qualitative assessment of project risks – determining the level of the risk (low, medium, or high) – along with assigning the responsibility of each risk to a contract party in various categories. GDOT uses the following risk categories:

- Scope Issues

- Environmental Issues
- Design Issues
- Right-of-Way Issues
- Local Agency, Utility, Railroad, and Other Stakeholders Issues
- Contracting and Procurement Issues
- Construction
- Force Majeure/Acts of God
- Financial and Economic Issues
- Management and Policy Issues

5.4 Challenges and Opportunities Utilization Table

We conducted fact-finding interviews with seven design-build contracting experts in State DOTs that currently have vibrant design-build programs. These experts evaluated the identified challenges, and answered with either "yes" meaning that they have experienced similar challenges or "no" meaning that the challenge was not experienced or was not applicable for their respective state DOT. A summary of this assessment is provided in Table 5.4.

These experts also evaluated the identified opportunities for efficiency enhancement of project delivery system selection for transportation projects in their own State DOT. Each opportunity is marked as "standard practice", "utilized in few projects", "not considered", "considered for future implementation", or "not allowed by the State law". A summary of this assessment is provided in Table 5.5.

Table 5.4
Challenges Related to Project Delivery System Selection
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Challenges	**Assessment of the Appropriateness of the Design-Build Project Delivery System for a Project**							
	Legal (statutory), internal (funding, resources, and leadership), and external (market-place conditions) barriers for utilizing design-build project delivery system	No	No	No	No	No	No	No
	Difficulty in identification and evaluation of major factors that drive the selection of design-build projects	No	No	No	No	No	No	No
	Lack of standard processes for selecting the project delivery system	No	No	Yes	Yes	No	Yes	No
	Risk Identification							
	Lack of a standard approach for identifying project risks and developing risk registers for design-build projects	No	No	Yes	Yes	No	Yes	No
	Coordination and communication problems among subject matter experts from several offices and technical areas for risk identification	No	No	No	No	No	No	No
	Risk Assessment and Allocation							
	Lack of standard risk assessment processes for qualitative and quantitative risk analysis	No	No	Yes	Yes	No	Yes	No
	Lack of standard risk allocation models for avoiding, mitigating, transferring, or sharing risks that were traditionally managed by state DOTs	No	Yes	Yes	Yes	No	Yes	No

Table 5.5
Opportunities to Enhance Efficiency of Project Delivery System Selection
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Opportunities	**Assessment of the Appropriateness of the Design-Build Project Delivery System for a Project**							
	State DOTs should develop, maintain, use, and update a standard design-build selection tool that systematically evaluates the appropriateness of design-build for transportation projects.	Standard practice	Not considered	Not considered	Not considered	Standard practice	Not considered	Not considered
	Risk Identification							
	State DOTs should develop, maintain, use, and refine a proper risk identification tool for design-build projects.	Standard practice	Standard practice	Utilized on a few projects /Considered for Future Use	Not considered	Standard practice	Not considered	Standard practice
	Risk Assessment and Allocation							
	State DOTs should develop, maintain, use, and refine proper risk assessment methods for design-build projects.	Standard practice	Standard practice	Utilized on a few projects /Considered for Future Use	Not considered	Standard practice	Not considered	Standard practice
	State DOTs should develop, maintain, use, and refine proper risk allocation matrices for design-build projects.	Standard practice	Standard practice	Utilized on a few projects /Considered for Future Use	Not considered	Standard practice	Not considered	Standard practice

5.5 Implementation Recommendations for GDOT

GDOT should continue using, maintaining, and updating the standard design-build selection tool that systematically evaluates the appropriateness of design-build for transportation projects.

Several State DOTs have developed and utilized a systematic decision support tool that is capable of capturing the design-build dynamics and reflecting the project outcomes. This project delivery selection tool is able to incorporate several influential criteria in assessing the appropriateness of design-build for the project. The tool should be continuously refined and updated based on feedbacks provided by experts who implement the tool and document lessons learned in design-build projects.

The following state DOTs have implemented this potential best practice:

- Colorado – CDOT utilizes a risk-based process to determine if there is a dominant or obvious choice of project delivery system among the three available choices (design-bid-build, design-build, and CM/GC). Using this process, project delivery system is selected based on specific project attributes and characteristics. Specifically, in this process, the appropriateness of each project delivery system is evaluated based on a series of primary evaluation factors, an initial risk assessment, and three secondary evaluation factors. The outcome of this process is a Project Delivery Decision Report that describes the decision about the project delivery system in details.
- Utah – UDOT uses a comprehensive process for selecting a proper innovative project delivery system for a project. This process evaluates the benefits and risks of design-bid-build, design-build, and construction manager-general contractor (CM/GC) using seven influential factors that have critical impact on the project outcomes.
- Georgia – The Georgia DOT has developed a systematic tool for the assessment of appropriateness of design-build for a project. This tool is based on a systematic approach

intended to help GDOT perform the critical task of evaluating the appropriateness of design-build project delivery system for a transportation project.

CHAPTER 6

PROCUREMENT

If the assessment of the design-build project delivery system indicates that design-build is a proper project delivery system for a project, then the state DOT should perform a rigorous evaluation of procurement methods and choose the most appropriate procurement method for the project. The procurement of design-build projects is a process by which a design-build team is selected to perform both design and construction services under a single contract (AGC 2011; El Wardani 2004). The procurement method, which delineates how an owner selects a design-build team for a project, has a significant impact on the outcome of the project. The procurement of public design-build projects by state DOTs requires establishing a fair and competitive evaluation process for selecting the most qualified contractor that has the highest probability of success on the project (AGC 2011; AASHTO 2008; Molenaar et la. 2005). The lack of a systematic procurement method may result in selecting an unqualified (or minimally qualified) design-build team, who is unable to deliver the project according to pre-determined scope and design requirements. The selection of an unqualified design-build team can lead to various project issues, such as schedule delay, poor quality, and cost overrun, which are common in poorly-managed design-build projects (Molenaar et al. 2005; AASHTO 2008). There are several common challenges for choosing an appropriate procurement method for selecting the most qualified design-build team.

Selecting an appropriate procurement method requires performing a rigorous evaluation of procurement methods available for the state DOT. The evaluation of procurement methods often involves making two critical decisions (Ashuri and Kashani 2012):

1) Decision about what should be the basis for proposal evaluation (basis of award): Whether the state DOT wants to include price and non-price criteria in proposal evaluation and final selection of the design-build team

2) Decision about whether the procurement should be one-phase (RFP process only) or two-phase (RFQ and RFP processes): Whether the state DOT wants to prequalify the contactors and possibly develop a short-list of qualified contractors for bidding.

The state DOT should consider these two critical decisions for selecting the proper procurement method for a transportation project from a number of available procurement methods. Making these two decisions and the consequent decision regarding the procurement method is not without challenges for design-build projects. We categorize challenges that state DOTs have faced in the procurement of design-build projects in the following areas: proposal evaluation (basis of award), proposer evaluation (single-phase vs. two-phase procurement process), and selection of procurement method.

6.1 Proposal Evaluation (Basis of Award)

The first decision that state DOTs should make prior to determining the appropriate procurement method is whether they want to include price and non-price criteria in proposal evaluation. State DOTs are encouraged to consider price as a major evaluation criterion in the procurement of design-build projects to keep the nature of the selection process as fair and competitive as possible (FHWA 2011). Competitive bidding is a common and well-established practice in the traditional project delivery, where the selection of the contractor is based on only price consideration (AGC 2011). The FHWA regulations for design-build contracting (23 CFR 636.201) and most state design-build regulations require transportation agencies to evaluate price in design-build procurement, especially where construction is a significant component in the scope of the work. However, in addition to price, non-price factors (i.e., technical considerations) can also be used as the basis of proposal evaluation. There are two approaches for the evaluation of design-build proposals as the following:

- Selection based on price considerations only
- Selection based on price and non-price factors (i.e., technical considerations)

The decision to include non-price factors in the selection of the design-build team depends on specific project goals. More specifically, this decision depends on whether the project benefits from evaluating proposers based on price and non-price factors (e.g., aesthetic aspect of the proposed design, design concept, schedule, project management plan, traffic management plan, third-party impacts, quality assurance and quality control plan, and any other relevant factors). The main objective is to select the proposal that brings the highest value (i.e., the greatest benefit) to the state DOT on the project. The use of non-price factors in the evaluation of proposals requires establishing proper evaluation criteria to rigorously assess and relatively rank design-build proposals.

6.1.1 Challenges of proposal evaluation

6.1.1.1 Limitations of evaluating design-build proposals based on price consideration only (limitations of low-bid as the basis of award)

The selection of the contractor based on price consideration only (also known as low-bid or hard-bid procurement method) simplifies the selection process. However, since price is the sole selection criterion, low-bid procurement usually requires well-developed design documents to prepare an accurate cost estimate (AGC 2011). These design documents, often referred to as bridging documents, are included in the project RFP and contract documents. To finalize the project design, design-build teams have to refer to these bridging documents as the basis for developing and finalizing the project design. The use of bridging documents to finalize the project design in design-build projects (also known as bridging) has the following disadvantages (DSV 2008):

- "*Bridging potentially limits the flexibility of the design-build team in integrating their own design ideas and solutions into the project design since basic solutions and concepts are determined before the design-build team is selected.*
- *Bridging can result in more claims and disputes since it requires the design-build team to take responsibility for performance and engineering features of the project design, performed by the state DOT and design consultants without any inputs from the contractor.*
- *Bridging hinders transferring design-related risks to the design-build team since it requires the state DOT to take the responsibility for those design components that are complete.*
- *Bridging hinders fast-tracking since it requires the state DOT and design consultants to spend extensive amount of time and resources to develop bridging documents*."

Selection that is solely based on price consideration can limit innovative design solutions. More specifically, including prescriptive design specifications in lieu of performance requirements in the procurement of the design-build team may not be consistent with the owner's goal of transferring the responsibility of design errors and omissions to the design-build team. The DBIA describers this challenge as the following:

> "*To the greatest extent possible, owners should avoid including prescriptive design or system selection decisions of any type unless it is necessary for technical coordination with the owner's existing physical plant systems or integration into existing maintenance and repair procedures. Prescriptive specifications have the effect of removing design responsibility for that specific building system from the design-builder and placing it with the owner. This act contravenes the basic premise of design-build: a single point of responsibility for design and construction. If designated minimum quality levels are desired by the owner, the performance requirements document may identify materials, building systems or sub-systems that cannot be used on the project.*" (DBIA Design-Build Manual of Practice 2012c)

Low-bid procurement method ensures open competition with a fairly standard and understood process by the contracting community. Selection of the design-build team based on price consideration only may result in lower project cost. However, it does not necessarily provide the best-value for the state DOT (El Wardani 2004; DBIA 2012b). The DBIA describes this major disadvantage of the low-bid procurement as the following:

> "*Low-bid procurement freezes technical requirements and design solutions through the use of designs, drawings, specifications and standards (called 'prescriptive specifications') and therefore mandates a single solution. The implications of this approach echo throughout the life of the project, resulting in a source selection process dominated by cost considerations rather than optimization of cost, performance and quality.*" (DBIA Design-Build Manual of Practice 2012c)

Low-bid procurement may encourage contractors to implement cost-cutting measures instead of quality enhancing measures (Scott et al. 2006). The added value of proposed design solutions in design-build projects may not be shown in a single figure as the bid price. Thus, it is unlikely that the state DOT selects the highest quality proposal using the quantitative-based low-bid procurement method. Therefore, low-bid is not an appropriate procurement method for large and complex projects that require contractor inputs and innovative solutions in design and construction (Molenaar and Gransberg 2001; El Wardani 2004; Scott et al. 2006).

6.1.1.2 Difficulty in the evaluation of design-build proposals based on price and technical considerations (difficulty of implementing best-value as the basis of award)

Considering the limitations of the low-bid procurement method, several state DOTs have decided to use a procurement process where price and other key non-price factors are considered in the evaluation and selection process. This procurement approach is known as best-value procurement method and has several variations that will be explained later in this chapter. Best-value procurement method is intended to minimize negative impacts (on project delivery cost, project delivery schedule, quality, environment, and the traveling public) and enhance the long-term performance and value of construction (Scott et al. 2006). The major challenge for state DOTs in best-value procurement is to define the basis for proposal evaluation (Scott et al 2006). Best-value procurement involves evaluating price and non-price factors that may not necessarily be the same on every project. Scott et al. (2006) describe this challenge as the following:

> "*It is critical to identify parameters that would actually add value to a project and be defensible to the industry and the public*."

State DOTs can consider non-price factors in proposal evaluation if they think that the project benefits from the use of such factors. Since each project has its unique goals and requirements, state DOTs have to deal with the critical issue of identifying the most appropriate non-price factors for the project. The major concern is describing the needs of the state DOT in a manner that will be commonly interpreted and understood (DBIA Design-Build Manual of Practice 2012c). Adding to the confusion, there is no general consensus among state DOTs on what should be the basis of contract award in best-value procurement. In the NCHRP research report 561, Scott et al. (2006) conducted a thorough examination of the literature, case studies, and solicitation documents of best-value contracts and identified common factors used in the best-value procurement of highway projects across the U.S., as the following:

- Cost
- Schedule
- Qualifications
- Quality
- Design alternates

These non-price factors can be further subdivided into technical and management factors, and past performance (DBIA Design-build Manual of Practice 2012c). The relative significance of price in best-value determination can vary based on the best-value award method. For instance, in the weighted criteria award method used by Oregon DOT, Virginia DOT, and Utah DOT, the weight of the proposed price in the final best-value score is 50%, 70%, and 90%, respectively (VDOT 2011b). The DBIA recommends that in best-value determination of design-build proposals, non-price (technical) factors should dominate the proposed price. The DBIA describes this recommended best practice, as the following:

> "*Although price is often a factor in the competition, it should not be the dominant factor. Experience shows that the lowest initial contract price does not necessarily equate to the best-value for the owner. A piece of equipment or a specific material may cost more at the outset, but could save money for the owner over the life of the asset due to durability or other advantages. In addition, a highly qualified design-builder can provide value through better coordination and scheduling,*

better communication and collaboration with the parties, cost savings through innovation and avoidance of cost growth, which in other models become an owner responsibility. Focusing the evaluation and selection on non-cost/price factors advances the owner's interests in obtaining the highest quality design-build services." (DBIA 2012b)

Although documented best practices by the DBIA recommend the use of non-price technical factors for selecting design-build proposals, identifying the appropriate weights for price and non-price factors is a complicated decision that depends on the unique requirements of the project. Scott et al (2006) describe this challenge as the following:

"*One conclusion emerging from this experience with best-value parameters is that the owner should customize the parameters for the needs of the given project rather than strive to find a one-size-fits-all standard system. To do otherwise would probably reduce the effectiveness of the project delivery system and create a procurement environment where minimal value, if any, could be accrued.*"

The use of non-price factors introduces several other challenges to state DOTs in the smooth execution of the best-value procurement method. Best-value procurement involves assessing the added value of non-price factors through objective evaluation (i.e., cost-based evaluation) or subjective evaluation (i.e., point scoring, adjectival rating, and pass/fail criteria). Cost-based evaluation of non-price factors is usually done through estimating post-construction life-cycle cost of operations and maintenance. Life cycle analysis (LCA) and life cycle cost analysis (LCCA) require establishing appropriate cost analysis algorithms that produce unbiased and reliable outputs. Improper identification of LCA and LCCA inputs can have devastating consequences on the validity of the output (Scott et al. 2006). Conversely, some non-price factors, such as experience of the team, past performance, and quality management organization cannot be measured on the basis of either capital cost or life-cycle cost. Evaluation of non-price factors that are difficult or impossible to measure in terms of cost requires involvement of subjective opinion in decision-making, which may raise issues as far as keeping the bidding environment competitive and transparent (VDOT 2011b; Molenaar et al. 2005).

6.1.1.3 Possibility of litigations and bid protests in best-value design-build projects

For both objective and subjective evaluation approaches, the state DOT requires justified evaluation criteria that are properly incorporated in the procurement process, or otherwise the state DOT may be open to litigation and bid protests regarding the basis of award. For instance, the DBIA describes the case of Sayer vs. Minnesota DOT as the following:

> "*In October 2010, the Minnesota Supreme Court decided the case of Sayer vs. Minnesota DOT. This litigation arose from a protest against the emergency reconstruction of the I-35W Bridge. The Minnesota Department of Transportation awarded the project to the Flatiron-Manson team, which was not the low bidder but had a much higher technical evaluation score. The disappointed low bidder team challenged the winning proposal as nonresponsive. The court acknowledged the Minnesota statute that authorizes design-build and best-value procurement in select cases, which permits the agency to consider factors other than price. The court went on to determine that the successful proposal did not contravene any of the mandatory requirements in the request for proposal. In any event, by the time of the decision, the project had already been completed with great success and had captured DBIA's 2009 award for best overall project.*" (DBIA Integration Quarterly 2011)

Similarly, for the case of "Route 460 Connector - Phase I" design-build project, the Virginia DOT (VDOT) was challenged by one of the unsuccessful proposers regarding the transparency of the procurement method that was used on the project. The $100 million project was derailed by a lawsuit in which VDOT narrowed its protest to one ground, demonstrating years of experience on the resume form (Roby 2011). As part of the best-value procurement method, proposers were required to present sufficient personnel expertise in various areas. The project RFP required the ROW manager of the design-build team to have the following requirements:

> "*The Right of Way Manager shall have at least ten (10) years of experience in managing complex right of way projects.* ***Evidence*** *of this experience will be of* ***sufficient detail*** *on the resume to* ***satisfy the requirements***."

The argument made by VDOT was two-fold:

1. "*The years of experience listed in section (d) of the resume form did not constitute sufficient evidence to satisfy the requirements of the RFP.*
2. *The experience and qualifications presented on the resume were not that of a Right of Way Manager*."

Judge's decision was in favor of the VDOT in that the argument made by the proposer was rejected because of the following (Roby 2011):

- "*Providing a mere number of years of experience is not "sufficient detail" as anticipated by the RFP.*
- *Moreover, the Right of Way Manager failed to buttress his assertion with corresponding detail.*
- *The Court has determined that the resume was deficient in that it failed to provide evidence of sufficient detail to support the contention that the Right of Way Manager had more than the ten-year minimum experience required by the Department.*"

Although Minnesota and Virginia DOTs won the trial, the success on similar court cases is not guaranteed for the other state DOTs. The DBIA summarizes a similar situation, in which the Pennsylvania DOT had to retreat. In the case of Brayman Construction vs Pennsylvania DOT, the Pennsylvania Supreme Court decided that the design-build best-value procurement method used by the Pennsylvania DOT violated the Pennsylvania Procurement Code. Furthermore, other Pennsylvania agencies are prohibited from procuring construction contracts through best-value procurement. The Pennsylvania Supreme Court noted that "*the practice does not comply with the Procurement Code's requirement that construction contracts be awarded through the processes of sealed competitive bidding or sealed competitive proposals*" (Construction Law Signal, Ruggieri 2011). The rule by the Pennsylvania Supreme Court, resulted from the argument that design-build contracts are construction contracts and do not require professional engineering and architectural services. Hence, they were subject to the requirements of the Pennsylvania Procurement Codes of objective evaluation and competitive sealed bidding. The Commonwealth Court decided that since design-build contracts do not require professional services, Pennsylvania agencies cannot use best-value procurement method or any other subjective evaluation process on these types of contracts. This important legal case is described, as the following:

> "*In Pennsylvania's public sector, best-value selection of design-build teams has not fared well against judicial challenges. The state Supreme Court ruled in 2011 that state officials must not use best-value selection for design-build. Brayman Construction vs. Pennsylvania Department of Transportation involved a challenge to a contract for rebuilding two I-90 bridges in Erie County. The court rejected the use of a short-list process and also dismissed the Pennsylvania Department of Transportation's (PennDOT) argument that best-value evaluation of design-bid proposals could qualify as 'competitive sealed bidding' under the governing statute. The state Supreme Court did let the Erie County project proceed because delaying the work on these critically needed bridge repairs would endanger the public. Nevertheless, the decision prevents PennDOT from relying on short-listing or best-value selection in the future.*" (DBIA Integration Quarterly Winter 2011)

The DBIA identifies the state legislative as one of the most critical barriers to best-value procurement of highway design-build projects. Several state DOTs have faced bid protests and litigation against subjective scoring systems used in RFQ and RFP evaluation processes. The DBIA emphasizes on the significance of the right legislative environment in the state as the following:

> "*The lesson of these cases is that having the right state legislation is critical. Outdated laws can prevent implementation of proven best practices. If the full advantages of design-build are to be realized, authorizing statutes should afford enough latitude in the procurement process so government officials can truly tap into the power of design-build*." (DBIA Integration Quarterly Winter 2011)

Flexibility of the state legislation is a key success factor to select the best method for evaluating design-build proposals considering specific project requirements. However, state DOTs must always act under their own statutory constraints to procure design-build projects. Despite these challenges, state DOTs have figured out several strategies to enhance the efficiency of proposal evaluation in design-build projects.

6.1.2 Opportunity for efficiency enhancement of proposal evaluation

6.1.2.1 Opportunity for efficiency enhancement: State DOTs should balance the need between innovation and technicality offered by best-value procurement and efficiency and transparency that can be gained through low-bid procurement.

Best-value procurement is best suited for projects in which price and project-specific technical considerations play a significant part (DBIA 2012b). State DOTs can benefit from the advantages of best-value procurement and consider an appropriate level of innovation and technicality in contract award. Use of best-value procurement provides state DOTs with the flexibility to choose the proposal that brings the highest degree of innovation and technicality to the project (i.e., added value). Best-value procurement often results in improved performance since the contract is awarded to the design-build team that offers the greatest performance and advantages to the project (Scott et al. 2006).

Despite significant benefits of best-value procurement, state DOTs should not ignore low-bid procurement as a powerful and transparent procurement method for certain design-build projects. Low-bid procurement has two fundamental advantages over best-value procurement in awarding design-build contracts: (a) offering the highest level of transparency in the selection process; and (b) expediting the process of contract award. In low-bid procurement, state DOTs can review price and technical proposals and award the contract to the lowest responsive and responsible bidder that meets all technical requirements. Low-bid procurement can be used on small projects where there is not much room for innovation. A summary of major benefits and challenges related to the two approaches for the evaluation of design-build proposals: (1) selection based on price consideration only; and (2) selection based on price and technical considerations are presented in Table 6.1 and Table 6.2 respectively. These benefits and challenges were identified through comprehensive literature review and content analysis of design-build contact documents and research reports. We validated these benefits and challenges through our structured interviews of design-build officials in several state DOTs.

Table 6.1

Benefits and Challenges of the Selection Based on Price Consideration Only

Selection Based on Price Consideration Only	
Benefits	**Challenges**
○ It promotes competition and a fair playing field on the basis of price ○ Price-based selection is a structured and justified methodology that may result in budget savings for the Department ○ Price-based selection is easy-to-understand for contractors ○ Price-based selection is most suitable for design-build projects where the design is too far advanced ○ Price-based selection is most suitable for noncomplex design-build projects where the opportunity to innovate is limited	○ The design-build team's approach in the technical proposal is not critically examined in the selection process, which may result in schedule and technical issues ○ It may encourage contractors to implement cost-cutting measures instead of quality enhancing measures ○ It may result in considerable cost growth as the design-build team may have incentive to request change orders ○ The most-qualified design-build team that can deliver the highest quality project may not be awarded ○ The design-build team's technical capabilities are not directly considered in selecting the winning design-build team ○ It may be difficult for the Department to foster innovation by allowing the submission of Alternative Technical Concepts (ATCs)

Table 6.2

Benefits and Challenges of the Selection Based on Price and Technical Considerations

<table>
<tr><th colspan="2">Selection Based on Price and Non-price Factors (Technical Considerations)</th></tr>
<tr><th>Benefits</th><th>Challenges</th></tr>
<tr><td>o It provides the Department with a flexible method for detailed evaluation of the design-build team’s proposed technical approach with respect to project-specific goals (e.g., cost, schedule, innovation, quality, safety and durability)
o It is most compatible with complex transportation projects where the Department should evaluate several technical aspects of the project besides the cost
o It provides the Department with the opportunity to foster innovation by allowing the submission of Alternative Technical Concepts (ATCs)</td><td>o It can be effectively used when the Department’s expectation and requirements can be clearly defined
o Including considerations other than price in the procurement requires a project-specific evaluation process for the design-build team’s qualifications, price proposal and technical proposal
o It requires the Department to assemble a project-specific evaluation team for design-build proposals
o Developing the evaluation plan and implementing the evaluation process may increase the project procurement cost
o Developing the evaluation plan and implementing the evaluation process may extend the project procurement time
o The evaluation team should include specific technical expertise, in order to review different aspects of the proposed design
o It requires an experienced facilitator to manage the proposal evaluation process and lead the evaluation team
o It may be difficult for the technical evaluation team to arrive at a consensus about a design-build proposal
o The technical proposal evaluation team should have training and experience in objective proposal evaluation
o The Department should elaborately describe its expectations
o The Department should elaborately describe its approach to objective evaluation of technical proposals in RFPs
o It may be difficult for design-build teams to understand the Department’s expectations and technical requirements
o It may be difficult for design-build teams to understand the Department’s approach for technical proposal evaluation
o Proposal preparation may be costly and time consuming for design-build teams
o The cost and difficulties of preparing proposals may reduce the participation of design-build teams
o It may require the Department to include stipends, in order to encourage the submission of high-quality design-build proposals
o It requires the Department to purchase the intellectual property of ideas from the design-build teams that submitted ATCs</td></tr>
</table>

We found out that the proposal evaluation approaches currently used by the Colorado DOT and the Florida DOT can be considered as best practices to enhance the efficiency of procurement process in design-build projects.

Colorado DOT (CDOT)

CDOT is authorized to use various procurement methods for design-build projects. Depending upon project-specific goals and the unique characteristics of the project, CDOT can use either low-bid or best-value procurement methods. The best-value procurement has several forms and variations in CDOT. CDOT procured several design-build projects using the best-value approach. These projects were typically large (over $50 million) and complex. For smaller and non-complex projects, CDOT uses the modified design-build procurement, in which the award criteria are based on “lowest price and technically acceptable”. This procurement method has been historically used for projects under $10 million. CDOT has slowly shifted away from the modified design-build procurement method. CDOT is currently considering the use of streamlined design-build procurement method for smaller and less complex design-build projects. Unlike the modified design-build procurement method that the award is only based on price consideration, the streamlined design-build procurement uses best-value award criteria instead of low-bid as the basis of award. Streamlined design-build is generally used for projects above $10 million.

Florida DOT (FDOT)

Florida DOT is authorized to use low-bid procurement method as well as variations of best-value procurement. Florida statutes classify design-build projects to the following two categories: design-build major and design-build minor. Design-build major statute (Section 337.11(7)(A), Florida Statutes) applies to a building, a major bridge, a limited access facility, or a rail corridor design-build project with an estimated cost of $10 million or more. Design-build minor statute (Section 337.025, Florida Statutes) applies to small projects, such as bridges under $10 million and other transportation projects (resurfacing) not allowed under Section 337.11(7) of Florida Statutes. Selection of the appropriate procurement method for design-build projects by the Florida DOT depends on the unique requirements of the project. The design-build guidelines of the Florida DOT describe the rational for selecting best-value and low-bid procurement methods for design-build projects, as the following:

> "*As a general rule, the low-bid design-build approach should be used on projects where the design and construction criteria are concise, clearly defined, and innovation or alternatives are not being sought. This might include bridge projects with a specified foundation type, span lengths, and beam type and resurfacing projects. Projects, which are awarded based on the low-bid design-build approach, will not utilize the letters of interest and short-listing process. However, when a number of alternatives may exist which could provide the outcomes desired, the Florida DOT can use the adjusted score design-build approach (Selection based on price and non-price factors). An example of this method is a bridge project where alternative foundations, spans, and material types are acceptable. All projects with right of way services included in the contract must be bid using the adjusted score bid process*." (FDOT 2011b)

6.2 Proposer Evaluation (Single-Phase vs. Two-Phase Procurement Process)

The second decision that the state DOT should make prior to selecting the appropriate procurement method is whether the state DOT wants to evaluate the qualifications of design-build teams. The main reason for evaluating qualifications of design-build teams is to ensure that those bidding on the project are actually capable of accomplishing their responsibilities (AGC 2011). If it is determined that such evaluation is necessary for the success of the project, then a two-phase selection process can be used. Two-phase selection involves evaluating statement of qualifications (SOQs) submitted by design-build teams in response to advertisement of request for qualifications (RFQs) by the state DOT. The evaluation of SOQs results in a shortlist of qualified design-build teams that later will be invited to submit their price and technical proposals for review by the state DOT. The second phase of the two-phase selection process starts with the issuance of request for proposals (RFPs). The qualified (i.e., shortlisted) design-build teams submit technical and price proposals in response to RFPs. The state DOT evaluates design-build proposals and awards design-build contracts based on either price consideration only or price and technical considerations. Two-phase selection process provides the owner with the opportunity to attract qualified proposers by narrowing down the list of competitors. Since two-phase selection requires advertisement of RFQs and evaluation of SOQs, the procurement process can be time-consuming and costly for the state DOT. Thus, two-phase selection is usually a better choice for the procurement of complex projects that require certain expertise (e.g., design and construction innovation) from design-build teams.

The single-phase selection process provides the owner with the opportunity to attract a large pool of design-build teams by allowing all the interested teams to respond to RFPs or invitation for bids. Because there are no criteria on the number and experience of participating design-build teams, single-phase selection enables both experienced and new firms to participate in the competition. The single-phase selection process also allows the owner to expedite the selection process and choose the best proposal in a time-efficient manner. Thus, single-phase selection is usually a better choice for expedited procurement of simple and non-complex projects with prescriptive design specifications (VDOT 2011b). Furthermore, the use of single-phase selection process by the state DOT requires less resources and the proposal evaluation costs by this method is typically low. The choice between single-phase and two-phase selection process is a difficult decision for state DOTs that introduces challenges for the evaluation of design-build Proposers.

6.2.1 Challenges of proposer evaluation

6.2.1.1 Inherent limitations of the single-phase selection approach for evaluating design-build proposers

The main objective of the owner in single-phase selection is to focus on proposal evaluation rather than proposer evaluation. Single-phase selection is usually associated with streamlined procurement methods that focus on price as the basis of award. Hence, single-phase selection can result in participation of both qualified and minimally qualified (or unqualified) contractors. The major issue is that such procurement methods can result in the selection of an unqualified contractor with the lowest bid price that can jeopardize the success of the project (DBIA Manual of Practice 2012c). Although the project goals may not involve innovations in design and construction, it is still critical to choose the lowest responsive bid proposed by the most responsible bidder.

In single-phase selection, the owner usually allows for participation of several proposers without prequalifying potential bidders. By doing so, a great opportunity to deeply analyze the past experience and technical competencies of design-build teams is missed (El Wardani 2004; El Wardani 2006; Scott et al. 2006). Thus, the use of single-phase selection is not a recommended approach for projects that require special qualification or particular expertise in certain areas of design and construction. Scott et al (2006) described this challenge as the following:

> "*Responsibility can be addressed through prequalification, whether through a blanket prequalification for multiple projects, or through prequalification/shortlisting as the first step of two-step procurement.*"

6.2.1.2 Industry concerns related to preparing design-build proposals that require extensive technical proposals as part of a single-phase procurement process

The use of single-phase selection process by the state DOT is subject to several challenges. For instance, when several design-build teams (more than 3 to 5) are competing on one project without being prequalified prior to RFP advertisement, the chance for winning the project is slim. The costs associated with proposal development for design-build projects are usually high, mainly because the project design prior to award is at preliminary stages (ENR Shaw 2012). Especially, when best-value procurement is used, proposers have to spend substantial time and resources to prepare competitive proposals with innovative ideas and solutions. Hence, in projects that the state DOT is not shortlisting the potential proposers, some design-build teams may avoid participating in the competition to avoid unnecessary proposal development costs (DBIA 2010). Additionally, when using single-phase procurement, the state DOT faces the challenge in identifying the proposers who actually have the qualifications to achieve the minimum requirements of the contract according to the agreed price and schedule (AGC 2011). Single-phase procurement allows for participation of both qualified and minimally qualified (or unqualified) contractors in the RFP process, which may not be suitable for all project types.

The two-phase selection process encourages highly qualified design-build teams to participate in the competition and helps the firms that are not shortlisted to avoid unnecessary proposal development costs (DBIA 2010). Shortlisting design-build teams may also encourage the qualified bidders to incorporate innovative design solutions and concepts in their design-build proposals since the odd of winning is reasonably higher than the single-phase selection process. The two-phase selection process allows the owner to shortlist the proposers based on specific qualification and requirements that are necessary for the success of the project. The use of two-phase selection is a recommended best practice, especially with qualifications-based selection and best-value procurement, for complex and large projects (DBIA Design-build Manual of Practice 2012c).

Design-build industry participants have major concerns regarding the use of single-phase selection process by owners. Owners often choose single-phase selection process to attract a large pool of design-build teams and they are more likely to focus on price rather than best-value. Thus, experienced firms that have the greatest qualifications to perform the work may not compete for the work so that they are not involved in the costly process of single-phase procurement (DBIA 2012b). As a result, the use of single-phase procurement by public owners, especially on large and complex projects may not be fully embraced by the industry. For instance, the DBIA and industry participants expressed their concerns regarding the single-phase procurement method used by the U.S. Army Corp of Engineers (USACE) as the following (DBIA 2012a):

> "*After numerous members approached DBIA with complaints about the one-step process, the Institute raised these concerns with USACE. The Corps was receptive and the new guidelines emphasize that the two-phase selection procedure is the only design-build contracting method authorized for civil works and work the Corps performs for other agencies and remains the highly preferred method for military construction projects. The one-step method may still be used on some military construction projects; however, the internal policy places specific conditions on the use of the one-step design-build procurement by the Corps, including approval from Headquarters USACE Chief of Construction.*"

6.2.1.3 Extensive time and resource requirements to prepare and evaluate RFQs/RFPs

Although state DOTs are recommended to use the two-phase selection approach, especially with best-value procurement, they need to consider its possible disadvantages. First of all, the single-phase selection process was mandated in some state DOTs by the state legislators for transportation projects. The single-phase selection process typically takes less procurement time compared to the two-phase selection process. Therefore, the single-phase selection process is often used for non-complex projects that can be delivered by a very large pool of design-build teams. Shortlisting is usually done through a formal RFQ process that imposes an additional administrative burden on the state DOT, who may lack expertise and required resources to evaluate design-build teams (VDOT 2011b). Especially in simple and non-complex design-build projects with low-bid procurement, in which price is the sole evaluation criteria, shortlisting may result in longer procurement time.

Shortlisting may be considered a challenge for new contractors that do not have proven records for past performance and documented experience. The problem is that some of these contractors may have satisfactory resources and expertise to perform the project successfully but they would not be shortlisted due to limited past performance working for the state DOT (El Wardani 2004; Molenaar et al. 2005; AASHTO 2008).

6.2.1.4 Possibility of litigations and bid protests in two-phase design-build projects

Shortlisting 3 to 5 firms is a recommended practice for two-phase selection. Quite often, state DOTs have found it difficult to explain to not-shortlisted teams why they were not invited to submit full proposals. This decision does not mean that these design-build teams are not qualified to perform the job but it means that there are more competent design-build teams that have provided better responses to the RFQ and therefore, were selected over these teams in a competitive bidding environment. The state DOT should pay ultimate attention that the process of proposer evaluation is equitable and fair to all participants. The process of proposer evaluation and the criteria for the assessment of the design-build team must be clearly described in the RFQ, in order to minimize the likelihood of bid protest or the possibility of litigation by not-shortlisted teams. Despite significant efforts by state DOTs to outreach to the industry, there is a fraction of highway contractors that still have substantial concern regarding the process of two-phase procurement method and do not understand the rationale and the basis of state DOTs for shortlisting. This resistance may become problematic if not handled properly by state DOTs through establishing a transparent and systematic process for proposer evaluation.

Responding to the fear of bid protest or lawsuit, some state DOTs have devised a new method to allow for the participation of more design-build teams in the RFP process. For instance, when using the adjusted score procurement method, the Florida DOT ranks design-build teams in the conclusion of the RFQ process based on their qualifications scores but does not prohibit the participation of any qualified team to submit proposal in response to the RFP. However, the scores will be carried out to the RFP process and will be considered in the final evaluation. Further, only 2 unsuccessful top ranking firms with highest SOQ scores are eligible for stipends. FDOT describes this process as the following:

> "*The responsive Design-Build Firms may elect to continue to participate in phase II of the procurement process by submitting notification to the procuring agent of its intent. The Short-list will be made up of all responsive Design-Build Firms satisfying the election and notification requirements identified in the advertisement.*" (FDOT 2011a)

The procurement process has a critical influence on the success of subsequent design and construction phases of design-build projects. Hence, state DOTs should invest sufficient amount of time, effort, and management resource in the evaluation of design-build teams. After critically reviewing the current practices of procurement in several state DOTs, we find several opportunities to enhance efficiency in the evaluation of design-build proposers.

6.2.2 Opportunity for efficiency enhancement of proposer evaluation

6.2.2.1 Opportunity for efficiency enhancement: State DOTs should balance the need between qualified bidders and competitive proposals offered by two-phase selection and expedited procurement and reduced resource requirements offered by single-phase selection.

State DOTs can consider the use of two-phase selection process on design-build projects that require qualified bidders and competitive proposals. Two-phase selection involves qualifying design-build teams prior to bidding. Two-phase selection may also involve shortlisting contractors and narrowing down the list of bidders to the most qualified contractors. Several state DOTs prefer to evaluate the qualifications of the design-build teams through an RFQ process, especially when they use a selection approach that is based on both price and non-price factors. Prequalification and the subsequent shortlisting of contractors can reduce the cost of reviewing design-build proposals (Ashuri and Kashani 2012; Transportation Design-Build Users Group, 2009). Shortlisting increases the chance of success for the shortlisted firms and reduces the industry costs for preparing price and technical proposals. As parts of its best practices, the DBIA suggests using the two-phase selection process especially with best-value procurement and recommends shortlisting three design-build teams at the conclusion of the first phase (DBIA 2012b). The FHWA recommends using two-phase procurement on all design-build projects as specified in the 23 CFR 636.201:

> "*State DOTs should consider using two-phase selection procedures for all design-build projects. However, if they do not believe two-phase selection procedures are appropriate for your project (based on the criteria in 23 CFR 636.202), a single phase selection procedure or the modified-design-build contracting method may be used*."

Although two-phase selection and prequalification of contractors has several benefits, state DOTs can consider using single-phase selection process to expedite the procurement process and the contract award. Since there is no need to prepare RFQs and SOQs in single-phase selection, this process is less cumbersome and requires less staff time and fewer resources. State DOTs can use single-phase selection to award simple and non-complex projects that can be delivered by most design-build teams. The FHWA recommends considering certain criteria in deciding whether two-phase selection procedures are appropriate for a design-build project (FHWA 2011). More specifically, the 23 CFR § 636.202 indicates that:

> *"…a negative response to any of the criteria recommended by the FHWA may indicate that two-phase selection procedures are not appropriate for the project.*
>
> - *Are three or more offers anticipated?*
> - *Will proposers be expected to perform substantial design work before developing price proposals?*
> - *Will proposers incur a substantial expense in preparing proposals?*
> - *Have you identified and analyzed other contributing factors, including:*
>   - *The extent to which you have defined the project requirements?*
>   - *The time constraints for delivery of the project?*
>   - *The capability and experience of potential contractors?*
>   - *Your capability to manage the two-phase selection process?*
>   - *Other criteria that you may consider appropriate?"*

Another way of expediting the proposal evaluation process and reducing the resource requirements is to request separate price and technical proposals, which is common practice among state DOTs. State DOTs can first review price proposals to evaluate their responsiveness and then review technical proposals based on price proposal ranking. Hence, by evaluation of price proposals before opening technical proposals, state DOTs can save significant time and resources since non-responsive bids will be dismissed. A summary of major benefits and challenges of using single-phase and two-phase selection processes are presented in Table 6.3 and Table 6.4 as identified by Ashuri and Kashani (2012):

Table 6.3

Benefits and Challenges of Single-Phase Selection

Single-Phase Selection	
Benefits	**Challenges**
○ It provides the owner with the opportunity to attract a large pool of design-build teams by allowing all interested teams to respond to RFPs ○ It allows the owner to expedite the selection process ○ The owner's cost of proposal review is typically low ○ It is most suitable for noncomplex design-build projects where there are many design-build teams that can deliver projects	○ It may reduce the owner's ability for the in-depth evaluation of design-build teams' qualifications ○ A large number of participants may limit the owner's ability for detailed evaluation of technical proposals ○ A large number of participants may discourage some design-build teams to participate due to low odds of winning

Table 6.4

Benefits and Challenges of Two-Phase Selection

Two-Phase Selection	
Benefits	**Challenges**
○ It allows the owner to use shortlisting in order to encourage highly qualified design-build teams to participate (the odds of winning is greater when shortlisting is practiced) ○ Shortlisting based on qualifications evaluation may reduce the owner's proposal review time ○ The two-phase procedure reduces the industry's overall cost of preparing design-build proposals ○ It is most suitable for complex design-build projects where a few qualified design-build teams can deliver projects	○ It requires the owner to assemble a project-specific team for evaluating design-build teams' qualifications and possibly shortlisting most qualified teams ○ A large number of respondents to RFQs may limit the owner's ability for detailed qualification assessment ○ A large number of respondents to RFQs may increase the qualification assessment time ○ It requires the owner to establish a set of objective criteria for evaluating (and possibly shortlisting) design-build teams ○ The additional cost of developing the qualifications evaluation plan and implementing the evaluation process add to the procurement cost of the project ○ It requires an experienced facilitator to manage the qualifications evaluation process and lead the evaluation team ○ It may be difficult for the qualifications evaluation team to arrive at a consensus about the qualifications of design-build team ○ The qualifications evaluation team should have training and experience in objective evaluation of design-build teams' qualifications ○ In the RFQ, the owner should elaborately describe its approach to objective evaluation of design-build team qualifications

We found out that proposer evaluation methods currently used by the Utah DOT and the Washington State DOT can be considered as best practices to enhance the efficiency of procurement process in design-build projects.

Utah DOT (UDOT)

Best-value procurement of design-build contracts by the Utah DOT involves a two-phase RFQ/RFP process. The template provided by the Utah DOT for instructions to proposers indicated the following:

> "*The intent of the Department is to award the contract to the responsive proposer whose proposal is most advantageous to the State, taking into consideration the price and technical factors (project goals) identified in the RFP. The Department procurement process for the project involves two phases:*
>
> - *Request for qualifications (RFQ) and submittal of statements of qualifications (SOQ), and the subsequent determination of the short-list.*
> - *Request for proposals (RFP) from the short-list and submittal of proposals, and the subsequent selection of the design-build team from the proposers*."

For the RFQ process of the "Bangerter Highway SR-154 project", the Utah DOT performed a combined evaluation of pass/fail evaluation factors (e.g., providing a cover letter, presenting sufficient legal liability, and meeting financial requirements) and technical evaluation factors (e.g., capabilities of the organization and key managers (high level), experience of the firm, past performance, and understanding and approach). For technical evaluation, the Utah DOT uses adjectival rating system. Those firms that passed the RFQ phase were able to bid on the project through the RFP process (UDOT 2010b).

On the other hand, the Utah DOT decided to use a streamlined low-bid procurement approach on the "I-80, EB/WB over Weber River Bridge Reconstruction" by evaluating technical proposals and awarding the contract to the lowest responsive proposal. In the RFP of this project, UDOT noted the following:

> "*The department will conduct an initial review of the technical proposals for responsiveness to the requirements set forth in the RFP. Technical proposals not responsive to the RFP may be excluded from further consideration and proposer will be so advised. The department may also exclude from consideration any proposer whose technical proposal contains a material misrepresentation. After the technical proposals have been reviewed, the department will open the price proposal of the proposers with responsive technical proposals. The department will review the price proposal for responsiveness to the requirements of the RFP. Price proposals not responsive to the RFP may be excluded from further consideration and the proposer will be so advised. The department may also exclude from consideration any proposer whose price proposal contains a material misrepresentation. Unless all proposals are rejected or UDOT otherwise elects not to award the contract, the project will be awarded to the proposer with a responsive proposal and the lowest price proposal*." (UDOT 2010a)

Washington State DOT (WSDOT)

The Washington State DOT (WSDOT) used a two-phase RFQ/RFP process for the procurement of the "SR 99 Bored Tunnel" design-build project. WSDOT described this procurement method in the RFQ of this project as the following:

> "*The issuance of this RFQ is part of the first step to solicit information from interested proposers in the form of an SOQ. WSDOT will evaluate and score submitted SOQs to determine the most highly qualified proposers to successfully deliver the project. The SOQ evaluation involves evaluating pass/fail criteria such as providing a letter of interest, meeting financial requirements (bonding*

capacities of the bidder), and presenting legal liability and qualitative elements, such as performance history, management plan and key personnel." (WSDOT 2009)

6.3 Selection of Procurement Methods

In practice, there are several procurement methods that can be classified with respect to the two important procurement decisions that the state DOT should make for the project, (1) determining the basis of award and (2) determining the selection process (single-phase or two-phase procurement). Figure 6.1 organizes commonly used procurement methods in design-build projects in a two-dimension space where the horizontal line defines the basis for proposal evaluation and contract award and the vertical line describes the number of phases through which the project is procured (i.e., single-phase (RFP only) or two-phase (RFQ and RFP)).

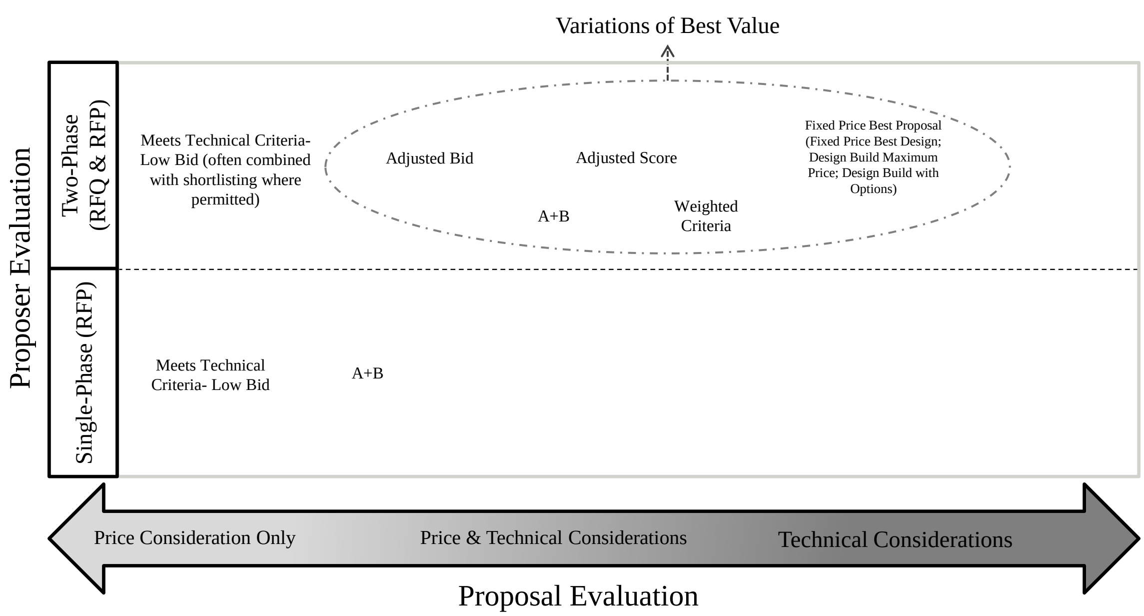


Figure 6.1

Categorization of Procurement Methods

Existing procurement methods are positioned in this two-dimensional graph considering their relative emphasis on proposal evaluation and proposer evaluation. Commonly used procurement methods by state DOTs for design-build procurement are the following:

- Low-bid (meets technical criteria) or hard bid: The award decision in the low-bid (meets technical criteria) selection is based on price. Typically, technical proposals are evaluated before any price proposals are reviewed. The price proposal is opened only if the technical proposal is found to be responsive by meeting the minimum technical requirements established in the RFP. The basis of award is quantitative, low bid.
- Variations of best-value: The award decision in the best-value selection is based on a combination of price and non-price factors. Best-value procurement method is beneficial and, in fact, necessary for the procurement of certain design-build projects. In Best-value procurement, a combination of bid price and technical (i.e., non-price) factors are considered for evaluation of design-build proposals. In practice, best-value has several variations as the following:
    - A+B
    - Adjusted Bid
    - Adjusted Score
    - Weighted Criteria
    - Fixed Cost – Best Proposal

Low-Bid (Meets Technical Criteria)

The award decision in the Meets Technical Criteria – Low-Bid selection (sometimes called fully responsive – lowest price) is based on price. Typically, the technical proposal review is done on a pass/fail basis. However, the state DOT may choose a numerical or adjectival ratings system for evaluating technical proposals. In this case, the minimum score required for the proposal to be considered responsive should be identified in the advertised RFP. These ratings are merely used as a way to determine whether a design-build team meets the minimum technical requirements of the RFP issued by the state DOT. These ratings are not used as the basis for awarding design-build contracts. For those design-build teams that successfully pass technical reviews, the award will be exclusively based on price proposals. The contract is awarded to the design-build team offering the lowest price. Low-bid selection is generally preferred on (small) projects where scope is clearly defined and opportunities for innovative design and construction methods and techniques are limited. Examples are highway projects with specified pavement type and geometric design, and minimal ancillary work items. Depending on project-specific goals, the state DOT may choose to implement the Meets Technical Criteria – Low-Bid approach in a single phase (RFP) or in two phases (RFQ and RFP). For instance, the Virginia DOT (VDOT) has procured several design-build projects using both single-phase and two-phase Meets Technical Criteria-Low Bid selection method, such as the "Route 29 Bridge Replacement" design-build project. The contract RFP describes the low-bid selection as follows:

> "*VDOT will open and read the Price Proposals publicly on the date and time set forth in the project RFP. After opening the Price Proposals, VDOT will determine if the Proposal of the Offeror with the lowest Proposal Price for the Project is responsive. If VDOT considers the Proposal of the Offeror with the lowest Proposal Price to be nonresponsive, then VDOT will determine if the Proposal of the Offeror with the next lowest Proposal Price is responsive. The proposal responsiveness review is based on the pass/fail evaluation of the following items: Offeror's bond capacity, Work history of the designer and the contractor, conceptual roadway plans, and conceptual bridge plans.*" (VDOT 2012b)

Best-Value

State DOTs use different variations of best-value to award design-build contracts. The main difference among these variations of best-value procurement is in their award algorithms. Below we explain these variations along with relevant examples.

A+B

A+B is one of the least complicated variations of best-value selection method. The proposed schedule of design-build teams to complete the project is the only non-price consideration in this approach. The worth of time (B) is calculated as the product of total project duration (in days) and the equivalent daily value of the completed project (in dollars), which is established upfront in the RFP. The worth of time is calculated for each design-build proposal considering the proposed number of days to complete the project. The calculated worth of time is added to the design-build team's proposed price (A). The basis of award is the lowest total cost (A+B). This calculated A+B is used only for the selection purpose. It does not affect liquidated damages established by the state DOT in the contract or any applicable special provisions for incentives/disincentives. For instance, the Colorado DOT used the A+B procurement method to award the "I-25 North" design-build project. The contract RFP describes the best-value determination as follows:

> "*The selection of a Contractor from the short-listed Proposers will be based upon the score of its Technical Proposal submittal. The Selection Team will review the submitted Technical Proposals to determine if they are responsive to the requirements of the Request for Proposal. Each responsive Technical Proposal will be evaluated by the individual members of the Selection Team, on the basis of the criteria provided in the Request for Proposal. The sealed Price Proposals will be opened on the date specified in the RFP. Comparison of Price Proposals will utilize the method known as 'A+B'. The 'A+B' method takes into account not only the price offerings of the Proposer, but also the time within which the Proposer*

will achieve the Substantial Completion of the construction of the project. The 'A' amount shall be the Price Proposal, total bid cost for construction as shown in the Bidding Schedule. The 'B' portion of the Price Proposal will be the product of the Proposer's Construction Calendar Days and the Road User Cost determined by the Department. The Road User Cost for this project is $35,000/day. The amount used for comparison of proposals to establish the lowest responsive Proposer for award purposed shall be as shown in the following equation:

('A+B' amount) = ('A' amount) + (Proposer Construction Calendar Days × Road User Cost)" (CDOT 2012a).

Adjusted Bid

The Adjusted Bid approach revises the bid price considering the non-price factors and uses the adjusted bid as the basis of awarding the design-build contract. It applies a numerical scoring system or a system that uses adjectival ratings that are eventually converted to numbers. The selection of the Adjusted Bid approach as an award algorithm indicates that the state DOT considers other factors besides price in evaluating design-build proposals and awarding the design-build contract. Each design-build proposal is scored (or rated) in several non-price (technical) categories, such as schedule, maintainability, management of traffic, and quality management plan. These scores are integrated into a single technical score for the proposal. The technical score is typically a value between 0 and 1 or 0 and 100. The details of scoring (rating) system must be fully described in RFQs and RFPs. For instance, the Washington State DOT (WSDOT) used the adjusted bid best-value approach to procure the "SR 99 Bored Tunnel Alternative Design-Build" project. The WSDOT used pass/fail evaluation criteria and point scoring to evaluate technical proposals.

The technical evaluation factors and their maximum available score for the “SR 99 Bored Tunnel Alternative Design-Build” project included the following:

- Executive summary (pass/fail evaluation)
- Proposer’s Approach to Management of the Project (10,000,000)
- Preliminary Baseline Contract Schedule (20,000,000)
- Tunnel Roadway Clearance Envelope (40,000,000)
- Excavation and Support of Bored Tunnel and Management of Ground Deformation Impacts (10,000,000)
- Design and Construction, Except Tunneling (10,000,000)

WSDOT describes the technical proposal evaluation process as follows:

> “*To determine the proposal technical score, WSDOT will evaluate technical requirements through pass/fail evaluation criteria and point scoring as described in the instructions to proposers (ITP), using the evaluation criteria described in the ITP. The technical evaluation score sheet in the ITP identifies the maximum scoring for each technical requirement. The technical evaluation score will be calculated by summing the Proposer’s points received out of the max available score (100,000,000). Each responsive Proposal will be assigned an Apparent Best-Value Score (ABVS) as determined by the following equation:*
>
> *ABVS = $P - (Sum of all TCs)*
>
> *Where: ABVS = The Apparent Best-Value Score; $P = The Total Proposal Price as provided on Form B; TC = Assigned Technical Credits;*
>
> *The Apparent Best-Value Proposal will be the responsive Proposal with the lowest ABVS.*” (WSDOT 2010)

Adjusted Score

The Adjusted Score approach uses a combination of technical score and bid price as the basis of awarding design-build contracts. This approach requires the use of a numerical scoring system. Alternatively, the state DOT may use a system that applies adjectival ratings that are later converted to numbers. The proposal evaluation process starts with reviewing and scoring technical proposals. Typically, each design-build proposal is scored (or rated) in several non-price (technical) categories, such as schedule, maintainability, management of traffic, and quality management plan. These scores are integrated into a single technical score for the proposal. The technical score is typically a value between 0 and 100. The details of scoring (rating) system must be fully described in RFQs and RFPs. For instance, the Colorado DOT used the adjusted score procurement method to award the "US 6 bridge replacement east of I-25" design-build project. The contract RFP describes the best-value determination as the following:

> "*The proposals will be reviewed for responsiveness based on the requirements set forth in the RFP. Responsiveness also includes conformance with the Guaranteed Maximum Prices of $50,000,000 for Bridge Enterprise (BE) and $56,000,000 for Non-Bridge Enterprise (Non-BE) elements of the Project. Award of the Project will be based on a Best-Value determination. The ranking of each of the Proposals shall be an assessment of price and the Technical Proposal. Accordingly, determination of the highest score is then defined by multiplying the Technical Proposal score by a ratio of the combined Guaranteed Maximum Prices (GMPs) for Bridge Enterprise and non-Bridge Enterprise GMPs as defined in the ITP divided by the Proposer's Price.*
>
> *Total Score = Technical Proposal Score × (BE GMP + Non-BE GMP) / (Submitted Proposer's BE Price+ Submitted Proposer's Non-BE Price)*

The Proposer with the highest score will then be determined to have the Best-Value Proposal and will be selected by CDOT." (CDOT 2012b)

Weighted Criteria

The Weighted Criteria method independently evaluates price and technical criteria, assigns weights to price and technical criteria, and uses the weighted score as the basis of awarding design-build contracts. The Weighted Criteria method requires the use of a numerical scoring system for evaluating design-build proposals with respect to different price and other technical criteria. Alternatively, the state DOT may use a system that applies adjectival ratings that are later converted to numbers. In this method, technical and price proposals are evaluated independently, typically with two distinct evaluation committees. Evaluators score each design-build proposal with respect to price and each of the technical criteria. The state DOT combines these scores using weights assigned to price and technical criteria. These weights are explicitly identified in RFPs. The total score (i.e., the weighted average of multiple criteria scores) is calculated for each design-build proposal and the design-build proposal with the highest score is selected as the best-value proposal. For instance, the New York State DOT (NYSDOT) used weighted criteria approach in the best-value procurement of "Kendrick Road Bridge" project. The proposal evaluation section of the project RFP notes the following:

"*Each technical proposal will be evaluated on the pass/fail and quality evaluation factors identified in the RFP. In order to be considered for award of the contract, the proposal must receive a pass rating on all pass/fail factors. The pass/fail evaluation factors include: legal requirements, financial requirements, administrative requirements, and disadvantaged business enterprise requirements. A selection committee appointed by the Department will determine the pass/fail status and overall quality rating of each proposal before the price proposals are opened and evaluated by the contract management bureau staff. The* *contract management bureau will evaluate the quality ratings and pricing information contained in the price proposals and prepares a recommendation to the selection official indicating which proposal represents the best-value to the Department. The selection official will then assess the recommendation and make a final determination as to which proposal offers the best-value to the department, considering the quality and price factors set forth in the ITP. The quality evaluation factors include: key personnel and experience, management approach, technical solutions, and project support. The best-value determination shall be based on the following:*

- *Proposal Price, which shall be 60% of the overall score*
- *Quality Evaluation, which shall be 40% of the overall score*" (NYSDOT 2013)

Fixed Price – Best Proposal

The Fixed Price – Best Proposal, also known as Fixed Price – Best Design, is a form of best-value procurement in which the state DOT establishes the contract price in the advertised RFP. The state DOT evaluates the design solutions and other technical aspects of design-build proposals and awards the contract to the design-build team that offers the best technical proposal (or the maximum scope) for the established contract price. For example, the Utah DOT used the fixed cost-best proposal approach in the best-value procurement of "I-15 corridor expansion (CORE)" project. The main objectives of the Utah DOT were to (UDOT 2013b):

- Spend all authorized funding on the corridor
- Provide the highest value within the budget
- Maximize the amount of work under a single contract
- Minimize inconvenience to the public

- Complete the project by 2014
- Uphold public trust
- Encourage innovation to add value

To achieve the project goals, the Utah DOT awarded the contract to the design-build team who was able to provide the highest value at the fixed price. The Utah DOT used the following performance measures to select the best-value proposal (UDOT 2013b):

- Lane Miles: The maximum achievable lane miles according to the project limits
- Impacts to traffic: The impact of construction on traffic delays and the number of lanes open to the traveling public during corridor expansion
- Schedule: The project schedule and earliest finish, because of the variable scope
- Maintenance Costs: The project design with lower maintenance costs was preferable

By soliciting the best design, UDOT received proposals with design and construction innovation. Hence, the RFP process resulted in proposals with more scope that UDOT had estimated to begin with. However, the best-value selection was protested by another proposer. UDOT was able to defend the selection process and avoided litigation and possible delay by reaching a settlement with the protesting team. State DOTs should be really cautious about the use of this best-value procurement method since in essence they are comparing apples to oranges in this approach (i.e., the scopes of proposals can be significantly different from each other). Transparency and consistency are central to the success of the Fixed Price – Best Proposal procurement method. Finally, UDOT concluded the following two important take-away points:

- Fixed Price – Best Proposal can present risk to the owner in terms of awarding the contract as it is more subjective
- Owner must have a defendable and auditable process for selection

The fixed price-best design or variable scope is an emerging procurement method that is gaining more popularity in the design-build environment. It provides the owner the flexibility to include specific goals, such as scope, design, and alternatives, in the award decision. However, it requires a tradeoff analysis among these objectives that can open the state DOT to litigation challenges.

6.3.1 Challenges of selection of procurement method

6.3.1.1 Lack of a consensus in definitions and the actual practice of various procurement methods among state DOTs

We conducted an extensive review of procurement methods that are available to state DOTs for design-build projects. Table 6.5 summarizes the results of a domestic scan of web-based materials regarding the design-build procurement options available in each state DOT. Note that the major sources of the information provided in Table 6.5 are websites of state DOTs. The availability of low-bid, best-value, and qualifications-based selection process is identified for each state DOT as of January 1, 2013; Indiana and Georgia are the only state DOTs that are not authorized to use best-value procurement for design-build projects. Georgia legislators just approved the use of best-value procurement method, effective July 1, 2013. Interestingly, several state DOTs, such as Alabama, Connecticut, New York, and Delaware, which have procured only a few design-build projects, are allowed to use best-value procurement for design-build projects. In fact, state DOTs that are recently authorized to use design-build for transportation project delivery have the ability to use best-value procurement for design-build team selection.

Table 6.5

Availability of various procurement methods for design-build projects in state DOTs

ID	State DOT	Low-Bid	Best-Value	Qualifications-Based Selection	Shortlisting	Paying Stipends to Non-Winning Proposals
1	**Alabama**	Authorized Never Used	Yes	No	Not Mentioned	Not Mentioned
2	**Alaska**	Yes	Yes	No	Yes	Yes
3	**Arizona**	Authorized Never Used	Yes	No	Yes	Yes
4	**Arkansas**	Authorized Never Used	Yes	No	Yes	Yes
5	**California**	Yes	Yes	No	Yes	Not Mentioned
6	**Colorado**	Yes*	Yes**	No	Yes	Yes
7	**Connecticut**	Authorized Never Used	Yes	No	Not Mentioned	Not Mentioned
8	**Delaware**	Authorized Never Used	Yes	No	Yes	Yes
9	**Florida**	Yes*	Yes	No	Yes	Yes
10	**Georgia**	Yes*	Yes	No	Yes	Yes
11	**Hawaii**	Authorized Never Used	Yes	No	Yes (One project)	Not Mentioned
12	**Idaho**	Authorized Never Used	Yes	No	Yes	Yes
13	**Illinois**	Authorized Never Used	Yes	No	Yes	Yes
14	**Indiana**	Yes	No	No	No	No
15	**Kansas**	Authorized Never Used	Yes	No	Not Mentioned	Not Mentioned
16	**Kentucky**	Authorized Never Used	Yes	No	Yes	Yes
17	**Louisiana**	Authorized Never Used	Yes	No	Yes	Yes
18	**Maine**	Yes	Yes	No	Yes	Yes
19	**Maryland**	Authorized Never Used	Yes	No	Yes	Yes
20	**Massachusetts**	Yes	Yes	No	Yes	Yes
21	**Minnesota**	Yes	Yes	No	Yes	Yes

(Sources: information was strictly retrieved from websites of state DOTs as of January 1, 2013)

Table 6.5 (cont'd)

ID	State DOT	Low-Bid	Best-Value	Qualifications-Based Selection	Shortlisting	Paying Stipends to Non-Winning Proposals
22	**Michigan**	Yes*	Yes**	No	Yes	Yes
23	**Mississippi**	Authorized Never Used	Yes	No	Yes	Yes
24	**Missouri**	Authorized Never Used	Yes	No	Yes	Yes
25	**Montana**	Yes	Yes	No	Yes	Yes
26	**Nevada**	Authorized Never Used	Yes	No	Yes	Yes
27	**New Hampshire**	Yes	Yes	No	Yes	Yes
28	**New Mexico**	Authorized Never Used	Yes	No	Yes	Yes
29	**New York**	Yes	Yes	No	Yes	Yes
30	**North Carolina**	Yes*	Yes	No	Yes	Yes
31	**Ohio**	Yes	Yes	No	Yes	Yes
32	**Oregon**	Yes	Yes	No	Yes	Yes
33	**Pennsylvania**	Yes*	No	No	Yes	Yes
34	**Rhode Island**	Yes	Yes	Yes	No	No
35	**South Carolina**	Yes	Yes	No	Yes	Yes
36	**Tennessee**	Authorized Never Used	Yes	No	Yes	Yes
37	**Texas**	Authorized Never Used	Yes	No	Yes	Yes
38	**Utah**	Yes*	Yes	No	Yes	Yes
39	**Virginia**	Yes*	Yes**	No	Yes	Yes
40	**Vermont**	Yes	Yes	No	Yes	Yes
41	**Washington**	Yes*	Yes	No	Yes	Yes
42	**West Virginia**	Yes	Yes	No	Yes	Yes
43	**Wyoming**	Authorized Never Used	Yes	No	Yes	Yes

*Allows both one-phase and two-phase for Low-Bid procurement
**Allows one-phase for Best-Value procurement (Best-Value procurement usually involves two-phases)
(Sources: information was strictly retrieved from websites of state DOTs as of January 1, 2013)

Low-bid procurement is usually done in single-phase, while best-value is done in two-phases for most state DOTs. However, there are exceptions to these general trends that are marked with one and two asterisks in the table. Colorado, Florida, Georgia, Michigan, North Carolina, Pennsylvania, Utah, Virginia, and Washington State DOTs have used two-phase low-bid procurement method for a few design-build projects. This is not a general practice in these state DOTs and low-bid has been conducted in a single-phase approach in these states too. Colorado, Michigan, and Virginia have used single-phase best-value procurement method for a few design-build projects. This is not a general practice in these state DOTs and best-value has been conducted in a two-phase approach in these states too. No state DOT is allowed to use qualifications-based selection to procure design-build projects. The use of shortlisting and the availability of stipends to non-winning shortlisted teams are determined for each state DOT. Shortlisting and paying stipends to non-winning teams are common practices in most state DOTs.

It can be seen that state DOTs use various procurement methods on design-build projects. While several state DOTs, such as the Colorado DOT and the Washington State DOT, have the flexibility to choose from a menu of procurement methods, some state DOTs, such as Pennsylvania and Indiana DOTs, have to use only low-bid for procurement, due to the statutory concern.

Several state DOTs are authorized to use best-value on design-build projects. However, the practice of best-value procurement and its award algorithms are quite different. For instance, the Florida DOT uses adjectival rating while other states, such as Washington State DOT prefer point scoring methods or a combination of both methods. State DOTs have a wide spectrum of available best-value procurement methods. The major issue is that the difference in award algorithms can cause confusion for the industry. Since the use of non-price technical criteria can change from one project to another one and from one state to another one, proposers may face difficulties in developing proposals and state DOTs may have issues in evaluating these proposals. The inconsistency in best-value award methods is a barrier to elevate the understanding of the industry toward requirements and anticipations of the state DOT set forth in the RFP.

The selection of procurement method for the project and development of the project RFQ and RFP are the final steps prior to project advertisement. Project advertisement among the interviewed state DOTs is usually handled by the office or contracting unit that handles design-build projects. Most state DOTs prepare project websites for project specific information and public announcements as well. Further, we identified that several state DOTs, such as Florida, North Carolina, Virginia, and Colorado DOTs, have a central projects database that provides potential bidders with information related to all DOT projects. Depending on the contracting unit resources, state DOTs may have different approaches to project advertisement. However, for design-build projects, it is recommended that the office of innovative contracting or similar offices handle advertisement and communication between the state DOT and contractors.

After critically reviewing the current practices of procurement method selection in several state DOTs, we find several opportunities to enhance efficiency in the procurement of design-build projects.

6.3.2 Opportunity for efficiency enhancement of selection of procurement method

6.3.2.1 Opportunity for efficiency enhancement: State DOTs should develop and use standard contract templates for RFQ and RFP processes.

State DOTs should develop standard templates for RFQ and RFP processes and use these standard templates in design-build projects. The design-build project delivery system has fundamental differences with the traditional design-build-bid project delivery system in several critical areas, such as allocation of responsibilities and risks among different contract parties, preliminary design development, submittal requirements, and proposal evaluation criteria that should be clearly addressed in RFQ and RFP documents. Because of these fundamental differences, state DOTs should avoid using traditional design-bid-build contract templates as the basis for developing design-build RFQ and RFP templates. Instead, state DOTs should try to develop appropriate templates that are customized for design-build projects.

The RFQ process for design-build projects starts with the issuance of RFQs followed by the evaluation of SOQs submitted by design-build teams in response to the RFQ. The template RFQ forms should properly address the following information:

- Introduction and general information
- Overall procurement and shortlisting process
- SOQ Evaluation process
- SOQ submittal requirements
- SOQ evaluation criteria and the scoring system used by the state DOT
- General information, such as the protest process, rights and disclaimers, and legal information
- Reference qualifications forms

The RFQ forms usually request for experience of the management team, past performance of the contractor on similar projects, the quality management organization of the contactor, bonding capacities of the bidder and similar qualifications, rather than price-related and technical considerations (AGC 2011). State DOTs can use the template RFQ forms and customize them according to the project requirements whenever two-phase procurement is used for design-build projects. Additionally, state DOTs should expand the use of pass/fail criteria especially in SOQ evaluation, since most of the RFQ forms require the design-build teams to restate the RFQ requirements and commit to meeting those requirements. Using pass/fail criteria instead of complicated scoring systems can simplify the evaluation process and help the state DOTs save considerable amount of time and resources to shortlist contractors in a timely manner (VDOT 2011b).

The RFP process for design-build projects can vary based on the selected procurement method for the project. The RFP process starts with issuance of RFPs followed by the evaluation of technical and price proposals by the state DOT. The RFP process may include pre-proposal meetings, ATCs, one-on-one meetings, and request for information (RFI) depending on the selected procurement method for the project. Several state DOTs have decided to prepare RFP templates for design-build projects in several sections. The template RFP forms should properly address the following information:

- Introduction and general information
- Procurement process
- Proposal evaluation process
- Proposal submittal requirements
- Project specific technical requirements
- Alternative technical concepts (ATCs)
- Pre-proposal meetings
- Contract award and execution

The required information is usually organized throughout the RFP in different sections. We identified that state DOTs have different approaches for developing RFP templates but a typical design-build RFP should have the following critical sections:

1. Instructions to Proposers (ITP)
2. General conditions and the scope of the contract

3. Project specific technical information

4. Reference documents

The instructions to proposers (ITP) section contains the information related to the procurement process, the selection approach, evaluation criteria and other general information that are subject to change based on the selected procurement method for the project. The RFP's Section 2 includes the necessary modifications to standard specifications of the state DOT to accommodate the use of the design-build project delivery system as well as the required contract specifications, such as bonding requirements, contract form, federal aid provisions, compensation and payment, and contract adjustments and disputes. The project-specific technical information section includes the project-related information that forms the technical and price proposals of design-build teams. Usually, the state DOT bears the responsibility for the accuracy of project-specific technical information (VDOT 2011b). Section 3 should be modified according to the project scope and design criteria and changes from one project to another. Finally, Section 4 contains the necessary technical reference data and material, such as maps, traffic forecasts, technical reports, design details, and environmental documentation.

In addition to saving time and resources, using templates for RFQ and RFP processes has another major benefit for the state DOT in that the industry participants become familiar with these templates and standard forms of agreement, and as a result, they can efficiently adjust themselves to the state DOT's requirements on design-build contracts (AGC 2012). State DOTs can seek assistance from industry and university consultants to develop and modify these drafts. We describe examples of standard contract templates that have been developed for transportation design-build contracts.

Virginia DOT (VDOT)

Virginia DOT has standardized the contract documents for their RFP process. The VDOT RFP document contains five parts that mostly have been drafted on a template basis except for project specific technical information. The five drafted parts include: (1) instructions to proposers; (2) technical requirements; (3) commercial terms; (4) general conditions; and (5) standard specifications to accommodate the use of design-build (VDOT 2011b). Instructions to proposers (ITP) usually describe submittal requirements of the contract, the procurement method used for the project, selection criteria, scoring criteria and the details of the procurement method. ITP part of the contract is subject to change depending on the procurement method and the evaluation criteria. Part 2 contains the technical requirements associated with the project, including drawings and design criteria. Among the rest of these templates, the project specific technical information changes from one project to another. Parts 3, 4, and 5 include the attachments, amendments, provisions, and the rest of the required documents for the project RFP. Except the project-specific requirements, the templates stay the same on every design-build project. Thus, VDOT has substantially reduced the amount of time and resources required for preparing contract documents for their design-build projects.

Colorado DOT (CDOT)

The Colorado DOT has standardized the contract documents for RFQ and RFP processes. The template for the RFQ process is available to the public. Design-build teams can refer to the RFQ template and other instructions to prepare the SOQs in a timely manner and with higher quality. CDOT also provides the RFP template in 4 sections: (1) Instructions to proposers; (2) technical requirements; (3) applicable standards, data, and reports; and (4) reference documents (CDOT 2013). Part 1, also known as contract provisions and instructions, describes contract components, obligations of the contractor, procurement approach and evaluation criteria, and other important instructions. Part 2 includes project specific technical information, such as project management plan, quality management plan, utilities, ROW, and Geotech related technical requirements. Parts 3 and 4 include standards, reference data, and reports to be used by proposers in development of proposals.

ConsensusDOCS, Design-Build Institute of America (DBIA), and American Institute of Architects (AIA)

Similar to state DOTs, various industry associations have developed standard forms of agreement, which are in common use by several owners. These forms have developed language for many situations that over time have been tested and refined in the legal system. Owners can use these standard forms of agreement and modify them according to their own requirements. For instance, the DBIA provides a suggested framework for the contents of an RFP for a best-value design-build project, which should be expanded/reduced, modified or detailed as required for each project situation. The template RFP contains the following four sections (DBIA Design-Build Manual of Practice 2012c):

1. Project Purpose Statement (Preamble)
2. Model Contract
3. Evaluation Factors/Basis for Award
4. Instructions to Offerors

Part 1 includes a clear description of the overarching goals and objective of the owner. The DBIA recommends that the project purpose statement should address the following (DBIA Design-Build Manual of Practice 2012c):

- "*Identification of Owner*
- *Overview of Project and Scope*

- *Goals, challenges, and constraints of stakeholders. A summary of the owner's and other stakeholders' project objectives, based on their goals, challenges, and constraints, should be ranked in general order of importance*."

Part 2, the model contract or contract form, at a minimum includes the performance requirements, the pricing arrangement, and all terms and conditions that will be included in the contract. The owners should clearly describe the mission statement, staffing, general characteristics, and other reference documents that are required for the contract. The model contract should be included in its entirety in the RFP since many aspects of it may affect proposed prices. Part 3, should explain the proposal evaluation process, the selection criteria, and the basis of award. The critical part of the RFP package is describing the decision process for selecting the design-build team for the project. The owner must clearly identify the basis for award--the evaluation and selection criteria, and their relative order of importance. Part 4, the instruction to offerors, should address the following information (DBIA Design-Build Manual of Practice 2012c):

- "*Identify the organization issuing the RFP and requesting design-build proposals*
- *Eligibility to Receive RFP Documents and to Submit a Design-Build Proposal*
- *Definition and Terms: The RFP, with attachments, will form the core of the contract between the owner and the design-builder*
- *Identify any pre-proposal conferences or briefing sessions/formal question and answer process*
- *Project Schedule: The elapsed number of calendar days allowed for design and construction, and any interim milestones for submittals*
- *Bond Forms, if applicable*"

6.3.2.2 Opportunity for efficiency enhancement: State DOTs should use consensus evaluation instead of individual evaluations, and pass/fail and adjectival scoring instead of point scoring for the assessment of design-build proposals.

State DOTs should use more pass/fail evaluation and adjectival rating to evaluate proposals especially where non-price factors and technical factors are considered. We performed a scan of design-build project RFPs from several state DOTs and found out that currently state DOTs use the following scoring systems for shortlisting and proposals evaluation:

- Pass/fail rating
- Adjectival rating
- Point scoring

Based on the scoring system and the evaluation method for the project, the proposer and proposal evaluation teams will have to assign pass/fail, a score (from a range e.g. 1 to 5), or an adjectival rating for each evaluation criterion. The point scoring system usually requires the involvement of subjective opinion in decision-making. Experts in various technical areas find it challenging to use such scoring systems. Hence, the proposal evaluation process becomes unnecessarily lengthy and differentiating among best-value proposals becomes more of a subjective decision that is inconvenient for the design-build construction industry. Consensus rating by the evaluation committee is a better practice than individual ratings. Consensus rating encourages discussion among the evaluation committee members. The final rating will be based on inputs from all members of the evaluation committee and will reflect interactions and discussions among the members. Consensus rating provides an easy-to-comprehend assessment for the design-build team and reduces the chance of bid protests or lawsuits. Similarly, state DOTs should consider using more pass/fail evaluation especially in the RFQ process, since the criteria used in the RFQ process are typically aimed to identify presence of certain qualifications. This practice helps streamline the process of proposer and proposal evaluation and makes the results more defendable with the industry.

The use of consensus-based adjectival rating helps state DOTs reduce possible bid protests and litigation cases. The use of pass/fail criteria, adjectival rating, and consensus rating are considered as best practices in the best-value procurement of design-build projects since these practices can expedite the proposal evaluation process, help the state DOT to efficiently differentiate among proposals, and provide a transparent framework to present the results of proposal evaluations.

6.3.2.3 Opportunity for efficiency enhancement: State DOTs should consider shortlisting 3-5 bidders and paying stipends to unsuccessful bidders, in order to enhance the chance of receiving high-quality proposals in the competitive bid environment.

Several state DOTs have decided to pay stipends to unsuccessful shortlisted proposers as a means of reducing the cost of participating in the RFP process and providing proposers with partial compensation for ownership of their concepts within the submitted proposals. Because stipends recover a portion of design-build proposal preparation costs, their use typically results in active and competitive participation of design-build teams (DBIA 2010). Especially in complex design-build projects that require innovative design and construction solutions, the use of stipends encourages proposers to compete with each other over lower costs, higher innovation, and added value to the project. Regarding the benefits of using stipends on design-build projects, the DBIA identifies the following benefits in the "DBIA Position Statement, Use of Stipends" (DBIA 2010):

- "*Stipends enhance competition by generating market interest in the project from the most highly qualified design-build teams*
- *Stipends help defray the cost of proposal development incurred by the design-build teams*

- *Stipends signal the owner's serious intention to carry the project forward*
- *Stipends encourage proposers to expend the time, money and resources to provide more creative and comprehensive solutions*"

Although the DBIA recommends the use of stipends on design-build projects, the DBIA suggests that owners should not make excessive demands from proposers since stipends cover partial costs of proposal evaluation. Nevertheless, in many jurisdictions, stipends are politically controversial (FHWA 2011). The policies of the FHWA allow federal-aid participation in stipends with certain stipulations as described in the 23 CFR 636.112 and 636.113:

"*23 CFR § 636.112 May stipends be used?*

At your discretion, you may elect to pay a stipend to unsuccessful offerors who have submitted responsive proposals. The decision to do so should be based on your analysis of the estimated proposal development costs and the anticipated degree of competition during the procurement process."

"*23 CFR § 636.113 Is the stipend amount eligible for Federal participation?*

(a) Yes, stipends are eligible for Federal-aid participation. Stipends are recommended on large projects where there is substantial opportunity for innovation and the cost of submitting a proposal is significant. On such projects, stipends are used to:

(1) Encourage competition.

(2) Compensate unsuccessful offerors for a portion of their costs (usually one-third to one-half of the estimated proposal development cost).

(3) Ensure that smaller companies are not put at a competitive disadvantage."

The costs for preparing design-build proposals are high and smaller design-build firms may have difficulty in competing with larger firms that can usually bear the costs for proposal preparation. By receiving stipends and partial reimbursement for proposal preparation costs, smaller firms may have the opportunity to compete over large and complex design-build projects. There is no fixed formula for determining the appropriate amount of stipends. Table 6.6 presents the formulas used by the identified state DOTs for calculating the amount of stipends in design-build projects (FHWA 2011):

Table 6.6

Formulas Used by State DOTs for Stipend Calculation in Design-Build Projects

State DOT	**Stipend Amount**	**Comments**
Arizona	0.2% of bid amount	
Colorado	$1,000,000	For a $1.186 billion project
Florida	Varies based on the project, every losing firm with responsive proposal receives a stipend	A recent $82 million project had a stipend of $100,000
Louisiana	Project-by-project basis	For the John James Audubon Bridge — $348 million project, a $300,000 stipend was paid
Massachusetts	Generally not	Except for Route 3 North Project
Maryland	Approximately 0.02% of the contract value	-
Montana	Case by case basis, have ranged from $24,000 to $120,000	-
North Carolina	Set on a case-by-case basis; Range from $0 to $100,000	-
Utah	I-15: $950,000 ($1.36 billion project) Legacy Parkway: $500,000 ($300 million project)	-
Virginia	Case-by-case basis from $10,000 to $100,000	-
Washington	$50,000 ($22 million project)	-

6.3.2.4 Opportunity for efficiency enhancement: State DOTs should consider paying stipends to non-winning teams and should clearly describe their approach towards acquiring the ownership right of proposers in the RFP.

Design innovations and technical solutions proposed by the qualified design-build teams often include valuable cost-saving innovations for state DOTs. Although these benefits may be difficult or even impossible to quantify, they can outweigh implementation costs. State DOTs are advised to acquire these innovations as intellectual property and utilize them on the project or on similar project types, wherever appropriate. In some instances, unsuccessful bidders may refuse to transfer their intellectual property. Therefore, to facilitate acquisition of technical solutions and design innovations of proposers, state DOTs should arrange for proper agreements prior to RFP advertisement. In fact, the project RFP should clearly stipulate that by accepting stipends, design-build teams should transfer the ownership of their proposals to the state DOT. On the other hand, state DOTs may face some opposition in acquiring the property rights by paying stipends. For instance, the DBIA notes that the stipends should not be tied to ownership rights of proposals (DBIA 2010). The FHWA recommends that state DOTs should not mandate the acceptance of stipends in return for acquisition of the intellectual properties unless required by the state laws. The policies of the FHWA regarding the acceptance of stipends and the acquisition of intellectual property rights are explained in the 23 CFR 636.112 and 636.113:

> *"23 CFR § 636.113 Is the stipend amount eligible for Federal participation?*
>
> *(b) Unless prohibited by State law, you may retain the right to use ideas from unsuccessful offerors if they accept stipends. If stipends are used, the RFP should describe the process for distributing the stipend to qualifying offerors. The acceptance of any stipend must be optional on the part of the unsuccessful offeror to the design-build proposal.*

(c) ***If you intend to incorporate the ideas from unsuccessful offerors*** *into the same contract on which they unsuccessfully submitted a proposal,* ***you must clearly provide notice of your intent to do so in the RFP***." (67 FR 75926, Dec. 10, 2002, as amended at 73 FR 77502, Dec. 19, 2008)

Whether the state DOT is paying stipends to encourage competing, improve the quality of proposals, or to acquire the property rights, the availability of stipends and the terms of their use should be clearly identified and documented in RFQ and RFP forms.

6.4 Challenges and Opportunities Utilization Table

We conducted fact-finding interviews with seven design-build contracting experts in State DOTs that currently have vibrant design-build programs. These experts evaluated the identified challenges, and answered with either “yes” meaning that they have experienced similar challenges or “no” meaning that the challenge was not experienced or was not applicable for their respective state DOT. A summary of this assessment is provided in Table 6.7.

These experts also evaluated the identified opportunities for efficiency enhancement of procurement of design-build projects in their own State DOT. Each opportunity is marked as “standard practice”, “utilized in few projects”, “not considered”, “considered for future implementation”, or “not allowed by the State law”. A summary of this assessment is provided in Table 6.8.

Table 6.7
Challenges Related to Procurement of Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Challenges	**Proposal Evaluation (basis of award)**							
	Limitations of evaluating design-build proposals based on price consideration only (limitations of low-bid as the basis of award)	No	No	No	No	No	No	No
	Difficulty in the evaluation of design-build proposals based on price and technical considerations (difficulty of implementing best-value as the basis of award)	No	No	No	No	Yes	Yes	No
	Possibility of litigations and bid protests in best-value design-build projects	No	No	No	No	Yes	Yes	No
	Proposer Evaluation (single-phase vs. two-phase procurement process)							
	Inherent limitations of the single-phase selection approach for evaluating design-build proposers	No	No	No	No	No	No	No
	Industry concerns related to preparing design-build proposals that require extensive technical proposals as part of a single-phase procurement process	Yes	Yes	No	Yes	Yes	Yes	Yes
	Extensive time and resource requirements to prepare and evaluate RFQs/RFPs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Possibility of litigations and bid protests in two-phase design-build projects	No	Yes	No	No	No	Yes	No
	Selection of Procurement Methods							
	Lack of a consensus in definitions and the actual practice of various procurement methods among state DOTs	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6.8
Opportunities to Enhance Efficiency of Procurement of Design-Build Projects
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Proposal Evaluation (basis of award)**							
	State DOTs should balance the need between innovation and technicality offered by best-value procurement and efficiency and transparency that can be gained through low-bid procurement.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	Proposer Evaluation (single-phase vs. two-phase procurement process)							
	State DOTs should balance the need between qualified bidders and competitive proposals offered by two-phase selection and expedited procurement and reduced resource requirements offered by single-phase selection.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	Selection of Procurement Methods							
	State DOTs should develop and use standard contract templates for RFQ and RFP processes.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should use consensus evaluation instead of individual evaluations, and pass/fail and adjectival scoring instead of point scoring for the assessment of design-build proposals.	Utilized on a few projects /Considered for Future Use	Not considered	Utilized on a few projects	Utilized on a few projects /Considered for Future Use	Utilized on a few projects /Considered for Future Use	Utilized on a few projects /Considered for Future Use	Utilized on a few projects
	State DOTs should consider shortlisting 3-5 bidders and paying stipends to unsuccessful bidders, in order to enhance the chance of receiving high-quality proposals in the competitive bid environment.	Standard practice	Utilized on a few projects*	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should consider paying stipends to non-winning teams and should clearly describe their approach towards acquiring the ownership right of proposers in the RFP.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice

*FDOT has changed their standard practice from shortlisting 3-5 teams to a long list without any limit on the number of participating design-build teams. However, the qualified teams will carry the qualifications score to the proposal evaluation phase.

6.5 Implementation Recommendations Consideration for GDOT

GDOT should balance the need between innovation and technicality offered by best-value procurement and efficiency and transparency that can be gained through low-bid procurement.

State DOTs have realized several significant benefits through availability of various procurement methods for design-build projects since they have the ability to decide based on the project-specific goals and objectives. State DOTs should consider low-bid procurement as a powerful and transparent procurement method for certain design-build projects. Low-bid procurement has two fundamental advantages over best-value procurement in awarding design-build contracts: (a) offering the highest level of transparency in the selection process; and (b) expediting the process of contract award. Further, state DOTs can benefit from the advantages of best-value procurement and consider an appropriate level of innovation and technicality in contract award. Use of best-value procurement provides state DOTs with the flexibility to choose the proposal that brings the highest degree of innovation and technicality to the project (i.e., added value).

The following state DOTs have implemented this potential best practice:

- Colorado – CDOT is authorized to use low-bid and adjusted score best-value procurement, and any other method the Chief Engineer determines appropriate for design-build projects.
- Florida – FDOT has the authority to use a variety of procurement methods, such as low-bid, adjusted score best-value, design-build hybrid, best-value maximum price, and design-build with options for design-build projects.
- Michigan – MDOT has the authority to use a variety of procurement methods, such as low-bid, best-value, fixed-cost variable scope, and project specific qualification, for design-build projects.

- North Carolina – NCDOT has the authority to use low-bid and best-value procurement for design-build projects. The best-value procurement in NCDOT involves two-phase RFQ and RFP processes.
- Utah – UDOT has the authority to use low-bid, best-value, and fixed-price best-design for design-build projects depending on the specific goals and objectives of the project. The best-value procurement in UDOT involves two-phase RFQ and RFP processes.
- Virginia – VDOT has the authority to use low-bid, best-value, and fixed-price procurement on design-build projects. The best-value procurement in VDOT usually involves two-phase RFQ and RFP processes.
- Washington – WSDOT has the authority to use low-bid and best-value procurement on design-build projects. The best-value procurement in WSDOT usually involves two-phase RFQ and RFP processes.

GDOT should use consensus evaluation instead of individual evaluations, and pass/fail and adjectival scoring instead of point scoring for the assessment of design-build proposals.

State DOTs have realized significant benefits through utilizing consensus evaluation, and pass/fail and adjectival scoring for assessment of design-build proposals. Consensus rating encourages discussion among the evaluation committee members. The final rating will be based on inputs from all members of the evaluation committee and will reflect interactions and discussions among the members. Consensus rating provides an easy-to-comprehend assessment for the design-build team and reduces the chance of bid protests or lawsuits.

The following state DOTs have implemented this opportunity or considered it for implementation:

- Colorado – CDOT uses adjectival and point scoring in evaluation of technical proposals. CDOT has utilized average of individual scores and consensus evaluation for best-value determination of design-build proposals on some design-build projects.

- Michigan – MDOT has utilized pass/fail scoring and consensus-based evaluation for responsiveness evaluation on a few design-build projects.
- North Carolina – NCDOT uses consensus rating for evaluation of technical proposals. NCDOT requires the technical review committee to submit an overall consensus technical proposal score in various categories.
- Utah – UDOT uses pass/fail scoring and consensus evaluation in responsiveness evaluation and best-value determination of design-build proposals.
- Virginia – VDOT uses consensus evaluation and group discussions to assign scores to technical proposals in various categories. VDOT also uses pass/fail evaluations to determine proposal responsiveness.
- Washington – WSDOT has utilized adjectival scoring and consensus evaluation to determine responsiveness of design-build proposals on some projects.

CHAPTER 7

ENVIRONMENTAL ANALYSIS AND PERMITTING

National Environmental Policy Act (NEPA) planning, environmental permitting, post-award NEPA analysis, and environmental re-evaluations are often identified as the critical path for delivery of federally funded projects (Wood 2011). For projects that do not utilize federal funding, most State DOTs are required to follow their own state's environmental planning process which often is similar in scope to the NEPA process. On design-build projects, the environmental planning and permitting process, the critical path to delivery, becomes more important as the initiation of some project phases, such as final design, ROW acquisition, and construction cannot begin until the NEPA planning is complete and environmental permits are acquired. NEPA documents for design-bid-build projects have often been very prescriptive which can lead to difficulties when applied to design-build projects where design is not finalized and possible changes are anticipated from the design-build team. The design-bid-build process is typically linear with each activity occurring sequentially and the NEPA document is written to help guide the alternative selected for the project. Design-build innately has schedule efficiencies throughout this process as activities can be overlapped which reduces the overall project schedule as seen in Figure 7.1 below:

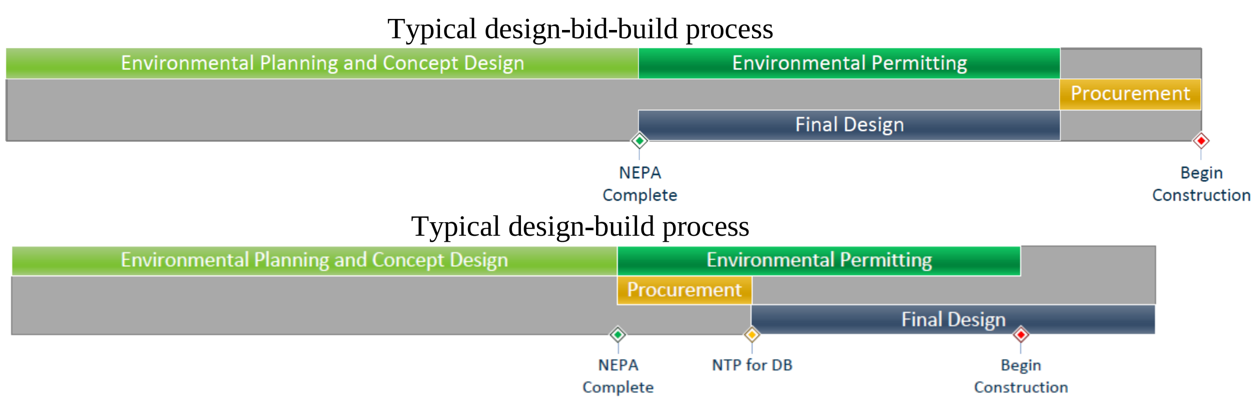


Figure 7.1

Typical Design-Bid-Build vs. Design-Build Process

Design-build also introduces complications to this process as the design and permitting requirements for the project are affected by the awarded design-build team's proposed design. Any changes to project scope, design, and impact area can cause disruptions to this critical path and delay the overall delivery schedule. For instance, post-award project changes often require modification to environmental permits and re-evaluation of NEPA planning documents that can cause delays to the delivery of the project. Construction is delayed while these documents are reviewed and approved. The environmental analysis and permitting process is typically linear as environmental resources are identified and impacts are avoided or quantified, permitted, and mitigated. All of these steps must be completed in a project area before any project can proceed to the construction stage within that area.

Design-build projects must complete all required NEPA activities and environmental permitting of design-bid-build projects, regardless if activities are overlapped. Environmental analysis activities can be grouped in three categories as the following (Texas Department of Transportation 2004):

1. Identify environmental resources and coordinate with regulatory agencies
2. Perform NEPA or environmental planning and impact mitigation
3. Acquire environmental permitting

These activities, how they are different for design-build contracting, challenges for each activity, and opportunities to overcome those challenges are discussed in greater detail throughout this chapter.

7.1 Identification of Environmental Resources and Coordination with Environmental Agencies

Identifying and quantifying impacts to the environment should be completed during the concept phase of any project. By the completion of the scoping or concept phase, the State DOT should have defined potential impacts to streams and wetlands, endangered species habitat, historic buildings or properties, archaeology resources, air quality, environmental justice, and increased noise volumes (Texas Department of Transportation 2004). These impacts are discovered and documented through coordination and special studies as part of the NEPA process and identified in the project concept report. Proper identification of environmental impacts is a major risk area in design-build projects that can have significant impacts to the project schedule. Therefore, prior to selection of a design-build team, State DOTs should work with regulatory agencies and identify all potential impacts to the environment.

Coordination with regulatory agencies early in the scoping of a project proves to result in better project decisions and more informed project solutions (Council on Environmental Quality 2007). This is beneficial to State DOTs when scoping design-build projects as they can identify potential project solutions and better quantify their impacts to the environment. Coordinating and collaborating with regulatory agencies early in the process reduce the likelihood of litigation as stakeholders are involved in project decisions and more likely to engage in problem solving when issues arise (Council on Environmental Quality 2007). Litigation is a major risk on design-build projects as it can cause drastic schedule delays if it brought on after the contract is awarded.

Unlike design-bid-build projects where the design is being advanced concurrently with the identification of resources, design-build projects during this phase should focus more on identification on project risks than actual design of the project (The Louis Berger Group, Inc. 2005). This risk identification in regards to the environmental planning and permitting process relies heavily on proper identification of environmental resources and potential environmental impacts.

7.1.1 Challenges to resource identification

7.1.1.1 Regulatory concerns with incomplete design in design-build projects

Regulatory agencies have limited staff to review and coordinate on projects (Center for Environmental Excellence 2008; Parametrix 2012). This limitation is more apparent on design-build projects where additional coordination and collaboration may be required to appropriately address and mitigate project risks and proposed alternatives. Design-build projects often involve accelerated delivery schedule and typically demand more of the regulatory agency staff time and resources.

Regulatory agencies are not typically involved in the scoping of projects outside of the NEPA process (WSDOT 2004). During the typical NEPA process, regulatory agencies are presented with set of known project alternatives or project corridor and provide comments on the alternatives or corridor. The need to properly manage environmental risks and resources on design-build projects may require agencies to identify additional areas of potential environmental resources which can cause a strain on resources.

A jointly held workshop by the Washington State DOT and regulatory agencies highlighted the following staffing concerns of the regulatory agencies:

- Agencies report that they are currently understaffed. They believe the design-build process will make this situation even worse.
- Agencies foresee a need to permit 'worst case' or 'multiple design option' scenarios, and they do not have the staff to undertake this effort.
- Agencies indicated that project decisions are made before they can become involved and they are not present for key discussions and decisions." (WSDOT 2004)

These concerns from regulatory agencies are driven by budgetary reasons. Regulatory agencies may lack the staff or travel budgets to attend numerous coordination meetings or to perform site visits (Wood 2011). Similarly, most State DOTs are facing inadequate capacity for delivery of the project. Staffing issues, particularly "the people responsible for managing the NEPA process, and the tools and technology used as part of the project development process" are generally categorized as internal NEPA risks and should be carefully analyzed prior to environmental planning (Wood 2011).

7.1.1.2 State DOT relationships with regulatory agencies

Regulatory agencies are also concerned with the pressure from design-build teams to reduce mitigation requirements. Regulatory agencies that are unfamiliar with design-build may have concerns that design-build teams will increase impacts to the environment in an effort for cost savings (Jim Cromwell, personnel communication, February 22, 2013).

State DOTs work to maintain strong relationships with regulatory agencies as they work together on numerous projects and will need to coordinate on future projects. These agencies are concerned that design-build teams will not be motivated to maintain good relationships as their motivation is financially related to the current project (The Louis Berger Group, Inc. 2007). Several State DOTs that were interviewed maintain an ownership role when coordinating with regulatory agencies. One State DOT interviewed is comfortable with design-build teams coordinating directly with regulatory agencies. A summary of concerns from regulatory agencies in each state is seen below:

- Utah DOT's (UDOT) past experience with regulatory agencies on design-build projects is that they are most concerned about protecting their interests and the environment. These agencies are concerned that design-build teams will not share these concerns and will simply look for cost cutting measures without regard to the environmental impacts (Brandon Weston, personnel communication, March 7, 2013).

- Colorado DOT's (CDOT) past experience with regulatory agencies on design-build projects is that the contract requirements protect the agency's interests (Jordon Rudel, personnel communication, February 26, 2013).

- Michigan DOT's (MDOT) past experience with regulatory agencies on design-build projects is that the regulatory agencies are not comfortable coordinating directly with design-build teams (Sheila Upton, personnel communication, February 28, 2013).
- North Carolina DOT (NCDOT) is not comfortable with design-build teams contacting regulatory agencies directly. NCDOT has strong relationships with regulatory agencies and is not willing to take a chance that a design-build team could jeopardize this (Theresa Bruton, personnel communication, March 15, 2013).
- WSDOT's past experience with regulatory agencies on design-build projects is that the regulatory agencies are concerned on what design-build teams may propose and the impacts of design-build team's proposed designs on the environment (Christina Martinez, personnel communication, February 27, 2013).
- Virginia DOT (VDOT) is comfortable with the design-build team coordinating directly with regulatory agencies (Jim Cromwell, personnel communication, February 22, 2013).

Each State DOT interviewed had a different comfort level with design-build teams coordinating with regulatory agencies, with most of them maintaining an ownership role in the coordination process.

7.1.1.3 Improper identification of resources

Identifying impacts to environmental resources is the basic step to environmental studies and permit acquisition. Proper identification or lack thereof influences the design-build team's ability to manage the project environmental risks and to efficiently design and construct the project. Improper identification and failure to adequately link these elements with the project design elements can negatively impact the schedule of the project (The Louis Berger Group, Inc. 2005).

The goal of environmental resource identification is to identify potential impacts and any environmental permits that may be required to construct the project. Environmental permits vary in complexity and the amount of time needed to acquire them. Identifying required permits early in the project development allows State DOTs to determine how best to manage the acquisition of various environmental permits.

7.1.1.4 Impact of environmental permitting on project schedule

Environmental permitting is a schedule critical task on most transportation projects. NCDOT has found that obtaining environmental permits is often the critical path to construction on design-build projects (Theresa Bruton, personnel communication, March 15, 2013). Environmental permits vary in complexity and the amount of time needed to acquire them. On design-bid-build projects, all environmental permits are typically obtained prior to advertising and awarding a contract. Design-build provides for environmental permits to be obtained in a few different ways that impact the project schedule (The Louis Berger Group, Inc. 2005):

- Obtain permits prior to awarding the design-build contract;
- Start the permit process prior to awarding the design-build contract and complete the permit post award;
- Obtain the permits after the design-build team has been selected, utilizing the design-build team’s proposed design.

Design-build allows flexibility in this process as the State DOTs have options on how to acquire the required permits; however, these options each come with their own set of challenges. State DOTs must determine which option is most beneficial to the project schedule. Incorrectly assessing the amount of time required to obtain permits can lead to poor choices in assigning the responsibility to obtain permits and can result in delays to the project schedule (The Louis Berger Group, Inc. 2007). Several State DOTs that were interviewed identified environmental permits as on the critical path of the schedule for delivery of design-build projects. A summary of State DOT approaches to permitting and their perception of obtaining permits that impact the project schedule are seen below:

- UDOT obtains all required environmental permits in advance of advertising and awarding a design-build contract. This allows the design-build team to expedite construction as they are not waiting on these to begin construction (Brandon Weston, personnel communication, March 7, 2013).

- CDOT rarely obtains permits in advance of advertising and awarding a design-build contract and often waits as long as possible to acquire permits to reduce the risk of needing permit modifications (Jordon Rudel, personnel communication, February 26, 2013).

- MDOT obtains most permits in advance of advertising and awarding a design-build contract. MDOT does not have experience with design-build projects with complex permitting, so this hasn't been an issue to date (Sheila Upton, personnel communication, February 28, 2013).

- NCDOT does not acquire any permits in advance to not limit design-build innovation by permit requirements. This has led to NCDOT identifying environmental permitting as the critical path on typical design-build projects (Theresa Bruton, personnel communication, March 15, 2013).

- WSDOT obtains most permits in advance of advertising and awarding a design-build contract. This often results in the need for permit modifications after the design-build team is on board which causes delays to the project schedule (Christina Martinez, personnel communication, February 27, 2013).

- VDOT views environmental permits as a critical element to the design-build project delivery schedule. VDOT has the design-build team obtain all permits after they are awarded the contract so that they can manage the schedule risk (Jim Cromwell, personnel communication, February 22, 2013).

State DOTs may inadvertently place environmental permits on the critical path by not advertising or awarding design-build projects until all permits have been obtained. Based on interviews with State DOTs, this challenge seems to exist regardless of the approach for managing permit acquisition.

7.1.2 Opportunities for enhancement in environmental resource identification and environmental agencies coordination

7.1.2.1 Opportunity for efficiency enhancement: State DOTs should partner with, fund positions, or co-habitat with regulatory agencies

State DOTs should partner with regulatory agencies to overcome fears that regulatory agencies will be pressured into lessening mitigation requirements (The Louis Berger Group, Inc. 2007). The partnering process will ensure that the State DOT and the agency are in alignment on the goals for the project. State DOTs and regulatory agencies have also found that the consultants on design-build teams that conduct the actual coordination with the regulatory agencies have incentive to maintain strong relationships with these agencies on future design-build and design-bid-build projects. These relationships help establish trust between regulatory agencies and the design-build team (The Louis Berger Group, Inc. 2007). Regulatory agencies have also stressed the importance of communication to keep them actively involved in the project and keep them updated on changes to the project. Keeping frequent communication helps overcome regulatory agency concerns that design-build teams are not motivated to maintain a similar strong relationship that they have with the State DOT (The Louis Berger Group, Inc. 2007). Early and consistent coordination has been identified as a best practice on any project with complex environmental permitting (Parametrix 2012).

State DOTs interviewed also identified that through partnering and coordination with regulatory agencies, they had achieved flexibility in the NEPA process and in some cases, the permitting process. A summary of each State DOT's approach and successes in partnering with regulatory agencies is seen below:

- UDOT has worked with regulatory agencies to allow for permitting based on approximately 30% design plans. Originally, regulatory agencies were uncomfortable with permitting based on an incomplete design; but through coordination and experience on design-build projects, they have developed a comfort level with this approach. UDOT values this relationship and maintains a role as a co-permittee on construction related permits that the design-build team acquires (Brandon Weston, personnel communication, March 7, 2013).
- CDOT coordinates early and often with regulatory agencies on design-build projects to keep them informed of the project status and decisions. This coordination and partnership has resulted in permit agencies focusing their efforts on the mitigation process instead of the actual strategy proposed by design-build teams or CDOT (Jordon Rudel, personnel communication, February 26, 2013).
- MDOT works with regulatory agencies to streamline the NEPA or environmental planning process where possible (Sheila Upton, personnel communication, February 28, 2013).
- NCDOT has developed a strong relationship through partnering with regulatory agencies and is the main point of contact to these agencies even after a design-build team is under contract. NCDOT extends this partnering to the awarded design-build team by coordinating a partnering session with all the regulatory agencies and the awarded design-build team to allow each agency to share their ideas and concerns on the project with the design-build team. This partnering session helps to establish trust between the regulatory agencies, NCDOT, and the design-build team and speeds up the permit process as the design-build

team knows what is important to the regulatory agencies when they are preparing the permits (Theresa Bruton, personnel communication, March 15, 2013).

- WSDOT has worked with regulatory agencies since they started using design-build project delivery. WSDOT reached out to regulatory agencies to document their concerns related to design-build and have worked to mitigate these concerns. This coordination and outreach has led to regulatory agencies' willingness to analyze project impacts without detailed design. One example of a regulatory agency issuing a permit based on 30% plans is the 401 permit for the Clean Water Act with the Environmental Protection Agency (EPA). WSDOT has committed to implementing a Post-Award Permit Management plan that becomes part of the design-build contract. This approach has allowed WSDOT to be less prescriptive in the permit and avoid modifying this permit once the final design is known (Christina Martinez, personnel communication, February 27, 2013).
- VDOT has worked with regulatory agencies on design-build projects for a number of years to the point where regulatory agencies are comfortable with the design-build process. Regulatory agencies in Virginia have been pleasantly surprised as design-build teams often reduce impacts over what is anticipated during the conceptual design for projects (Jim Cromwell, personnel communication, February 22, 2013).

A review of publications by State DOTs including design manuals and conference presentations has identified the following examples of early coordination success stories, opportunities, and State DOT requirements:

Early coordination with regulatory agencies by Washington State DOT (WSDOT)

WSDOT has identified that working with regulatory agencies during the scoping and concept phase of the project is invaluable for building trust, properly identifying resources, and evaluating potential environmental commitments (WSDOT 2004). WSDOT has identified several best practices for working with regulatory agencies on design-build projects as identified below:

- *“Coordinated Meetings with Agencies - WSDOT will provide project updates and obtain input from resource agencies and jurisdictions at regularly scheduled meetings.*
- *Mitigation Task Force – As project effects become better defined, WSDOT will invite resource agency participation in identifying appropriate project mitigation.*
- *Project Design Presentations – WSDOT will invite resource agencies to provide input on design outcomes during the project preliminary design.*
- *Project Scoping Meetings – WSDOT will record resource agency concerns about the project and identify natural resource protection objectives.*
- *Discipline Reports – WSDOT will invite cooperating agency comment on project environmental documents.*
- *Commitments Database – WSDOT will track project environmental commitments during the life of the project and incorporate them into the design-build contract. Environmental commitments will be performance based.”*

WSDOT started early partnering with the permitting agencies on the SR 520 project to streamline the NEPA and SEPA (State Environmental Policy Act) processes. This early partnering provided WSDOT with inputs on the project concept development and preliminary design. Partnering with the permitting agencies and working with them to develop a list of anticipated environmental commitments accelerated the delivery of the SR 520 design-build project (Merdith 2011).

Early coordination with regulatory agencies by Florida DOT (FDOT)

Florida DOT regularly develops an Advance Notification (AN) package that is distributed to all project stakeholders including regulatory agencies early in the plan development process. The AN provides basic project information and anticipated permits required for the project. FDOT has found that the preliminary coordination process with regulatory agencies takes six (6) to twelve (12) months (FDOT 2011).

Funding positions at regulatory agencies for large projects or the entire design-build program can overcome agency staffing worries (Parametrix 2012). This will also ensure that agency staff priorities will align with State DOT priorities to keep project critical activities moving forward (Center for Environmental Excellence 2008). This can be especially critical on large projects where several alternatives are being considered and the project corridor is extensive.

Co-locating resource agency staff with the State DOT can allow the resource agency to be involved early-on in project development and scoping decisions (Parametrix 2012). This helps ensure agency and DOT goals are in alignment and decisions can be made quickly and effectively while managing environmental concerns (WSDOT 2004).

Co-location or other staff and resource intensive methods to coordinate with regulatory agencies are not appropriate for all projects. The council on environmental quality has established four levels of collaboration in NEPA decision making. These four levels are defined below (Council on Environmental Quality 2007):

- Inform: provide sufficient objective information for regulatory agencies to understand the goals and issues of the NEPA process;
- Consult: obtain feedback on issues, goals, alternatives, and analysis from regulatory agencies;
- Involve: consistently solicit and consider regulatory agency's input throughout the NEPA process to ensure their concerns are understood and addressed in the NEPA planning;
- Collaborate: engage regulatory agencies in development of NEPA alternatives and work with them throughout the entire NEPA process.

The appropriate level of coordination should be utilized for various regulatory agencies, with the higher levels of coordination being utilized for agencies most affected by the proposed project. These higher levels of coordination can be achieved through regular coordination meetings or co-location.

These strategies will increase costs and the amount of resources required at the early planning phases of a project. These cost increases result in benefits later in the project development as the State DOT has better relationships with regulatory agencies, more project information, and a design alternative that likely has fewer impacts (Parametrix 2012). These benefits should reduce costs in later project development phases and may offset the increased costs of earlier phases.

FDOT has experimented with various methods for expediting permitting on design-build projects including:

- *"Coordinate with the permitting agencies and keep them involved in the decision making during the Project Development & Environment (PD&E) process. Having one-on-one periodic meetings with the agencies is recommended in addition to the submission of the Preliminary Coordination Package. Obtaining "preliminary" commitments from the agencies in writing during the PD&E process helps to expedite the permit application during design.*

- *Perform enough design work upfront to obtain permits during the PD&E process instead of having to apply for permits during the design phase. This would eliminate part of the permitting work from the Design-Build scope of work. Written prior concurrence from the permitting agencies will have to be obtained.*

- *Identify construction activities that can begin before final permits are received. This would enable the design consultant to start design in project features that do not require permits. The Contractor could start working in those areas while the design consultant is working in other design and permit application activities."*

These three permitting options are implemented by most State DOTs and utilizing a combination of these is considered a best practice. Early coordination should be done on all projects with complex permitting issues and as FDOT notes, permits that have lengthy acquisition times should be acquired by the State DOT prior to advertising the project in an effort to accelerate the construction for the design-build team.

7.1.2.2 Opportunity for efficiency enhancement: State DOTs should examine alternative solutions during the concept phase by clearing additional areas for each environmental special study to allow for innovation

An advantage of design-build project delivery is that it provides design-build teams the opportunity to propose alternate design solutions to more efficiently deliver the project or to provide cost savings (The Louis Berger Group, Inc. 2005). The opportunities for innovation may be limited if the environmental studies completed as part of the NEPA planning process are limited to clearing or defining a preferred alternative. On design-bid-build projects, the same consultant team typically performs both the environmental analysis and the final design. This typically leads the design team to advancing the design further than required during the NEPA process once a preferred alternative, other than the "no build" alternative, has been identified. In design-build, this work is unnecessary and can result in some undesirable consequences as found by NYDOT (NYDOT 2011):

- "Artificial constraint of options and opportunities for DB innovation and creativity;
- Elimination of potential qualified Proposers or creation of a competitive disadvantage if a Proposer's preferred means and methods are eliminated in the design process; and/or
- Duplicative design efforts and associated duplicative expenses, if the selected Design-Builder opts for a different design solution."

State DOTs should work to clear an environmental corridor as opposed to a specific design solution. This allows proposing design-build teams to work within that corridor without violating or reopening the NEPA document. Examples from several State DOTs who were interviewed can be seen below:

- UDOT allows flexibility in the environmental planning process in areas where there is minimal risk of impacts to environmental resources. This increases the importance on the necessity to properly identify these resources early in a project's development (Brandon Weston, personnel communication, March 7, 2013).
- CDOT strives to define maximum anticipated impacts for a project in their "Base Design", which is the basis for the environmental planning document. This allows the design-build team to work within the predefined maximum impacts without having to re-evaluate the environmental planning document (Jordan Rudel, personnel communication, February 26, 2013).
- MDOT's local FHWA office has pushed for projects to be classified into the appropriate level of NEPA planning document very early in a project's development. This has led to the incorporation of non-prescriptive NEPA documents, as the design is not advanced enough to provide detailed design information as the NEPA document is developed (Sheila Upton, personnel communication, February 28, 2013).
- NCDOT clears a wider than necessary environmental footprint on all highway projects regardless of the delivery method. NCDOT does this so that the design is not limited to a specific solution regardless of who completes the final design (Theresa Bruton, personnel communication, March 15, 2013).
- WSDOT works with regulatory agencies to allow maximum flexibility in the environmental planning document. WSDOT describes possible construction methods, potential impacts, and clears a wide project footprint in their environmental planning document. This allows the design-build team to propose innovative solutions that may not

have been considered during the environmental planning without requiring the document to be re-evaluated (Christina Martinez, personnel communication, February 27, 2013).

- VDOT clears as large of a design footprint as possible during the environmental planning process to provide maximum flexibility for design-build innovation (Jim Cromwell, personnel communication, February 22, 2013).

These State DOTs have realized that by clearing as wide of a footprint as possible as part of the NEPA process, they can allow for maximum innovation by design-build teams. Each State DOT interviewed takes a slightly different approach to expanding the NEPA corridor. These differing approaches are driven by each State DOT's comfort level with the risks associated with allowing the design-build team's design to determine a project's environmental impacts as well as the comfort level of their local regulatory agencies and FHWA Division Office (AASHTO 2007).

7.1.2.3 Opportunity for efficiency enhancement: State DOTs should be flexible to utilize several strategies for acquiring environmental permits

State DOTs have identified that early initiation of environmental permitting tasks that are known to have a long lead time in the concept phase will reduce their impact on the critical path of the project (The Louis Berger Group, Inc. 2005). When permitting is acquired in advance by the State DOT, risks associated with changing the permit should be transferred to the design-build team (The Louis Berger Group, Inc. 2005). This allows the State DOT to coordinate and gain approval from environmental agencies early in the process and follow through on commitments made at those early stages. This can help build trust between the State DOT and environmental agencies and may allow additional flexibility and risk transfer on future design-build projects.

There are three strategies that State DOTs can employ to obtain environmental permits (The Louis Berger Group, Inc. 2005).

- Acquire the permit in advance of the procurement of the design-build team and require the design-build team to comply with all commitments of the permit;
- Acquire the permit after procurement of the design-build team and coordinate the impacts and permit requirements based on the design-build team's proposed design (additional requirements of the design-build team can be managed through a Supplemental Agreement);
- Require the design-build team to prepare all permits on behalf of the State DOT and to incur any fees, mitigation requirements, or construction alternatives associated or incurred as a result of the permit requirements.

All three of these options are valuable to State DOTs and one or multiple options can be used on the same project based on differing complexities associated with the permitting. On most design-build projects, expedited project delivery is an important project goal; with this in mind, State DOTs should employ the strategy that allows for the fastest delivery of the project while not incurring or transferring additional or unnecessary risks to the design-build team. When considering obtaining permits in advance, State DOTs should consider the implications and probability of the permits needing to be modified after the design-build team is on board. If this modification process will reduce or eliminate the schedule benefit of obtaining the permit in advance, then the State DOT should look for opportunities to add flexibility into the permit or consider waiting to acquire the permit after the design-build team is procured (The Louis Berger Group, Inc. 2007).

Several environmental permits, such as the 404 and 401 permits that are normally completed by the State DOT during a design-bid-build project, may be better managed by the design-build team on design-build projects as the mitigation and impacts will be affected by the design-build team's proposed design (Merdith 2011). This strategy is particularly useful on permits that can be obtained while the design-build team is completing the final design of the project or constructing certain phases or sections of the project while permits are being obtained on other areas of the project (The Louis Berger Group, Inc. 2007).

Interviews with State DOTs indicated that each State has an accepted strategy for some or all permits and applies that strategy to all projects. If the State DOT employs multiple strategies, they typically utilize the same strategy for the same permit or types of permits. State DOTs that allowed design-build teams to obtain permits typically maintained an ownership role in the permit process as the permittee or co-permittee. A summary of these interviews is shown below:

- UDOT obtains all non-construction related permits in advance of advertisement of a design-build contract. This allows them to manage their relationship with the regulatory agencies and provide assurance to the regulatory agencies that their interests will be protected. UDOT does allow the design-build team to acquire construction related permits, but maintains an ownership role as the co-permittee (Brandon Weston, personnel communication, March 7, 2013).

- CDOT rarely obtains any permits in advance of awarding a design-build contract. CDOT reduces their risk and regulatory agencies' concerns by coordinating the contract language with regulatory agencies to ensure they are comfortable with the requirements the design-build team must comply with. Construction related permits are obtained by the design-build team, while more complex permits are only prepared by the design-build team and CDOT maintains ownership by reviewing and submitting the permits to the regulatory agencies. (Jordon Rudel, personnel communication, February 26, 2013).

- MDOT obtains all permits in advance of advertising and awarding a design-build contract. MDOT obtains all permits in advance to mitigate regulatory agencies' concerns that the design-build team will push them to permit environmental impacts that they are not comfortable with (Sheila Upton, personnel communication, February 28, 2013).

- NCDOT used to acquire all permits in advance of advertising and awarding a design-build contract. They found that acquiring permits in advance limited design-build innovation as design-build teams were more eager to comply with the existing permit requirements than take the schedule risk for permit modifications. NCDOT now requires the design-build team to prepare all permits and submit them to NCDOT for review and submittal to regulatory agencies. NCDOT maintains the permittee role for all permits (Theresa Bruton, personnel communication, March 15, 2013).

- WSDOT tries to acquire all permits in advance of awarding a design-build contract which could result in WSDOT becoming responsible for long term mitigation and/or maintenance such as the Section 401 permit for the Clean Water Act. WSDOT allows the design-build team to acquire all construction related permits and WSDOT typically does not maintain a role in obtaining these permits (Christina Martinez, personnel communication, February 27, 2013).

- VDOT transfers the requirement for all permit acquisition to the design-build team. VDOT is not involved in the permit process and is not the permittee. VDOT requires the design-build team to manage the permit process. VDOT maintains an oversight role requiring the design-build team to provide evidence that all permits have been acquired prior to issuing Notice to Proceed (NTP) for land disturbing activities (Jim Cromwell, personnel communication, February 22, 2013).

It has been cited a best practice to identify and select a permit acquisition strategy that best fits a specific project or permit requirement. However, our interviews with leading State DOTs indicate that each State seems to have a general permit acquisition strategy that is based on the type of permit with most State DOTs maintaining an ownership role in all but the basic construction related permits.

7.2 NEPA and Quantification and Mitigation of Environmental Impacts

The National Environmental Policy Act (NEPA) of 1969 established a national policy to "encourage productive and enjoyable harmony between man and his environment (National Environmental Policy Act 1969)." This act created the Council on Environmental Quality (CEQ) and set policy on how the Federal Government must evaluate the impacts of a project on the environment. This process was further guided by the CEQ in 1978 which issued Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR §§ 1500–1508).(FHWA n.d) These procedures established three levels of environmental actions, documentation requirements, commenting and public involvement processes, and document filing requirements. The CEQ relations also required each federal agency to develop its own regulations to comply with NEPA (UDOT 2009). To be eligible for federal funding for transportation activities, agencies must comply with the following activities (UDOT 2009):

- *"Comply with all applicable environmental requirements, including NEPA and Section 4(f) of the Department of Transportation Act of 1966.*
- *Prepare documentation of compliance to a level appropriate to the undertaking's potential to cause significant harm to the environment.*
- *Evaluate alternatives (including a no-action or no-build alternative) and make decisions that balance the need for the project with the social, economic, and environmental impacts of the project.*
- *Inform governmental entities and the public and give them an opportunity to be involved in decision-making.*
- *Implement measures to avoid, minimize, or mitigate environmental impacts."*

Federal guidelines, 23 CFR 771.115, have established three classes of action that determine how agencies must comply with NEPA. The three classes of action are (UDOT 2009):

- *"Class I – Environmental Impact Statement (EIS) is prepared for projects that would cause a significant adverse effect on the environment.*

- *Class II – Categorical Exclusion (CE) is prepared for projects that would cause minimal social, economic, or environmental impact.*

- *Class III – Environmental Assessment (EA) is prepared for larger-scale projects that do not meet the requirements for a CE or those for which the significance of the environmental impact is not clearly established. If the environmental analysis and interagency review during the EA process find that a project would have no significant impacts on the environment, a Finding of No Significant Impact (FONSI) is issued. If the review finds that the project would have significant impacts, an EIS must be prepared."*

State DOTs work with FHWA to determine which class of environmental action is appropriate for each project. Once a class of action has been determined, State DOTs begin navigating the NEPA process. Completing the NEPA process is the major goal of the preliminary phase of a project.

NEPA documents for design-bid-build projects have often been very prescriptive in each of the "special studies" that compile the document as well as in the alternative selected for the project. Several State DOTs, such as Colorado, Washington, Virginia, Michigan, and North Carolina have learned that adding flexibility to NEPA documents can prevent the need for NEPA re-evaluations after letting and accomplish the goals of the project without limiting innovation opportunities by design-build teams (ICF Consulting 2008).

State DOTs currently follow Federal Guidelines in regard to NEPA planning and design-build project delivery. The guidelines that control design-build contracting are listed under the Code of Federal Regulations (CFR) Title 23: Highways, Part 636 – Design-Build Contracting; Section

636.109 of this title indicates the rules that State DOTs must follow when completing the NEPA process with respect to design-build delivery method. These guidelines allow a State DOT to advertise and award a design-build contract prior to the completion of the NEPA document provided that the following stipulations are met:

- Only Preliminary Design is advanced until the completion of the NEPA planning process
- The design-build contract must include appropriate provisions ensuring that all environmental and mitigation measures identified in the NEPA document will be implemented
- The design-build team must not prepare the NEPA document or have any decision making responsibility with respect to the NEPA process
- Any consultants who prepare the NEPA document must be selected by and subject to the exclusive direction and control of the contracting agency
- The design-build team may be requested to provide information about the project and possible mitigation actions, and its work product may be considered in the NEPA analysis and included in the record
- The design-build contract must include termination provisions in the event that the no-build alternative is selected

7.2.1 Challenges in NEPA and quantification and mitigation of environmental impacts

7.2.1.1 Conventional prescriptiveness constraints of NEPA

Regulatory agencies have been working with the NEPA process on design-bid-build projects for over 40 years. On a typical design-bid-build project, as the project design develops, the design parameters are written into the NEPA document and corresponding “special studies” to document the exact impacts of the project's design on the environment. Design-build lends itself to the final design differing from preliminary design as the design-build teams propose innovative ideas or work to design and construct a more cost-effective project while meeting the project goals. Design-build team's innovation is often constrained by the requirements written into the NEPA document that limit innovation opportunities or trigger a NEPA re-evaluation (Wood 2011).

Several studies have been conducted to identify sources of project delay related to the NEPA process. The NEPA process is a wide reaching process that is based on evaluating alternatives and balancing environmental impacts across alternatives and resources (AASHTO 2007). Individual statutes governing the special study areas of air, water, parks, historic properties, rare and endangered species, and other resources are narrowly defined. This narrow definition is further complicated by a lack of guidance on how to compare and balance impacts across areas (AASHTO 2007). This coupled with inconsistent mandates and variations and rigid interpretations in policy and regulations compound the time required for the NEPA planning process (Parametrix 2012; AASHTO 2007).

7.2.1.2 Mitigation of NEPA impacts while not limiting innovation

As part of the NEPA process, State DOTs are required to identify and evaluate all relevant and reasonable measures to mitigate the impacts to the environment caused by transportation projects (FHWA n.d). The CEQ has defined mitigation as:

- *"Avoiding the impact altogether by not taking a certain action or parts of an action.*
- *Minimizing impacts by limiting the degree or magnitude of the action and its implementation.*
- *Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.*

- *Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.*
- *Compensating for the impact by replacing or providing substitute resources or environments."*

These approaches should be evaluated sequentially with avoidance being considered the first option and compensating for the impact as the final option (FHWA n.d). The documentation of mitigation measures is referred to in the NEPA process as a commitment. Environmental commitments can be generated under different laws, regulations, or procedures which may overlap. The overlap of laws, regulations, and procedures can cause challenges when developing commitments as they can become unclear, inconsistent, or contradictory (UDOT 2009). Examples of additional environmental laws, regulations and procedures can be seen below:

- Title VI of the Civil Rights Act of 1964
- Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970
- Americans with Disabilities Act
- Executive Order 12898 (Environmental Justice)
- Section 4(f) of the Department of Transportation Act
- Clean Air Act
- Safe Drinking Water Act
- Farmland Protection Policy Act
- Resource Conservation and Recovery Act of 1976
- Comprehensive Environmental Response, Compensation, and Liability Act
- National Historic Preservation Act

- Archaeological and Historic Preservation Act
- Section 6(f) of the Land and Water Conservation Act
- Endangered Species Act
- Executive Order 11988 (Floodplain Management)
- Executive Order 11990 (Protection of Wetlands)

State DOTs must work to ensure that mitigation measures do not conflict with one another and do not limit opportunities for the design-build team to provide innovation (AASHTO 2007). AASHTO has written recommendations on ways to optimize the current process and ways that the current process can be improved by reforming environmental laws to integrate them and eliminate conflicts (AASHTO 2007). To date, it does not appear that current transportation legislation has attempted to take into account these recommendations.

7.2.1.3 Permit agency concerns about pressure from design-build teams

Permitting agencies are also used to seeing permits and mitigation being written to mitigate for exact impacts to the environment. To be able to permit a project, agencies desire the same level of design information that they are used to seeing (WSDOT 2004). Agencies are concerned that the effects of the project that must be known and understood to allow permitting to occur will not be available under design-build if the design is not developed to the level of detail required for permitting. Agencies prefer to permit for actual impacts and not for hypothetical situations that a design-build team may or may not comply with (The Louis Berger Group, Inc. 2007).

Resource agencies will consider permitting for the worst case scenario a solution; but in these cases, they often want the level of mitigation to remain the same even if the environmental impacts are decreased. Regulatory agencies have a history of working with State DOTs and there is a familiarity and level of trust between the two (The Louis Berger Group, Inc. 2007). Agencies are worried that design-build teams will attempt to reduce permitted mitigation requirements if their proposed design reduces impacts. By performing advance permitting, agencies want assurances that the design-build team will comply with the agreed mitigation regardless of the impacts of the final design (WSDOT 2004). Additionally, resource agencies that are inexperienced working with design-build teams may worry that design-build teams will not complete the mitigation requirements of the permits or will try to substitute alternate mitigation measures (The Louis Berger Group, Inc. 2007). Interviews with State DOTs identified that each has received input from regulatory agencies on their comfort level with design-build projects and the role of the State DOT and the design-build team. A summary of these interviews is below:

- UDOT works with regulatory agencies to obtain permits based on approximately 30% plans. This level of plan development for permitting makes regulatory agencies uncomfortable, but they have been willing to permit projects with this low level of design. UDOT would like to utilize incentive based permits on design-build projects, but regulatory agencies have been unwilling to allow this to date (Brandon Weston, personnel communication, March 7, 2013).

- CDOT has worked with regulatory agencies for a number of years on design-build projects and has established a comfort level with them. CDOT works with agencies to establish contract requirements and permits are obtained using the detailed design plans prepared by the design-build team (Jordon Rudel, personnel communication, February 26, 2013).

- NCDOT has a strong working relationship with regulatory agencies. NCDOT does not allow the design-build team to coordinate directly with regulatory agencies and acts as the main point of contact. Regulatory agencies are comfortable with this process (Theresa Bruton, personnel communication, March 15, 2013).

- WSDOT has had problems with the design-build team complying with permit requirements for construction related permits that are acquired by the design-build team. WSDOT is seeing that design-build teams are not always motivated for strict permit compliance and that typical monetary fines are seen as the cost of doing business. Regulatory agencies are pushing for WSDOT to play a larger role in enforcing compliance (Christina Martinez, personnel communication, February 27, 2013).

- VDOT originally encountered fears from regulatory agencies that design-build teams would increase impacts to the environment in an effort to find cost savings. Regulatory agencies have been surprised as design-build teams have typically reduced impacts vs. what was originally anticipated (Jim Cromwell, personnel communication, February 22, 2013).

State DOTs with experienced design-build programs seem to have overcome the fears of regulatory agencies. However, as WSDOT has learned, State DOTs must be involved in enforcing permit compliance.

7.2.2 Opportunities for enhancement in NEPA and quantification and mitigation of environmental impacts

7.2.2.1 Opportunity for efficiency enhancement: State DOTs should add flexibility to the NEPA document and special studies by identifying alternative mitigation strategies, maximum impacts, and performance mitigation measures.

State DOTs can encourage innovation in design-build teams by adding an appropriate level of flexibility to the NEPA document specifications. State DOTs have found that flexibility in the NEPA document and being less prescriptive in terms of design solutions results in higher levels of innovation (Kross 2007). This means that the focus of the NEPA document should be to clear a footprint for the construction of the project and not to design a solution to the project's need and purpose. This innovative solution often leads to lower project cost and win-win outcome for the State DOT and the design-build team. State DOTs have identified that by using performance mitigation for NEPA commitments, they can increase design-build innovation. A common form of performance based mitigation is for sound barriers for noise abatement.

Use of Performance specification for Noise Abatement

Design-bid-build projects often layout prescriptive parameters for noise abatement walls, often providing a station range, wall height, and centerline offset for the noise walls. This level of prescriptiveness can limit design-build team's opportunities to modify the design as shifting the noise walls would require a re-evaluation of the NEPA document. FHWA has identified that Transportation Departments can instead determine the level of noise abatement required for the project but let the design-build team determine how best to achieve that level of noise abatement (Alexander 2009). This requirement can be included in the RFP as a performance specification that the Department can verify by modeling the design-build team's proposed solution and conducting an after construction noise assessment to confirm that the impacts were abated as required by the NEPA document. This flexibility saves time in the delivery of the project by reducing the chance for the project to need a re-evaluation of the NEPA document and reduces the level of design required by the State DOT prior to project advertisement and award to a design-build team. Innovation is also promoted as design-build teams are not limited by the specific requirements for the location and height of the noise abatement barrier and are able to propose locations for the noise abatement barrier that may differ from the NEPA planner or State DOT's initial ideas for their location. Without this flexibility, a shift in the location and change in the height of a noise abatement barrier would cause the NEPA document to be Re-Evaluated and potentially delay the project.

Some examples from various RFPs of several State DOTs are shown below:

Transfer of design and construction of noise barriers in VDOT

VDOT transfers the design and construction of the noise barriers to design-build teams. They require that the design-build team follow the mitigation guidelines established in the Noise Analysis completed as part of the NEPA process. The basic design process is described below:

The Design-Builder will provide permanent noise mitigation in compliance with the Virginia State Noise Abatement Policy and the Highway Traffic Noise Impact Analysis Guidance Manual. The final barrier location(s) and dimension(s) will be determined during the final design noise analysis. A Noise Abatement Design Report (NADR) shall be furnished by the Design-Builder at its sole cost and expense. The final noise mitigation design will utilize the design year traffic volumes defined in the reevaluation of the Preliminary Noise Analysis (date to be determined) and associated noise levels.

Once the design of the noise barriers is complete and has been approved by VDOT and FHWA, VDOT requires the design-build team to provide a copy of the design report to all beneficiaries of the noise barrier. This includes coordination and completion of citizen survey which also requires concurrence from VDOT.

Transfer of design and construction of noise barriers in Texas DOT (TxDOT)

Texas DOT also transfers the design and construction requirement of noise barriers to the design-build team. They do this with minimal contract language and instead rely on their design manuals to govern how the wall is designed and constructed. The main requirement of the contract is for the noise barrier to comply with the decibel reduction requirements of the NEPA document as seen below:

- *Design-Build Contractor shall design and construct the noise/sound walls to achieve the decibel reduction requirement in the NEPA Approval(s).*
- *Panel design and construction shall limit the risk of falling debris resulting from traffic impacting the sound wall.*
- *Timber sound walls are not allowed.*

Transfer of design and construction of noise barriers in NCDOT

NCDOT requires the design-build team to design and construct the noise barrier, but their RFP language implies that they provide more than just a decibel reduction requirement. They only require the design-build team to design the wall envelopes which implies that the noise report documents the height requirements of the noise barrier. NCDOT does transfer the risk of design changes that impact the noise barrier to the design-build team by requiring them to revise the noise report if necessary and design and construct the noise wall as necessary. Example language from an NCDOT RFP that includes noise barriers is shown below:

> *The Design-Build Team shall design and construct the sound barrier walls listed in the April 4, 2012 Design Noise Report and perform all geotechnical investigations necessary to design the foundations. The Design-Build Team shall be responsible for the wall envelope details. If the Design-Build Team revises the horizontal and/or vertical alignments such that greater noise impacts are possible on surrounding receptors, the Design-Build Team shall reanalyze and complete a revised noise report, if necessary, for NCDOT and FHWA review and acceptance. The April 4, 2012 Design Noise Report will be provided to the Design-Build Team to assist in their determination of anticipated additional noise impact on current receptors due to design changes. If adjustments to, or addition of, sound barrier walls are required as a result of design deviations, the Design-Build Team shall be responsible for all costs associated with the adjustments and/or additions.*

Transfer of design and construction of noise barriers in Missouri DOT (MoDOT)

MoDOT transfers the responsibility for designing and constructing noise barriers to design-build teams without providing any documentation or any noise analysis. The design-build team is responsible for determining where noise barriers are feasible based on a cost per benefited receptor requirement. This contract language may be considered too risky for design-build teams as it may be difficult to bid without knowing if noise barriers are feasible or not. Contract requirements of the design-build team are:

> *The Contractor shall provide noise mitigation in accordance with MoDOT's Traffic Noise Policy for a Type I Project and with 23 CFR Part 772. Noise analysis*

shall be performed using FHWA's Traffic Noise Model version 2.5. Existing noise levels have been determined and are provided in Book 4.

If walls are used for noise mitigation, the cost of a noise wall must not exceed $30,000 per benefited receptor. The cost index shall be calculated using a cost of $20 per square foot for a noise wall. The cost per residence shall be calculated over the length of the project. That is, the cost of all noise walls must not exceed $30,000 multiplied by the total number of benefited receptors from Ballas Road to the [easternly] *project limits.*

Further complicating the process, once the design-build team completes the noise abatement analysis, the benefited receptors are allowed to vote by simple majority if the barrier will be constructed. This uncertainty is difficult for design-build teams to quantify and MoDOT and other State DOTs may benefit by performing some of this effort in advance of advertising a project. An example of this language is shown below:

The Contractor shall conduct the noise analysis from Ballas Road to the eastern terminus of the Project and determine the need for sound abatement within these limits. Information on proposed sound abatement, including proposed noise levels and the type, size, and location of the abatement measures shall be provided to MoDOT for Approval. MoDOT will present the proposed sound abatement design to the benefited receptors. Each benefited receptor will receive one vote in determining if the sound abatement will be constructed. A simple majority of benefited receptors, for a section from interchange to interchange, will determine if the sound abatement is to be constructed. MoDOT will complete this voting process within 45 days of receiving the sound study and design information from the Contractor. Once MoDOT completes the voting process, MoDOT will then provide the results to the Contractor so the Contractor can proceed with *construction of the sound abatement. If a majority of benefited receptors for a section vote "no" on abatement, noise abatement shall not be constructed.*

Use of performance based mitigation for other types of environmental impacts

Interviews with State DOTs indicated that there is a desire within State DOTs to push for more performance based mitigation strategies. One area that State DOTs are gaining the ability to use a type of performance mitigation is for stream and wetland impacts. This is done by identifying streams and wetlands within the corridor in the NEPA document and stating that they may be impacted by the project. The design-build team becomes responsible for determining actual impacts and often the mitigation associated with those impacts through the permit process.

State DOTs that were interviewed have had success using broad descriptions of impacts or by using language that describes potential impacts. This approach has allowed design-build teams to propose changes to a project's design without triggering time consuming re-evaluations of the NEPA or State environmental planning document. Excerpts from our interviews with various State DOTs who utilize broad descriptions of potential impacts can be seen below:

- UDOT incorporates limited flexibility in their NEPA documents. NEPA documents are vague and flexibility is left for the project's final design in areas where there is minimal chance that the proposed design could affect environmental resources. While this approach does not allow for maximum flexibility for design-build teams, it protects UDOT's and regulatory agency's interests while providing for flexibility in areas where impacts to the environmental are not as much of a concern (Brandon Weston, personnel communication, March 7, 2013).

- CDOT uses a "Base Design" in the preparation of their NEPA documents. CDOT strives to define maximum impacts in the "Base Design" (Jordan Rudel, personnel communication, February 26, 2013).

- MDOT's local FHWA division has pushed MDOT to identify what level of NEPA document is required for a project at very early stages of a project's design. This has led to very non-prescriptive NEPA documents, as the design has not progressed far enough to quantify exact impacts. Due to the non-prescriptive nature of MDOT's NEPA documents, re-evaluations are not common on MDOT projects (Sheila Upton, personnel communication, February 28, 2013).
- NCDOT tries to examine a wide corridor and describe potential impacts on all projects regardless of the delivery method. This allows for the design to change without requiring a re-evaluation (Theresa Bruton, personnel communication, March 15, 2013).
- WSDOT has partnered with regulatory agencies and their local FHWA division to allow for maximum flexibility in the NEPA document. WSDOT does not define a worst case scenario, but discusses likely construction methods and their potential impacts. This allows design-build teams to propose innovative designs that may alter environmental impacts. WSDOT strives to clear a corridor for the design-build team to be able to work within (Christina Martinez, personnel communication, February 27, 2013).
- VDOT clears a large footprint for the project so that design-build teams have maximum flexibility when completing the final design and construction. VDOT clears a corridor larger than what they anticipate a design-build team would impact by the proposed project (Jim Cromwell, personnel communication, February 22, 2013).

Each State DOT interviewed has a different comfort level, allowing for flexibility in the NEPA document. For design-build contracts, any flexibility offered to the design-build team increases the opportunities for innovation.

Use of broad description of impacts in NEPA

While several State DOTs often use prescriptive language in developing NEPA documents, some state and Federal agencies commonly use broad language to describe impacts on their NEPA documents and corresponding "special studies". This broad language creates flexibility in the final design and construction of the project without requiring the NEPA document to be updated every time a design change is made. Below is an example from an approved Environmental Assessment, which resulted in a Finding of No Practical Alternative (FONPA), for Robins Air Force Base in Georgia for the construction of basinwide improvements for stormwater drainage. The lead Federal Agency on this project is the U.S. Army Core of Engineers (USCOE) (URS Group, Inc 2012). The quote below from the NEPA document describes permit requirements of the agency and contractor without describing actual impacts or mitigation. This allows the agency to finalize these impacts in the final design and permitting stage of the project without needing to re-evaluate the NEPA document:

> *"Adverse impacts to streams/wetlands or floodplains may be acceptable only if there is no practicable alternative, potential impacts have been minimized, and compensatory mitigation is provided for unavoidable adverse impacts. Because of the location of the existing culverts and the need to upgrade the culverts within the same footprint, there is no practicable alternative that would meet the project requirements. Therefore, the Proposed Action must be located within the previously indicated streams. 78 CEG/CEAO has prepared a Finding of No Practicable Alternative (FONPA) to explain the necessity of working in the subject streams. <u>In addition, the construction activities would be minimized to the maximum extent practicable and would comply with appropriate local, state, and federal regulations and permits, as well as an approved Erosion, Sediment and Pollution Control Plan. Therefore, construction of the Storm Water Drainage System (SWDS) improvements would result in insignificant adverse impacts to surface waters on Robins AFB.</u>*

This document complies with NEPA and CEQ regulations through language describing how impacts will be mitigated and why the impacts are necessary. This example shows that impacts can be described in general terms (URS Group, Inc. 2012).

> *The total area of impact to the wetland (estimated to be approximately 0.1 hectare [0.3 acre] of new impact) and required wetland mitigation, if any, would be calculated prior to construction using the final design plans and wetland boundary delineation. Project 27/b would be fully coordinated with the USACE, Savannah District and would comply with the appropriate Clean Water Act (CWA) Section 404 permit. Because the programming date for this project precludes Section 404 coordination at this time, coordination would occur at an appropriate future time prior to construction.*

This document was developed prior to final construction plans being finalized, as is a commonality on design-build projects. Impacts are approximated and final mitigation and permitting is allowed to stand on their own, separate from this document. This strategy allows the USCOE to achieve an approved NEPA document while not describing final project impacts and not requiring the document to be subject to a re-evaluation if the final impacts differ from what is anticipated when the NEPA document is developed. This language discusses impacts to wetlands that will be incurred by the project but the language is broad enough that the design and permitting are able to stand alone as the exact impacts are not described in the NEPA document (URS Group, Inc 2012).

Missouri DOT (MoDOT)

MoDOT has identified that incorporating flexibility into the NEPA document allows design-build teams to propose innovation (Kross 2007). Missouri DOT strives to focus on the footprint of the proposed project instead of a design solution. This innovation has led to lower costs and quicker delivery of projects. MoDOT's Safe and Sound Bridge Program also provides an excellent example of identifying acceptable mitigation measures, performance mitigation measures, and defining maximum environmental impacts (Jim Peterson, personnel communication, 2009). This project replaced over 800 structurally deficient bridges in Missouri and obtained a NEPA document for all of the bridges in approximately one year. The NEPA document identified maximum allowable impacts for each bridge and acceptable mitigation strategies based on the actual impacts of the proposed bridge replacement by the design-build team (Jim Peterson, personnel communication, 2009). MoDOT used a Practical Design Guide as guidance for all bridge designs, balancing traditional wants of AASHTO and MoDOT with the needs of the facility being designed and constructed as quickly and cost effectively as possible (Jim Peterson, personnel communication, 2009). Requirements for impacts to streams and wetlands were included in the RFP as seen in the contract language below:

> ***"5.3 Wetlands and Waters of the US***
>
> *<u>The Contractor shall fulfill the terms and conditions of both the Clean Water Act Section 404 permit and the Section 401 Water Quality Certification, as required by the U.S. Army Corps of Engineers (USACE) and the MoDNR, respectively.</u> The Contractor shall integrate design practices to avoid and/or minimize potential Work impacts to wetlands and waters of the U.S. The Contractor shall participate in the development of all stream and/or wetland mitigation required to fulfill the permitting requirements, as described in Book 2, Section 5.9.*
>
> *The Contractor shall maintain the natural low flow characteristics of all stream crossings, including temporary crossings.*
>
> *The Contractor shall provide the following deliverable; cut and fill quantities, location of impacts and bridgework design plans including cross-sections as necessary to secure Clean Water Act Section 404 permits and 401 certificates.*
>
> *<u>For Work on Project Bridges that have one-tenth or less acre permanent fill in waters of the US and no other environmental impacts, no pre notification to</u>*

the USACE is required. These preliminary plans do not require cross-sections and can be approved within one month."

This contract language allowed the 401 and 404 permits to stand on their own and for the design-build team to comply with all requirements of these permits. As indicated in the last paragraph, MoDOT coordinated with the United States Army Core of Engineers (USACE) to streamline the process for impacts under 0.1 acres of permanent impact to streams and wetlands.

7.2.2.2 Opportunity for efficiency enhancement: State DOTs should establish programmatic agreements with federal and environmental agencies to streamline the environmental planning and permitting process and to provide flexibility in the NEPA document

Programmatic agreements with Federal and Environmental agencies can streamline the development of the NEPA document by providing pre-approved mitigation measures for various environmental impacts. The FHWA Every Day Counts (EDC) Initiative suggests continuous and expanded use of programmatic agreements to save time and streamline the processes for acquiring various permits (Every Day Counts 2012). Agreements between State DOTs and Federal and Local agencies result in streamlined project reviews and often lead to improved relationships. When programmatic agreements exist for avoiding, minimizing, and mitigating impacts, projects can be reviewed much more quickly. Equally important, these agreements provide an essential foundation for shared understanding and effective working relationships between State DOTs and regulatory agencies. Expanding the use of programmatic agreements has proven valuable in streamlining project reviews, reducing project implementation time and increasing trust among State DOTs and regulatory agencies (Every Day Counts 2012). Programmatic agreements allow for project level decisions to be governed by a larger agreement that expedites decision making and streamlines project level agreements (Parametrix 2012).

The State DOTs should have two goals when expanding the use of programmatic agreements (Every Day Counts 2012):

- "*Identifying situations in which new programmatic agreements will be beneficial; and*
- *Assisting in expanding existing Programmatic Agreements to a regional, statewide, or national level. Divisions and State DOTs should explore which program areas could benefit from using Programmatic Agreements on a regional scale. Divisions should then coordinate with neighboring states to highlight and prioritize opportunities to create multistate and/or regional programmatic agreements."*

There are two common challenges to expanding the use of programmatic agreements (Center for Environmental Excellence 1999):

- Lack of trust between the Agencies; and
- Worries that mitigation will not be adequate for the impacts.

State DOTs can overcome these challenges by initially using programmatic agreements for simple issues and then as the relationships between agencies are strengthened through the trust formed by following through on these Programmatic Agreements, the use of programmatic agreements can be expanded to situations that require more complex mitigation strategies (Center for Environmental Excellence 1999).

Programmatic agreements with federal and environmental agencies can allow the State DOT to create performance measures for the mitigation of environmental impacts. Environmental impacts are typically quantified based on exact impacts according to actual impacts identified by the preliminary design (Venner Consulting 2005). Mitigation measures are then designed specifically for that preliminary design. On design-build projects, quantifying and subsequently mitigating for specific impacts may lead to more frequent re-evaluations of the NEPA document if the proposed design change affects the previously quantified impacts. This limits opportunities for innovation and depending on the aggressiveness of the project schedule may dis-incentivize innovation by the design-build team since they will avoid any changes that may trigger a re-evaluation. Programmatic agreements often are based on performance measures, but can simply be a list of acceptable mitigation strategies based on different thresholds and types of impacts (Venner Consulting 2005). State DOTs that were interviewed identified that programmatic agreements were beneficial to expediting the NEPA and permitting processes, but none of the State DOTs mentioned programmatic agreements that were specific to design-build. Some useful programmatic agreements that were identified in the interviews are summarized below:

- UDOT has a programmatic agreement with the State Historic Preservation Office (SHPO) and USACE for history and Section 106 compliance. This programmatic agreement speeds up the overall NEPA process as impacts to historic properties are more efficiently mitigated (Brandon Weston, personnel communication, March 7, 2013).

- CDOT identified that they have programmatic agreements with various regulatory agencies to aid the NEPA process (Jordan Rudel, personnel communication, February 26, 2013).

- MDOT utilizes a programmatic agreement that the Michigan Department of Environmental Quality (DEQ) has with USACE which allows the DEQ to sign off on 404 permits that are not in a Section 10 Navigable Waterway. This results in MDOT being able to obtain 404 permits on average in under 2 months. The 404 permit process in other states can take from six months to over a year depending on the level of permit required (Sheila Upton, personnel communication, February 28, 2013).

- MDOT has programmatic agreements with SHPO that allows MDOTs historians and archaeologists to sign off on most history and archaeology studies without submitting them to SHPO for review (Sheila Upton, personnel communication, February 28, 2013).

- NCDOT has a programmatic agreement with FHWA, USACE, North Carolina DNR and several other partnering agencies which allows for the 404 permitting and NEPA environmental process to be done concurrently. This process includes seven concurrence points where all affected agencies sign off on the project as currently designed and agree to the mitigation and avoidance measures proposed. This process expedites the permit process and requires all agencies to work together towards a common goal (Theresa Bruton, personnel communication, March 15, 2013).

These State DOTs have realized time savings in a project's development and NEPA planning process by using programmatic agreements to expedite the planning and permitting process. While these programmatic agreements aren't written specifically to aid design-build projects, they do allow State DOTs to expedite their delivery.

Programmatic agreements may also include recommendations to include incentives in the contract for reducing impacts to the environment and can allow State DOTs to establish maximum impacts within the NEPA document and special studies (Venner Consulting 2005). These maximum impacts are then quantified and considered in the NEPA decision and design-build team is incentivized to reduce the impacts where possible. This flexibility also reduces the chance that changes proposed by the design-build team will initiate the need for a NEPA re-evaluation or permit modifications.

Use of Programmatic agreements in Missouri DOT

Missouri's Safe and Sound bridge program which cleared over 800 bridges in approximately one year was made possible largely by the development and implementation of programmatic agreements with environmental agencies that had jurisdiction over environmental resources impacted by the bridge's replacement (Jim Peterson, personnel communication, 2009). These programmatic agreements provided design-build teams with acceptable mitigation strategies based on the level and type of impact to an environmental resource.

Use of Programmatic agreements in Oregon DOT

Oregon DOT has obtained programmatic agreements that they consider applicable to all design-build projects. Below is the language they include in all design-build RFPs to add flexibility for the design-build team:

> ***"(5) Programmatic Agreements*** - *The following programmatic agreements may be applicable to the Project:*
>
> - *Peregrine Falcon Management Plan with Oregon's Department of Fish and Wildlife (ODFW)*
> - *Programmatic drilling agreement with National Marine Fisheries Service (NMFS)*
> - *Programmatic permits and agreements Agency has developed as part of the Oregon Transportation Improvement Act (OTIA) III Statewide Bridge Delivery Program, Oregon, including:*
>   - *Regional General Permit for ODOT Bridge Repair and Replacement, including 401 certification (US Army Corps of Engineers), July 29, 2004, Permit No. 200400035*
>   - *Informal Concurrence and Formal Biological Opinion and Conference & Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation, OTIA III Statewide Bridge Delivery Program, Oregon (United States Fish and Wildlife Services (USFWS) and NMFS), June 28, 2004*
>   - *Memorandum of Agreement with USDA Forest Service and BLM, July 2004"*

In addition, Oregon transfers the risk that if the programmatic agreements are not applicable to the project, then it is the responsibility of the design-build team to notify Oregon DOT as such with appropriate documentation.

> ***"(6) Environmental Performance Standards*** *- As part of the programmatic permitting and agreements, environmental performance Standards have been developed which are applicable to OTIA III Bridge projects. These programmatic permits and agreements shall be utilized and complied with, to the extent feasible, in the performance of the Work. If Design-Builder concludes that the programmatic permits and agreements are not feasible for the Project, Design-Builder shall submit documentation explaining the basis of that conclusion to Agency Project Manager. The documentation shall address impacts to Project scope, schedule, budget and the ability to meet the OTIA III Program goals. The documentation will be included in the Environmental Compliance Plan."*

Use of Programmatic Agreements in Iowa DOT (IA-DOT)

IA-DOT, FHWA, USACE, US Fish and Wildlife Service (USFWS), EPA, and Iowa DNR have entered into a programmatic agreement to streamline the mitigation process for unavoidable adverse impacts on transportation projects. This process was developed to create more flexible and ecologically responsive mitigation framework for permitting. Since this programmatic agreement is between three major permitting agencies and FHWA, the document allows for the integration of multiple natural resource issues and regulatory requirements into a single process that better facilitates permit compliance and resource management (Center for Environmental Excellence 2013).

7.2.2.3 Opportunity for efficiency enhancement: State DOTs should acquire time-consuming and high-risk permits early on and leave non-critical permits to be attained by the DB team

Environmental permits are typically required for a State DOT to comply with regulatory environmental agencies, state, federal, and local laws. On a design-bid-build project, the State DOT typically obtains all required environmental permits prior to advertisement and letting. On design-build projects, State DOTs are increasingly choosing to transfer the responsibility for preparing and obtaining environmental permits to design-build teams, especially those permits that are dependent on the final design solution proposed by the design-build team. State DOTs practice three major environmental permitting strategies on design-build projects (Molenaar 2005):

- The State DOT secures permits and the design-build team is responsible for modifying and/or complying with permits.
- The State DOT secures some early action high risk permits and the design-build team is responsible for modifying and complying with those permits as appropriate, as well as for obtaining the remaining permits.
- The design-build team is responsible for obtaining and complying with all permits.

The State DOT should consider acquiring the most critical permits or those with the highest risk prior to the advertisement of design-build projects, with responsibility transferred to the design-build team for any amendments and changes that must be approved by the sponsoring or regulatory agency (The Louis Berger Group, Inc. 2005). Several State DOT interviews indicated that many State DOTs take the approach of acquiring most non construction related permits in advance to reduce risk to design-build teams and to expedite design-build team's ability to move to construction.

A summary of State DOTs that were interviewed who obtain most permits in advance can be seen below:

- UDOT acquires all environmental related permits in advance of advertising design-build projects to allow the design-build team to expedite construction as they are not waiting on these permits to begin construction. Construction related permits that would typically be acquired by a contractor on design-bid-build projects are still obtained by the design-build team (Brandon Weston, personnel communication, March 7, 2013).
- MDOT obtains as many permits as possible prior to advertisement of design-build projects. MDOT anticipates that this reduces risk to design-build teams and results in lower bid prices (Sheila Upton, personnel communication, February 28, 2013).
- WSDOT typically obtains all environmental permits on design-build projects in advance of advertising a project. WSDOT's experience is that if these permits are acquired early, they often must be modified once the design-build team is on board. WSDOT is attempting to push regulatory agencies to allow for performance based mitigation. The goal of performance based permitting would be to identify mitigation results that regulatory agencies are trying to achieve instead of permitted specific mitigation strategies (Christina Martinez, personnel communication, February 27, 2013).

State DOTs should utilize risk allocation matrices on design-build projects and identify environmental permits that can be transferred to the design-build team that do not include adverse amounts of risk and jeopardize the success of the project. State DOTs can consider transferring the following responsibilities to the design-build team (The Louis Berger Group, Inc. 2005):

- Require the design-build team to acquire and comply with environmental permits
- Modifications to environmental permits (regardless of which party acquired the permits)
- Compliance with the acquired environmental permits

- Financial costs that may arise from permit violations
- Schedule changes that may happen due to permit violations
- Acquire construction related permits

The State DOT should identify more of these risks that may be traditionally managed by the State DOT but can be transferred to the design-build team and explicitly state them in the RFPs.

Below are examples of contract language from several State DOTs indicating how each assigns risks and responsibilities for permit acquisition:

Maryland DOT

Maryland DOT State Highway Administration Design-Build Manual

Maryland DOT typically acquires all permits for permanent impacts on design-build projects while the design-build team is responsible for temporary and construction permits (State Highway Administration Maryland Department of Transportation 2013). Maryland DOT does require the design-build team to acquire any permit modifications that are required based on their proposed design and requires them to take on the schedule and cost risk associated with the modification. Modification requirements of their design-build manual can be seen below:

> *"The Design Build Team (DBT) may elect to modify the Conceptual Plans prepared by State Highway Agency (SHA), and may, in effect [create] additional impacts on a regulated resource. However, it is the DBT's sole responsibility to obtain, at their expense, approved permit modifications. SHA will coordinate modified permit approvals but SHA will not be responsible for delays in the project schedule for securing the permit modification."*

Maryland DOT appears to allow design-build teams to modify the original permit in such a way that actual impacts and corresponding mitigation are increased. This is unusual in comparison to many other State DOTs who will allow design-build teams to modify permits, but only to reduce impacts and not to increase them. This is likely due to Maryland DOT's decision to acquire all permits based on the Conceptual Plans prepared for the RFP.

Michigan DOT (MDOT)

MDOT tries to obtain all permits in advance of advertising a design-build contract to reduce risk for design-build teams and to obtain better bid prices. Some examples below are from various MDOT RFPs.

I-94 Reconstruction

For this project, MDOT had begun the permit process, but had not acquired all permits prior to advertisement. MDOT used clear contract language to inform the design-build teams the status of the permit process and to maintain the risk associated with delays in the permit process.

> ***4.2.3 Permits***
>
> *MDOT is in the process of obtaining permits from the Michigan Department of Environmental Quality (MDEQ) that are anticipated to cover unavoidable impacts as indicated in Exhibit 2-4-B. MDEQ permits obtained by MDOT to date for the Project are included in Exhibit 2-4-B. The Contractor may anticipate any remaining MDEQ permits to cover impacts as indicated in Exhibit 2-4-B [that] will be approved prior to Award.*

NCDOT

NCDOT has utilized a variety of permit options on various projects. In the past, some permits were obtained by NCDOT with modification requirements transferred to the design-build team, while other permits were considered the responsibility of the design-build team. NCDOT used to vary this strategy based on the goals of the project and the amount of time anticipated to acquire each permit and the time impact to the project schedule.

Example language from the NCDOT US 70 RFPs can be seen below:

US 70 New Location:

This project was advertised for the design and construction of 12.5 miles of US 70, a four lane divided highway on new location. On this project, NCDOT utilized a combination of the common permit strategies, acquiring some in advance and transferring the acquisition responsibility of others to the design-build team. Contract language regarding the permit requirements can be seen below.

> ***General***
>
> *The US Army Corps of Engineers Section 404 Permit and the Not considered Department of Environment and Natural Resources (DENR), Division of Water Quality Section 401 Water Quality Certification have been issued for the R-2554 corridor, which [include] the final design permit for the R-2554BA section currently under construction and a phased or preliminary permit for sections R-2554BB and R-2554C.*

On this project, NCDOT has obtained several permits in advance of advertising the design-build RFP. This reduces the risk to the design-build team as they are not responsible for obtaining these permits.

> *The Design-Build Team shall be responsible for preparing all documents necessary for the Department to obtain the environmental permits for the construction requirements of this project. In addition to the above permits, a Neuse Riparian Buffer Authorization, and a Central Coastal Plain Capacity Use Analysis (CCPCUA) Permit will be required. The Design-Build Team shall not begin ground-disturbing activities, including utility relocations in jurisdictional areas, until the environmental permits have been issued (this does not include permitted investigative borings covered under a Nationwide Permit No. 6 and utility relocation work outside jurisdictional resources noted below). The Design-Build*

Team shall not be allowed to operate under the Department's Nationwide Permit No. 6.

While NCDOT did obtain some permits in advance, other permits as indicated in the section above are the responsibility of the design-build team. NCDOT requires jurisdictional areas (areas permitted by the US Army Core of Engineers) to have all permits obtained before ground disturbing activities can begin in that area.

Oregon DOT

Base RFP Documents

(8) Permits *- Design-Builder shall apply for and obtain all necessary environmental permits not previously obtained by Agency. Design-Builder shall prepare the design and conduct construction activities such that no action or inaction on the part of Design-Builder shall result in non-compliance with the requirements of Laws applicable to the project.*

Oregon DOT obtains some permits as they see necessary for each project, but includes a catch all statement as shown above to require transfer the risk and obligation for identifying and obtaining all other required permits.

WSDOT (WSDOT)

WSDOT uses a combination of permit acquisition strategies on design-build projects.

I-405 Auxiliary Lane

This project was to design and construct a northbound auxiliary lane on I-405 from 195th St to SR 527.

2.8.4.2 PERMITS AND APPROVALS

2.8.4.2.1 Permit Acquisition

WSDOT has obtained the permits and approvals listed below. WSDOT anticipates that permits will be obtained prior to Contract award and will be incorporated into this RFP by addenda:

- *Section 404 Nationwide Permit – U.S. Army Corps of Engineers; and*
- *Section 402 National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities – Washington State Department of Ecology (Ecology).*

WSDOT states the permits they have obtained or are in the process of obtaining in Book 2 of their RFP documents. Obtaining permits in advance can help expedite the design-build team into construction.

> *The Design-Builder shall acquire the following permits and approvals (if necessary) and comply with all associated environmental requirements:*
>
> - *Noise Variance – City of Bothell;*
> - *Notice of Intent for demolition activities – Puget Sound Clean Air Agency Local demolition permit –City of Bothell;*
> - *Notice of Intent for geotechnical borings – Ecology;*
> - *Notice of Intent for installing, modifying, or removing piezometers – Ecology;*
> - *Notice of Intent for installing, modifying, or decommissioning wells – Ecology;*
> - *Water Quality Modification Permit – Ecology; and*
> - *Administrative Order for Chemical Treatment – Ecology.*

WSDOT transfers the responsibility for permits that are specific to the final design to the design-build team. These types permits do not typically take a long period of time to acquire and can be acquired concurrently with the design phase after award of the contract.

7.2.2.4 Opportunity for efficiency enhancement: Advertising and awarding projects prior to the completion of NEPA can improve project schedule.

Design-build also allows a unique approach to project delivery and the NEPA process by allowing a project to be advertised and awarded prior to completion of the NEPA process (Design-Build Contracting 2009). Although this practice is not commonly utilized on design-build projects due to the challenges associated with implementation, this practice is allowed by Federal Regulations. This unique approach introduces new project risks that a no-build NEPA alternative may be selected and mitigation and permitting requirements for the project are not finalized upon award of the project (Kross 2007). Procuring a design-build team prior to completion of NEPA can also provide an opportunity to expedite the overall delivery of the project as seen in Figure 7.2 below:

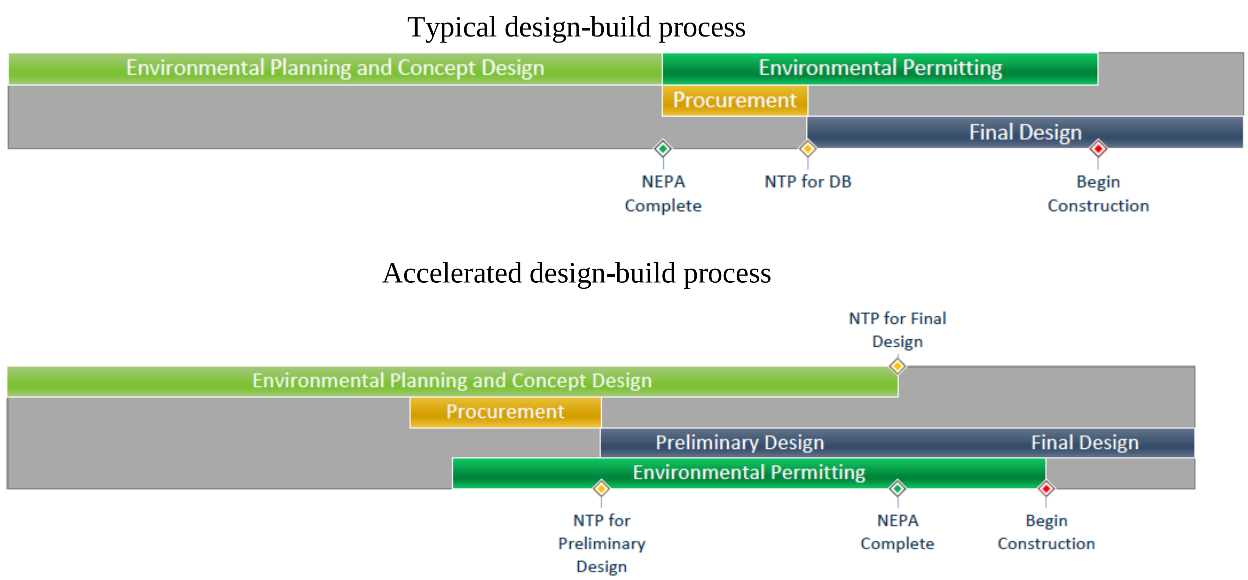


Figure 7.2

Typical Design-Build vs. Accelerated Design-Build

Accelerating the delivery of the project by procuring and awarding a design-build contract prior to the completion of the NEPA planning process also introduces additional risks to the project. Some common risks that must be properly managed include (Merdith 2011):

- It can be difficult to establish and meet a project schedule if delays occur in the NEPA analysis.
- Federal funding can be jeopardized if actions are taken that violate NEPA requirements.
- Perception that alternatives are not being properly considered because a design-build team has been selected.

Some of these risks can be managed by properly managing the design-build contract to ensure that NEPA requirements are not violated and that CFR requirements are followed ensuring that no final design or construction activities are begun until the completion of NEPA (Design-Build Contracting 2009). Schedule risks are inherent with the NEPA planning process and only projects with relatively certain NEPA completion dates should be considered for procurement prior to NEPA completion. Overall, this opportunity to expedite project delivery through awarding the design-build contract prior to the NEPA completion is considered high-risk for all State DOTs. Our interviews with State DOTs confirmed that the common perception is that the risks associated with this opportunity outweigh the rewards of an accelerated schedule. Some State DOTs indicated that the design-build community is not comfortable with the additional risk and uncertainty associated with NEPA not being complete. A summary of our interviews with State DOTs is below:

- UDOT does not advertise and award projects until NEPA is complete. UDOT is unwilling to take on the additional risks associated with advertising and awarding a project prior to the NEPA document being approved (Brandon Weston, personnel communication, March 7, 2013).
- CDOT does not advertise and award projects until NEPA is complete. CDOT and the design-build community in Colorado are uncomfortable with the additional project risks

that may result if NEPA is not completed until after the project's award (Jordon Rudel, personnel communication, February 26, 2013).

- MDOT does not advertise and award projects until NEPA is complete. Michigan's FHWA Division Office is not comfortable with MDOT's design-build experience and does not want them to introduce the additional risks associated with advertising and awarding a project prior to NEPA document being approved (Sheila Upton, personnel communication, February 28, 2013).

- NCDOT has advertised projects prior to NEPA being complete, but has not awarded projects prior to NEPA completion. When projects are advertised prior to NEPA completion, NCDOT includes a disclaimer in the contract that the scope could change (Theresa Bruton, personnel communication, March 15, 2013).

- WSDOT has only advertised and awarded projects prior to NEPA completion when the project schedule is accelerated to the point where it could not be delivered any other way. WSDOT tries to avoid this opportunity when possible due to the risks associated with it such as schedule uncertainty and additional mitigation costs that may need to be added by supplemental agreement after award. Design-build teams in Washington are hesitant to bid on these projects as they are unsure if the project will advance (Christina Martinez, personnel communication, February 27, 2013).

- VDOT does not advertise and award projects until NEPA is complete. VDOT sees the potential schedule benefits, but has determined the risks associated are not worth the time savings (Jim Cromwell, personnel communication, February 22, 2013).

To the best of our knowledge, this opportunity has been utilized on only one design-build project, SR 520 by WSDOT.

Concurrent procurement and NEPA in the WSDOT SR 520 project

WSDOT advertised and awarded the SR 520 project prior to the completion of NEPA. Utilization of this opportunity accelerated the construction of the project. The design-build team was able to begin design work while the NEPA document was being completed and was able to begin construction one month after NEPA completion (Merdith 2011). With the complexities associated with the project using the typical design-bid-build process, the project would not have started construction for at least a year. Even using the typical design-build process of waiting for the completion of NEPA to procure a design-build team, construction on the project would not have started for six to nine months while the design was being finalized and permits were acquired. WSDOT found several considerations for environmental compliance to be very important in the selection of the design-build team:

- Clearly define WSDOT's leadership role on environmental documentation, permitting and commitments.
- Identify milestone links between the design and environmental processes.
- Incorporate a phased notice to proceed.
- Establish clear and frequent communication to allow the design and environmental processes to proceed in parallel.
- Provide environmental expectations and fully define what constitutes environmental compliance.
- Include qualifications for key environmental staff.
- Provide contract language for how environmental compliance will be monitored and measured.

It is worth noting that concurrent NEPA and procurement are not normal practice for WSDOT on design-build projects. However, this innovative practice can be extremely beneficial in terms of project schedule if associated risks can be properly managed.

7.3 Post-Award Environmental Management in Design-Build Contracts

Design-bid-build projects typically do not have many environmental related risks to consider once the NEPA planning and permitting is complete. Impacts are identified, quantified, and permitted as appropriate and prescriptive mitigation requirements are included when advertising and awarding the construction contract. The only outstanding environmental risk involves contractor compliance with permit requirements. On the other hand, upon completion of the NEPA document, design-build projects typically have 70% of the design remaining. This introduces additional risks that the final design will not match the design considered in the NEPA decision and the design used in permits that were acquired prior to advertisement and award. These risks are magnified when the NEPA document prescriptively quantifies actual impacts anticipated based on the preliminary design (The Louis Berger Group, Inc. 2007).

The State DOT and design-build team are both at risk for impacts to the environment even in situations where the State DOT transferred all permitting risks to the design-build team. Impacts to the environment typically result in fines and in some cases lawsuits, State DOTs can be held responsible for noncompliance by the design-build team as the project sponsor or the permittee (Molenaar et al. 2005). State DOTs should work to enforce environmental compliance and incentivize design-build teams to work to minimize impacts to the environment (Aufdencamp and Mickelson 2013).

7.3.1 Challenges in post-award environmental management in design-build contracts

7.3.1.1 Re-evaluation of the NEPA document triggered by proposed design changes

Many State DOTs and FHWA division offices are quick to assume that any proposed change to the NEPA document requires a re-evaluation of the NEPA document. While this can be avoided by adding flexibility to the NEPA document as discussed earlier, no amount of flexibility will eliminate the need to Re-Evaluate the NEPA document on certain projects. Changes are especially common on design-build projects where the NEPA document is often completed based on 30% or less complete plans. Re-evaluations can be time consuming to complete and when triggered after a contract has been awarded, become a risk that is difficult for a design-build team to manage. Below is an example of language from Utah DOT that is typically found in most State DOTs' Plan Development Process manuals.

1. *"Purpose and Applicability of Re-evaluations*

   Purpose. *Re-evaluations have the following two purposes:*

   - *To ensure that the project design is being developed in a way that is consistent with previous commitments in the Categorical Exclusion (CE), Finding of No Significant Impact (FONSI), or Record of Decision (ROD)*
   - *To address changes in the design, projected impacts, or planned mitigation measures"*

These blanket statements are designed to limit the risks of the State DOT on a project prior to advertising for construction and are likely written with design-bid-build projects in mind. On design-build projects however, this language limits the ability for a design-build project to improve a project's overall schedule if any change proposed by the design-build team will trigger a re-evaluation.

7.3.1.2 Permit modification triggered by proposed design changes

State DOTs should determine early in the development of a project which party is best suited to prepare and obtain required environmental permits. In this process, State DOTs will often begin long and complex permitting in the scoping or concept phase of a project. Permits obtained in advance of advertising the RFP for a design-build project are typically procured with plans that are 30 percent complete. While this level of design is preferable to design-build teams to allow them maximum flexibility in the final design of the project, regulatory agencies prefer to issue permits based on actual impacts and a higher level of design completion. State DOTs must balance the design advancement to provide enough information to obtain permits, while advancing the design too far and limiting innovation. The higher level than 30 percent level of design that results from satisfying the regulatory agency can result in the requirement of a permit modification based on the design-build team's proposed design (The Louis Berger Group, Inc. 2007). This can lead to project delays while the design-build team or the State DOT prepares the permit modification (Parametrix 2012).

Another issue with the State DOT acquiring the permit in advance of advertising and awarding the contract is that the permit may contain mitigation requirements that may be above and beyond what is actually required based on the final design (The Louis Berger Group, Inc. 2007). Permitting agencies are concerned that when impacts are reduced, the design-build team may also look to reduce mitigation commitments (WSDOT 2004). These agencies have agreed to a certain level of mitigation and typically do not wish to allow a lower level of mitigation regardless of if the impacts are reduced (The Louis Berger Group, Inc. 2007). In this case, the design-build team will typically be responsible for preparing a permit modification that shows the actual impacts and also includes the original mitigation measures.

7.3.2 Opportunities for enhancement in post NEPA and contract management

7.3.2.1 Opportunity for efficiency enhancement: State DOTs should consider allowing the design-build team to accept the risk of NEPA re-evaluations (schedule and cost risks) by requiring the design-build team to complete the re-evaluation or to provide required documentation for NEPA re-evaluation.

Many State DOTs and FHWA division offices are quick to assume that any proposed change to the NEPA document requires a re-evaluation of the NEPA document. Using flexible language when describing impacts to the environment in the NEPA document can reduce the risk of needing to re-evaluate the NEPA document. Another measure to reduce State DOT risk for re-evaluations is to require the design-build team to perform the re-evaluation. This can expedite the development of the re-evaluation and promote better management of the project design and compliance with the NEPA document. NCDOT currently utilizes this practice on most of their DB projects. NCDOT partners with the DB team in the preparation and review of the re-evaluation to ensure that it complies with the NEPA regulations. For instance, NCDOT has allowed a DB team to propose a new alternative to the NEPA document and then worked with the DB team after letting to get the new preferred alternative approved by the FHWA. State DOTs are often constrained in their resources available to complete these re-evaluations and so the need for one can cause unnecessary delays to the project.

Most State DOTs and local FHWA division offices currently view this practice as against Federal Regulations which state (Design-Build Contracting 2009):

> "*The design-builder must not prepare the NEPA document or have any decision making responsibility with respect to the NEPA process*."

In rejecting the option of allowing the design-build team to perform the re-evaluation, they are considering the re-evaluation the same as a NEPA document. However, the courts have repeatedly ruled that a re-evaluation is not a NEPA document, but instead is an affirmation that the preferred alternative is still valid or a recommendation for a Supplemental or Updated NEPA document (ICF Consulting 2008). State DOTs that we interviewed had differing comfort levels with allowing the design-build team to perform the re-evaluation. Some State DOTs allow the design-build team to perform the re-evaluation, while others allow them to perform all special study updates and provide all backup information; one State DOT interviewed does not allow the design-build team to perform or take part in the re-evaluation. A summary of these interviews is given below.

- UDOT has not needed to perform many re-evaluations on design-build projects. UDOT assumes that the length of time typically required to perform a re-evaluation inhibits design-build teams from proposing changes that would trigger a re-evaluation as they are responsible for the project's schedule. When a re-evaluation is required, UDOT performs the re-evaluation but requires the design-build team to provide all supporting documentation (Brandon Weston, personnel communication, March 7, 2013).

- CDOT requires the design-build team to update all special studies and perform the re-evaluation. CDOT maintains an ownership role by reviewing the re-evaluation and submitting it to FHWA. If the re-evaluation determines that the NEPA document is no longer valid, then CDOT re-opens the NEPA process and the design-build team is responsible for the schedule risk. CDOT has not had a project that required the NEPA document to be re-opened (Jordon Rudel, personnel communication, February 26, 2013).
- MDOT does not allow the design-build team to perform the re-evaluation or update any special studies. MDOT does not have a high number of re-evaluations on design-build projects due to the non-prescriptive nature of their NEPA documents (Sheila Upton, personnel communication, February 28, 2013).
- NCDOT requires the design-build team to update all special studies and perform the re-evaluation. NCDOT maintains an ownership role by reviewing the re-evaluation and submitting it to FHWA. If the re-evaluation determines that the NEPA document is no longer valid, then NCDOT partners with the design-build team to complete the NEPA process. (Theresa Bruton, personnel communication, March 15, 2013).
- WSDOT does not allow the design-build team to perform the actual re-evaluation. WSDOT does require the design-build team to update all special studies and produce all required backup information for the re-evaluation (Christina Martinez, personnel communication, February 27, 2013).

- VDOT does not allow the design-build team to perform the actual re-evaluation. VDOT does require the design-build team to update all special studies and produce all required backup information for the re-evaluation. VDOT then writes the actual re-evaluation and coordinates with regulatory agencies and FHWA using the information provided by the design-build team. VDOT performs a re-evaluation on all projects prior to a project's advertisement and again before authorizing ROW acquisition (Jim Cromwell, personnel communication, February 22, 2013).

Below specific language from various State DOT RFPs are provided that show how State DOTs shift the risk of a re-evaluation to the design-build team:

Transferring NEPA re-evaluation risk to the design-build team in North Carolina DOT (NCDOT)

North Carolina transfers the risk of a re-evaluation to the design-build team including all schedule and costs associated with changes to the NEPA document.

> ***North Carolina DOT (NCDOT):*** *The Design-Build Team shall be responsible for any activities, as deemed necessary by the Department or the FHWA, resulting from changes to the NCDOT preliminary design, including but not limited to, public involvement and NEPA re-evaluation. The Department shall not honor any requests for additional contract time or compensation for completion of the required activities resulting from changes to the NCDOT preliminary design.*

Transferring re-evaluation responsibility to the design-build team in Washington State DOT (WSDOT)

WSDOT also transfers all cost and schedule risks associated with a re-evaluation to the design-build team. WSDOT has additional language indicating they will perform coordination as required as part of the re-evaluation process.

__WSDOT:__ WSDOT has prepared an Environmental Classification Summary (Appendix E4) in support of a NEPA Documented Categorical Exclusion (DCE) to address the scope, impacts, and mitigation for the Project. In addition, WSDOT has issued a State Environmental Protection Act (SEPA) Determination of Non-Significance (Appendix E5). If the design of the Project is altered by the Design-Builder in such a way that causes additional impacts to the environment and/or surrounding communities, additional environmental analysis and documentation may be required. If required, the Design-Builder shall be responsible for preparing any additional environmental documentation. In addition, the Design-Builder shall pay all costs and accept all responsibility for any schedule delays associated with securing the additional environmental approvals.

If required, the environmental re-evaluation shall follow the WSDOT Environmental Procedures Manual and 23 CFR 771. It is anticipated that the environmental re-evaluation and related approvals will not be required, provided changes in roadway alignments and grades do not result in additional social, economic, or environmental impacts. WSDOT will coordinate with all previously-involved agencies as part of any re-evaluation process. Final determination regarding the necessity of environmental re-evaluations shall be made by WSDOT and the Federal Highway Administration (FHWA).

All environmental re-evaluations shall be subject to written approval by WSDOT and FHWA.

Transferring NEPA re-evaluation risk to the design-build team in New York State DOT (NYSDOT)

New York DOT transfers all cost and schedule risks associated with a re-evaluation to the design-build team. Additionally, they require the design-build teams to accept risks associated with other environmental laws.

New York State DOT

3.3 COMPLIANCE WITH APPROVED NEPA ACTION

NEPA environmental approval for the subject project has been granted based on analysis and documentation of potential environmental impacts of the identified preferred alternative. This analysis is summarized along with any identified environmental commitments and depicted in the April 2012 Final Design Report/Environmental Analysis (APRIL, 2012 FDR/EA) document for the subject project. If during detailed design and/or construction[,] the Design-Builder introduces design elements, variations, or methodologies that potentially induce environmental impacts that differ from those identified in the approved April 2012, FDR/EA document or is unable to comply with established environmental commitments[,] then the NEPA process for this project will need to be re-evaluated by the Design-Builder and reviewed by the Department prior to proceeding with construction. This requirement also applies to proposed variations which may affect resources covered under Section 106, Section 4(f), Executive Order 11990 (wetlands), and other applicable federal and state environmental regulations. The need to re-evaluate the NEPA process may impact the overall project schedule.

Transferring NEPA re-evaluation risk to the design-build team in Texas DOT (TxDOT)

TxDOT requires the design-build team to be responsible for all environmental studies and the reevaluation. TxDOT’s RFP language is unique in that it implies that the design-build team is responsible for any action that was not identified in Environmental Approvals and not only for those introduced by the design-build team.

Responsibilities Regarding 4.2.2 Environmental Studies

The Design-Build Contractor shall be responsible for conducting additional and/or continuing environmental studies based on the Project approved NEPA document and Project schematic. The Design-Build Contractor shall be *responsible for conducting environmental studies and re-evaluations caused by actions not identified in the Environmental Approvals, actions not covered specifically by existing resource and regulatory agency coordination, or incorporation of Additional Properties into the Project. The Design-Build Contractor shall be responsible for all coordination of environmental studies with appropriate Governmental Entities, except where TxDOT has agreements with Governmental Entities to perform such coordination.*

Transferring re-evaluation responsibility to the design-build team in Florida DOT (FDOT)

When a design-build team proposes design changes after the environmental document has been approved, FDOT requires the design-build team to coordinate with FDOT to determine if a reevaluation is required. If FDOT determines that a reevaluation is required, the design-build team is responsible for updating or developing all required special studies and the environmental reevaluation document (FDOT 2011). The requirements of FDOT's Design-Build Guidelines state:

"Prior to the authorization of Design-Build projects under either Federal or State funding, a reevaluation of the environmental impacts shall be made. If a major design change is proposed after the authorization, then a written reevaluation must be produced as required in the Plan Development & Engineering (PD&E) Manual. The Design-Build Firm shall provide the information to the District Environmental Management Office to determine if the proposed design changes warrant a reevaluation. The Design-Build Firm is responsible for conducting any needed environmental studies and completing the documentation for the environmental reevaluation. For Federal-aid projects, FDOT shall obtain FHWA's approval of the NEPA reevaluation before the Design-Build Firm can proceed."

FDOT has made this a standard practice by including this requirement in their Design-Build Guidelines. This is more progressive than most states which simply include this requirement in their contract language. Including this in their Design-Build Guidelines establishes this as a best practice that should be done on all projects.

State DOTs should allow the design-build team to perform the re-evaluation or provide backup information. This will reduce the burden of the State DOT to perform the re-evaluation and allow the design-build team to partially control the schedule risk associated with the re-evaluation. While not all State DOTs interviewed and State DOT RFPs that were reviewed exercise this opportunity, due to the large number of State DOTs that utilize at least a portion of this opportunity, it should be considered a best practice.

7.3.2.2 Opportunity for efficiency enhancement: State DOTs should consider allowing the design-build team to accept the risk of obtaining or modifying environmental permits (schedule and cost risks) by requiring the design-build team to complete the permit application and/or modification or to provide required documentation for the permit modification

State DOTs often obtain most environmental permits in advance of advertising and awarding a design-build contract. Permits are typically written for an exact impact to the environment and when permits are developed based on 30% plans, this can lead to the permit not matching the final design prepared by the design-build team (The Louis Berger Group, Inc. 2005). Regulatory agencies prefer to not permit projects based on hypothetical or estimated impacts (The Louis Berger Group Inc. 2007). Permit modifications are needed to update permits to match the final design impacts. State DOTs, even those who acquire permits in advance, have found that transferring the responsibility for updating permits to the design-build team is more desirable for all parties.

Design-build teams prefer to have as much control over the permitting process as possible with direct access to permitting agencies. Regulatory agencies are open to allowing the design-build team to prepare and acquire permits with the understanding that the State DOT is involved, all parties practice open communication, and the design-build team is monitored to not cut corners

(The Louis Berger Group, Inc. 2007). State DOTs vary in their comfort level in how much access to regulatory agencies they are willing to permit the design-build teams to have. State DOTs value their relationships with regulatory agencies and do not want to jeopardize them.

State DOTs should work with regulatory agencies to establish which permits should be obtained in advance and which should be acquired after award of a design-build contract. This allows State DOTs to evaluate the benefits of early permit acquisition with the risk of permit modifications (The Louis Berger Group, Inc. 2007). State DOTs must then assess if the design-build team should acquire the outstanding permits and if they should prepare any permit modifications. State DOT interviews and reviews of design-build RFPs from various States has indicated that most State DOTs do allow the design-build team to acquire or prepare outstanding permits and acquire or prepare permit modifications as necessary.

Our interviews with State DOTs and review of State DOT RFPs indicates that State DOTs do not currently evaluate permits on a project by project basis and determine which party should be responsible for obtaining each permit for a specific project. Instead, State DOTs appear to either acquire most or all permits in advance of a project's advertisement, or transfer all permit acquisition or preparation duties to the design-build team. State DOTs, who were interviewed, that require the design-build team to prepare or acquire all permits are summarized below:

- CDOT waits as long as possible in a project's development to obtain environmental permits to minimize the risk of permit modifications. CDOT requires the design-build team to prepare all permits and submit them to CDOT to process and coordinate with regulatory agencies (Jordan Rudel, personnel communication, February 26, 2013).

- NCDOT used to obtain most permits in advance of advertising a design-build project. NCDOT found that this limited innovation and now requires the design-build team to prepare most permits and submit them to NCDOT to process and coordinate with regulatory agencies. NCDOT remains the permittee on all projects (Theresa Bruton, personnel communication, March 15, 2013).

- VDOT requires the design-build team to prepare all permits and is not involved in the permit process. VDOT transfers the risks associated with permit acquisition to the design-build team and only require proof that all required permits have been obtained prior to allowing the design-build team to begin construction (Jim Cromwell, personnel communication, February 22, 2013).

Other State DOTs interviewed obtain most permits in advance, but do require the design-build team to prepare any permit modifications and prepare any outstanding permits. A summary of these State DOTs is below:

- UDOT acquires all permits in advance of advertising and awarding a design-build contract. UDOT does require the design-build team to provide all backup information required for permit modifications. UDOT shares the schedule risk with design-build teams associated with permit modifications based on which party caused the need for the modification (Brandon Weston, personnel communication, March 7, 2013).

- MDOT acquires most permits in advance of advertising and awarding a design-build contract. MDOT requires the design-build team to prepare any permits that were not acquired in advance and MDOT acquires the actual permit. MDOT also allows the design-build team to prepare any permit modifications as required (Sheila Upton, personnel communication, February 28, 2013).

- WSDOT acquires most permits in advance of advertising and awarding a design-build contract. WSDOT experience is that acquiring permits in advance almost always results in permit modifications which are prepared by the design-build team and acquired by WSDOT. WSDOT allows the design-build team to acquire construction related permits (Christina Martinez, personnel communication, February 27, 2013).

A review of State DOT design-build RFPs indicates that most State DOTs do require the design-build team to prepare or acquire permit modifications and that some State DOTs require the design-build team to prepare and/or acquire all permits. Below are examples from various State DOT RFPs that were reviewed.

North Carolina DOT (NCDOT)

NCDOT found that when permits were acquired in advance, it limited innovation; therefore, NCDOT has adopted a strategy of requiring the design-build team to prepare most permits and submit them to NCDOT for review and submittal to regulatory agencies (Theresa Bruton, personnel communication, March 15, 2013).

On the I-485 project, NCDOT transferred the responsibility for obtaining all permits to the design-build team. Schedule assumptions for the amount of time needed to acquire these permits was made by NCDOT. If permit requirements exceed those anticipated by NCDOT, the risk to the project schedule and the additional mitigation costs are borne by the design-build team. By utilizing this practice, NCDOT has assumed schedule risks up to a certain point and transferred the remaining risks to the design-build team.

I-485 from I-77 to Rea Road:

This project was advertised for the design and construction for the 9.5 mile widening of I-485 to a six lane divided highway. On this project, NCDOT transferred the acquisition responsibility of all permits to the design-build team. Contract language regarding the permit requirements can be seen below.

> *The Design-Build Team shall be responsible for preparing all documents necessary for the Department to obtain the environmental permits for the construction of this project. Permit applications shall be required for the: US Army Corps of Engineers (USACE) Section 404 Permit, Not considered Department of Natural Resources (DENR) Division of Water Quality (DWQ) Section 401 Water Quality Certification and Not considered Department of Natural Resources*

(DENR) State Stormwater Permit. Based on the anticipated limited impacts to jurisdictional resources, a Nationwide Permit No. 23 is probable. Thus, the timeline for obtaining the permits outlined in this scope of work reflects that a Nationwide Permit No. 23 will be required; and the Department will not honor any requests for additional contract time or compensation for any efforts required in order to obtain an Individual Permit, including but not limited to public involvement, additional design effort, additional construction effort and / or additional environmental agency coordination and approvals.

NCDOT does not always transfer all permit responsibilities to the design-build team. On some projects, permits are acquired in advance. On these projects, risks for permit modifications are still transferred to the design-build team as seen in the example below.

US 70 New Location:

Major Permit Modification Request Process

It shall be the Design-Build Team's responsibility to acquire information and prepare permit drawings that reflect the impacts and minimization efforts resulting from the project as designed by the Design-Build Team. Further, it shall be the Design-Build Team's responsibility to provide these permit impact sheets (drawings) depicting the design and construction details to the Department as part of the permit application. The Design-Build Team shall be responsible for developing the permit modification request for all jurisdictional impacts. The permit modification request shall include all utility relocations that are being coordinated by the Design-Build Team. At a minimum, the permit application shall consist of the following:

Cover Letter

Minutes from the 4B and 4C meetings

Permit drawings (with and without contours)

Half-size plans

Completed Forms (Section 404 ENG 4345, etc.) appropriate for impacts

The Department will re-verify and update, as needed, the required environmental data that expires prior to the completion of the activity causing the impact in the jurisdictional areas. These include, but are not limited to, federally protected species, re-verification of wetland jurisdictional areas, historic sites, archaeological sites and 303d (impaired) streams.

NCDOT states all the requirements of the permit applications and permit modifications as well as their role in the process. This clear contract language allows design-build teams to adequately analyze and bid the risks associated with obtaining environmental permits for the project.

Major Permit Timeframe

The Design-Build Team should expect it to take up to 11 months to accurately and adequately complete all designs necessary for permit application, submit application to the Department, and obtain approval for the permits from the environmental agencies. Agency review time will be approximately 90 days from receipt of a "complete" package. No requests for additional contract time or compensation will be allowed if the permits are obtained within this 11-month period. With the exception of location and survey work; utility relocation work outside jurisdictional resources that adheres to the aforementioned requirements, and permitted investigative borings covered under Nationwide No. 6 secured by the Design-Build Team, no mobilization of men, materials, or equipment for site investigation or construction of the project shall occur prior to obtaining the permits (either within the 11-month period or beyond the 11-month period). The Department will not honor any requests for additional contract time or compensation, including idle equipment or mobilization or demobilization costs, for the Design-Build Team mobilizing men, materials (or ordering materials), or *equipment prior to obtaining all permits. The Department will consider requests for contract time extensions for obtaining the permits only if the Design-Build Team has pursued the work with due diligence, the delay is beyond the Team's control, and the 11-month period has been exceeded. If time were granted[,] it would be only for that time exceeding the 11-month period. This 11-month period is considered to begin on the Date of Availability as noted elsewhere in this RFP.*

The Design-Build Team needs to be aware that the timeframes listed above for review by PDEA, NCDWQ, and the USACE, to review any permit applications and / or modifications begin only after a fully complete and 100% accurate submittal.

NCDOT also allows set amount of time for the design-build team to prepare all required permits and times for agency review of the permits. NCDOT further limits the risk to the design-build team by taking on risks for schedule delays that appear to be outside the design-build team's control.

Mitigation Responsibilities of the Design-Build Team

The Design-Build Team shall be responsible for examining and possibly providing on-site mitigation for R-2554BB & C (Reference On-Site Mitigation Scope of Work).

The Department has acquired compensatory mitigation for Neuse River Buffer Impacts and unavoidable impacts to wetlands and surface waters due to project construction from the Ecosystem Enhancement Program (EEP). This mitigation was based on the impacts required by the R-2554C Right of Way Plans provided by the Department and the R-2544BB Preliminary Plans provided by the Department.

Should additional jurisdictional impacts result from revised design / construction details, suitable compensatory mitigation for the Neuse River Buffer, wetlands and / or streams shall be the sole responsibility of the Design-Build Team. Therefore, it is important to note that additional mitigation shall be approved by the agencies

> *and such approval shall require, at a minimum, the preparation and approval of a Mitigation Plan before permits / permit modifications are approved and before construction can commence.*

In this project, NCDOT allowed modifications to permits that were acquired in advance of the project's advertisement. This again transfers the risk for environmental permitting to the design-build team and conforms the environmental permitting to the specific design of the project. Mitigation was obtained for known impacts that were anticipated to be required regardless of the design-build team's proposed design.

WSDOT

I-405 Auxiliary Lane

This project was to design and construct a northbound auxiliary lane on I-405 from 195th St to SR 527.

> ***2.8.4.2.2 Permit Compliance, Modifications, and Additional Approvals***
>
> *The Design-Builder shall follow the requirements of all permits and commitments referenced in this Section, and any other permits that are obtained for the Project. The Design-Builder shall provide WSDOT with timely notice of its intent to propose an alternative construction method or a design change that is inconsistent with a particular permit, environmental requirement, or commitment. WSDOT will work with the Design-Builder and will bring final detailed proposals provided by the Design-Builder to the regulatory agencies for permit modifications, to obtain new permits, and to re-initiate ESA consultation as required. The Design-Builder shall be responsible for preparing any additional environmental documentation needed to secure the additional environmental approvals required for implementation of the Design-Builder's alternative proposals.*

WSDOT requires the design-build team to adhere to all requirements and commitments for the permits that were acquired in advance and acquired by the design-build team. WSDOT works with the design-build team and regulatory agencies to obtain any permit modifications as required.

> *The Design-Builder shall pay all costs and accept responsibility for any schedule delays resulting from a proposed alternative construction method or design change, including, but not limited to, implementation of an approved ATC. Such costs and schedule delays may result from changes in impacts to the environmental resources addressed in Section 2.8.4.3. In addition to the direct costs associated with preparing documentation for and securing additional environmental approvals, the Design-Builder shall be responsible for costs including, but not limited to, WSDOT labor and materials expenses incurred in gaining environmental approvals. The Design-Builder shall also be responsible for additional mitigation costs such as site acquisition, design, and construction [,] should this be required as a result of increased impacts.*

WSDOT transfers the risk associated from any permits that are required as a result of an ATC to the design-build team. This risk includes all costs and schedule delays associated with additional permit acquisitions. In this RFP, WSDOT indicated which permits it was acquiring and which permits the design-build team would be responsible for. Additional permits not listed in the RFP become the responsibility of the design-build team.

VDOT

VDOT requires the design-build team to obtain all required permits and be the permittee. This is the highest level of risk transfer to design-build teams as they are fully responsible for all risks associated with permit acquisition and compliance.

Route 29 Bypass

This project was to design and construct a bypass around Charlottesville, Virginia on SR 29.

> *The Design-Builder will be responsible for compliance with pre-construction and construction-related environmental commitments and will be responsible for compliance with preconstruction, construction-related permit conditions, as well as post-construction monitoring if required by regulatory agencies. The Design-Builder will assume all obligations and costs incurred by complying with the terms and conditions of the permits and environmental certifications. Any fines associated with environmental permit or regulatory violations will be the responsibility of the Design-Builder.*

VDOT requires the design-build team to be the permittee and be responsible for all compliance with all permits.

UDOT

UDOT acquires all permits in advance of advertising and awarding design-build projects. As seen in the example below from the I-15 Core project, UDOT does require the design-build team to prepare permit modifications.

I-15 Core

The project was to widen and reconstruction of the I-15 corridor in Utah County Utah. Part Three Section 4 of the RFP contains a summary table of required design-build environmental submittals.

Table 7.1 presents sample submittal requirements related to permits and permit modifications:

Table 7.1

A Sample Summary of Required Environmental Submittals by the Design-Build Team

Submittal	For Approval	Schedule
Utah Pollution Discharge Elimination System (UPDES) General Permit for Construction Activities (including dewatering)	No	Prior to NTP2
Storm Water Pollution Prevention Plan (SWPPP) (including Erosion & Sediment Control (E&SC) Plan)	No	Prior to issuing a Notice of Intent (NOI) for the permit
Remediation Report / No Further Action (NFA) Letter	No	Report within 30 Working Days of the completion of remediation / NFA letter within three weeks of report receipt
404 Permit Modifications (Nationwide/Individual)	Yes	Prior to submittal to Agency
Stream Alteration Permit(s)	No	Prior to construction in or near streams

As seen in the table, the design-build team is responsible for preparing the 404 permit modifications. UDOT does require the design-build team to prepare the construction related permits associated with erosion control, stream alteration, and storm water management.

7.3.2.3 Opportunity for efficiency enhancement: State DOTs should consider providing incentives to the design-build team to encourage reduction in the environmental impacts of the project.

Regulatory agencies’ main goal is to protect the environment and they worry that since design-build teams do not have this same goal that they will increase impacts to the environment. One way that State DOTs have worked to alleviate this concern is to provide incentives to design-build teams to reduce environmental impacts and to promote compliance with environmental permits. Incentive amounts should consider what level of design was used to develop initial impact estimates (The Louis Berger Group, Inc. 2007). When impact estimates are based on the worst-case-scenario, incentives should be reduced or based on a lower impact threshold than identified in the worst-case-scenario. Otherwise, when impacts are simply adjusted for the final design, they appear to have met the incentives; but in reality, the initial impacts were simply overstated (The Louis Berger Group, Inc. 2007).

State DOTs may require design-build teams to purchase compensatory mitigation as part of the permitting process. This practice is another way that design-build teams can be incentivized to reduce environmental impacts as reducing impacts reduces the amount of mitigation that must be purchased (Theresa Bruton, personnel communication, March 15, 2013).

Interviews with State DOTs and reviews of State DOT RFPs indicate that incentives for environmental compliance are becoming more common on design-build projects. Some State DOTs such as Utah are pushing regulatory agencies to utilize incentive based permitting to encourage design-build teams to look for opportunities to reduce impacts during the design of projects. To date, regulatory agencies do not appear open to promoting incentives in permitting. UDOT was the only State DOT interviewed who specifically mentioned the use of incentives. A summary of how UDOT uses incentives can be seen below.

- UDOT uses incentives to reward design-build teams for maintaining a clean construction site and properly maintaining their erosion control Best Management Practices (BMP). On some projects, UDOT has allowed the public to comment and score their perception of the design-build team's environmental compliance and tied incentive rewards to the public scoring. This encourages the design-build team to maintain a good working relationship with the public and to control erosion and other environmental activities. UDOT is trying to push regulatory agencies to allow for incentive based permits, but this has not been allowed to date (Brandon Weston, personnel communication, March 7, 2013).

Review of State DOT RFPs indicates that the use of incentives for environmental compliance is not a common practice, but does appear to be used by State DOTs with more experience on design-build projects. Examples from design-build RFPs from two State DOTs can be seen below.

WSDOT

WSDOT appears to use incentives for environmental compliance on most of their design-build projects. Seven WSDOT RFPs were reviewed and incentives related to environmental compliance and protection were utilized on six of them. This indicates that WSDOT considers incentives to be a valuable tool to help protect the environment. An example from WSDOT's I-405 design-build project is below:

I-405/Not Experienced 195 St to SR 527 Northbound Auxiliary Lane

> ***1-08.11(2).1 Environmental** 1 **Compliance***
>
> ***General.** Adhering to the environmental commitments, relative to all phases of project development, will prevent environmental degradation, reduce work delays and cost increases, minimize negative publicity and reduce the number of upset citizens/landowners. The portion of the incentive award allocated to Environmental Compliance is up to $220,000. This is the maximum amount that can be earned from all environmental compliance criteria combined. The amount*

is divided among the three environmental compliance criteria, as shown in [Table 7.2].

Table 7.2

Incentive Awards and Criteria for Environmental Compliance

Criteria	Maximum Possible Award
A. Environmental Awareness	$50,000
B. Environmental Inspections and Compliance Monitoring	$100,000
C. Reaching to Non-Compliance Monitoring	$70,000
Total Maximum Award	$220,000

On this project, WSDOT included incentives for environmental compliance up to $220,000. This was approximately 1.2% of the contract price. WSDOT included specific requirements for the design-build team to achieve these incentives and paid the design-build team quarterly for achieving incentive goals.

NCDOT

NCDOT does not appear to use incentives on most design-build projects. One NCDOT RFP that was reviewed included incentives related to compliance with environmental regulations. This project was the US 70 Goldsboro bypass from east of SR 1556 to east of SR 1323. An excerpt from this RFP can be seen below:

US 70 Goldsboro bypass from east of SR 1556 to east of SR 1323

The Design-Build Team will be eligible for an incentive in the amount of $100,000 if construction operations have been performed in accordance with all environmental regulations and the Specifications, and the Design-Build Team does not receive any violations (Immediate Corrective Action (ICA), Construction

Industry Compliance Assistance (CICA), Notice of Violation (NOV) and / or Construction & Demolition (C&D)) at any time during project construction.

This incentive rewards design-build teams for complying with environmental regulations and not receiving violation notices.

7.3.2.4 Opportunity for efficiency enhancement: State DOTs should require the design-build team to have an environmental management plan and an environmental compliance manager to oversee the environmental impacts of the project and ensure compliance with permit requirements

State DOTs should include requirements for design-build teams to develop and enforce environmental management or compliance plans as part of the design-build contract. The environmental management plan establishes procedures of how to manage incidents and accidents to minimize their impact to the environment (Aufdencamp and Mickelson 2013).

Studies and practice from State DOTs have identified that to properly manage environmental compliance, the State DOT and/or the design-build team should have an environmental compliance manager on site at all times during construction (The Louis Berger Group, Inc. 2005). The environmental compliance manager serves several important functions on design-build projects (Aufdencamp and Mickelson 2013):

- Permit writer – preparing permits or permit modifications;
- Contingency planner – develops plans for how to manage accidents and incidents that impact the environment;
- Design reviewer – ensures the design meets the contract requirements from an environmental compliance standpoint;
- Regulatory point of contact – provides regulatory agencies with a single point of contact when incidents occur or when they have concerns;

- Stormwater inspector – monitors stormwater runoff to ensure that environmental compliance goals are being met and that erosion control measures are adequately performing; and
- Emergency coordinator – manages the action plan when incidents occur to manage the incidents and coordinate clean up quickly.

Review of various State DOT RFPs indicates that requirements for an environmental compliance plan and an environmental compliance manager is a fairly universal requirement on most design-build projects. Examples from various State DOT RFPs can be seen below.

NCDOT

NCDOT uses and environmental compliance manager or erosion and sediment control supervisor on all design-build projects to ensure that all environmental ordinances and regulations are met. An example of language from two NCDOT RFPs can be seen below:

US 70 Goldsboro bypass from east of SR 1556 to east of SR 1323

> *Certified Supervisor – Provide a certified Erosion and Sediment Control / Stormwater (E&SC/SW) Supervisor to manage the Design-Build Team and subcontractor(s) operations, ensure compliance with Federal, State and Local ordinances and regulations, and to manage the Quality Control Program.*

Similar language is included in every RFP that was reviewed from NCDOT. NCDOT does not appear to require an environmental compliance plan on most of their design-build projects.

Oregon DOT

Oregon DOT includes the requirement for the design-build team to prepare an environmental compliance plan on all design-build projects and has this requirement in their design-build RFP template document. Oregon DOT does not include a specific requirement for an environmental compliance manager, but does require the design-build team to comply with all of the responsibilities normally assigned to this individual. Contract language from Oregon's Base RFP can be seen below:

> ***(9) Environmental Compliance Plan*** *- Design-Builder shall prepare and implement an Environmental Compliance Plan by the date required in Subsection (13), and shall update the plan as needed, as new fieldwork is completed, and as new or modified mitigation or environmental compliance strategies are developed throughout the term of the Contract.*

Oregon goes on to identify all of the requirements of the environmental compliance plan:

> *The Environmental Compliance Plan shall (a) identify all applicable environmental permits, programmatic agreements, orders, opinions, clearances, and authorizations and their requirements; (b) identify key environmental compliance personnel roles and responsibilities; (c) identify procedures for achieving and documenting environmental compliance; (d) establish procedures for identifying and resolving non-compliance; and (e) establish procedures for emergency response. In addition, the Environmental Compliance Plan shall address the process and procedures Design-Builder's environmental team will employ to ensure 100 percent compliance with environmental permits, programmatic agreements (if using), orders, opinions, clearances and authorizations, and protection of the environment. The Environmental Compliance Plan shall also include a schedule for accomplishment of each activity.*

UDOT

UDOT requires design-build teams to establish an environmental protection program on all design-build projects. UDOT does not specifically identify an environmental compliance manager's role, but does require that the design-build team comply with the activities typically identified as the responsibility of the environmental compliance manager. An example from UDOT's I-15 CORE project can be seen below:

I-15 CORE

Environmental Protection Program (EPP)

Develop, implement, and maintain an EPP that documents the measures and outlines procedures that will be taken to avoid, minimize, and mitigate impacts to the environment from the Work.

The EPP shall:

- *Establish and implement environmental compliance measures that are consistent with permit requirements, agency expectations, and the environmental commitments for the Project listed in the Environmental Summary Table.*
- *Implement and document environmental awareness training for all personnel who will be working on the Project.*
- *Demonstrate and communicate the Design-Builder's environmental commitment.*
- *Demonstrate how the Design-Builder will implement a "zero environmental violation" tolerance on all Project activities.*
- *Monitor and report on the Design-Builder's environmental compliance.*

Minnesota DOT (Mn/DOT)

Mn/DOT requires both an environmental compliance plan and an environmental compliance manager on all design-build projects. In addition to requiring the design-build team to have an environmental compliance manager, Mn/DOT also provides an environmental compliance manager to oversee environmental compliance issues.

Example language regarding the requirements regarding environmental compliance from Mn/DOT's St. Anthony Bridge replacement project can be seen below:

St. Anthony's Bridge Replacement

Environmental Management Plan

The Contractor shall submit an Environmental Management Plan (EMP) that describes the Contractor's approach to mitigating environmental impacts and contains the following elements:

- *Environmental personnel and training*
- *Mitigation measures*
- *Weekly and monthly reporting*
- *Environmental notification contact list*
- *Schedule of EMP activities*
- *Spill Containment Plan to describe the Contractor's plans to prevent, contain, clean up, remove, dispose and mitigate all regulated material spills. The Spill Containment Plan shall include a Notification List for containing and reporting.*
- *Construction noise mitigation techniques*

Mn/DOT requires that the design-build team has a full environmental compliance team that reports to Mn/DOT's environmental compliance manager. This team consists of all specialty personnel who can monitor specific portions of the construction and ensure that all facets of environmental compliance are met.

This requirement is identified in the below language:

> ***4.2.3.1.1 Environmental Personnel***
>
> *The Contractor shall designate an Environmental Team that reports directly to the Mn/DOT Environmental Compliance Manager (ECM). The Contractor's Environmental Team shall include those persons responsible for permitting, erosion and sediment control, environmental compliance, environmental monitoring, and hazardous materials.*

Specific role and responsibilities include:

- Permitting Specialist
- Storm Water Pollution Prevention Plan Designer
- Wetland Specialist
- Certified Erosion and Sediment Control Supervisor, and
- Installer

These personnel each have a role in ensuring that the design-build team complies with all environmental regulations, requirements, and commitments.

VDOT

VDOT includes a requirement of an environmental compliance manager on all design-build projects. While VDOT does not require an environmental compliance plan, the responsibilities of the environmental compliance manager cover all of those requirements typically found in an environmental compliance plan. Example language from VDOT's Route 29 Bypass regarding these requirements can be seen below:

Route 29 Bypass

Requirement for an environmental compliance manager:

> ***(j) Environmental Compliance Manager*** *– This individual should serve as the environmental compliance manager for the Project, responsible for ensuring*

compliance with all environmental commitments during the construction of the project. The Environmental Compliance Manager shall be available to review designs and [suggest] modifications to the designs, if necessary, based on field conditions and construction activities.

This individual shall be assigned to the Project full time and required to be onsite for the duration of the Project once construction activities commence.

VDOT makes a point to identify that the environmental compliance manager must be onsite for the duration of the project's construction.

WSDOT

WSDOT requires both an environmental compliance plan and an environmental compliance manager on all design-build projects. Example language from WSDOT's I-405 Auxiliary Lane project can be seen below:

I-405/Not Experienced 195 St to SR 527 Northbound Auxiliary Lane

Requirement for an environmental compliance plan:

2.8.3.2 ENVIRONMENTAL COMPLIANCE PLAN (ECP)

2.8.3.2.1 Documentation and Approval

The Design-Builder shall prepare and implement an Environmental Compliance Plan (ECP) that identifies roles and responsibilities of key personnel, procedures for environmental compliance, procedures to identify and correct non-compliance events, and procedures for emergency response. WSDOT's goal is to ensure environmental compliance with no permit violations.

Requirement for an environmental compliance manager:

2.8.3.2.2 Environmental Personnel, Communications, and Training (Part I)

2.8.3.2.2.1 Key Personnel: Environmental Compliance Manager (ECM)

***2.8.3.2.2.1.1** Roles and Responsibilities*

The ECM shall be responsible for the overall environmental compliance for the Project, and shall function as principal technical advisor and coordinator for environmental issues. The ECP shall identify all critical roles, responsibilities, and authorities of the ECM. The ECP shall identify the roles and responsibilities of other staff, and their roles in assuring environmental compliance. The ECP shall identify how the ECM will interact with WSDOT's Environmental Compliance Assurance Inspector (ECAI), as WSDOT's ECAI will be performing compliance audits and will be working closely with the ECM.

The ECM shall be on site for the duration of the Project. If the Design-Builder replaces the ECM, the Design-Builder shall provide an equally or more qualified replacement, contingent upon WSDOT's approval. If during the course of the Contract, WSDOT finds that the ECM is not ensuring implementation of the ECP, then WSDOT may require replacement of the ECM in accordance with Section 1-05 of the General Provisions.

TxDOT

TxDOT requires the design-build team to have an environmental compliance plan and an environmental compliance manager on all design-build projects. Example language from TxDOT's IH-35E Managed Lanes project can be seen below:

IH-35E Managed Lanes

Requirement for an environmental compliance plan:

4.1 General Requirements

The Developer shall deliver the environmental commitments required by the Contract Documents and all applicable federal and state Laws and regulations. The Developer shall develop, operate, and maintain a Comprehensive Environmental Protection Program (CEPP) for the Work to ensure environmental compliance with all applicable Environmental Laws and commitments. The

Program shall obligate the Developer to protect the environment and document the measures taken during the performance of the Work to avoid and minimize impacts on the environment from the design, construction, maintenance, operation, and rehabilitation activities of the Project.

Requirement for an environmental compliance manager:

4.4.1 Environmental Compliance Manager (ECM)

Developer shall designate a full-time ECM for the Work. The ECM shall report and coordinate all issues directly with TxDOT and the Developer's Project Manager. In the event the ECM, in consultation with Developer's Project Manager and TxDOT, is unable to reach satisfactory resolution of environmental issues, the ECM shall provide written notification to the Developer and TxDOT outlining the concerns, actions taken in attempt to correct the concerns, and provide a recommendation as to the suggested course of action.

CDOT

CDOT requires the design-build team to prepare an environmental compliance plan on all design-build projects. A specific role for an environmental compliance manager is not identified in the RFP documents, but the environmental compliance plan requires the design-build team to complete all activities normally assigned to an environmental compliance manager. An example from CDOT's I-25 North design-build RFP can be seen below:

I-25 North

Requirement for an environmental compliance plan:

ENVIRONMENTAL REQUIREMENTS

The Contractor shall comply with all requirements of all applicable environmental laws, Regulations, and Governmental Approvals issued there under, whether obtained by CDOT or the Contractor. The Contractor shall prepare an Environmental Compliance Work Plan for the Project, specifically identifying all *of the environmental compliance requirements, permits, and environmental mitigation activities for the Project and the Contractor's approach for complying with the requirements. The Environmental Compliance Work Plan shall be submitted to CDOT for Acceptance within 60 Days of NTP 1. The Environmental Compliance Work Plan shall be updated every three months, to show the status of environmental compliance Activities and shall be submitted to CDOT for Acceptance.*

7.4 Challenges and Opportunities Utilization Table

We conducted fact-finding interviews with seven environmental experts in State DOTs that currently have vibrant design-build programs. These experts evaluated the identified challenges, and answered with either "yes" meaning that they have experienced similar challenges or "no" meaning that the challenge was not experienced or was not applicable for their respective state DOT. A summary of this assessment is provided in Table 7.3.

These experts also evaluated the identified opportunities for efficiency enhancement of environmental planning and permitting process for design-build projects in their own State DOT. Each opportunity is marked as "standard practice", "utilized in few projects", "not considered", "considered for future implementation", or "not allowed by the State law". A summary of this assessment is provided in Table 7.4.

Table 7.3
Challenges Related to Environmental Analysis and Permitting on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Identification of Environmental Resources and Coordination with Environmental Agencies**							
	Regulatory concerns with incomplete design in design-build projects	Yes	-	Yes	No	Yes	Yes	Yes
	State DOT relationships with regulatory agencies	Yes	-	Yes	Yes	No	No	Yes
	Improper identification of resources	Yes	-	Yes	Yes	No	Yes	Yes
	Impact of Environmental Permitting on project schedule	No	-	No	Yes	No	No	Yes
	NEPA and Quantification and Mitigation of Environmental Impacts							
	Conventional prescriptiveness constraints of NEPA	Yes	-	No	No	Yes	No	Yes
	Mitigation of NEPA impacts while not limiting innovation	Yes	-	No	No	Yes	No	No
	Permit agency concerns about pressure from design-build teams	No	-	Yes	Yes	No	No	Yes
	Post-Award Environmental Management in Design-Build Contracts							
	Re-evaluation of the NEPA document triggered by proposed design changes	Yes	-	No	Yes	No	Yes	Yes
	Permit modification triggered by proposed design changes	Yes	-	Yes	No	No	No	Yes

Table 7.4
Opportunities to Enhance Efficiency of Environmental Analysis and Permitting on Design-Build Projects
Has your state DOT utilized these opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Identification of Environmental Resources and Coordination with Environmental Agencies**							
	State DOTs should partner with, fund positions, or co-habitat with regulatory agencies	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should examine alternative solutions during the concept phase by clearing additional areas for each environmental special study to allow for innovation	Standard practice	-	Standard practice	Standard practice	Utilized on a few projects	Standard practice	Standard practice
	State DOTs should be flexible to utilize several strategies for acquiring environmental permits	Standard practice	-	Standard practice	Not considered	Not considered	Not considered	Standard practice
	NEPA and Quantification and Mitigation of Environmental Impacts							
	State DOTs should add flexibility to the NEPA document and special studies by identifying alternative mitigation strategies, maximum impacts, and performance mitigation measures	Standard practice	-	Standard practice	Standard practice	Utilized on a few projects	Standard practice	Standard practice
	State DOTs should establish programmatic agreements with federal and environmental agencies to streamline the environmental planning and permitting process and to provide flexibility in the NEPA document	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Utilized on a few projects
	State DOTs should acquire time-consuming and high-risk permits early on and leave non-critical permits to be attained by the design-build team	Not considered	-	Standard practice	Not considered	Standard practice	Not considered	Standard practice
	State DOTs should consider advertising and awarding projects prior to the completion of NEPA to expedite project schedule	Considered for future use	-	Not considered	Utilized on a few projects	Not considered	Not considered	Utilized on a few projects

Table 7.4 (cont'd)

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Post-Award Environmental Management in Design-Build Contracts**							
	State DOTs should consider allowing the design-build team to accept the risk of NEPA re-evaluations (schedule and cost risks) by requiring the design-build team to complete the re-evaluation or to provide required documentation for NEPA re-evaluation.	Standard practice	-	Not considered	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should consider allowing the design-build team to accept the risk of obtaining or modifying environmental permits (schedule and cost risks) by requiring the design-build team to complete the permit application and/or modification or to provide required documentation for the permit modification.	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should consider providing incentives to the design-build team to encourage reduction in the environmental impacts of the project.	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should require the design-build team to have an environmental management plan and an environmental compliance manager to oversee the environmental impacts of the project and ensure compliance with permit requirements.	Standard practice	-	Not considered	Not considered	Standard practice	Standard practice	Standard practice

7.5 Implementation Recommendations for Consideration for GDOT

GDOT should add flexibility to the NEPA document and special studies by identifying alternative mitigation strategies, maximum impacts, and performance mitigation measures

State DOTs have realized several significant benefits through considering flexibility in environmental analysis and permitting. There have fewer reevaluations of the NEPA or state environmental planning documents. Additionally, less upfront work has been required to develop project plans to clear NEPA or state environmental planning documents since these documents can be developed utilizing less detailed designs. Design-build teams also prefer this strategy since flexibility in NEPA allows them to entertain new design ideas and propose cost-effective solutions for the project.

State DOTs that have implemented this potential best practice are the following:

- Colorado – defines maximum anticipated impacts in their "Base Design" which defines the project limits in the environmental planning document.
- Michigan – documents all potentially affected resources and possible impacts but does not document a design solution. Also works to ensure the NEPA document clears areas outside of the anticipated construction footprint that will be needed by the design-build team.
- North Carolina – North Carolina clears a wide corridor to allow for flexibility in final design regardless of the project delivery method (design-build or design-bid-build).
- Virginia – clears an environmental footprint much wider than anticipated to be required by the design-build team; anticipated impacts are documented with the flexibility that the design-builder can alter impacts.
- Washington – clears an anticipated corridor by describing and quantifying anticipated approaches to the final design.

GDOT should consider allowing the design-build team to accept the risk of NEPA re-evaluations (schedule and cost risks) by requiring the design-build team to complete the re-evaluation or to provide required documentation for NEPA re-evaluation

State DOTs and design-build teams have realized benefits by requiring the design-build team to update or provide documentation to update the NEPA document. State DOTs benefit by not expending resources to update special studies and/or prepare the NEPA reevaluation. Design-build teams benefit as they are able to better control the project schedule as they are not waiting on the State DOT to update special studies and/or prepare the NEPA reevaluation.

State DOTs that have implemented this potential best practice are the following:

- Colorado – design-build team updates special studies and Colorado DOT writes the reevaluation.
- North Carolina – design-build team prepares all special study updates and writes the reevaluation; North Carolina reviews and submits these documents to FHWA.
- Virginia – design-build team prepares all special study updates and Virginia DOT writes the reevaluation, performs additional coordination with regulatory agencies as required, and submits the reevaluation to FHWA.
- Washington – design-build team prepares all special study updates and Washington State DOT writes the reevaluation and submits to FHWA.

CHAPTER 8

ROW ACQUISITION

The Right of Way (ROW) acquisition process is a major component of delivering a transportation project. To build a roadway project, the property for the roadway footprint must be acquired. ROW regulations govern how Federal, State, and local agencies can acquire this property (FHWA 2012). ROW regulations begin with the 5th and 14th amendments which prevent private property from being taken for public use without just compensation (Research and Innovative Technology Administration, 2011). The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (the Uniform Act) identify procedures that State DOTs must follow when acquiring ROW using federal funds (FHWA 2012). These provisions encourage acquisition through negotiation with property owners instead of invoking the government's right to use eminent domain through condemnation.

Additional ROW are often required for the construction of transportation projects. FHWA's Every Day Counts initiative notes that the ROW acquisition process is a major part of delivering transportation projects (FHWA 2012). Federal funding authorization for ROW on transportation projects requires the NEPA planning process to be complete with a recommendation for a defined project alternative. The ROW acquisition process typically takes one to two years and can be a major source of project delay if not performed concurrently with other activities and can easily become the critical path to a project's schedule. ROW acquisition has typically been identified as one of the top three sources of project delay along with environmental planning and permitting and utility relocations (AASHTO 2008).

The ROW acquisition process typically has five basic steps (Research and Innovative Technology Administration, 2011):

- Planning: identify the need to acquire ROW and communicate this need through public meetings and project correspondence.

- Appraisal: the process of using a professional known as an appraiser to determine a fair market value for the property being acquired. The appraisal is then presented to the property owner in writing and negotiations can commence.
- Acquisition: the process of acquiring the property from the property owner. This process can be completed by the property owner accepting the offer, negotiations with the property owner, or if the negotiations fail, the State DOT can use the condemnation process to acquire the property. In this case, a jury trial determines the appropriate compensation level.
- Relocation: if the property being acquired has occupants that need to be relocated, then they must be compensated for the relocation. This compensation includes replacement housing, standards for replacement housing, and relocation planning and advisory services.
- Property Management: once the property is acquired, the State DOT must clear the ROW by moving, selling, or demolishing any property improvements.

Depending on the number of properties or parcels to be acquired, these five steps can take several years to accomplish for a transportation project. To further add to the criticality of the overall project schedule, on design-bid-build projects, State DOTs typically choose to acquire all required ROW and easement necessary to construct the project prior to advertising and letting the project for construction. Design-build provides State DOTs with the flexibility to perform ROW acquisition tasks concurrently with other project delivery tasks (Analysis Systems et al. 2009). Previous research has identified that performing ROW activities concurrently with other functions is a best practice and should be utilized whenever possible to expedite the delivery of the project (Ware and Cambridge Systematics 2006).

Figure 8.1 below shows how overlapping ROW acquisition with procurement can expedite the overall project schedule:

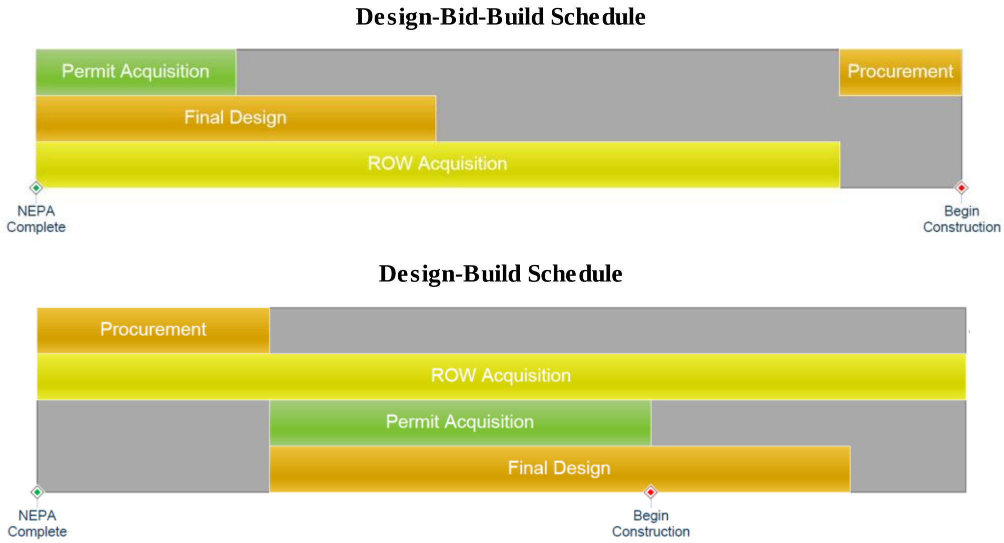


Figure 8.1

Design-Bid-Build vs. Design-Build ROW to Construction Schedule

Design-build also provides State DOTs with the flexibility to transfer ROW acquisition to the design-build team. This transfer of risk allows the design-build team to manage the schedule for the ROW acquisition and proceed to construction in areas where ROW has already been acquired while allowing the remaining ROW to be acquired while not holding up the overall project schedule (Analysis, Systems et al. 2009, FHWA 2012).

ROW acquisition on design-build projects requires a balance between acquiring ROW that may not be needed for the proposed design by the design-build team and expediting the overall delivery schedule of the project (Analysis, Systems et al. 2009). ROW acquisition for design-build projects involves critical activities, such as identifying ROW impacts and determining ROW acquisition strategy, and performing ROW acquisition tasks. We will discuss challenges related to the ROW acquisition process for design-build projects and propose opportunities to enhance the efficiency of ROW acquisition strategies for design-build projects.

8.1 Identification of ROW Impacts and Determination of a Row Acquisition Strategy for Design-Build Projects

During the concept development phase, State DOTs attempt to gather preliminary information regarding the existing and required ROW of the project. The information gathering involves identifying the project corridor limits, anticipated impacts, and estimated construction limits. Preliminary information can be helpful to the project teams later in the preliminary design and procurement phases, as it supports the ROW plan development. Initial ROW identification in the concept phase, also helps the project teams determine whether the project can be completed within the existing ROW, or if additional ROW acquisition is required for the project prior to the development of preliminary design and/or conducting environmental permitting activities (FHWA 2012). Early ROW identification provides technical engineering information for the design team and ROW professionals, which can later be used during the preliminary and final design stages.

The State DOT should review and discuss the initial ROW plans in order to develop a meaningful strategy towards the project ROW acquisition. In their ROW acquisition strategy, State DOTs determine the roles and responsibilities of purchasing the project ROW. Based on detailed interviews with seven State DOTs, the research team identified that to secure the design-build project ROW, State DOTs usually choose one of the following three approaches:

- Develop specific ROW plans and acquire the project ROW for a specific project corridor;
- Develop ROW plans and acquire ROW after the design-build team is procured and has identified the ROW required for their specific design;
- Provide preliminary ROW plans to the design-build team and transfer the responsibility of ROW acquisition to the design-build team based on specific needs of the proposed design of the design-build team.

The first approach limits the risk to the design-build team since the State DOT has more control over how much ROW is acquired. The approach requires the State DOT to develop specific ROW plans without considering alternative design or construction solutions, which may require additional ROW to accommodate the design-build team's proposed design. ROW plan development and acquisition for a specific project corridor is suitable for projects with major ROW risks or projects that do not have innovative solutions as a major project goal. ROW acquisition can be a challenging process and the State DOT is exposed to the following risks in this approach.

- The State DOT has to bear the costs of unnecessary ROW acquisition for ROW that is bought and then not needed based on the design-build team's design;
- Delays to the project schedule and construction start if the ROW is not acquired in accordance with contractual dates.

The second approach requires the State DOT to work with the design-build team to determine the ROW needs for their design and acquire the ROW in a timeframe that works with the design-build teams' schedule. This approach should be utilized on projects that have minimal ROW needs, but where the ROW required is dependent on the design-build team's proposed design. This strategy requires more effort from the side of the State DOT to develop ROW plans and acquire ROW in an expedited manner, but it allows the State DOT more control over the ROW costs and may be less expensive in terms of real estate costs.

The third approach is suitable for projects in which alternative and innovative solutions are anticipated from proposers. In these cases, ROW scope and plan development may be delayed to the preliminary design or the procurement phase, so that proposers can modify ROW plans and acquire the required ROW based on their own designs. This approach focuses on innovative solutions and may require studying potential project ROW limits for alternative project corridors (Research and Innovative Technology Administration, 2011).

Regardless of the State DOT's approach towards the ROW acquisition, the State DOT's strategic plan in the concept phase should define two important items: preliminary ROW cost estimate and acquisition responsibilities (Group 2009). Defining these items can be a challenge on design-build projects due to the project complexity and multiple options that may be available for ROW acquisition. Preliminary ROW cost estimate should consider not only the ROW required for the construction of the project, but also ROW requirements for environmental mitigation, tolling infrastructure, and utility needs. The ROW costs associated with these other activities can have major impacts on projects with significant budget constraints. These additional ROW costs are not considered until later stages in the project and hence, they may influence the preferred alternative for the project.

Selecting the appropriate ROW acquisition method early in the development of the project can be a challenge as the project is not fully defined and the availability of staff, funding, and resources may be unknown. Making this selection early in the project development will allow State DOT resources to be utilized more efficiently later in the project development as roles and responsibilities are better defined and staff effort can be expended in those areas which are of the greatest benefit to the project.

8.1.1 Challenges in identification of ROW impacts and determination of a ROW acquisition strategy for design-build projects

8.1.1.1 Identification of ROW impacts based on incomplete design plans

Design-build is based on the idea that a project is advertised with minimal design completed and that the design-build team will complete the design and construction. Since the final design and construction are being done by the design-build team, State DOTs may have difficulty anticipating the amount of ROW that may be required to complete a project (Ware and Cambridge Systematics 2006).

State DOTs typically identify or acquire a baseline amount of ROW prior to advertising and awarding a design-build contract. Additional challenges are then presented if the ROW needs anticipated by the State DOT differ from the proposed final design by the design-build team (Eric

Lyons, personal communication, March 7, 2013; Theresa Bruton, personal communication, March 15, 2013; Kevin Sullivan, personal communication, February 26, 2013). Several challenges were identified through interviews with several State DOTs:

- Which party is responsible for the cost and schedule risks if additional ROW is required?
    - Does this vary if the change is caused by the design-build team's proposed design vs. something that was not properly identified by the State DOT?
- What is the process for managing additional ROW that was acquired pre-bid but was not required for construction?
- Should State DOTs provide incentives for design-build teams to reduce ROW requirements? How?

These additional challenges are managed differently by each State DOT that was interviewed in this research. All State DOTs interviewed have varying degrees of success with their management of these challenges, but no universal best practice appears to exist.

8.1.1.2 Management of third party ROW needs

On design-bid-build projects, third parties, such as environmental agencies and utility owners are often coordinated with throughout the development of a project. This coordination is typically done through back and forth submittals for review and comment but without the third party being truly collaborated with on the project (Towcimak, Waymack et al. 2004). This submittal review process is typically fragmented throughout the development of the project, and changes are not quickly and succinctly communicated to the third parties resulting in delays or project issues when the design does not meet their needs (American Association of State, Transportation et al. 2007). This is especially true if the third party needs to include additional ROW for environmental mitigation or utility ROW or easement. This normal challenge on design-bid-build projects is exacerbated on design-build projects when these issues are not identified until after a design-build team is under contract (Eric Lyons, personal communication, March 7, 2013). If not properly managed, this challenge can lead to additional costs and project delays for the State DOT and/or the design-build team.

8.2.2 Opportunities in identification of ROW impacts and determination of a ROW acquisition strategy for design-build projects

8.1.2.1 Opportunity for efficiency enhancement: State DOTs should coordinate project ROW needs with utilities, environmental mitigation requirements, tolling infrastructure, and other project needs that may affect ROW

Project ROW requirements are defined by several factors in addition to land required to construct and maintain the project. There are several other portions of project delivery that if properly coordinated with can substantially shorten project delivery. ROW should play a major role in the project scoping process (FHWA 2012). This increased role during the scoping phase can lead to a longer planning period for the project, but should help accelerate later stages of the project. Delays in ROW acquisition traditionally occur when ROW is not integrated into the development of a project (Keck 2010). During the development of the project, State DOTs should coordinate project ROW requirements with the other major delivery milestones, as the following:

- Utility relocation requirements: State DOTs should coordinate with utility owners during the planning stage of the project to identify those utilities which maintain their own ROW or easement and will need to be relocated to new ROW or easement as part of the construction of the project (Analysis, Systems et al. 2009). Additionally, it may be beneficial to State DOTs to expand the width of ROW for the project in anticipation of future permitted utilities or State DOT Intelligent Transportation Systems (ITS) and Advanced Transportation Management System (ATMS) lines.
- Environmental mitigation: mitigation for impacts to the environment can be completed in a variety of ways. Some mitigation strategies may require additional ROW, such as

constructing sound barriers, developing and maintaining mitigation banks, purchasing flood easements, protecting endangered species, or hazardous waste cleanup (Ware and Cambridge Systematics 2006, Analysis, Systems et al. 2009, Campbell, Solomon et al. 2009)

- Tolling infrastructure: Additional ROW may be required for the construction of toll booths, toll gantries, or other tolling infrastructure (Keck 2010).

These activities can be coordinated by the State DOT partnering "from the top down" with utility owners, regulatory and permitting agencies, and internal departments (Ware and Cambridge Systematics 2006). The formation of informal networks between these various groups can shorten the delivery of the project by identifying ROW needs earlier in the project development and providing training and resources to these groups when appropriate (Ware and Cambridge Systematics 2006). The team approach created by partnering encourages State DOTs and other groups to work together to navigate around problems and create solutions (Ware and Cambridge Systematics 2006).

Upper management support within State DOTs has been shown to aid creating a constructive project development atmosphere where team members are encouraged to work together to accomplish a common goal of successful delivery of a project; this helps to foster a "Supportive Institutional Environment" (Ware and Cambridge Systematics 2006).

Some examples from State DOTs on early coordination and partnering efforts are shown below:

Florida DOT (FDOT):

FDOT has used design-build for project delivery for over twenty years. In their effort to keep up with rapid demand, FDOT has looked for innovative ways to expedite ROW acquisition. Some of FDOT's established practices to expedite and coordinate ROW acquisition include (Ware and Cambridge Systematics 2006):

- Established written procedures specifying the timing, participation, and agenda of team meetings.
- District 5 creates professional teams for projects with a common goal of ensuring ROW is available to keep the project's construction on schedule. Team members work together to expedite reviews and submittals when submittal milestone dates are missed to make the property available for construction.
- Worked with environmental agencies to develop their Efficient Transportation Decision-making program. This program consolidates environmental databases and helps define potential environmental issues including those that affect ROW.
- Florida DOT strives to identify all permit requirements including additional ROW needs prior to project advertisement (FDOT 2011).

Texas DOT (TxDOT):

TxDOT has acquired additional ROW to minimize the negative environmental impacts of the projects by providing additional workspace for cut and fill limits. Some example projects are (Ware and Cambridge Systematics 2006):

- On State Highway 130, the project's construction would impact limestone caves and limestone voids which in turn impacted endangered blind spiders. In addition to providing additional training to bulldozer operators to minimize the impacts, "additional ROW was also acquired to prevent intrusion into the spider habitat".
- TxDOT acquired 250 acres for wetlands mitigation and worked with two cities to maintain the area as a city park by purchasing conservation easements.

California DOT:

Utilizes multi-functional teams made up of various disciplines to ensure all project stakeholders understand the issues of one another. This allows them to identify issues and additional ROW requirements earlier in the project development process when changes to project scope are less expensive (Ware and Cambridge Systematics 2006).

Utah DOT (UDOT):

UDOT works with utility owners and environmental planners and regulatory agencies to ensure that ROW needs are properly planned and coordinated.

UDOT coordinates with utility owners prior to project advertisement to determine possible ROW or easement needs. These needs are then conveyed to the design-build team via the contract requirements (Richard Manswer, personnel communication, March 7, 2013).

UDOT obtains major project permits in advance of advertisement and award of design-build projects to ensure that enough ROW is obtained for any mitigation requirements (Michele Page, personnel communication, March 7, 2013).

On the I-15 CORE project, UDOT identified ROW impacts in the early stages of the project and coordinated ROW needs with utility owners and ROW requirements for environmental permitting which allowed UDOT to define a ROW corridor that the design-build team could use (UDOT 2013).

8.1.2.2 Opportunity for efficiency enhancement: State DOTs should identify project goals and select a ROW acquisition strategy that helps achieve them

State DOTs should choose an appropriate approach toward the ROW acquisition of the project as early as possible. The ROW acquisition strategy for the project should help the State DOT in determining the required level of flexibility in developing the ROW footprint for the project. Early decision-making regarding the ROW acquisition approach can facilitate future efforts for ROW plan development and negotiations with property owners (FHWA 2012). The decision of ROW acquisition strategy is a major decision with substantially consequential impacts on several dependent decisions throughout the project development.

In addition, the State DOT can benefit from overlapping ROW acquisition responsibilities and procurement of the project (Analysis, Systems et al. 2009). State DOTs can employ several strategies for acquiring ROW on design-build projects. In employing a strategy, State DOTs determine roles and responsibilities for acquisition and purchase of project ROW. A single strategy or a combination of strategies can be used for a project's ROW acquisition and State DOTs should evaluate their options and select the method that is most beneficial for the goals of the project. Strategies available to State DOTs for ROW acquisition on design-build projects can be summarized as the following (Towcimak, Waymack et al. 2004, FHWA 2012):

- Perform ROW acquisition in advance of advertising and awarding a design-build project. This approach is typically utilized when the ROW footprint of the project is not expected to change or the State DOT would like to maintain the ownership of the entire ROW process. This also helps minimize the ROW risk for the design-build team. However, it limits the opportunity for developing any possible innovative design solution from the design-build team that will locate outside the predetermined ROW.
- Perform ROW acquisition after the design-build team is selected based on the design-build team's proposed design. This approach is typically utilized when the State DOT anticipates that ROW footprint changes depending on the proposed design of the design-build team, but wants to maintain the ownership of the ROW process. This approach helps minimize the ROW risk for the design-build team, but adds additional risks to the State DOT if the ROW is not acquired in time for the design-build team's construction.
- Include ROW acquisition services in the design-build contract is typically utilized when the State DOT anticipates that ROW footprint changes depending on the proposed design of the design-build team. This approach allows the design-build team to dictate ROW acquisition schedule by employing additional resources to expedite ROW activities for multiple parcels. Hence, there is an opportunity for cost/schedule savings through close

coordination of design and ROW acquisition activities. Risks for delays in ROW acquisition are typically transferred to the design-build team.

- Including ROW acquisition services and the land purchase costs in the design-build contract. This approach is similar to the previous approach except that the design-build team includes the estimated cost of purchasing the land in its proposal. This provides cost certainty for the State DOT at the point of the project award for the entire cost of project design, ROW purchase, and construction. This approach is considered high-risk for the design-build team and may inflate the bid price through higher contingency. In the cases of parcels that must be condemned, this approach also may require the design-build team to pay the State DOT the value of the condemnation as only government entities have the power to condemn landowners. This approach has not been used on a design-build project, but is common on public-private-partnership projects with a concessionaire as the concessionaire can recoup this cost over the ownership period of the concession.

Each strategy has advantages and disadvantages that will be further discussed in Section 8.2.2 along with examples from State DOTs who utilize each practice. The State DOT should be flexible to consider all options for ROW acquisition and utilize the most appropriate option considering specific project goals. The critical issue is to evaluate ROW acquisition strategies early during the planning phase of the project and make prompt decision for the process of ROW acquisition. Early decisions should be made concerning which strategy to employ based on specific project goals and the schedule of the project (Towcimak, Waymack et al. 2004). By selecting a strategy in the planning and scoping phase of a project, State DOTs are able to use this strategy to shape future project decisions and determine what party should be responsible for managing the other major project delivery activities.

8.2 Execution of ROW Acquisition Tasks

ROW acquisition tasks are typically main components of any transportation project (FHWA 2012). Design-build project delivery system provides the opportunity that the ROW acquisition tasks are overlapped with other project activities thereby accelerating the overall delivery of the project (Analysis, Systems et al. 2009).

ROW acquisition is a high risk area with the potential to cause several challenges to the success of the project (FHWA 2012). Issues in the process of ROW acquisition can cause problems to the overall project, such as delaying the project delivery schedule, lengthy and/or costly court cases, utility conflicts, and cost overruns, due to increases in value of real estate properties. Avoiding and mitigating such risks by the State DOT requires identifying roles and responsibilities, and assigning them to the appropriate party (Analysis, Systems et al. 2009).

State DOTs generally maintain the responsibility of ROW acquisition and secure the required ROW prior to the start of the bidding process (Analysis, Systems et al. 2009). Securing project ROW prior to bidding requires development and preparation of ROW plans during preliminary design and coordination with the Office of ROW and project consultants. State DOTs may practice early ROW acquisition to ensure design-build teams are not delayed by ROW acquisition and to expedite the overall delivery of the project. State DOTs are also in the best position to appraise, negotiate, and purchase ROW (FHWA 2012). However, acquiring ROW prior to advertising and awarding a design-build project may diminish the benefits of design-build due to several disadvantages, as the following (Analysis, Systems et al. 2009):

- Reduced level of flexibility of the design-build team in final design and construction,
- Limited degree of innovation in design (the project footprint is usually fixed),
- Increased real estate costs (if the State DOT acquires ROW that is not necessary for the design-build team's proposed design).

Although State DOTs generally maintain ROW acquisition responsibilities, the design-build project delivery system enables State DOTs to transfer this responsibility to design-build teams. When ROW acquisition is transferred to the design-build team, the design-build team becomes responsible for finalizing ROW plans, negotiating with property owners, and securing the project ROW (Towcimak, Waymack et al. 2004, Analysis, Systems et al. 2009, FHWA 2012).

The design-build project delivery system allows design-build teams for construction to proceed in advance of the entire ROW being acquired. The ROW must still be acquired for an area of the project before construction can commence, but this added flexibility allows design-build teams an opportunity to expedite the project schedule by overlapping construction and ROW acquisition tasks (FHWA 2012).

There are several challenges related to ROW acquisition tasks that State DOTs have tried to overcome with innovative strategies over the years. Most recently, State DOTs have pushed for greater flexibility in performing ROW acquisition tasks. The FHWA's Every Day Counts (EDC) Initiative has provided guidance on ways to expedite performing ROW acquisition tasks within the existing legislation environment (FHWA 2012). This flexibility includes performing advanced ROW acquisition tasks where ROW is acquired prior to the completion of the NEPA process, coordinating and overlapping ROW acquisition with other project delivery activities, and utilizing incentive payments to advance acquisition and relocation (FHWA 2012). Although some of these opportunities are applicable to both design-build and design-bid-build project delivery systems, the goal of expediting the project delivery is at the heart of these innovative solutions.

8.2.1 Challenges in execution of ROW acquisition tasks

8.2.1.1 ROW acquisition as the critical path to a project's schedule

ROW acquisition is often considered as one of the top three sources of transportation project delay and can take several years to complete (AASHTO 2007). State DOTs acquire all required project ROW prior to advertising and awarding a design-bid-build contract to a contractor. The FHWA will not authorize ROW funding except in hardship or protective buy situations until the completion of the NEPA planning process. For design-build projects, the ROW acquisition process can be a hindrance to the overall delivery of the project depending on how the acquisition process is managed.

State DOTs utilize different approaches to perform ROW acquisition tasks for design-build projects depending on the preference and willingness of the State DOT to transfer and/or take on project risks. Each ROW acquisition strategy has risks that can delay the project. Below, we present examples of performing ROW acquisition tasks from three State DOTs. Respective challenges for the practice of each State DOT regarding ROW acquisition tasks in design-build projects are summarized, as the following:

- Colorado DOT (CDOT) attempts to acquire all required project ROW in advance of advertising a design-build project (Kevin Sullivan, personnel communication, February 26, 2013). While this ROW acquisition strategy prevents the acquisition process from delaying the design-build team, it results in schedule delays in advertising and awarding the project while the required ROW is acquired. Delays may also occur if additional ROW is required; CDOT maintains the responsibility for acquiring any additional ROW and any delay caused by the additional acquisition must be managed by the design-build team.
- North Carolina DOT (NCDOT) identifies base ROW map requirements that are results of early coordination with third parties and the environmental planning process. NCDOT then transfers the requirement for ROW acquisition to the design-build team who is responsible for performing ROW acquisition tasks, but not the actual land purchase (Theresa Bruton, personnel communication, March 15, 2013). This strategy attempts to transfer all ROW risks associated with project delay to the design-build team who can utilize additional ROW acquisition resources if necessary to speed the acquisition process. While NCDOT's risks associated with ROW acquisition are minimized, design-build teams most likely

include contingencies in their bid prices to mitigate risks associated with delayed acquisitions.

- UDOT utilizes varying ROW acquisition strategies depending on the scope of the project and the number of parcels to be acquired. One strategy that UDOT has used when ROW acquisition is the critical path to a project's construction is to retain a program manager who is responsible for performing ROW acquisition tasks. The ROW acquisition is completed by the program manager on behalf of UDOT while the design-build team is completing the final design and beginning construction. UDOT and the program manager coordinate with the design-build team to prioritize the parcel acquisition process based on the design-build team's needs (Eric Lyons, personnel communication, March 7, 2013). While this process allows UDOT to ramp up or down program manager resources to speed the ROW acquisition process when needed to minimize schedule risks associated with ROW acquisition, UDOT is still responsible for schedule risks to the project if parcels are not acquired in time for construction. Design-build teams may also include contingencies in their bid prices to mitigate risks associated with delayed acquisitions.

8.2.1.2 Management of ROW acquisitions for a large number of parcels

Projects with a large number or complex ROW parcels to be acquired introduce additional challenges to design-build projects. The ROW acquisition process for projects with a large number of ROW parcels can take two to three years and managing this with the overall project schedule may result in States opting to utilize a different project delivery system for these types of projects (AASHTO 2007). For instance, some States DOTs, such as CDOT, typically do not utilize design-build for projects with a large number of ROW acquisitions (Kevin Sullivan, personnel communication, February 27, 2013). Other State DOTs, such as NCDOT and UDOT, utilize strategies that attempt to minimize the impact of this challenge to the overall project schedule.

State DOTs should evaluate their ability or the design-build team's ability to acquire the required ROW prior to beginning construction. This evaluation should realistically consider the amount of risk related to delays that the design-build team may incur while waiting for the ROW to be acquired. This risk causes State DOTs such as CDOT to not use design-build for projects with a large number of ROW acquisitions (Kevin Sullivan, personnel communication, February 27, 2013).

8.2.2 Opportunities in execution of ROW acquisition tasks

8.2.2.1 Opportunity for efficiency enhancement: State DOTs should utilize effective ROW management tools

State DOTs are realizing a need to implement electronic management systems to maintain and track ROW acquisition tasks (Ware and Cambridge Systematics 2006). Lack of proper management of ROW acquisition tasks can cause project delay. Projects with a large number of ROW parcels that are required for construction can be difficult to manage using traditional management methods. As ROW acquisition proceeds at different speeds for the various parcels, management of all of these tasks can become cumbersome and losing sight of key parcels can substantially delay a project. Document management systems are becoming increasing important as State DOT resources are reduced and knowledgeable employees leave taking institutional knowledge with them. AASHTO recommended that State DOTs utilize current technology to the greatest extent possible (Towcimak, Waymack et al. 2004). Management strategies that are being employed by various States are summarized, as the following:

Minnesota DOT (Mn/DOT)

Mn/DOT Utilizes Right-of-Way Electronic Land Management System (REALMS) for ROW tracking and management. REALMS allowed Mn/DOT to realize the following benefits (Ware and Cambridge Systematics 2006):

- *"Linkage to other Mn/DOT databases to populate REALMS;*

- *Sharing and use of consistent data both among internal staff Statewide (eight district offices and the central offices) and with consultants, providing a single authoritative source for all ROW information;*
- *Increased ability to process more ROW projects simultaneously;*
- *Ability to use the database as an improved cost comparison tool and to improve project resources forecasting; and*
- *Provision of real-time ROW project information at the customer's desktop."*

TxDOT:

TxDOT requires the use of a GIS based electronic tracking system to monitor and report progress on tasks. This tracking system is critical to keeping acquisition tasks on schedule by tracking individual tasks for each parcel and comparing these to the project schedule. Automatic alerts are issued several days in advance of review response due dates and when submittals do not meet scheduled dates (Ware and Cambridge Systematics 2006). Example contract language that is included when ROW acquisition services are included in the design-build contract can be seen below:

> *"Developer shall employ software that is fully compatible with the software in use by TxDOT, or fully transferable to TxDOT's systems. Developer must supply and maintain a web-based, parcel-by-parcel database that incorporates the fields and information required by TxDOT's approved ROW tracking system: ROWIS. Developer must maintain and participate in any other required ROW tracking system required by the Contract Documents or otherwise agreed to by the parties. The database shall be fully accessible to Persons authorized by TxDOT."*

Missouri DOT (MoDOT):

MoDOT uses GIS software to facilitate real time cost-analysis of projects. This software also allows MoDOT to identify project boundaries, encroachments, property lines, and other ROW data quickly and easily (Analysis, Systems et al. 2009).

Utah DOT (UDOT)

UDOT requires design-build teams acquiring ROW to input and update parcel status in a web-based tracking document. This web-based tracking system allows UDOT ROW staff, field agents, and the design-build team's ROW consultants to log in and track and monitor the ROW acquisition process. All communications with property owners, appraisals, negotiations, and other ROW acquisition activities are monitored and tracked through this software (Analysis, Systems et al. 2009).

ROW tracking requirements on UDOT's I-15 South Payson Interchange to Spanish Fork River Project RFP are described as the following:

> *"**ROW Tracking System.** Input and update parcel status in Web-based spreadsheet tracking document system or as directed by the Department. Upload spreadsheet tracking document into ePM."*

This language is straightforward and to the point. The design-build team is required to input and update the ROW acquisition status on a parcel basis. This web-based tracking tool allows UDOT and the design-build team to quickly determine the status of any parcel's acquisition and the status of the overall acquisition process (Eric Lyons, personnel communication, March 7, 2013)

Virginia DOT (VDOT)

VDOT includes the following language in their design-build contracts when ROW acquisition services are also included in the contract:

> *"The Design-Builder shall obtain access to and use VDOT's Right of Way and Utilities Management System ("RUMS") to manage and track the acquisition process. RUMS will be used for Project status reporting; therefore, entries in*

RUMS shall be made at least weekly to accurately reflect current Project status. VDOT standard forms and documents, as found in RUMS, will be used to the extent possible. Training in the use of RUMS and technical assistance will be provided by VDOT."

This electronic reporting allows VDOT to maintain oversight of the ROW acquisition process and to adequately manage the overall acquisition process. VDOT indicated that they do sell and have sold the source code to other State DOTs for them to customize for their use (Les Griggs, personnel communication, April 10, 2013).

8.2.2.2 Opportunity for efficiency enhancement: State DOTs should utilize advance acquisitions

State DOTs can utilize advance acquisition procedures to acquire ROW prior to completion of the NEPA planning process. By acquiring ROW parcels in advance of NEPA completion, State DOTs can realize several benefits (Wood, Kassoff et al. 2011):

- Accelerated project delivery;
- Protective buying (acquiring ROW early to save money on land costs); and
- Corridor preservation: purchasing a project corridor before the land can be developed for other purposes.

Advance ROW acquisition may only be utilized in special cases and is not suitable for all projects. It can limit the benefits of design-build through limitation in innovation opportunities and federal guidelines have strict parameters on when this process can be used (Analysis, Systems et al. 2009). Advance acquisition is beneficial to design-build projects, but should be utilized on a corridor preservation approach or for protective buy situations. Neither of these options is specific to the design-build project delivery system. Several State DOTs that were interviewed utilize advance acquisitions for these two scenarios regardless of the project delivery method. State DOTs who practice advance acquisitions can be seen below.

- UDOT practices corridor preservation for projects that are in the planning stage but may not be in the ROW acquisition phase of the project for several years. UDOT works with local municipalities to identify when land that is needed for a future project is identified to be developed. UDOT is then able to acquire these parcels prior to them being developed (Eric Lyons, personnel communication, March 7, 2013).
- NCDOT uses advance acquisitions in cases of hardship acquisitions or special cases such as protective buys. NCDOT does not typically acquire any ROW prior to advertising and awarding a design-build contract (Theresa Bruton, personnel communication, March 15, 2013).
- VDOT uses advance acquisitions in cases of hardship acquisitions or special cases such as protective buys. VDOT does not typically acquire any ROW prior to advertising and awarding a design-build contract (Les Griggs, personnel communication, April 10, 2013).
- CDOT has used advance acquisitions in special cases to accelerate ROW acquisition (Kevin Sullivan, personnel communication, February 26, 2013).
- Michigan DOT (MDOT) has not utilized advance acquisitions for design-build projects due to lack of need or special circumstance. MDOT has used advance acquisitions on design-bid-build projects (Chris Young, personnel communication, April 11, 2013).

8.2.2.3 Opportunity for efficiency enhancement: State DOTs should maintain ownership of ROW acquisition

State DOTs may choose to acquire all required ROW for design-build projects. This can be done prior to advertising and awarding the contract, proceed concurrently with design-build procurement, or continue while the design-build team completes the project design. Acquiring ROW before advertising a design-build contract can expedite the delivery of a project as it allows design-build teams to proceed to construction without needing to wait on ROW acquisition (Group 2009).

Similar risks are involved as with early ROW acquisition in that State DOTs can end up purchasing more ROW than is needed for the project's construction and innovative opportunities are reduced by establishing the project footprint. These risks should be considered along with the goals of the project to determine when to acquire the ROW for the project (Group 2009). ROW professionals have also complained that attempting to acquire ROW in advance of the final design strains relationships with property owners as they are unable to document an accurate project footprint for them (Analysis, Systems et al. 2009).

State DOTs should retain ROW acquisition services and acquire the ROW in advance of advertising and awarding a design-build project when there is minimal risk to the State DOT that they will either not acquire enough ROW or too much ROW for the design-build team's proposed design.

When the State DOT chooses to acquire the ROW concurrently with the design-build team developing the final design for the project, the State DOT should include a schedule for anticipated ownership and right-of-entry dates for all ROW required for the project. This will reduce the risks to the design-build team and thereby reduces project's costs and contingencies. The State DOT should retain the risk associated with project delays due to delays in ROW acquisition (Group 2009). State DOTs should acquire the ROW after awarding the design-build contract for projects where the State DOT is in the best position to acquire the ROW. The following examples illustrate when the project would be expedited by the State DOT acquiring the ROW concurrently with the design-build team completing the Final Plans:

- When the State DOT has time to start the acquisition process prior to awarding the design-build contract and they can complete the acquisition quicker than the design-build team;
- When the State DOT has transferred a large amount of risk to the design-build team in other areas. In this case, the State DOT may be in a better position to acquire the ROW to limit the design-build team's risk.

Some examples from various State RFPs who acquired ROW in advance or maintained ownership of the ROW acquisition process after the award of the design-build project are seen below.

UDOT

UDOT selects the strategy for ROW acquisition that is most likely to achieve their project goals. For the I-15 CORE project, UDOT determined that utilizing their program manager to acquire the ROW would retain the risks associated with ROW acquisition with UDOT and limit the risk of the design-build team. This was a very complex project where a large amount of risk was transferred to the design-build team.

I-15 CORE

> ***Administrative Requirements***
>
> *The Department will retain possession of each parcel and all improvements, if any, made thereon by the Design-Builder. The Design-Builder's access and use of the Right of Way (ROW) arises solely from the permission granted by the Department under the Contract.*

The above contract language made it clear to proposing design-build teams that UDOT would maintain ownership of the ROW acquisition process.

> ***Status of Right-of-Way***
>
> *The Department will acquire all permanent ROW for the Project, including Perpetual Easements (PEs), and Utility Easements (UEs). The Department will acquire Temporary Easements (TEs) only as shown on the ROW Plans included in Part 5. The ROW Plans included in Part 5 show the ROW that the Department owns or is acquiring for the Project.*
>
> *The Design-Builder shall be allowed access to each parcel identified in Attachment 19-A (Right-of-Way Schedule) as each parcel is acquired and as the Department provides the Design-Builder notice. The Department will provide the Design-Builder with status reports, written notice of parcel access, and any applicable*

restrictions that may apply. The Design-Builder shall not access any parcel on which access has not been provided.

UDOT did not commit to any schedule requirements to deliver the 300 parcels required for this project, but did work with the design-build team to prioritize the ROW acquisition based on the design-build team's proposed construction schedule (Eric Lyons, personnel communication, March 7, 2013).

11400 South Interchange

For this project, UDOT also retained ownership of the ROW acquisition.

5.2.1 Department Responsibilities

The Department has primary responsibility for the acquisition of parcels within the Planned ROW Limits, including Utility Easements necessary for the relocation of known Utilities. The Department may also acquire additional parcels, subject to the provisions of Section 5.3 (Acquisition Schedule). Department acquisitions will be on the planned ROW acquisition schedule, which will be finalized by the Department after award of the Contract; see Section 5.3 (Acquisition Schedule). The Department will be responsible for relocations of occupants associated with acquisitions.

For this project, UDOT committed to a ROW schedule as part of the contract documents. UDOT retained the responsibility for risks associated with not meeting their contractual ROW schedule.

5.3 Acquisition Schedule

A preliminary ROW acquisition schedule will be completed by the Department at issuance of the First Notice to Proceed (NTP 1). Any change to the Project design resulting from the Department's inability to obtain parcels within the Planned ROW Limits will be deemed a Department-Directed Change. Any delay in meeting the Final ROW Acquisition Schedule will be considered a Department-Caused Delay to the extent that it delays the Critical Path of the Project Schedule. The

Department will notify the Design-Builder of any anticipated delay in meeting the Final ROW Acquisition Schedule. In such event, the Design-Builder shall immediately determine whether the delay affects the Critical Path and, if so, to what extent it might be possible to avoid the delay through alternative construction methods or similar actions. The Design-Builder shall promptly meet with the Department to determine the best course of action.

CDOT

CDOT acquires all required ROW in advance of awarding design-build projects. The ROW acquired is based on the project's Basic Configuration (Kevin Sullivan, personnel communication, February 26, 2013). CDOT clearly conveys this to the proposing design-build teams in the contract documents and transfers the risk of additional ROW to the design-build team including the land purchase price. An example is presented below:

I-25 North

Status of Right-of-Way

CDOT does not anticipate the need to acquire additional ROW or USAFA Easements for the Basic Configuration for this Project.

If the Contractor finds it necessary to acquire additional ROW, USAFA Easement, or temporary or permanent easements to complete the Work, the Contractor shall:

1. *Be required to obtain the additional ROW or Easements at their own cost*
2. *Reflect this acquisition in the Project Schedule*
3. *Follow the requirements contained in this section for acquisition of additional ROW/Easement*

CDOT will retain possession of each parcel and all improvements, if any, made thereon by the Contractor.

This language clearly informs the design-build teams of the status of the ROW acquisition and the transfer of risk associated with additional ROW required for the design-build team's design.

MDOT

MDOT has acquired all required ROW on all design-build projects to date. MDOT has not had a project where the schedule could not accommodate acquiring the required ROW in advance of the design-build team's construction (Chris Young, personnel communication, April 11, 2013). MDOT transfers the risk of additional ROW needs to the design-build team for both the schedule and costs risk. MDOT noted in our interview that the design-build team has not required additional ROW on a project to date. An example of where the ROW acquisition has continued past the project award can be seen below:

I-96 from Wacousta to M-43

This section describes the status of the ROW acquisition and establishes the schedule upon which the acquisition process will be completed.

> *MDOT is purchasing permanent and temporary Right of Way for the Project as shown in Exhibit 2-7-A, ROW Work Map. The Contractor shall limit all proposed construction to within existing and proposed ROW, easements, and grading consents except as provided herein. The Contractor shall not begin any removal or construction work on M-43 or Canal Road until after MDOT notifies the Contractor that all of the required permanent and temporary Right of Way required has been obtained, and that ROW Certification has been submitted and accepted by the FHWA. ROW acquisition for all parcels shown in the ROW Work Map will be completed by September 1, 2010.*

MDOT transfers all risks associated with additional ROW acquisition to the design-build team.

> *MDOT will be responsible for the acquisition of the additional right of way at the Contractor's cost, except as provided for in Book 1, Section 6.1.2. Acquisition of additional right of way could take up to 16 calendar months for the first 10 parcels and 30 Days for each additional parcel from the time the written notification is submitted by the Contractor. Schedule implications associated with the acquisition*

of additional Right of Way shall be the responsibility of the Contractor. The cost of additional Right of Way required by the Contractor's design shall be included in the Contract Price.

This language clearly requires the design-build team to include the costs of any additional ROW in their bid price and to account for the schedule risk associated with additional acquisitions.

8.2.2.4 Opportunity for efficiency enhancement: State DOTs should transfer responsibility for ROW acquisition to the design-build team

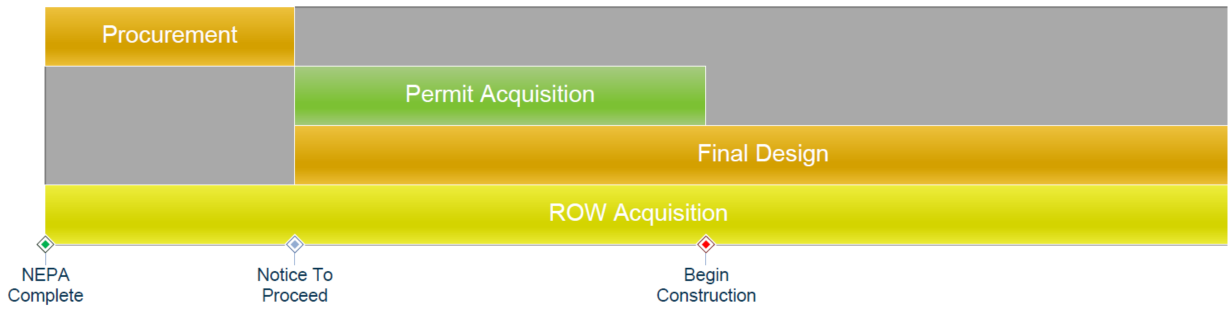
Increasingly, State DOTs are shifting the risk of ROW acquisition to design-build teams (FHWA 2012). State DOTs are transferring this activity regardless of the size or complexity of projects. State DOTs are realizing that projects are delivered more efficiently by transferring control of schedule critical activities, such as ROW acquisition, to the design-build team. This approach provides the design-build team with maximum flexibility for innovation while allowing them to control one of the most schedule critical activities for delivering the project. Design-build teams are given the flexibility to modify and finalize ROW plans according to the project design and State DOTs can realize cost and schedule benefits as only the ROW necessary for the design-build team's design is acquired and the design-build team can better manage the ROW acquisition process as part of the overall project schedule (American Association of State, Transportation et al. 2007). On these projects, the design-build team can modify and develop ROW plans in an efficient manner to substantially reduce the real estate costs. The ability to modify ROW plans allows the design-build team greater flexibility, and opportunities for innovative solutions in design and construction of the project (Analysis, Systems et al. 2009). Finally, in complex design-build projects with alternative corridors, the State DOT may decide to study and prepare ROW plans on those alternative corridors and transfer the responsibility of finalizing ROW plans and acquiring the project ROW to the design-build team, which reduces the administrative burden (Analysis, Systems et al. 2009). To practice this strategy, State DOTs should have the required authorization from the State legislative and also make sure that the project will benefit from it (FHWA 2012).

State DOTs can also realize the benefits of acquiring just enough ROW needed for the design-build team's proposed design by waiting to begin ROW acquisition after the design-build team has been procured. However, by retaining ownership of the ROW acquisition activities, the State DOT has retained control of one of the most schedule critical tasks and may become responsible for the inability to acquire ROW in a reasonable amount of time (FHWA 2012).

By including ROW acquisition services in the design-build contract, the State DOT gains the benefit of only acquiring as much ROW as is required for the construction of the project, while also allowing the party in the best position to manage the schedule risk control that risk (Ware and Cambridge Systematics 2006). The design-build team is able to plan the ROW needs for the project and prioritize the acquisition order of the parcels to fit their staging and construction means and methods.

This ability to control the schedule can result in an extreme overlap of construction, permitting, and final design activities by the design-build team as seen in Figure 8.2 below:

Design-build process with ROW acquired by State DOT



Design-build with ROW acquisition included in the contract

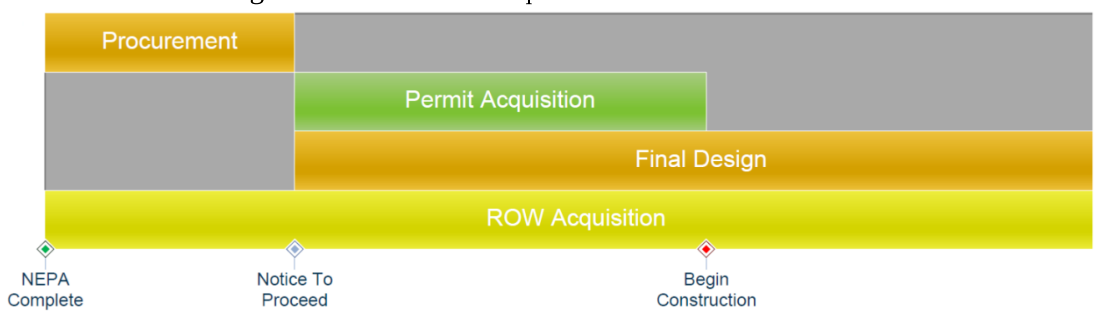


Figure 8.2

State DOT Acquiring ROW vs. Design-Build Team Acquiring ROW

By allowing the design-build team to control the ROW acquisition process, it allows the design-build team to acquire those parcels that are most critical to the construction schedule and begin construction sooner thereby allowing them to speed up the overall delivery of the project (Ware and Cambridge Systematics 2006, Analysis, Systems et al. 2009).

FHWA recommends several design-build contract requirements be implemented when transferring ROW acquisition responsibilities to the design-build team (FHWA 2012):

- Ensure conformance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act);

- Allow phased construction which allows ROW and construction to be completed in phases to expedite the overall project delivery;
- Include a reasonable schedule for design, ROW acquisition, and construction to keep project costs down;
- Require the establishment of a local ROW office on large complex projects;
- Utilize a project tracking system and quality control system;
- Final determination of just compensation is the State DOTs responsibility; and
- Establish safeguards to prevent incentive payments to property owners.

When transferring the responsibility of ROW acquisition to design-build teams, State DOTs should also consider the following ROW-related risks:

- Delays to the project schedule due to litigation challenges
- Risks that may arise due to non-compliance with relevant laws and regulations (Uniform relocation and Real Property Acquisition Policies Act of 1970)
- Delays and costs that may arise during ROW appraisal and condemnation offers
- Delays in relocation of the property owners
- Cost overruns due to inaccuracy of the real estate cost estimates
    - This risk is only transferred in situations that the contractor has the responsibility for preparing estimates and purchasing ROW

The challenge that may arise in this opportunity is additional costs and risk premiums that design-build teams usually require for baring the risks and providing the services. State DOTs must provide comprehensive details of the acquisition process in the RFP since most design-build teams are relatively inexperienced in ROW tasks (FHWA 2012). Design-build teams may be tempted to speed up the acquisition process by pushing property owners to accept offers or attempt to force them into condemnations to accelerate their ability to proceed to construction. State DOTs should include contract language that discourages these practices and places the design-build team at risk for lost Federal funding if the Uniform Act is not followed (Leg Griggs, personnel communication, April 10, 2013).

If the State DOT decides to transfer the responsibility of performing ROW acquisition tasks to the design-build team, the expectations of that requirement should be clear. As with other contract requirements, when requirements are vague, design-build teams will bid and assume the bare minimum.

Despite these challenges, a growing number of State DOTs are incorporating ROW acquisition into their contracts. Most State DOTs include only acquisition services in the contract and not the actual land costs. Each State DOT states the requirements associated with acquisition services in different levels of detail, but they all convey similar requirements. All State DOTs that were reviewed included compliance with the Uniform Act as part of their contract language, but Virginia DOT actually penalizes the design-build team if they do not comply with the Act by holding the design-build team responsible for the Federal funding that is forfeited by non-compliance. Allowing the design-build team to acquire ROW is considered a schedule risk that is best managed by the design-build team (FHWA 2012). Example language from State DOTs whose Request for Proposals (RFP) include ROW acquisition services are shown below:

VDOT

VDOT typically includes ROW acquisition services in all of their design-build contracts. They require the design-build team to utilize prequalified ROW acquisition personnel to perform all work. Typical language included in their design-build contracts is shown below:

> *"The Design-Builder, acting as an agent on behalf of the Commonwealth of Virginia ("Commonwealth"), shall provide all right of way acquisition services for the Project's acquisition of fee right of way and permanent, temporary and*

utility easements including survey plats. Right of way acquisition services shall include certified title reports, appraisal, appraisal review, negotiations, relocation assistance services and parcel closings, to include an attorney's final certification of title or title insurance. The Design-Builder's lead right of way acquisition consultant shall be a member of VDOT's prequalified right of way contracting consultants (listed on VDOT's website) and the Design-Builder's right of way team shall include VDOT prequalified appraisers and review appraisers (also listed on VDOT's website). VDOT will retain authority for approving the scope of the appraisal and the appraiser, just compensation, relocation benefits, and settlements. VDOT must issue a Notice to Commence Right of Way Acquisition to the Design-Builder prior to any offers being made to acquire the property. This represents a hold point in the Design-Builder's Baseline Schedule. VDOT must also issue a Notice to Commence Construction to the Design-Builder once the property has been acquired and prior to commencing construction on the property. This also represents a hold point in the Design-Builder's Baseline Schedule. The Design-Builder will NOT be responsible for the right of way acquisition costs. As used in this RFP, the term "right of way acquisition costs" means the actual purchase price paid to a landowner for right of way, including fee, any and all easements, and miscellaneous fees associated with closings as part of the Project. All right of way acquisition costs will be paid by VDOT, and shall not be included in the Offeror's Price Proposal."

In addition to requiring the use of prequalified personnel, VDOT also includes checks and balances in the contract through several hold points:

- Approving the scope for the acquisition activities,
- Approving just compensation offers,

- Issuance of a “Notice to Commence Right of Way Acquisition” before any offers can be made to property owners, and
- Issuance of a “Notice to Commence Construction” once the property has been acquired.

VDOT retains the responsibility for actual purchase price for the ROW including all fees associated with closing. This reduces design-build team’s risk as they are only responsible for managing the schedule associated with acquisition activities. The ROW limits are defined by the conceptual drawings that are provided to design-build teams, VDOT likely inhibits innovation by also including the following language:

> *“Notwithstanding the foregoing provision, should additional right of way (whether fee or easements) be required to accommodate Design-Builder’s unique solution and/or Contractor’s means, methods and resources used during construction above and beyond the right of way limits depicted on the conceptual plans included in the RFP Information Package, then all right of way acquisition costs for such additional fee or easements shall be paid by the Design-Builder. These costs would include (but not be limited to) the costs of any public hearings that may be required, actual payments to property owners and all expenses related to the additional acquisitions and associated legal costs as well as any additional monies paid [to] the landowners to reach a settlement or to pay for a court award. In the event additional right of way is needed as a result of an approved scope change request by the Design-Builder, the Design-Builder shall follow the procedures indicated in the “Right of Way Acquisition Guidelines” (Chapter 5 of VDOT’s Right of Way Manual of Instructions; http://www.virginiadot.org/business/row-default.asp). Additionally, the Design-Builder is solely responsible for any*

schedule delays due to additional right of way acquisition associated with the Design-Builder's design changes and no time extensions shall be granted."

This clause puts the responsibility for cost and schedule risk associated with additional ROW that may be required for the design-build team's proposed design on the design-build team. By requiring the design-build team to pay the actual land purchase price for additional ROW, VDOT limits their risk of increased ROW costs for a solution that likely saves the design-build team money. As a method to enforce compliance with the Uniform Act, VDOT also includes the following provision:

> *"If the Design Builder and/or the Right of Way sub-consultant does not follow 49 CFR Part 24 Uniform Relocation and Real Property Acquisition Act of 1970 (The Uniform Act) in the performance of the acquisition and/or relocation processes, or fails to obtain or create any mandatory written documentation in their right of way parcel file, the Design Builder shall be responsible for any and all expenses determined to be ineligible for reimbursement of federal funding (80% of amount)."*

This clause not only serves to enforce compliance with the Uniform Act, it also transfers the risk of not complying with the requirements of the Uniform Act. State DOTs that acquire ROW without complying with this legislation forfeit Federal reimbursement for those parcels that were acquired without following the Federal requirements. VDOT protects itself from this risk by penalizing the design-build team and requiring them to be responsible for all land costs associated with this loss of reimbursement.

TxDOT

Texas includes clear language in their RFP document stating that the design-build team is responsible for acquisition services but not for the actual purchase price:

> *"Developer shall be responsible for the remaining right of way acquisition services at the time of contract execution or as otherwise specified by TxDOT. Developer shall be responsible for coordinating with TxDOT's existing*

contractors on the Project. The purchase price of the associated right of way parcels, with the exception of Developer-Designated ROW, will not be the responsibility of the Developer."

This language is found in the general scope section for the project making the roles and responsibilities for ROW acquisition clear. Additional ROW acquisition requirements are found in a subsequent chapter of the RFP:

"This Section 7 sets forth the ROW activities assigned to Developer, including pre-acquisition and acquisition activities, and designates which ROW activities TxDOT will conduct. This section also sets forth the requirements applicable to the Work assigned to Developer related to the acquisition of Project ROW. Developer shall provide all services necessary to acquire title to the Project ROW, in form and substance acceptable to TxDOT, in the name of the State; relocation of displaces; and clearance/demolition of the improvements from the Project ROW, as more fully described in the following sub-sections."

The ROW section of the RFP spells out all activities associated with ROW acquisition that are the responsibility of the design-build team. TxDOT maintains the right to review, approve, and audit the ROW acquisition process, but does not dictate hold points. The typical contract language below ensures the design-build team complies with the Uniform Act, but is not penalized for non-compliance.

"All Project ROW activities must be completed and documented in compliance with all applicable Laws, including the Uniform Act, and the rules and regulations implementing the Uniform Act."

NCDOT

NCDOT lists all acquisition service requirements, regulations, and legislation that design-build teams must comply with in the first paragraph of the ROW section of their RFP as seen below in an excerpt from their TIP U-2800 design-build RFP:

> *"The Design-Build Team shall employ qualified, competent personnel who are currently* ***approved by the NCDOT Right of Way Branch,*** *herein after referred to as the Department, to provide all services necessary to perform all appraisal, appraisal review, negotiation and relocation services required for all right of way and easements, including but not limited to permanent utility easements, necessary for completion of the project in accordance with G.S. 136-28.1 of the General Statutes of North Carolina, as amended, and in accordance with the requirements set forth in the Uniform Appraisal Standards and General Legal Principles for Highway Right of Way, the North Carolina Department of Transportation's Right of Way Manual, the North Carolina Department of Transportation's Rules and Regulations for the Use of Right of Way Consultants, the Code of Federal Regulations, and Chapter 133 of the General Statutes of North Carolina from Section 133-5 through 133-18, hereby incorporated by reference, including the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. For a list of firms currently approved, the Design-Build Team should contact ..., in the NCDOT Right of Way Branch, at .... . The Design-Build Team shall perform the services as set forth herein and furnish and deliver to the Department reports accompanied by all documents necessary for the settlement of claims and the recordation of deeds, or necessary for condemnation proceedings covering said properties. The Design-Build Team, acting as an agent on behalf of the State of North Carolina, shall provide right of way acquisition services for TIP U-2800 in Forsyth County."*

All ROW acquisition personnel must be prequalified with NCDOT as well as the acquisition must comply with applicable North Carolina and Federal laws as listed. NCDOT further goes on to define their role and detailed responsibilities of the design-build team:

> *"With respect to the payments, costs and fees associated with the acquisition of right of way in this contract, the Department will be responsible for only direct payments to property owners for negotiated settlements, recording fees, any relocation benefits, and deposits and fees involved in the filing of condemnation of any claims. The Department will assume responsibility for all costs associated with the litigation of condemned claims, including testimony by the appraiser(s). The Design-Build Team shall be responsible for all other acquisition related payments, costs and fees, including but not limited to attorney fees required for all non-condemnation acquisitions."*

NCDOT is responsible for payments to property owners for actual land purchase as well as fees and relocation costs. NCDOT also maintains responsibility for fees and litigation costs associated with condemnation filings; this limits the design-build team's risk with respect to condemning properties.

Oregon DOT

Oregon DOT requires the design-build team to acquire all ROW required for construction of the project. The following language is included in Oregon DOT's base design-build procurement documents; this language is simple and straightforward:

> ***"ROW Acquisition by Design-Builder -*** *Unless otherwise Stated in the* ***DB Special Provisions,*** *ROW shall be acquired by Design-Builder in accordance with the following Agency Standards:*
>
> - *ODOT ROW Manual*
> - *ODOT ROW Engineering Manual*

- *ODOT ROW & Rail/Utility Coordination Contractor Services Guide found at: http://egov.oregon.gov/ODOT/HWY/ROW/publications.shtml*
- *Code of Federal Regulations, 23 CFR 710*
- *The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (The Uniform Act 42 USC 4610 et seq. and 49 CFR Part 24)*
- *ROW Appraisal Guidelines*
- *All other relevant State and federal laws*

Prior to commencement of any ROW, Design-Builder shall submit to Agency PM, for review and approval, a written acquisition and relocation plan prioritizing appraisal, acquisition and relocation strategies, identifying a schedule with reasonable time frames for orderly relocation of residents and businesses, and incorporating Agency approval checkpoints."

Oregon DOT identifies major applicable laws and regulations and major responsibilities of the design-build team. Oregon implies that the design-build team is not responsible for the actual purchase price for ROW, but they do not explicitly State that Oregon DOT is responsible for this cost.

8.3 Challenges and Opportunities Utilization Table

We conducted fact-finding interviews with seven ROW experts in State DOTs that currently have vibrant design-build programs. These experts evaluated the identified challenges, and answered with either "yes" meaning that they have experienced similar challenges or "no" meaning that the challenge was not experienced or was not applicable for their respective state DOT. A summary of this assessment is provided in Table 8.1.

These experts also evaluated the identified opportunities for efficiency enhancement of ROW acquisition process for design-build projects in their own State DOT. Each opportunity is marked as "standard practice", "utilized in few projects", "not considered", "considered for future implementation", or "not allowed by the State law". A summary of this assessment is provided in Table 8.2.

Table 8.1
Challenges Related to ROW Acquisition on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Identification of ROW Impacts and Determination of a ROW Acquisition Strategy for Design-Build Projects**							
	Identification of ROW impacts based on incomplete design plans	No	No	Yes	No	Yes	No	-
	Management of third party ROW needs	No	Yes	Yes	No	Yes	No	-
	Execution of ROW Acquisition Tasks							
	ROW acquisition as the critical path to a project's schedule	No	No	Yes	No	Yes	Yes	-
	Management of ROW acquisitions for a large number of parcels	No	No	No	No	Yes	Yes	-

Table 8.2
Opportunities to Enhance Efficiency of ROW Acquisition on Design-Build Projects
Has your state DOT utilized these opportunities on design-build projects?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Opportunities	**Identification of ROW Impacts and Determination of a ROW Acquisition Strategy for Design-Build Projects**							
	State DOTs should coordinate project ROW needs with utilities, environmental mitigation requirements, tolling infrastructure, and other project needs that may affect ROW	Standard practice	Standard practice	Standard practice	Not considered	Standard practice	Standard practice	-
	State DOTs should identify project goals and select a ROW acquisition strategy that helps achieve them	Not considered	Not considered	Considered for future use	Utilized on a few projects	Standard practice	Utilized on a few projects	-
	Execution of ROW Acquisition Tasks							
	State DOTs should utilize effective ROW management tools	Not considered	Utilized on a few projects	Standard practice	Not considered	Standard practice	Standard practice	-
	State DOTs should utilize advance acquisitions	Utilized on a few projects	Standard practice	Utilized on a few projects	Utilized on a few projects	Standard practice	Utilized on a few projects	-
	State DOTs should maintain ownership of ROW acquisition	Standard practice	Standard practice	Standard practice	Utilized on a few projects	Standard practice	Utilized on a few projects	-
	State DOTs should transfer responsibility for ROW acquisition to the design-build team	Not considered	Not considered	Considered for future use	Standard practice	Standard practice	Standard practice	-

8.4 Implementation Recommendations for Consideration for GDOT

GDOT should continue to coordinate project ROW needs with utilities, environmental mitigation requirements, tolling infrastructure, and other project needs that may affect ROW

State DOTs have realized benefits of early coordination with utilities, environmental mitigation requirements, tolling infrastructure, and other project needs that may affect required ROW. Identifying these needs during the project's concept development has allowed State DOTs to avoid delays and change orders due to additional ROW requirements being identified after a design-build contract has been awarded.

State DOTs that have implemented this potential best practice are the following:

- Colorado **-** coordinates ROW requirements closely with utility relocations and environmental mitigation efforts.
- Utah – coordinates upfront with utility owners to identify needs to mitigate this risk. Utah also obtains and coordinates permits and the NEPA process prior to award of design-build contracts to ensure adequate ROW is acquired.
- Virginia – performs early coordination with utilities and identifies an anticipated ROW footprint. This footprint also takes into consideration all mitigation and environmental permit requirements.

GDOT should select a ROW acquisition strategy that helps GDOT achieve project-specific goals

State DOTs have several options (depending on State laws) to acquire ROW on design-build projects. These options are:

- Acquire the ROW using internal resources in advance of advertising and awarding the design-build contract
- Acquire the ROW using internal resources after award of the design-build contract
- Require the design-build team to acquire the ROW needed for the project

Each option has benefits and risks that must be considered with the goals of the project. Projects with expedited delivery as the primary goal often have the ROW acquired in advance to the project to construction, while projects that have an ROW footprint that is likely to change may wait until after the design-build contract is awarded to acquire the ROW.

Utah DOT has implemented this potential best practice as the following:

- Utah – conducts a risk analysis on all design-build projects and selects the ROW acquisition method that best accomplishes project goals and reduces project risks.

All other State DOTs that were interviewed either acquire all ROW prior to advertising or awarding a design-build contract, or require the design-build team to acquire all ROW.

CHAPTER 9

UTILITIES COORDINATION AND RELOCATION

It is commonly accepted that it is in the public's best interest to allow utility facilities to share rights-of-way (ROW) with public roads and streets (FHWA, 2011). Virtually, all highway projects involve the presence of utilities; utility facilities often need to be relocated when roadway widening or construction impacts these facilities (WSDOT, 2012). Delays and inefficiencies in utility coordination and relocation activities result in higher bid prices, change orders, damage claims, and project delays (Quiroga, 2012). The utility relocation and adjustment process is often on the critical path of a project's schedule (Cambridge Systematics, Inc., 2006).

The two critical issues that have been identified to create inefficiencies in utility relocations are inaccurate utility information and poor coordination/management of the relocation process (Quiroga, 2012). This is especially true on design-build projects when the state DOT is evaluating project risks and trying to develop a fair Request for Proposal (RFP) package (Transportation Design-Build Users Group, 2009).

There are three basic steps in the utility relocation process that are typical for most state DOTs and challenges and opportunities have been identified in each step that should be properly managed when adjusting and/or relocating utilities. The three commonly identified critical steps in the utility adjustment and relocation process are (FHWA 2011):

- Utility identification;
- Utility coordination; and
- Utility relocation.

These steps can be further broken down into smaller activities that should be completed in the utility coordination and relocation process.

Minnesota DOT has identified fifteen distinct steps in their utilities manual (Cambridge Systematics, Inc., 2006):

1. Utility identification;
2. Initial utility contact for coordination;
3. Utility information meeting;
4. Review of information from utility owners;
5. Utility design meeting;
6. Request for utility relocation plans;
7. Utility coordination follow-up;
8. Utility design change meeting;
9. Gopher State One Call utility verification;
10. Utility relocation plan and schedule review;
11. Utility agreements and reimbursement;
12. Permits for construction projects;
13. Utility information in contract documents;
14. Construction; and
15. Close out.

This chapter describes the three major steps in detail and identifies opportunities for efficiency enhancement for each.

9.1 Identification of Utilities

Utilities along a project corridor should be identified early in project's development (Towcimak, 2004). Early identification allows state DOTs to properly plan for utility relocation costs and schedules as well as mitigate any environmental risk associated with relocations (Sterling 2009). Proper identification of utilities is important on all transportation projects, but is essential on design-build projects to properly mitigate project risks such as relocation delays, finding unknown utilities during construction, and quarreling with utilities over compensable reimbursements (Cambridge Systematics, Inc., 2006; Campbell, 2009; Towcimak, 2004; Sterling 2009).

In the past, state DOTs identified utilities by researching old utility plans, coordinating with utility owners, and field surveying obvious utility valves, poles, and manholes. This process leads to inaccurate utility information that does not provide design-build teams or state DOTs with adequate data to make informed design decisions to avoid or minimize utility relocations (Towcimak, 2004). State DOTs should look for ways to obtain better quality utility information to encourage innovation through utility avoidance measures by design-build teams (Towcimak, 2004).

9.1.1 Challenges to utility identification

9.1.1.1 Insufficient or inaccurate identification of utility locations

Unknown existing utilities can be an expensive risk to discover during construction. In addition to higher project costs, delays to the project, additional environmental impacts, or injuries or casualties can result if utilities are not properly identified (Starnes 2012) In the past, existing utilities were identified using above ground utility markers in conjunction with existing utility records (Sterling 2009). Examples of issues that exist with using traditional methods to depict existing utilities are identified below (Sterling 2009):

- *Records were not accurate in the first place—design drawings are often not "as built," or installations were "field run," and no record was ever made of actual locations.*

- *On old sites, there have usually been several utility owners, architects, engineers, and contractors installing facilities and burying objects for decades in the area. The records seldom get put in a single file and are often lost—there is almost never a composite map.*
- *References are frequently lost. The records show something 28 feet from a building that is no longer there, or from the edge of a two-lane road that is now four lanes or part of a parking lot.*
- *Lines, pipes, and tanks are abandoned but do not get taken off the drawings.*

As-built drawings are another source for existing utility information but they often lack the detail required for design purposes. For example, depth or cover information is often not referenced to a recognized elevation datum and changes to surface level topography can lead to inaccuracies in this information (Sterling 2009).

9.1.1.2 Disputes on determination of utilities compensable property rights

Utility relocations in most states are only reimbursable when the utility's facilities reside within their own ROW or easement. In these situations, a state's property laws require the state DOT to compensate utility owners who are required to relocate. State DOTs require utility owners to provide documentation when the utility owners believe they have a compensable property interest (WSDOT Utilities Manual 2012). This documentation typically includes:

- *A deed showing fee title ownership to the property;*
- *A deed showing easement rights to use the property; or*
- *A court finding of prescriptive easement rights.*

This documentation is not always readily accessible and property records are often old or incomplete. This can lead to disputes between state DOTs and utility owners especially in instances where a utility's compensable property interest is determined by whether or not the utility was in place before or after the road was constructed. On design-build contracts where an expected schedule is often a stated project goal, delays or improper management in determining when utilities owners have a compensable property interest can delay the overall project (Ellis 2009).

9.1.2 Opportunities for efficiency enhancement

9.1.2.1 Opportunity for efficiency enhancement: State DOTs should conduct utility engineering and subsurface utility engineering activities early in the project development process

Utility relocations on transportation projects are fraught with risks. One of the best ways to minimize the risk associated with utility relocations is to avoid the relocation during the design phase of the project. Subsurface Utility Engineering (SUE) is the process of gathering and depicting existing utility information (Cambridge Systematics, Inc., 2006). SUE has proven to benefit highway agencies and impacted utilities in a variety of ways (FHWA 2011):

- Unnecessary utility relocations are avoided reducing costs and providing schedule savings;
- Unexpected conflicts are reduced or eliminated as the exact location of utilities are known and accurately shown on the construction plans; and
- Safety is enhanced as contractors can employ safety measures when working around utilities or stage construction differently to ensure utilities are protected and avoided.

SUE has four commonly recognized quality levels (QL) and state DOTs generally obtain the quality level appropriate for the level of design being done on a project (FHWA 2011). The four levels as defined by FHWA are:

- QL-D: QL-D is based on existing utility records and verbal recollections. These are not considered highly reliable sources of information and this level of SUE should only be used for initial project planning and route selection.

- QL-C: QL-C involves field surveying of existing visible utility facilities such as manholes, power poles, valve boxes, etc. combined with existing utility records. This level of information often omits utilities that don't have access boxes within the project limits and is not appropriate for design and avoidance of utilities.
- QL-B: QL-B is the process of surveying and "designating" the existence and horizontal location of all utilities within the project limits. This level of information allows state DOTs and design-build team to accurately identify avoidance measures and estimate costs associated with utility impacts and relocations.
- QL-A: QL-A is the process of using non-destructive techniques to accurately locate the horizontal and vertical location of utilities. It also provides the exact size, type, condition, and material of utility lines which can help utility owners and state DOTs make informed decisions on relocations and replacements. This level of information is critical when excavating near utilities or driving structural supports for walls and bridges into the ground (FHWA 2011).

SUE data is essential for project designers in the effort of avoiding utility relocations as a result of transportation construction projects (Towcimak, 2004). FHWA has identified that SUE typically costs less than 0.5% of construction costs but saves $4 for every $1 spent and saves as much as 20% of time on the overall project delivery (FHWA 2011). In addition, studies conducted from 2001 to 2012 in the United States and abroad on utility relocations have consistently identified SUE as a best practice (Cambridge Systematics, Inc., 2006; Towcimak, 2004; Wood, 2011; Transportation Design-Build Users Group, 2009; AASHTO, 2007). Early identification of utilities in the project development phase allows utility relocation costs to be considered during the alternatives analysis. SUE information is essential for being able to properly identify and quantify a project's impacts to utilities (Wood, 2011).

Many states have requirements to obtain SUE information pre-bid on all design-build projects. This limits risks to both the state DOT and the proposing design-build teams by allowing both parties to accurately identify utilities that may be in conflict with the proposed project as well as accurately estimating the cost of relocation or avoidance of the conflict (Cambridge Systematics, Inc., 2006; Moeller, 2002). The responsibility for developing SUE information has typically been a shared responsibility between state DOTs and design-build teams with state DOTs providing some level of information pre-bid and the design-build team responsible for verifying and updating that information (Transportation Design-Build Users Group, 2009). Obtaining reliable utility information is very important on all projects but especially design-build projects as undiscovered utilities can cause huge delays to the project when discovered during construction (AASHTO, 2007). The level of SUE information obtained pre-bid varies from different states. Information on several states and their requirements for SUE on design-build projects is shown below:

Minnesota DOT (Mn/DOT)

> *"Mn/DOT requires Subsurface Utility Engineering (SUE) to locate underground facilities on all design-build projects. A SUE provider obtains utility quality level B information by applying appropriate surface geophysical methods to determine the existence and horizontal position of underground facilities. Appendix C of the Utilities Manual provides a detailed explanation of SUE."*

QL-B SUE information is commonly obtained for design-build projects as it is the most cost effective in that it provides accurate information without requiring non-destructive excavation. Mn/DOT obtains QL—B SUE information and then meets with utility owners to develop Utility Agreements and gather information on the accuracy of the SUE information (MinnDOT, 2010).

Georgia DOT (GDOT)

> *"Implementation of SUE - The Department requires the use of SUE on all design-build projects and recommends that District Utilities Engineers and Project Managers consider its use on any project where inaccurate underground utility information would negatively impact the project in a significant way."*

GDOT requires SUE information be obtained on all design-build projects. They base the level of SUE information required on the percentage of design complete when the project is considered. Design-build projects are typically advertised when the design is 30% complete which correlates to QL-B SUE being obtained (GDOT 2009).

Washington State DOT (WSDOT)

WSDOT requires SUE to be performed on all projects at a level depending on the scope of work of the project. WSDOT encourages the use of QL-B SUE or higher when appropriate to minimize their risks on projects (WSDOT, 2012). WSDOT has developed a table (Figure 9.1) to help project managers determine when each level of SUE is appropriate for a project:

Type of Work	Quality Level Required			
	D	C	B	A
HMA Overlay Only	X	?		
Guardrail Installation		X	?	
Pipe/Drainage Structures			X	?
Ditch/Pond Excavation			X	?
Roadway Excavation/Widening			X	?
Clearing and Grubbing Operations	X	?		
Removal of Structures and Obstructions	X	?		
Surfacing	X	?		
HMA or PCCP	X	?		
Advanced Geotechnical Work			X	?
Bridge Structures			X	?
Retaining Walls			X	?
Piling			X	?
Signal Systems			X	?
Illumination Systems			X	?
Signing		X		
ITS Systems			X	?
Railroad Crossings			X	?
Roadside Planting		X	?	
Fencing		X	?	
Striping	X			
Mailboxes		X		
Sidewalks	X	?		
Guideposts	X	?		
Monuments	X	?		
Irrigation Systems		X	?	
Curbing	X			
Temporary Erosion Control		X	?	
Sanitary Sewers			X	?
Water Mains			X	?
Concrete Barrier	X			
Pit Site Production	X	?		
X – Minimum level required ? – Depending on what is found, may need to complete further study to identify conflict areas				

Figure 9.1

WSDOT Project Work Type SUE Levels

(Copyright of WSDOT)

9.2 Coordination of Utilities

Utilities and state DOTs agree that inadequate utility coordination is a frequent problem on all projects (Ellis 2009). Insufficient communication, scheduling, and planning for ROW acquisition, design, and construction inhibits the ability for timely utility relocations or identifying avoidance measures. Utility owners have limited resources and in the past have been unwilling to dedicate resources to a project until it is clear that a project is moving to construction. The increasing popularity and success of design-build projects appears to be providing comfort to utility owners that design-build projects are moving forward, and that State DOTs and design-build teams are looking to collaborate with utility owners to aid in making projects successful (UDOT Interview 2013).

Relocating utilities on design-build projects is a complicated process that involves coordination between multiple parties during different phases of the project development. Utility coordination has three major phases on a design-build project:

- Coordination Pre-Bid
- Coordination Post-Award during design-build team's design phase
- Coordination during construction

Early and ongoing coordination with utility owners is important to develop working relationships with utilities. Allowing utilities a seat at the table during early project scoping meetings helps develop trust between state DOTs and utility companies and foster a partnership that aids in working towards solutions that can minimize utility conflicts and relocations/adjustments (Cambridge Systematics, Inc., 2006). AASHTO has identified that frequent coordination and communication with utility companies reduces costs, reduces delivery time, and improves the quality of the overall process (Towcimak, 2004).

Once a design-build contract has been awarded, the design-build team is often required to coordinate with utilities to identify utilities, potential conflicts, and design relocations. Utility owners and the design-build team need to have a strong working relationship to collaborate on a design that is the most beneficial to the project, and not the one that is simply the cheapest for the design-build team to construct. Involving utilities in the design phase of projects allows them to propose solutions that minimize impacts to their facilities. This coordination is most effective when all utility companies are present so that solutions can be developed that accommodate all utility facilities and not just a single facility while causing additional impacts to others (Towcimak, 2004). Utility coordination has traditionally been a pre-construction activity only. Studies of utility coordination in Australia and Canada have found that continuing utility coordination into the construction phase can result in overall cost savings to the project as the design-build team is able to stage construction to accommodate utility relocation delays without delays to the overall project (Campbell, 2009).

Early coordination and communication with utilities in a cooperative environment leads to proper sequencing and scheduling of activities and ensures timely relocation prior to project construction. Early coordination can also help to establish parameters for the design-build contract, such as moratoriums on cutovers, pre-qualified subcontractors, and acceptable design parameters (Towcimak, 2004).

9.2.1 Challenges in utility coordination

9.2.1.1 Reluctance of utility owner to work with design-build teams

Design-build projects require utility owners and design-build teams to work in a different manner than they have in the past. On traditional design-bid-build projects, designers and state DOTs work with utility owners to identify utilities and to design relocations. This process is typically a multistep process with back and forth submittals to utility owners to identify utility locations, identify impacts, and to design relocations (Towcimak, 2004). Design-build projects typically are advertised to multiple bidding design-build teams before the utility coordination and relocation process has been completed. This leads to utility owners receiving inquiries from multiple bidding design-build teams. Requiring utility owners to coordinate with multiple design-build teams can put a strain on resources during the bid phase (Tom Bane, personal communication, February 27, 2013).

Utility owners may also be reluctant to work with design-build teams due to experiences on past design-bid-build projects. In the past, contractors working on design-bid-build projects may have had to wait on a utility owner to relocate before they can proceed with their construction activities (Towcimak 2004). This may give the utility owners the impression that the contractor is simply saying "get out of my way" (Ellis 2009). These past experiences may have led to a contentious relationship between contractors and utility owners that can be a detriment to coordinating on a design-build project (Tom Bane, personal communication, February 27, 2013). For a design-build project to be successful, utility owners and the design-build team must overcome past experiences and work together.

A common challenge echoed by design-build teams is how to manage utilities that are unresponsive during coordination attempts (Utility Relocation Task Force, 2004). Common issues encountered when coordinating with utilities are:

- *"Lack of participation by utility companies in site reviews and coordination meetings;*
- *Lack of timely response to requests for information;*
- *Lack of timely information about changes to project schedules and revisions to proposed project plans;*
- *Frequent personnel changes over the life of a project (Utility Relocation Task Force, 2004)."*

9.2.1.2 Deficiency in addressing utility impacts on environmental resources and ROW needs

Utility relocations are not often considered early in the design phase of projects. This can lead to decisions regarding environmental studies and ROW needs that do not properly consider where utilities will need to be relocated to (Towcimak 2004).

Utility impacts that are not properly considered in the environmental planning process can lead to the selection of a design alternative that has high utility relocation costs compared to other alternatives with other impacts being relatively equal. Without properly considering utility impacts to environmental resources, a project's schedule and budget may suffer if these impacts are discovered after the environmental planning process has completed and an alternative has been selected (Wood 2011).

ROW needs are largely based on roadway project requirements. Coordination with utility owners often occurs later in the project development process, which can lead to ROW requirements being defined and acquired without consideration for utility relocation needs (Ellis 2009). If utility relocation needs are not considered during the ROW planning of a project, additional ROW may be required to complete the relocation for a project. This can lead to ROW being acquired multiple times from the same property owner and unnecessary project delays. FHWA encourages state DOTs to coordinate ROW needs with utility owners (Moeller, 2002).

9.2.2 Opportunities for efficiency enhancement

9.2.2.1 Opportunity for efficiency enhancement: State DOTs should consider obtaining Memorandums of Understanding (MOUs) or Master Utility Agreements (MUAs) with utilities as major pre-bid utility coordination tasks

During early coordination with utility companies on design-build projects, state DOTs are realizing that establishing agreements that dictate each party's responsibilities is critical for translating information discovered during coordination to solutions and scope items for the design-build contract (Cambridge Systematics, Inc., 2006). This has led to the common establishment of Memorandums of Understanding (MOUs) and Master Utility Agreements (MUAs) as a major milestone of pre-bid utility coordination (Moeller, 2002; Minnesota DOT, 2010).

Each state DOT manages the MOU/MUA process a little differently and treats the agreements differently with some being contractual documents that are included in the project RFP or some are nonbinding agreements indicating what each party's intended role and their corresponding responsibilities will be on the project. State DOTs should endeavor to standardize whatever process and agreement they choose to develop as this saves time and energy when executing future agreements (Towcimak, 2004), (Moeller, 2002).

Utah DOT (UDOT) obtains MUAs with all utility owners prior to advertising a design-build contract. The MUA establishes the framework for how the design-build team, utility owner and UDOT must coordinate and work together for the design and construction of the project. The MUA also establishes how the work will be conducted; ex: specialty work, union labor, moratoriums on cutovers, etc. UDOT is looking to enhance this process by developing statewide MUAs with utility owners that they work with frequently on design-build contracts (Richard Manser, personal communication, March 7, 2013).

Florida DOT (FDOT) obtains MUAs on all projects regardless of the delivery method. The MUA identifies roles and responsibilities with respect to utility relocations. FDOT tries to obtain all MUAs prior to advertising a design-build contract, but this is not always possible when projects are expedited (Tom Bane, personal communication, February 27, 2013).

North Carolina DOT (NCDOT) obtains utility agreements with water and sewer utilities to include their relocation work in the design-build contract. NCDOT develops agreements with other more complex utilities that relocate themselves and have a compensable property interest (Teresa Bruton, personal communication, March 15, 2013).

Australia develops multilevel MOUs with utility companies and considers these to be living documents that can be updated by all parties as projects develop. The multilevel MOU allows for the document to be refined from a high-level document with general principles and intent for both parties to work cooperatively to a contract-level agreement that documents actual project design, relocation, and avoidance decisions (Campbell, 2009).

9.2.2.2 Opportunity for efficiency enhancement: State DOTs should consider including utility coordination in design-build contracts

Utility coordination is an activity that should be continued throughout the entire life cycle of a project's delivery (Campbell, 2009). On design-build projects, state DOTs are realizing that requiring the design-build team to coordinate with utility owners provides a benefit to both the project and the state DOT (Towcimak, 2004).

Utility owners benefit through coordination and input on the final design of the project and can provide the design-build team accurate information on relocation schedules and costs allowing the group to make informed decisions on when and how to relocate utilities in conflict with the proposed project (Towcimak, 2004).

State DOTs realize additional staffing benefits in transferring utility coordination to design-build team. Utility coordination on design-bid-build projects is typically done by the state DOT with one or two individuals typically providing utility coordination for every project in a section of the state. By transferring utility coordination to the design-build team, state DOT personnel have more time to coordinate on design-bid-build projects. This transfer of responsibility is becoming more important as state DOTs are continually being tasked with delivering more projects with fewer resources (Transportation Design-Build Users Group, 2009).

This challenge needs to be addressed in design-build contracts through clear contract language that provides design-build teams a method for recourse when dealing with unresponsive utilities. Our review of various state DOTs indicates that this issue is being addressed by most state DOT RFPs.

A review of various state DOTs' RFPs has shown that they differ on the extent they require design-build teams to coordinate with utility owners. Some state DOTs require design-build teams to conduct regular meetings with utility owners where others include vague contract language stating that utility coordination is the design-build team's responsibility. Some examples from various state DOT RFPs are shown below:

Minnesota DOT (Mn/DOT)

Mn/DOT includes utility coordination in all design-build contracts. Mn/DOT provides very clear contract language that requires design-build teams to coordinate with utility owners:

> *"The Contractor's obligations with respect to each impacted Utility shall include the following activities, all of which shall constitute a part of the Work:*
>
> *Coordination and schedule verification with all Utility Owners as necessary for all Utility Work.*
>
> *Preparation and processing of all applicable Mn/DOT Utility Permit Applications (Exhibit B) for the Utility Work performed by the Contractor or by the Utility Owners.*
>
> *Whether the Utility Work is performed by the Contractor or by the Utility Owner, identification, verification, and Approval that the design and construction of all affected and existing Utilities are compatible with the remainder of the Project. This shall be accomplished by incorporation by the Contractor of the designs on the Project plans; providing coordinate information, profile information, and potholing for confirmation of conflicts for all Utility Relocations, as well as existing Utilities, that are not in conflict with the Project; surveying the pertinent points in the field for exact placement of the Utility facilities; and incorporating the above information by the Contractor on the Contractor's CADD drawings, and ultimately on the Contractor's As-Built Documents. If the Utility Owner performs*

the design and construction of the Utility Relocation, the design information will meet only the standard of quality necessary for the Utility Owner to construct the Utility Relocation."

Mn/DOT requires the design-build team to prepare all required utility permits for the project and to coordinate and verify all utility work. The design-build team is required to coordinate with utility owners and Mn/DOT to develop Utility Agreements which define, negotiate, and order the performance. The Utility Agreements also indicate applicable terms and conditions of the Utility Work. Mn/DOT does not identify how often the design-build team and utility owners are required to meet but does require both Mn/DOT and the design-build team to be willing to meet whenever the other party requests a meeting to discuss the Utility Work.

New York DOT (NYDOT)

NYDOT includes vague language in their RFP regarding coordination requirements. They require the design-build team to coordinate and meet at least monthly with utility owners. Sample language from the Kendrick Road Bridge RFP is shown below:

"4.2.1. Utility Coordination

The Design-Builder shall coordinate its design and construction efforts with utility owners as set forth in Part 2 - General Provisions of the Contract. All design and construction work performed by the Design-Builder shall be coordinated with the utility owners, and shall be subject to the utility standards and applicable provisions of the Contract Documents.

The Design-Builder shall notify the Department at least five working days in advance of each meeting with a utility owner's representative scheduled by the Design-Builder and shall allow the Department the opportunity to participate in each meeting. The Design-Builder shall also provide to the Department copies of *all correspondence between the Design-Builder and any utility owner, within seven days after receipt or sending, as applicable."*

NYDOT additionally saves staff resources by allowing the design-build team to perform all coordination and only attends meetings when they are able to. The Kendrick Road Bridge RFP also includes provisions for the design-build team to notify NYDOT if a utility owner is not cooperating on the project:

"4.4. COORDINATION REQUIREMENTS

The Design-Builder shall make diligent effort to obtain the cooperation of each utility owner as necessary for the project. If the Design-Builder becomes aware that a utility owner is not cooperating in providing needed work or approvals, the Design-Builder shall notify the Department immediately of such problem. After such notice, the Design-Builder shall continue to diligently seek to obtain the utility owner's cooperation, and the Department and Design-Builder each shall assist the other party as reasonably requested by such other party with regard to the problem."

This language limits the risk of the design-build team in terms of coordination and allows them relief if a utility is uncooperative. Later in this RFP, NYDOT includes additional coordination requirements:

"4.4.2. Design Builder's Coordination Requirements

The Design-Builder shall be responsible for coordination with utility owners. It is important that Utility Owners be kept informed of the Design-Builder's activities and schedule. In addition to satisfying any requirements set forth in applicable Governmental Rules and Standards, including but not limited to Part 753, the One-Call notification requirements referenced in DB §107-15, the Department's Utility Work set forth in Exhibit A to this Part 4, and in any DB Utility Agreements that may have been executed, the Design-Builder shall undertake including the *following activities, which have been identified by the Department as important to utility owners:*

A. *Keep utility owners well informed of construction schedules and notify the utility owners at least twenty-four hours in advance of any work in the vicinity of the utility owners' facilities, that will not impact service;*

B. *Keep utility owners well informed of changes that affect their facilities;*

C. *In addition to any required notice, give the utility owners 48 hours notice of potential impacts to service;*

D. *Coordinate with those utility owners who perform their own work by scheduling adequate time to accomplish their work."*

This additional coordination language identifies the outcomes of the coordination and the notice requirements between the design-build team and utilities. NYDOT includes a requirement for the design-build team to meet monthly with utility owners and monthly meetings are required throughout the project's design and construction:

"4.4.4. Meetings and Coordination

The Design-Builder shall schedule meetings with each utility owner, the Design-Builder and the Department. These meetings are for the purpose of reviewing all items related to the utility work, including all items which affect the Baseline Progress Schedule, the time required to procure construction material and the period of time utility service may be curtailed. These meetings will also be used to reach concurrence on the number and extent of known affected utility lines or issues, to discuss the possible elimination of conflicts, to establish the methods to be used at each specific location and procedures for addressing conflicts discovered during design and/or construction.

The Design-Builder shall jointly schedule at least monthly utility meetings with the Department or their duly authorized representative to discuss project progress, issues, and planned work for all phases of utility work including design and construction. These meetings shall include the Design-Builder's and the Department's personnel with responsibilities for utilities. The Design-Builder and the Department will jointly develop the agenda for these meetings. The Design-Builder shall be responsible for providing meeting facilities unless otherwise agreed. The Design-Builder shall keep minutes of the coordination meetings and distribute copies of the minutes to participants, including representatives of utility owners (even if not present) who have facilities in the areas reviewed, within five working days after the meeting date."

NYDOT clearly identifies the requirements of coordination and the design-build team's responsibilities for both the monthly meetings and the documentation of those meetings.

North Carolina DOT (NCDOT)

A review of multiple NCDOT RFPs indicates that North Carolina requires the design-build team to include a team member who is knowledgeable of the NCDOT Utility Coordination process. NCDOT transfers all utility coordination responsibilities to the design-build team as seen below:

"UTILITIES COORDINATION SCOPE OF WORK *(5-2-12)*

The Design-Build Team shall obtain the services of a Private Engineering Firm (PEF) knowledgeable in the NCDOT Utility Coordination Process involved with utility relocation / installation and highway construction. The Design-Build Team shall be responsible for coordinating all utility relocations, removals, and / or adjustments where the Design-Build Team and Utility Company, with concurrence from the Department, determine that such work is essential for highway safety and performance of the required highway construction. Coordination shall be for all utilities whether or not they are specifically identified in this scope of work and *shall include any necessary utility agreements when applicable. NCDOT will be the approving authority for all utility agreements and approval of plans."*

NCDOT's contract language is simplistic and to the point. They do not identify how the design-build team is to coordinate with utilities or how often they are required to meet. They simply transfer all coordination responsibilities and maintain an oversight role by approving utility agreements and plans.

Oregon DOT (ODOT)

ODOT includes contract language similar to that of NCDOT. The language is simple and straightforward and requires the design-build team to provide coordination to identify and resolve all utility conflicts but does not spell out how the design-build team should accomplish coordination activities.

> ***"(3) Coordination*** *- Design-Builder shall have the responsibility of coordinating the Project design and construction with all Utilities that may be affected. Design-Builder shall be responsible for identifying, verifying the existence of, determining if conflicts exist, and resolving all Utility conflicts on the Project. Activities include, but are not limited to, the following:*
>
> - *Identifying the full extent of Utilities in the Project Site*
> - *Verifying Utility owners and locations of Utilities*
> - *Locating Utilities and identifying potential conflicts not previously identified*
> - *Providing information to Agency to assist in acquiring additional ROW or easements, if necessary*
> - *Coordinating and/or designing/constructing the Adjustment of Utilities and/or new Utilities in accordance with this Subsection"*

Washington State DOT (WSDOT)

WSDOT requires the design-build team to coordinate and determine resolutions for all utility relocations. WSDOT provides greater detail on what is required for coordination than NCDOT or ODOT as seen below:

> *"The Design-Builder will be responsible for the coordination and resolution of all Utility Relocation issues relating to the Project as set forth in the Contract Documents. The Design-Builder's services shall include the following, except as otherwise provided in General Provisions Section 1-07.17 or in this Section 2.10:*
>
> - *Identification and verification of all utilities located within or near the Project's Right-of-Way or otherwise impacted by the Project.*
> - *Identification of any Utility easements or other rights or interests in real property inside or outside the Project's Right-of-Way that may require quitclaim or other release.*
> - *Notifications to Utility Owners with respect to relocation of their utilities.*
> - *Drafting and negotiation of Relocation Agreements with Utility Owners.*
> - *Coordination of design and construction efforts for all Relocations.*
> - *Verification that each Relocated Utility, as designed and constructed, is compatible with and interfaces properly with the Project.*
> - *All Incidental Utility Work.*
> - *Confirmation that all appropriate Governmental Approvals have been obtained by or on behalf of each person that is performing Relocation Construction Work, obtaining and paying the cost of such Governmental Approvals where required pursuant to Section 2.10.1.42.3 and verification that all construction work (whether performed by or on behalf of the*

Design-Builder or any Utility Owner) complies with the requirements of the applicable Government Approvals."

We have reviewed several design-build RFPs from different state DOTs regarding the utility coordination. We concluded that utility coordination can be considered as a requirement of the design-build team. This is apparently considered a best practice and should be employed on all design-build projects.

9.2.2.3 Opportunity for efficiency enhancement: State DOTs should partner with utility owners and encourage design-build teams to partner with utility owners to create solutions that minimize or avoid relocations

Simply coordinating and including utilities in project design meetings is not enough to ensure that all project team members are working to expedite the project's delivery and avoid or minimize utility relocations and adjustments. State DOTs should treat utilities like a partner in project development decisions. Partnering has been shown to be an incentive to utilities to respond quickly to project questions and issues and work cooperatively towards the best design solution for all team members (Towcimak, 2004). State DOTs can prove to utilities that they are a partner by sharing in costs of relocations and implementing design alternatives that may be more expensive to construct, but save costly and time consuming relocations (Towcimak, 2004).

Cooperation ensures that utility relocations can be done with minimal disruption (Cambridge Systematics, Inc., 2006). State DOTs should encourage innovative solutions to utility avoidance and relocations. This "out of the box" thinking can provide cost and schedule savings to utility owners, the State DOT, and design-build teams (AASHTO, 2007).

Australia includes contract language in design-build contracts to incentive partnerships between design-build teams and utility owners; this is called a "gainshare provision". Gainshare provisions allow a sharing of monetary savings realized through innovative cost savings measures by the design-build team. The contract requirements indicate how the gainshare provisions distribute the savings (Campbell, 2009). Several state DOTs take advantage of a cost savings for utility relocations by including relocations in the design-build contract. Design-build teams are incentivized to minimize or avoid relocations when they are responsible for the relocations costs.

Partnering should not stop when the project is awarded to a design-build team. Success of the project is partially contingent on the design-build team being able to property coordinate and partner with utilities to employ design solutions that benefit both the design-build team and the utility owner (Towcimak, 2004). Many state DOTs include contract language in their RFPs that requires or encourages design-build teams to establish cooperative relationships with utility owners. Some examples of language from various state RFPs are reviewed below:

NYDOT

NYDOT includes language requiring the design-build team to cooperate with utility owners to the extent possible. While this language is technically vague and would be difficult to prove if the design-build team complied with, it does encourage design-build teams to partner with utilities:

> *"Cooperate with the utility owners to solve relocation/installation issues to the extent that such relocations/installations are consistent with the Design-Builder's Scope of Work as otherwise set forth in the Contract Documents and without causing the Department to incur any unnecessary expense to the Project, or causing the utility owners to incur unnecessary expense;*
>
> *Act diligently in continuing the positive relationship that the Department has developed with the utility owners;"*

NYDOT coordinates with utilities before awarding a design-build contract and has established trust and partnerships with these utilities. In transferring coordination responsibilities to design-build teams, NYDOT encourages design-build teams to continue that relationship throughout the design-build process.

Virginia DOT (VDOT)

Virginia includes language similar to NYDOT in that they require the design-build teams to attempt to avoid conflicts and relocations where possible. Again, this requirement is vague and would be difficult to prove non-compliance, but it does push design-build teams to avoid and minimize relocations. Example language is shown below:

> *"The Design-Builder shall make all reasonable efforts to design the Project to avoid conflicts with utilities, and minimize impacts where conflicts cannot be avoided."*

Our review of state DOT RFPs indicates that partnering between design-build teams and utilities is not commonly required. This is a recommended best practice by AASHTO and FHWA and is recommended to be included by state DOTs in future RFPs.

9.2.2.4 Opportunity for efficiency enhancement: State DOTs should coordinate anticipated utility relocations with other project disciplines, especially ROW and environmental planning and permitting

State DOTs are discovering that the different disciplines required to deliver a project cannot be developed in a vacuum. Each of the major project disciplines: ROW, utilities, design, construction, and environmental, all need to be coordinated in order to deliver a successful project. Decisions made in one area without considering the other disciplines can have a negative effect on the overall project; whereas decisions that consider the impacts to all phases of the project are more likely to lead to success for the project (Cambridge Systematics, Inc., 2006). This is especially true when coordinating utility relocations with required ROW and potential environmental impacts.

Utilities and ROW are critically tied together. Utilities are often located within highway ROW, and widening or relocation of highway projects requires utilities to be relocated (FHWA 2011). If the locations of utility relocation are not properly considered during the ROW development, then utilities may not have room to install their relocated facilities and the state DOT may have to acquire additional ROW later in the project's development (Towcimak, 2004). State DOTs should also consider purchasing the ROW required for utility relocations when the utility is currently within their own ROW. This will prevent the property owner from being contacted and impacted multiple times for the same project (Towcimak, 2004). FHWA and AASHTO encourage coordination between ROW acquisition and utility relocations and for state DOTs to purchase ROW as required for utility relocations to both reduce inconvenience to property owners and to reduce overall project delivery schedule (Towcimak, 2004; Moeller, 2002).

Utility impacts should also be considered and coordinated during the selection of the preferred NEPA alternative. Utility relocations should be balanced with highway construction costs when determining the preferred alternative (Wood, 2011). Additionally, the utility relocations must be considered and cleared in the NEPA document; when utilities are not cleared during the NEPA process, utility companies or the state DOT must conduct additional environmental work to perform the required relocations (Wood, 2011). This can delay a project while the additional environmental work is completed.

9.2.2.5 Opportunity for efficiency enhancement: State DOTs should ensure that contract language is clear to design-build teams on their required role in utility coordination

To ensure a successful design-build project, state DOTs must adequately and accurately define the scope of work in the RFP documents. When the scope of work is not adequately or accurately defined, the state DOT often must supplement the contract after it is awarded to include all the requirements that were intended to be in the contract (Transportation Design-Build Users Group, 2009).

When utility coordination or relocation responsibilities are included in a design-build contract, it is important that the language in the contract documents clearly identify the roles and responsibilities of each party. It should be clear to bidding design-build teams the schedule limitation of utility work such as moratoriums on cutovers, utility protection requirements, the amount of time a particular utility relocation is anticipated to take, or which utilities the design-build team is expected to be responsible for the design and relocation of their facilities (Towcimak, 2004). It is equally important to include information on what responsibilities are being maintained by the utilities and by the state DOT (Transportation Design-Build Users Group, 2009). Our research team examined several state DOTs' RFP documents and analyzed them for clarity and noted strategies for scope clarity that should be considered in all RFPs. In this examination of state DOT RFPs, it is noted that three major areas in regard to the utility scope of work should be clear:

- Clarity in roles and responsibilities for both the design-build team, the state DOT, and the utility owner;
- Clarity on the requirements for each utility identified as a potential conflict;
- Clarity on the requirements and procedures governing utilities that are unknown during the bid phase of the project.

Some examples of RFPs that employ both clear and vague contract language are analyzed below:

Minnesota DOT (Mn/DOT)

Mn/DOT has very clear contract language on what is required of the design-build team. They clearly identify a section of the RFP that dictates the design-build team's responsibilities with regard to utilities.

> *"The Contractor's obligations with respect to each impacted Utility shall include the following activities, all of which shall constitute a part of the Work."*

Mn/DOT also notes what work they are going to perform and is excluded from the design-build team's responsibilities.

> *"The Utility Work also excludes the following obligations assigned to Mn/DOT in the Utility Agreements and Municipal Agreement."*

This clarity in contract language reduces the risks to bidding design-build teams as they know what their responsibilities are and the clarity in the contract language allows them to assume that all bidding design-build teams are bidding on the same scope of work.

WSDOT

WSDOT's design-build RFP includes clear language that is straight to the point on the responsibilities of the design-build team. WSDOT explicitly determines the utilities that have been identified as requiring relocation as part of the project and the design-build team's responsibility with respect to each. Utilities that were not accurately scoped or identified in the RFP documents are subject to the change order provision in the contract whereby the design-build team may be due an increase in contract time and/or an increase in the contract price depending on the nature of the undefined or under defined utility. Utilities that are not properly described, but reduce the design-build team's costs will result in a credit from the design-build team to WSDOT. Example contract language for managing utility change orders is shown below:

> *"Subject to Sections 1-07.17(9).4, 1-07.17(12) and 1-07.17(13) and to any other Contract requirements relating to entitlement to Change Orders, if any Major Underground Utility located within the limits of the Project's Right-of-Way or in the vicinity of any Project work outside the Project's Right-of-Way (as shown in the Conceptual Plans and/or described in Technical requirements Section 2.10) is not identified in the Utility Information with Reasonable Accuracy, then the Design-Builder shall be entitled to (a) an extension of the Contract Time to the extent that any delay in a Critical Path is directly attributable to the correction of such inaccurate information, (b) delay and disruption damages that are directly attributable to the inaccuracy, (c) for Category #1 Utilities only, an increase in the Contract Price on account of any other increased costs of the Work (excluding Relocation Costs) which are directly attributable to the correction of such*

inaccurate information and (d) for Category #2 Utilities only, an increase in the Contract Price on account of any other increased costs of the Work (including Relocation Costs) which are directly attributable to the correction of such inaccurate information. WSDOT shall be entitled to a credit if a Category #2 Major Underground Utility is not described in the Utility Information with Reasonable Accuracy and the inaccuracy has the effect of reducing the Design-Builder's costs."

NYDOT

NYDOT includes several statements in their RFP that is clear as to the design-build team's responsibility, but is not easy to enforce. This type of language typically includes language that is difficult to define and therefore, difficult to prove whether the design-build team adequately complied with the contract. Two examples are shown below:

"The Design-Builder shall carry out its work carefully, and skillfully, and shall support, and secure utilities so as to avoid damage and keep them satisfactorily maintained and functional.

"All such repairs made by the Design-Builder shall be performed in a good and workmanlike manner."

These two statements lead design-build teams to perform at a high level in the completion of the project, but words like carefully, skillfully, and workmanlike are ambiguous and are generally interpreted liberally in contract documents.

NYDOT does include clear contract language for the critical work items as part of the scope of utility work. NYDOT includes a table in their RFP that identifies all known utility conflicts, the planned relocation or adjustment for each conflict, the party responsible for the relocation/adjustment, and a point of contact for the utility owner. An example from NYDOT's Kendrick Road Bridge RFP is shown in the table below:

Table 9.1 Utility Conflicts, the Planned Relocation/Adjustment, the Party Responsible for the Relocation/Adjustment, And a Point of Contact for the Utility Owner (Copyright of Kendrick Road Bridge RFP, 2013)

Utility Conflict	**Location**	**Owner**	**Planned Adjustment**	**Point of Contact**
U/G Telecommunications Fiber and Copper Cables conflict with expansion of the bridge foundation to the west.	South end and north end of the Kendrick Road bridge	University of Rochester	Owner to relocate existing cables from current location in front of and along backwalls through existing sleeves in backwalls. Estimated duration of work is four weeks. **Work to be performed by Owner's subcontractor under a competitively bid contract and be completed by April 1, 2013.**	XX, Facilities / Cable Engr IT Networking and Communications 727 Elmwood Avenue Rochester, NY 14627 xxx@rochester.edu Ph: 585-275-24XX
Storm/Sanitary Sewer Manholes and Facilities conflict with pavement work on approach to the bridge. A storm drain conflicts with expansion of the bridge to the west.	North approach to the Kendrick Road bridge	Monroe County Pure Waters (in the City of Rochester)	Vertical adjustments to drainage structures and manholes. Existing 36" CMP outlet to canal will be in conflict with proposed abutment extension and new wingwall **- Relocation Required; design and construction work to be completed by the Design-Builder.**	XX County DES 7100 City Place 50 W. Main Street Rochester, NY 14614 xxx@monroecounty.gov Ph: 585-753-76XX

Table 9.1 (Cont'd)

Pedestrian Lighting on the approach to the bridge conflicts with approach work.	North end of bridge	City of Rochester	Remove, inspect, store and reinstall lighting; **design and construction work to be completed by Design-Builder**.	XX, Street Lighting Coord. 30 Church Street Room 012A Rochester, NY 14614-1206 xxx@cityofrochester.gov Ph: 585-428-12XX
Underground 34 kV primary electric cables conflict with embankment widening and trail access/relocation.	Crosses Kendrick Road under north approach to the Kendrick Road bridge	Rochester Gas & Electric -- Electric	Design and relocate buried electric cables beneath the north edge of Erie Canal Trail (beneath BIN 4443840). Estimated duration of work is four weeks. **Work is to be completed by Owner's [subcontractor]** (competitively bid for this work) before May 1, 2013.	XX Rochester Gas & Electric Corp. 89 East Avenue Rochester, NY 14649-0001 xxx@rge.com Ph: 585-724-80XX

9.3 Relocation of Utilities

Utility relocations and adjustments are often identified as a critical element in project development (Cambridge Systematics, Inc., 2006). State DOTs have established policies and practices that govern under what conditions public funding may be used to relocate utilities to accommodate highway construction. Utility relocations are eligible for Federal funding as part of the construction contract when state law requires the state to pay for the relocation (Cambridge Systematics, Inc., 2006).

There are several common issues identified for delays associated with utility relocations. These include:

- *Increased workload on utility relocation crews due to an increase in highway and bridge construction,*
- *Utility's lack of financial and personnel resources to execute relocation,*
- *Inadequate coordination or sequencing among utilities using common poles and ducts,*
- *Utility companies giving low priority to relocations, and*
- *Phasing of construction and utility relocation work out of sequence (Ellis 2009).*

These issues, if not properly managed, can create additional and unnecessary delays on design-build contracts. These issues are all related to two major challenges, utilities' lack of resources to perform relocations and improper coordination of relocation activities (Ellis 2009).

On design-build projects, utility relocation is often begun based upon an agreed upon schedule between the design-build team and utility owners. This is due to the coordination requirement included in most state DOT RFPs which requires the design-build teams to coordinate with utilities to determine relocation designs and schedules. Relocations can begin at any point during the execution of the design-build contract as long as all of the requirements of the contract have been met. The ability for the design-build team to coordinate the relocation schedule allows for the utility relocation to be completed in a manner that is most beneficial to the project schedule (Towcimak, 2004). The authority and requirement to coordinate the utility relocations allow the design-build team better control over the project schedule and clearly allow for faster delivery of the project vs. design-bid-build projects (Towcimak, 2004). Additionally, design-build teams can perform clearing and grading work for utility companies to allow for more expeditious relocations regardless of whether or not utility relocations are a responsibility of the design-build team (Towcimak, 2004).

9.3.1 Challenges in utility relocations

9.3.1.1 Unclear determination of responsibility for utility relocations

It is important that roles and responsibilities be clear on design-build contracts. Unclear contract language can lead to disputes after the project is awarded. Design-build contracts are often advertised with around a 30% level of plan completion, this level of plan development often does not have utility impacts identified. Since utility impacts have not been fully identified, it can be difficult to include specific contract requirements for utility relocations that have not been designed and may or may not be impacted by the project's final design (Molenaar, 2005).

Utility relocation requirements that are unclear, or transfer too much risk to the design-build team (for example requiring the design-build team to be responsible for unidentified utility relocations) may be too much risk for a state DOT to transfer in a design-build contract (Molenaar, 2005).

9.3.1.2 Uncontrollable impact of utility relocations on the project schedule

Utility relocations are often cited as one of the top factors that cause project delays. In urban areas, this problem can be exasperated as multiple utility owners must be coordinated with and relocated. Utilities are often relocated in a linear progression, with each utility completing their relocation before the next one can begin (AASHTO, 2007).

Utility relocations on construction projects often fail to meet schedule commitments. This is largely due to the roadway contractor and utility contractor not being on the same page with regard to the sequence of construction activities. When one party is delayed, then the other party's schedule is affected (Ellis 2009).

State DOTs have little or no authority over utility companies that fail to relocate in a timely fashion or to meet project schedules (AASHTO, 2007). Most state DOTs do not have the authority to pay for utility relocations. This results in the relocation being done at the utility owner's cost; and therefore a low priority for the utility company (AASHTO, 2007). FDOT has seen this challenge exemplified by the design-build process, where FDOT does not have the authority over the utility owner to force them to relocate in accordance with the project schedule (Tom Bane, personal communication, February 27, 2013).

9.3.1.3 Unfamiliarity of design-build teams with utility relocation work

Design-build teams may be unfamiliar with complex utility relocations such as power, communications, and high pressure pipelines. This can lead to a reluctance of utility owners to allow a design-build team to perform utility relocations and reluctance of design-build teams to take on utility relocations (Towcimak 2004). This unfamiliarity can also cause scheduling issues if the design-build team underestimates the amount of time required for a utility relocation or if the design-build team improperly schedules the phasing of work (Ellis 2009).

9.3.2 Opportunities for efficiency enhancement

9.3.2.1 Opportunity for efficiency enhancement: State DOTs should consider including utility relocations in the design-build contract

Design-build offers state DOTs the opportunity to transfer risks to the design-build team when appropriate (Molenaar, 2005). Including utility relocations in a design-build contract has been documented as a best practice by numerous studies (Towcimake 2004; AASHTO, 2007; Ellis

2009). State DOTs following this best practice are increasingly transferring utility relocation responsibilities to design-build teams in addition to utility coordination responsibilities (Towcimak, 2004).

Our review of design-build RFPs from various states has indicated that when the design-build team is required to perform utility relocations, the full scope of this work can include:

- Identifying utility impacts;
- Coordinating or designing utility relocations;
- Relocating utility facilities;
- Recording utility as-builts to document utility relocations.

All of these activities may or may not be included in all design-build contracts that include utility relocations. Some of these activities may be retained by the utility owner such as designing utility relocations or recording utility as-built information.

Including relocations in the contract provides the design-build team with greater control over a schedule critical activity. Utility relocations are often on the critical path of a project's delivery; and by allowing a design-build team to perform or contract for the performance of a utility relocation, it allows the design-build team to control the work in a manner that minimizes the risk of project delays (Towcimak, 2004). Allowing the design-build team to perform utility relocations also reduces the risk of third-party delays by reducing the utility owner's role to simply inspection and verification that the work was completed per their requirements (Transportation Design-Build Users Group, 2009). The risk of the design-build team being delayed while they wait on the utility owner to relocate can be eliminated (Moeller, 2002).

Design-build teams are also incentivized to examine innovative solutions when design and construction of utility relocations are included in the design-build contract (Cambridge Systematics, Inc., 2006). This works to create a better relationship with utility owners and works to a lower project price for the state DOT as all parties are incentivized to avoid relocations

(Cambridge Systematics, Inc., 2006). State DOTs have found that incorporating utility relocations into a design-build contract has numerous additional benefits including (Towcimak, 2004):

- *"Greater utilization of contractor's equipment and manpower.*
- *Less duplication of effort on items such as traffic control.*
- *Lower bid prices by consolidating items such as excavation under a single contract."*

Some state DOTs such as FDOT are experimenting with the use of cost-sharing provisions for utility relocations in the design-build contract. FDOT is performing additional work prior to advertising a design-build contract to design proposed relocations and develop a cost estimate for those utilities that are in conflict with the project. Design-build teams are then expected to include this cost estimate for the relocation in their bid price. Costs above or below this bid price are shared depending on how the cost difference is incurred (Tom Bane, personal communication, February 27, 2013). The scenarios and cost sharing results are shown in Table 9.2 below:

Table 9.2
FDOT Utility Cost Sharing Provision

(Tom Bane, personal communication, February 27, 2013)

Cost Over/Under	**Relocation design used (FDOT or design-build team)**	**Responsibility for cost overruns/sharing**
Over	FDOT	FDOT pays additional costs when their proposed relocation design is used by the design-build team
Over	Design-build team	Design-build team pays additional costs when they use their own proposed design for utility relocations
Under	Both	Cost savings are split 50/50 between FDOT and the design-build team

A challenge to including utility relocations in the design-build contract is that design-build teams may be unfamiliar with working with utility owners or performing relocations. Design-build teams are generally skilled at common utility relocations such as storm and sanitary sewers, water lines, gas lines, and conduit (Towcimak, 2004). Utility owners may be reluctant to allow design-build teams to perform specialty work. This issue can be addressed in the contract when utility owner preapproved or prequalified subcontractors are required by the contract documents (Towcimak, 2004). This also helps ensure that all design-build teams are clear on the requirements of the contract and who is allowed to perform specialty work. Design-build teams may find utility work difficult at first as they do not have established relationships with utility owners and may be inexperienced with coordinating and installing utility facilities (Moeller, 2002). These challenges are overcome through project experience, and even design-build teams who are unfamiliar with managing utility relocations can realize significant potential for schedule saving (Moeller, 2002).

Another challenge to including utility relocations in a design-build contract is how to manage utilities that are shown incorrect or unknown at the time of advertisement but are discovered after a design-build team is selected. Our review of state DOT RFPs found that some state DOTs would like this risk to fall to a design-build team as it is the design-build team's responsibility to begin coordination during the bid process and to verify existing utilities and identify conflicts. Other state DOTs retain this risk and include contract language that indicates that utilities which are misidentified on the plans or not shown on the plans are considered extra work and subject to a change order. State DOTs that consider inaccurate utilities or unknown utilities to be extra work consider how inaccuracy affects the cost of performing the work. WSDOT requires the design-build team to give money back to the state DOT when actual utility locations decrease the cost of completing the project. Several state DOT RFPs that were examined also put the risk of utility impacts as a result of the design-build team's proposed innovative designs with the design-build team. This would apply when the base design provided by the state DOT did not impact the utility, but the design-build team's proposed design does impact that utility.

RFPs from several state DOTs were reviewed and it appears that the including utility relocations in the design-build contract is now considered a common practice. Example RFP language is presented and analyzed below:

Minnesota DOT (Mn/DOT)

Mn/DOT clearly designates design and construction responsibilities to design-build teams in respect to utility relocations:

> *"The Contractor's obligations with respect to each impacted Utility shall include the following activities, all of which shall constitute a part of the Work:*
>
> - *Design, construction, and/or inspection costs or reimbursement of inspection costs for all Utility Work for which such responsibility is assigned to the Contractor.*
>
> - *Whether the Utility Work is performed by the Contractor or by the Utility Owner, identification, verification, and Approval that the design and construction of all affected and existing Utilities are compatible with the remainder of the Project. This shall be accomplished by incorporation by the Contractor of the designs on the Project plans; providing coordinate information, profile information, and potholing for confirmation of conflicts for all Utility Relocations, as well as existing Utilities, that are not in conflict with the Project; surveying the pertinent points in the field for exact placement of the Utility facilities; and incorporating the above information by the Contractor on the Contractor's CADD drawings, and ultimately on the Contractor's As-Built Documents. If the Utility Owner performs the design and construction of the Utility Relocation, the design information will meet only the standard of quality necessary for the Utility Owner to construct the Utility Relocation."*

Mn/DOT ensures clear contract language regarding the design-build team's responsibilities with regard to utility relocations. Mn/DOT executes Master Utility Agreements (MUA) with each identified utility owner and the requirements with respect to the design-build team for relocation requirements that are identified in the MUA. Utilities that were previously unidentified are considered extra work and the design-build team is entitled to a change order.

WSDOT

Washington State DOT splits utilities into two categories where category 1 utilities are not eligible for reimbursement and category 2 utilities are eligible for reimbursement. Both category 1 and category 2 utilities are eligible to have their relocation included in the design-build scope of work; however, category 1 utilities that are included in the scope of work require the utility owner and the design-build team to enter into an agreement whereby the utility pays the design-build team for the relocation. WSDOT identifies all category 1 and 2 utilities that are known to be in conflict with the proposed project and further indicates which utilities are included in the scope of work. Example RFP language is shown below:

> *The following ten Utilities have been identified as crossing within the proposed Project facilities. Depending on the design, these Utilities may be designed around, either permanently or temporarily Protected in Place, or relocated during construction. The Design-Builder and the Utility Owner shall consider all options in the design process. Any selected option shall be performed at the Utility Owner's cost. All Utilities are classified as Category 1.*

In this case, all utilities identified by the project are considered Category 1 and any relocation required by the design-build team will be paid for by the utility owner directly to the design-build team. WSDOT does not have the authority to require utility owners to allow the design-build team to perform their relocations, but allows them the option of utilizing the design-build team's services for ease and risk transfer.

WSDOT also includes clear requirements on how unknown or mislabeled utilities are handled and accepts the risk or unidentified utilities:

Subject to Sections 1-07.17(9).4, 1-07.17(12) and 1-07.17(13) and to any other Contract requirements relating to entitlement to Change Orders, if any Major Underground Utility located within the limits of the Project's Right-of-Way or in the vicinity of any Project work outside the Project's Right-of-Way (as shown in the Conceptual Plans and/or described in Technical Requirements Section 2.10) is not identified in the Utility Information with Reasonable Accuracy, then the Design-Builder shall be entitled to:

a) an extension of the Contract Time to the extent that any delay in a Critical Path is directly attributable to the correction of such inaccurate information,

b) delay and disruption damages that are directly attributable to the inaccuracy,

c) for Category #1 Utilities only, an increase in the Contract Price on account of any other increased costs of the Work (excluding Relocation Costs) which are directly attributable to the correction of such inaccurate information and

d) for Category #2 Utilities only, an increase in the Contract Price on account of any other increased costs of the Work (including Relocation Costs) which are directly attributable to the correction of such inaccurate information.

WSDOT shall be entitled to a credit if a Category #2 Major Underground Utility is not described in the Utility Information with Reasonable Accuracy and the inaccuracy has the effect of reducing the Design-Builder's costs.

WSDOT clearly identifies how each category of utility is managed when they are not located within reasonable accuracy. WSDOT further goes on to define reasonable accuracy as:

"Reasonable Accuracy" shall mean that a Major Underground Utility is referenced in the Utility Information, and

1. *The Utility's actual centerline location is within 10 feet of the horizontal centerline location indicated in the Utility Information (with no limitation on vertical location), and*

2. *One of the following applies, with regard to any difference (whether larger or smaller) between the Utility's actual inside diameter, excluding casings and any other appurtenances (the "actual size") and the inside diameter indicated for such Utility in the Utility Information (the "stated size"):*

Stated Size	***Actual Size***
12" or less	*Not more than 24"*
Greater than 12" but less than or equal to 36"	*Stated size ± 50%*
Greater than 36" but less than or equal to 72"	*Stated size ± 25%*
Greater than 72"	*Stated size ± 15%*

This language removes ambiguities from the contract and protects WSDOT and design-build teams by establishing appropriate levels of risk for inaccurate utility locations provided during the project bid phase.

9.3.2.2 Opportunity for efficiency enhancement: State DOTs should consider providing incentives to utility owners to expedite relocations by reimbursing them for normally non-reimbursable relocations

Utility relocations are generally one of the longest activities on a project schedule (Cambridge Systematics, Inc., 2006; Campbell, 2009; Towcimak, 2004; Keck, 2010; Moeller, 2002). Some state DOTs have realized that by providing incentives to utility owners through reimbursing them for normally non-reimbursable expenses, relocations are completed faster allowing the quicker completion of the overall project (Cambridge Systematics, Inc., 2006). Utilities do not prioritize non-reimbursable relocations as most utilities are private entities with the goal of making profits and maintaining good services to their customers. Hence, utilities prioritize upgrading facilities and repairing damaged lines over relocating due to highway widening (Keck, 2010). Reimbursing non-reimbursable utilities comes at an additional cost to state DOTs, but the benefits of a shorter project delivery schedule and earlier opening for the project may outweigh additional costs associated with the reimbursement (Cambridge Systematics, Inc., 2006). Reimbursements should be tied to guaranteed relocation schedules and preferably relocation schedules that include expedited construction. This practice is not currently utilized as Federal funding is not eligible to be used to reimburse utilities that do not reside within their own ROW or easement.

Australian transportation agencies enjoy good working relationships with utilities and are able to encourage utilities to relocate within reasonable time frames. This is due to in part that all utility relocations are considered reimbursable (Campbell, 2009). A study of Australia and Canada Utility and ROW Best Practices noted that state DOTs should promote incentive-based reimbursement for utility relocations. This incentive-based structure recommends tying several milestone dates throughout the relocation process to the incentive whereby if a utility misses one milestone date, then they forfeit any reimbursement (Campbell, 2009).

ASSHTO recommends cost sharing measures for utilities regardless of whether or not they reside within their own ROW or easement or were present prior to the construction of the highway also known as prior rights. Utility owners are incentivized to relocate in a timely manner to eliminate the cost and project delays associated with researching prior rights information (Towcimak, 2004). Research of state RFPs indicates that reimbursing utility owners for non-reimbursable relocations is not a common practice. Georgia DOT (GDOT) is the lone state that seems to utilize this practice for all design-build projects by allowing utilities to elect to include their relocation, if required, in the design-build contract regardless of prior rights. Other states seem to include this incentive to utility owners only when timely completion of a project is a higher priority. GDOT documents this through their Memorandum of Understanding (MOU) process. The GDOT MOU with utility owners allows utility owners to elect to include the relocation of their facilities in the design-build contract.

9.4 Challenges and Opportunities Utilization Table

We conducted fact-finding interviews with seven utility experts in State DOTs that currently have vibrant design-build programs. These experts evaluated the identified challenges, and answered with either "yes" meaning that they have experienced similar challenges or "no" meaning that the challenge was not experienced or was not applicable for their respective state DOT. A summary of this assessment is provided in Table 9.3.

These experts also evaluated the identified opportunities for efficiency enhancement of the utility coordination and relocation process for design-build projects in their own State DOT. Each opportunity is marked as "standard practice", "utilized in few projects", "not considered", "considered for future implementation", or "not allowed by the State law". A summary of this assessment is provided in Table 9.4.

Table 9.3
Challenges Related To Utilities Coordination and Relocation on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Challenges	**Identification of Utilities**							
	Insufficient or inaccurate identification of utility locations	Yes	Yes	No	Yes	Yes	-	-
	Disputes on determination of utility compensable property rights	No	Yes	No	No	No	-	-
	Coordination of Utilities							
	Reluctance of utility owner to work with design-build teams	No	Yes	No	No	Yes	-	-
	Deficiency in addressing utility impacts on environmental resources and ROW needs	No	Yes	No	No	Yes	-	-
	Relocation of Utilities							
	Unclear determination of responsibility for utility relocations	No	Yes	No	No	Yes	-	-
	Uncontrollable impact of utility relocations on the project schedule	No	Yes	No	No	Yes	-	-
	Unfamiliarity of design-build teams with utility relocation work	No	Yes	No	No	No	-	-

Table 9.4
Opportunities to Enhance Efficiency of Utilities Coordination and Relocation on Design-Build Projects
Has your state DOT utilized these opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Identification of Utilities**							
	State DOTs should conduct utility engineering and subsurface utility engineering activities early in the project development process	Utilized on a few projects	Standard practice	Considered for future use	Standard practice	Standard practice	-	-
	Coordination of Utilities							
	State DOTs should consider obtaining Memorandums of Understanding (MOUs) or Master Utility Agreements (MUAs) with utilities as major pre-bid utility coordination tasks	Not considered	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should consider including utility coordination in design-build contracts	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should partner with utility owners and encourage design-build teams to partner with utility owners to create solutions that minimize or avoid relocations	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should coordinate anticipated utility relocations with other project disciplines, especially ROW and environmental planning and permitting	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should ensure that contract language is clear to design-build teams on their required role in utility coordination	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	Relocation of Utilities							
	State DOTs should consider including utility relocations in the design-build contract	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should consider providing incentivizes to utility owners to expedite relocations by reimbursing them for normally non-reimbursable relocations	Not considered	Not considered	Not considered	Not considered	Standard practice	-	-

9.5 Implementation Recommendation Considerations for GDOT

GDOT should continue to ensure that contract language is clear to design-build teams on the design-build team's required role in utility coordination and relocations.

Design-build projects are generally more successful when the State DOT and design-build team both understand the work the design-build team is contractually obligated to perform. Clear contract requirements allow the design-build team to accurately scope and bid these requirements. Since, utility coordination and relocation requirements are often excluded from the scopes of design-bid-build contracts, contractors whose main experience is on design-bid-build projects, may be unfamiliar with performing this type of work when asked to do so on design-build projects. Clear contract requirements can help to mitigate this challenge so that all bidding design-build teams understand what is required vs. only those design-build teams with experience in these areas. State DOTs that have implemented this opportunity are the following:

- Washington – explicitly states design-build team requirements with respect to utility coordination and relocation and lists out those requirements.
- New York – provides a table in the contract that identifies all utilities located on the project, the location of each utility, the planned adjustment or relocation that has been previously coordinated, and who will be performing the relocation (State DOT, utility owner, or design-build team)
- Minnesota – explicitly states all utility coordination and relocation requirements in the contract. The contract also states the work that the design-build team is not responsible for, which aids the design-build team in limiting their risks and likely reduces the contingencies in their bids.

CHAPTER 10

ALTERNATIVE TECHNICAL CONCEPTS

Alternative technical concepts (ATCs) are changes proposed by design-build teams to basic configurations, scope, design, or construction criteria of the project supplied by the state DOT (FHWA 2013a; Molenaar et al. 2005). These proposed changes should provide a solution that is equal or better than the pre-specified requirements in the RFP. ATCs require review and approval of the state DOT prior to contract award; and if approved, they may be incorporated as part of the proposing team's technical and price submittal. ATCs have huge potential for accruing sizable benefits in terms of cost savings, increased constructability, and schedule reduction (Ashuri and Kashani 2012). ATCs provide additional flexibility to the proposers that will enhance innovation on the project and result in efficiencies in time, cost, and quality (Molenaar et al. 2005). Major benefits of using ATCs on design-build projects include the following (EDC 2012b):

- Involves contractors through pre-award meetings
- Allows competitors to submit confidential proposals for consideration
- Encourages innovation in design-build teams
- Advances the use of new technology, materials, and construction methods
- Promotes best-value solutions
- Allows owners to receive full competitive value for proposals

State DOTs typically use ATCs on large design-build projects with opportunities for innovation. Hence, their implementation depends on the degree of innovation in the technical solutions offered by design-build teams. The following State DOTs have used ATCs on large design-build or public-private partnership projects: California, Colorado, Florida, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Nevada, Texas, Utah, Virginia and Washington. According to FHWA, currently 19 states evaluate the use of ATCs on design-build projects (EDC 2012b; FHWA 2013a).

Although several state DOTs consider the use of ATCs on design-build projects, the use of ATCs is subject to certain challenges.

10.1 Challenges of evaluation and use of ATCs

10.1.1 Difficulty in maintaining confidentiality and fairness (unbiased evaluation) among the bidders

Approval of ATCs is subject to a confidential review, which may require one-on-one meetings between the state DOT and the proposer for better understanding of concepts. Since ATCs are considered as intellectual property of the proposers and can significantly affect the outcome of the proposal evaluation process, it is imperative for the contract parties to maintain confidentiality during the review and approval process (Autry 2012; EDC 2012b). To maintain confidentiality, state DOTs require their employees and engineers, who are involved in the review and evaluation process of ATCs, to sign confidentiality agreements. Those involved in the ATC process are also required to sign agreements regarding the conflict of interest so that they will not prefer a certain proposal because of personal interests.

10.1.2 Determination of an "equal or better" design solution in comparison to base design

Proposed ATCs should result in benefits in terms of cost savings, added value/scope, or both for the state DOT. Simply put, ATCs should result in an equal or better solution compared to the base design that is identified in the project RFP (EDC 2012b). Evaluation of the added value or cost savings (equal or better solution) for the state DOT is challenging and requires analyzing various features of the proposed ATC, such as design details, construction issues, permit modifications, and ROW impacts. Thus, implementation of ATCs is subject to approval of the state DOT.

10.1.3 Excessive resource requirements of the ATC review process

The proposed changes may require excessive time or cost for review, evaluation, and investigation by the state DOT. Since ATCs typically include a deviation from the basic configuration, their review requires involvement of experts from various technical areas. These technical experts should evaluate proposed ATCs and provide proposers with adequate feedback that whether proposed ATCs are in conformance with NEPA permits, ROW limits, utilities, design standards, and most importantly project goals. The review process of ATCs can require significant time and extensive resources (Autry 2012; Coblentz 2012; EDC 2012b). For instance, interviews with the Florida DOT highlighted that one particular design-build project required over 50 one-on-one meetings between proposers and one engineer in the design division for discussion of several ATCs (Interview with FDOT 2013b). Similarly, the Maryland State Highway Administration (MSHA) reviewed several ATCs on “Intercounty Connector (ICC)” program. The ATC review and evaluation process by MSHA involved several meetings with proposers and staff from various technical areas (Coblentz 2012).

10.1.4 Significant impacts on NEPA permits, ROW, utilities, and other critical areas

The proposed changes may have negative environmental, traffic, safety, and maintenance/operational impacts. Implementing ATCs by the design-build team can expose the project to certain risks that can have significant consequences for both the state DOT and the design-build team (EDC 2012b). State DOTs usually prefer to have the NEPA document ready prior to RFP advertisement. Thus, changes to the basic configuration can trigger a NEPA re-evaluation or permit modification, which may not be at the best interest of the state DOT. Although state DOTs transfer the risks of NEPA re-evaluation and permit modifications to the design-build team, ATCs can delay the project schedule and result in cost over-runs. Similarly, ATCs can have significant impact on the project ROW and require additional ROW acquisition to accommodate changes to the basic configuration. Especially when the state DOT attempts to perform early acquisitions to expedite the project delivery schedule, ATCs can pose challenges to the project success. Therefore, evaluation of ATCs’ impacts on NEPA permits, ROW, utilities, and other critical areas is a challenging process.

10.1.5 Conflicts with Title 23 CFR 636.209(b) (supplement not substitute base proposals)

The use of ATCs on design-build projects may be in conflict with Title 23 CFR 636.209(b) of the FHWA, which states:

> "*At your discretion, you may allow proposers to submit alternate technical concepts in their proposals as long as these alternate concepts do not conflict with criteria agreed upon in the environmental decision making process. Alternate technical concept proposals may supplement, but not substitute for base proposals that respond to the RFP requirements*."

However, the FHWA has approved several waivers for this rule under the Special Experimental Project No. 14 (SEP-14). State DOTs can apply for waivers under the SEP-14 and if approved, they can use ATCs as substitutes for the base proposal. For instance, on May 6, 2010 the Washington State DOT (WSDOT) submitted a request to the FHWA for a waiver of the requirements of title 23 CFR 636.209(b) under the SEP-14. The FHWA approved the method used by WSDOT for evaluating ATC's during the RFP process as satisfactory and granted WSDOT a programmatic waiver on June 1, 2010. In their request, WSDOT stated:

> "…*we understand that the concern underlying this requirement (23 CFR 636.209(b)) is to ensure fair and open competition, and to make sure that all proposers are competing for the same project. The WSDOT hereby requests that the requirement to submit separate proposals for the base and the 'alternative' technical concepts be waived, allowing each proposer the opportunity to submit ATCs for pre-approval and then to submit a proposal with or without ATCs*." (WSDOT 2010b)

Additionally, WSDOT agrees to annually submit to the Washington Division Office a program evaluation report that at a minimum addresses the following items (WSDOT 2010b):

- The number of projects where the ATC process was utilized
- The number of proposers on each project
- The number of ATCs generated on each project
- The best-value price as proposed and the engineer's estimate for each project
- A comprehensive list of any complaints about the proposed ATC process
- A comprehensive list of any formal protests associated with projects utilizing the proposed ATC process
- Any additional reportable factors that the FHWA deems appropriate

Similarly, the FHWA approved the method used by the Maryland State Highway Administration (MSHA) for evaluating ATCs during the proposal review process of the "Interstate 95 (1-95) at Contee Road Interchange" project. The FHWA states that

> "*Pre-approval of deviations from RFP requirements that otherwise would be deferred until after the contract is awarded was required as part of this process. The proposed ATC process gave the MSHA the ability to factor each proposer's technical solutions into the selection process, allowing a true 'best-value' selection and gave the MSHA access to solutions from all proposers. It also gave the successful proposer a head start on implementation of its ATCs and avoided unnecessary costs and risks for proposers to advance a base design that may not be used*." (FHWA 2012d)

The MSHA required the proposers to provide certain details related to their ATCs. More specifically, the FHWA describes these details as the following:

> "*As part of the ATC submittal and review process, the proposer was required to provide details concerning how the ATC would impact vehicular traffic, environmental impacts (favorable or unfavorable) identified on appropriate environmental documents, community impacts, safety, and life-cycle of the project infrastructure costs (including impacts on the cost of repair and maintenance). The ATC process, therefore, led to approved ATCs that minimized the impact on the environment, did not reduce the overall quality of the final product, and would provide the 'best-value' for the contract*." (FHWA 2012d)

While some state DOTs have substantial experience with ATCs, others are still experimenting the use of ATCs. Considering the benefits of using ATCs and the value that the state DOT can get from implementing innovative concepts, we recommend the following efficiency enhancement opportunities to better utilize ATCs on design-build projects.

10.2 Opportunity for efficiency enhancement of evaluation and use of ATCs

10.2.1 Opportunity for efficiency enhancement: State DOTs should provide a standard process to receive, evaluate, and approve ATCs for design-build projects that benefit from innovation.

State DOTs should allow design-build teams to submit ATCs on design-build projects and benefit from equal or better opportunities on the project. ATCs can help both the state DOT and the design-build team achieve efficiencies in project cost, schedule, and time and provide added value through the implementation of value engineering concepts during the procurement phase (Migliaccio et al. 2009). However, proposing ATCs by design-build teams is subject to pre-approval by the state DOT, otherwise the proposer would be uncertain about the approval of any deviations from the project RFP. The FHWA requires state DOTs to decide whether they approve the ATCs as a substitute or addition to the base proposals prior to proposal submission. Additionally, to allow submission of ATCs through a waiver of the requirements of title 23 CFR 636.209(b) under the SEP-14, the FHWA should approve the methods used by the state DOT for evaluating ATCs during the RFP process.

Proposers who wish to submit ATCs should provide the state DOT with an ATC submittal package that addresses the requirements of the state DOT identified in the RFP. The ATC package at a minimum should address the following critical elements (UDOT 2011a; WSDOT 2010b):

- Detailed Description of the ATC
- Deviations from the project RFP
- Potential impacts on vehicular traffic (both during and after construction), environmental impacts, community impacts, safety, and life-cycle of the project and infrastructure costs, including impacts on the cost of repair, maintenance, and operation (as required by the FHWA)

- Proposed modifications to the RFP
- Analysis of the ATC: An analysis justifying the use of ATCs and demonstrate how the use of ATCs would benefit the project

The analysis should help the state DOT determine whether the project with ATC is “equal or better” than the project without the ATC (WSDOT 2010b). The submitted ATC package should be critically examined and reviewed by experts from various technical areas to ensure that the proposed changes provide added value to the project. If the ATC deviates from the RFP and is approved by the state DOT (FHWA must approve such change as applicable), then the project RFP should be updated accordingly. The approved design exceptions or deviations are usually added in the form of an addendum to be considered by all proposers. However, the proposers have the option to include or exclude their proposed ATCs in their final proposal.

ATCs can be utilized on similar projects as basis for design development. The ideas and solutions used in ATCs, such as novel interchange or bridge designs can be utilized by the state DOT on similar projects to expedite the project development process. Further, the proposed ATCs provide an opportunity for professional development and learning inside the state DOT. ATCs have the potential to revolutionize the way the state DOT has been doing design and construction. It provides technical experts of the state DOT in several areas, such as design, environmental, ROW and utilities with new ways of thinking and innovation to overcome the challenges of highway design and construction. Reviewing ATCs by technical experts of the state DOT also helps them realize the value of engineering and professional input in the design process. More specifically, it enables in-house design and engineering professionals to realize the value of developing in-house design for the state DOT, since ATCs can directly affect the project outcomes.

The benefits of ATCs for design-build projects can go beyond dollar values and savings in design and construction costs. For instance, the ATC process can be used as a tool for testing new ideas by the contractor, especially where accepting the risks of implementing new ideas is possibly high for the state DOT. State DOTs may have difficulty in accepting design, scope, and market-related risks of developing and implementing new ideas on design-build projects. However, the design-build team has the opportunity to try new ideas since they are better positioned to develop new ideas and to make their idea to work on actual projects. Where the design-build team accepts the risks of developing and implementing innovative solutions, there is relatively less risk for the state DOT. If new ideas and innovative solutions do not work or precede as expected, at a minimum, the contractor must provide the base design. Below we provide examples of ATC submissions and review processes for the Maryland State Highway Administration and the Washington State DOT.

Maryland State Highway Administration (MSHA)

The MSHA has taken advantage of the ATC process in procurement of four design-build contracts for the \$2.5 billion, 19-mile, "Intercounty Connector (ICC)" program. The MSHA best-value procurement offered proposers the opportunity to ask the state highway administration (SHA) to pre-approve proposed deviations from certain design requirements and performance specifications. The main objective of this approach was to encourage proposers to incorporate innovation and design flexibility into their proposals. On the ICC program, 165 ATCs were submitted, 71 of which were approved. The approved ATCs minimized the impact on the environment, improved the overall technical quality of the final product, and helped decrease the cost of the project (Papernik et al. 2010).

The ICC program consisted of 4 individual design-build contracts namely contract A, B, and C. Contract A, the first segment of the ICC, consists of 7.2 miles of new, controlled access, six lane, tolled roadway with three interchanges including I-370/MD 355, I-370\Shady Grove Road and Metro Access Road, and ICC/MD 97 (MSHA 2008). Contract B, the third segment of the ICC, extends from east of Maryland 97 to west of US 29. It includes 7.0 miles of new, controlled access, six-lane, tolled roadway; with two interchanges including ICC/MD 182 and ICC/MD 650 (MSHA 2008). Contract C, the second segment of the ICC, consists of approximately 3.7 miles of new, controlled access, six-lane tolled MD 200 roadway, approximately 2.0 miles of US-29 Auxiliary lanes and Ramps, and approximately 2.5 miles of Auxiliary lanes, Collector-Distributor roadways and Ramps along I-95 (MSHA 2008). Contract D/E, the fourth and final segment of the ICC, extends the ICC from I-95 to US 1, including a partial interchange at Virginia Manor Road. The ATC results of contracts A, B, and C are presented in Table 10.1, Table 10.2, and Table 10.3 respectively.

Table 10.1

ATC results for contract A (Adopted from MSHA (2008))

Proposer	ATCs Submitted	Approved	Submitted with Proposal
IC	32	13	10
IC3	6	2	2
FT	2	1	1

Table 10.2

ATC results for contract B (Adopted from MSHA (2008))

Proposer	ATCs Submitted	Approved	Submitted with Proposal
MD200	31	10	10
TS	29	18	15

Table 10.3

ATC results for contract C (Adopted from MSHA (2008))

Proposer	ATCs Submitted	Approved	Submitted with Proposal
IC3	19	9	6
Shanska	14	11	9

The MSHA used the same approach to evaluate and consider ATCs for implementation in procurement of the Interstate 95 (1-95) at Contee Road Interchange project. The method of evaluating ATCs by the MSHA during the proposal review process was deemed satisfactory under the SEP-14 waiver, and therefore, the MSHA received a waiver from the requirement that states "Alternate technical concept proposals may supplement, but not substitute, for base proposals that respond to the RFP requirements." The proposers were allowed to submit their ATCs for pre-approval by the MSHA. The MSHA did not approve ATCs that had a significant deviation from the requirements of the RFP for this project, unless it was determined, that the proposed end product based on the deviation was equal to or better than the end product absent the deviation. The proposers were then permitted to incorporate the pre-approved ATC into their final proposal, as they saw fit. It was not required that all approved ATCs be included in the Final Proposal. Below in Table 10.4, we present a list of accepted or conditionally accepted ATCs by the MSHA along with the estimated construction cost savings, estimated future construction cost savings, and estimated future maintenance cost savings as estimated by the design-build team:

Table 10.4

MSHA Design-Build ATC Data (Adopted from MSHA (2008))

ATC No.	Design-Build Team	Estimated Construction Cost Savings	Estimated Future Construction Cost Savings	Estimated Future Maintenance Cost Savings
1	American Infrastructure	1,200,000	1,100,000	500,000
2	American Infrastructure	340,000	315,000	15,000
4	Intercounty Connector Constructors, L.L.C	250,000	-	-
5	Intercounty Connector Constructors, L.L.C	Minimal	-	-
7	Intercounty Connector Constructors, L.L.C	75,000	-	-
10	Intercounty Connector Constructors, L.L.C	450,000-500,000	-	-
12	Intercounty Connector Constructors, L.L.C	500,000	-	-
15	G.A. & F.C. Wagman, Inc	400,000	-	-
16	G.A. & F.C. Wagman, Inc	240,000	-	-

The usage of this ATC process allowed each Proposer to realize a construction cost savings for this project between approximately $640,000 and $1,790,000 in their bids and ultimately savings to the MSHA. Additionally, while cost savings were not quantified by all proposers, there will be future savings to the Administration for future construction costs when the Contee Road Bridge is widened and with maintenance savings in areas such as future bridge deck rehabilitation and painting of structural steel.

Washington State DOT (WSDOT)

The Washington State DOT submits annual reports of ATC evaluation and implementation in accordance with the Memorandum of Understanding dated October 26, 2010 between the FHWA and WSDOT. The latest report published by WSDOT describes the current practice of using ATCs as follows:

> "*The concept and process for incorporation of ATCs in the DB proposal process was already an established practice as a part of that program when WSDOT proposed using DB on federally funded projects. WSDOT has found the use of ATCs to be a valuable tool that allows our proposers to apply their innovative skills to optimize our projects to the benefit of our agency and the taxpayers. The sheer volume alone of ATCs submitted confirms their popularity among proposers on WSDOT projects. The ATC is one of the ways that the competitive influence of the design build procurement can be harnessed to the benefit of the agency and taxpayers. As stated in the waiver application, the ATC process is founded on the concept that an ATC must be equal to or better than the original or base project concept. This ensures the 'level playing field' that is essential for competitive bidding without the need for a second, unaltered base proposal. The ATC process also allows a certain level of control by the agency over potential risks contemplated by proposers*." (WSDOT 2012)

The report also states the key elements in the ATC process as follows:

- *"The proposer takes responsibility for obtaining necessary approvals for their ATC (including Design Deviations and third party approvals).*
- *WSDOT reserves the right in its sole discretion to reject any ATC that it is not equal or better, or would require excessive time or cost to review, evaluate, or investigate.*
- *The ATC process is confidential. Proposers do not fear that their proprietary innovations will be disclosed to their competitors. Participants in the review and evaluation process are required to sign confidentiality agreements."*

The following are examples from specific design-build projects where ATCs have provided valuable contributions and innovations for WSDOT (WSDOT 2012):

- *"The I-405 -195th to SR 527 Auxiliary Lane project: One proposer performed some field investigation and determined that the depth of pavement on an existing shoulder was greater than shown in the contract documents. In an ATC, they proposed that the shoulder be left in place instead of removed and replaced. This ATC was approved. This team was not the best-value proposer, however. Once the contract was awarded and stipends paid, WSDOT received the right to use this idea. The idea that originated with an ATC was then implemented under the contract with a savings of $138,929.*
- *I-5 -Joe Leary Slough to Nulle Road Pavement Rehab project: One proposer submitted an ATC to reuse portions of the existing guardrail instead of the wholesale replacement of all guardrail elements as originally envisioned. This provided a savings to the contract in both time and dollars along with a transfer of responsibility to the design builder for evaluating which guardrail sections must be replaced and which could be reused.*

- *I-405 – Not Experienced 8th to SR 520 Braided Ramps project: A proposer submitted two ATCs that together shifted the ramp alignment and raised the ramp profile from the original concept. This eliminated the stacked roadway (and associated future maintenance costs), reduced excavation and wall quantities and reduced construction impacts to the neighboring regional hospital and medical center.*
- *SR-520 – Pontoon Construction project: The winning team proposed an ATC that reduced the size of the casting basin to be constructed but compensated for the smaller facility by building it faster and accelerating the pontoon casting schedule to meet the original delivery date specified. This resulted in a significant savings in bid price and still met the original delivery date for the pontoons.*
- *On the SR-520 – Floating Bridge and Landings project: The winning team proposed two ATCs that provided an alternative bridge superstructure system that made extensive use of precast concrete columns, piers and roadway deck sections. This choice of superstructure significantly reduced the amount of exposed steel as well as cast in place concrete work performed over Lake Washington. This resulted in significant cost and schedule savings as well as reduced environmental risk.*
- *On the SR-520 – Floating Bridge and Landings project: The winning team proposed two ATCs that reconfigured the floating bridge maintenance facility and dock to make more efficient use of the space available, reduce life cycle operating costs and further reducing impacts to the surrounding, sensitive community.”*

Table 10.5 presents a summary of ATC submissions in design-build projects as provided by WSDOT for the FHWA. WSDOT describes the ATC process as "a valuable and effective tool that helps to further refine our design-build projects and obtain the best-value for taxpayers". The high frequency of proposing ATCs and participation by proposers during the procurement phase shows that the ATC process is well established and accepted by industry as confirmed by both statistical and anecdotal data. WSDOT also states:

> "*This ATC process provides another avenue for application of the competitive market influence to the design-build procurement method within the bounds of the level playing field and to the benefit of our taxpayers. Additionally, this process makes use of the FHWA waiver authorization to avoid extra, duplicative efforts by our proposers and evaluation teams associated with the preparation and review of a second, unaltered proposal.*"

Colorado DOT (CDOT)

The Colorado DOT has a slightly different approach toward evaluating ATCs. CDOT design-build guidelines state the following regarding the ATC process:

> "*Design-build teams shall submit technical approaches to any structures not historically used by CDOT. CDOT will not permit design-build teams to use technical approaches that vary from what is historically used by CDOT, unless the design-build team has already received approval of CDOT. However, proposers are encouraged to recommend alternatives to the basic configuration, temporary configuration, additional requested elements (AREs), and changes to the quality management, geotechnical and pavement (excluding pavement types), earthwork, drainage, roadways, structures, maintenance of traffic, public information, modifications to the standard specifications requirements, and architectural requirements (contract drawings) that are equal or better in quality or effect (as*

determined by CDOT in its sole discretion). These recommendations are categorized as 'Alternative Configuration Concepts' (ACCs). Other RFP sections are not subject to the ACC process." (CDOT 2013)

The project RFPs by CDOT explain that whether proposed changes will be considered ACC or ATC. For instance on the "US 36 Managed Lane/BRT Project", CDOT identifies changes to Book 2, Section 1, AREs and portions of AREs as ACC. The approach used by CDOT is described as the following:

"*CDOT encourages the Proposer to recommend alternatives to the Basic Configuration as described in Book 2, Section 1; AREs and portions of AREs. Recommended alternatives to the requirements of Book 2, Section 1 shall be considered ACCs.*

CDOT encourages the Proposer to recommend alternatives to the technical requirements found in Book 2, Sections 2 through 19 that are equal or better in quality or effect (as determined by CDOT in its sole discretion). Recommended alternatives to the requirements found in Book 2, Sections 2 through 19 shall be considered ATCs. Other RFP sections are not subject to the ATC/ACC process." (CDOT 2013)

Table 10.5

Washington State DOT Design-Build ATC Data Adopted from "Annual Report on Alternate Technical Concept Programmatic Waiver (2012)"

Award Date	Execution Date	Contract No.	Fed Funded	Contract Name	Winning Proposer (other proposers listed below)	Winning Proposal Amount	Number of Proposers	Engineer's Estimate	ATCs Allowed?	ATCs Submitted	ATCs Approved	ATC Complaints?	ATC Protest?
11/9/09	11/25/09	7,726	Y	I-405, 8th St to SR 520 Braided Ramps-Interchange	Guy F. Atkinson Construction LLC	$107,500,000	3	$175,100,000	Y	5	5	No	No
					Kiewit Construction Company	-	-		-	2	2	-	-
					Granite Construction Company	-	-		-	4	4	-	-
8/24/09	9/11/09	7,761	Y	I-405, 195th St to SR 527 - Auxiliary Lane	Kiewit Construction Company	$19,263,000	4	$30,000,010	Y	1	1	No	No
					Canyon Park Constructors	-	-		-	Non-Responsive			-
					Granite Construction Company	-	-		-	3	3	No	No
					Tri-State Construction	-	-		-	2	2	No	No
6/22/09	7/13/09	7,766	Y	I-5 Et All, Active Traffic Management System	Elcon Corporation	$34,450,000	2	$37,948,029	Y	5	3	No	No
					Parsons/RCI	-	-		-	1	0	No	No
					Signal Electric	-	-		-	8	3	No	No
1/8/10	2/12/10	7,826	Y	SR 520 Pontoon Construction	Kiewit/General JV	$367,330,000	3	$600,000,006	Y	11	6	No	No
					Flatiron/Graham/Turner	-	-		-	5	4	No	No
					Skanska/Mowat/Manson	-	-		-	1	1	No	No
10/29/10	11/29/10	7,963	Y	SR 520, Eastside Transit And Hov Project	Eastside Corridor Constructors (Granite)	$306,278,000	3	$422,064,082	Y	27	15	No	No
					Kiewit/Atkinson J.V.	-	-		-	24	13	No	No
					Skanska/Flatiron J.V.	-	-		-	27	13	No	No
12/17/10	1/6/11	7,999	Y	SR 99, Bored Tunnel Alternative	Seattle Tunnel Partners (Dragados/Tutor-Perini)	$1,089,700,002	2	$1,056,945,208	Y	8	4	No	No
					Seattle Tunneling Group	-				18	14	No	No

Table 10.5 (cont'd)

Washington State DOT Design-Build ATC Data Adopted from "Annual Report on Alternate Technical Concept Programmatic Waiver (2012)"

Award Date	Execution Date	Contract No.	Fed Funded	Contract Name	Winning Proposer (other proposers listed below)	Winning Proposal Amount	Number of Proposers	Engineer's Estimate	ATCs Allowed?	ATCs Submitted	ATCs Approved	ATC Complaints?	ATC Protest?
2/4/11	2/18/11	8,016	Y	I-5, Joe Leary Slough To Nulle Rd Vic Paving	Granite Construction Company	$14,553,000	5	$18,641,000	Y	9	7	No	No
					Tri-State Construction	-	-		-	4	0	No	No
					IMCO Construction	-	-		-	5	3	No	No
					Graham Construction	-	-		-	0	0	No	No
					Balfour Beatty	-	-		-	3	3	No	No
8/11/11	8/31/11	8,066	Y	SR 520 Evergreen Point Floating Bridge and Landings Project	Kiewit/General/Manson JV	$586,561,000	3	$640,769,000	Y	17	12	No	No
					Flatiron/Skanska/Traylor	-	-	-	-	18	4	No	No
					520 Corridor Constructors	-	-	-	-	62	27	No	No
9/7/11	10/5/11	8,177	Y	US 2, Rice Road Intersection - Safety Improvements	Lakeside/Tri-State JV	$2,170,507	3	$2,750,002	Y	1	0	No	No
					Guy F. Atkinson Construction LLC	-	-	-	-	9	3	No	No
					IMCO Construction	-	-	-	-	1	0	No	No
1/23/12	Not Executed Yet	8,204	N	I-405, Not Experienced 6th to I-5 Widening and Express Toll Lanes	Flatiron Constructors, Inc	$155,500,001	4	$249,999,996	Y	-	-	No	No
					Kiewit Infrastructure West	-	-	-	-	-	-	-	-
					Guy F. Atkinson Construction LLC	-	-	-	-	-	-	-	-
					Granite-Mowat J.V.	-	-	-	-	-	-	-	-
Not Awarded Yet	Not Executed Yet	8,216	N	SR 9/SR 92 Intersection - Intersection Improvements	Guy F. Atkinson Construction LLC	$3,346,888	3	$3,900,000	Y	-	-	-	-
					Northwest Construction	-	-	-	-			-	-
					Granite Construction Company	-	-	-	-	Non-Responsive			
Not Awarded Yet	Not Executed Yet			* Contract not executed yet. Details not available.									
								TOTALS		281	152	0	0

Utah DOT (UDOT)

The Utah DOT (UDOT) has used the ATC process on several design-build projects. On most design-build projects, the Instructions to Proposers (ITP) as part of the project RFP will describe the ATC process requirements and procedures. However, UDOT defines ATC as the following:

> "*A deviation from the requirements of the as-issued contract documents (i.e. RFP, including work and performance requirements, 30% concept drawings, etc.) which promotes innovation and is equal or better in performance, quality or effect of the end product absent the deviation, as determined by the Department in its sole discretion, and which has successfully been used elsewhere under comparable circumstances.*" (UDOT 2011a)

Any changes that the contractor wishes to perform on these items should be proposed as an ATC in a timely manner so that it can be reviewed and be approved or rejected by UDOT prior to contract award. Further, UDOT recommends that a concept may not be eligible for an ATC in case of the following:

> "*A concept is not eligible for consideration as an ATC if, in the Department's sole judgment, it is premised upon or would require:*
>
> *a. A reduction in Project scope, performance, or reliability.*
>
> *b. The addition of a separate Department project to the Contract (such as expansion of the scope of the Project to include additional roadways).*
>
> *c. An increase in the amount of time required for Substantial Completion.*" (UDOT 2011a)

The template ITP of best-value design-build projects prepared by UDOT explains the ATC process and the responsibilities of UDOT and proposers. For instance, on both "I-15; S Payson Interchange to Spanish Fork River" and "I-15; South Layton Interchange" best-value design-build projects, the contract provision describes the ATC process and the required submissions in "Section 3" of the ITP as the following:

> "*Sections ITP.3.1 through 3.2 set forth a process for pre-Proposal review of Alternative Technical Concepts (ATCs) that conflict with the requirements for design and construction of the Project, or otherwise require a modification of the technical requirements of the Project. This process is intended to:*
>
> *A. Allow Proposers to incorporate innovation and creativity into the Proposals.*
>
> *B. Allow the Department to consider Proposer ATCs in making the selection decision.*
>
> *C. Avoid delays and potential conflicts in the design associated with the deferring of reviews of ATCs to the post-award period.*
>
> *D. Obtain the best-value for the public.*
>
> *Any ATC that, if implemented, would require further environmental evaluation of the Project, may be allowed, provided that the Proposer bears the schedule and cost risk associated with such additional environmental evaluation. If the Proposer is not able to obtain the approvals necessary to implement the ATC, the Proposer is obligated to develop the Project in accordance with existing approvals and without additional cost or extension of time…*" (UDOT 2012)

10.2.2 Opportunity for efficiency enhancement: State DOTs should maintain confidentiality during the ATC review process and hold one-on-one meetings with design-build teams.

To better discuss the feasibility of ATCs and understand the proposer's concepts, one-on-one meetings may be held between the proposer and the state DOT. The one-on-one meetings and communications between the state and the proposer should be strictly confidential. The state DOT employees and consultants may also be required to sign confidentiality agreements prior to participating in one-on-one meetings. Similarly, the proposers should not be allowed to disclose any portion of ATCs to third parties, such as state or federal agencies that may have an interest in the ATCs, without gaining approval of the state DOT. Finally, the state DOT should not indicate in any manner that submitting ATCs would affect the proposer's technical score prior to submission. Providing positive or negative feedback regarding the effect of ATCs on proposer's technical score prior to proposal submission can give advantages to a single proposer, which would be unfair to the remaining proposers.

The research team identified that the ATC review process in the interviewed state DOTs requires signing confidentiality agreements. For instance, the ATC review process of the "ICC program" by the Maryland State Highway Administration (MSHA) involved several experts from various technical areas that were required to sign confidentiality agreements regarding non-disclosure of the ATC contents. Those team members reviewing ATCs were not allowed to participate in procurement of final design-build proposals. They also had to sign an affidavit regarding the conflict of interest to ensure they had no reasons to influence any proposals during the procurement of the project (Coblentz 2012). The same approach was used by the Utah DOT (UDOT) in the Diverging Diamond Interchange at Pioneer Crossing and Interstate 15 (I-15) in Utah County. The project was awarded to the proposer who submitted an innovative ATC to use a Diverging Diamond Interchange instead of the basic configuration. UDOT experts that were involved in the ATC review process were required to sign confidentiality agreements for non-disclosure of the ATC contents. Regarding holding confidential meetings with proposers, state DOTs typically have similar approaches.

Most state DOTs require design-build teams to fully disclose their proposed ATCs to the successful design-build team after the contract award, especially when stipends are paid to unsuccessful proposers. Paying stipends to unsuccessful proposers encourages design-build teams to propose technical solutions that can result in higher value for the project. In return, to facilitate the transfer of technical solutions and concepts of unsuccessful proposers, the state DOT should arrange for proper agreements prior to the RFP process. Most state DOTs require shortlisted proposers to sign agreements to disclose all the performed work (proposal concepts and solutions) to the successful design-build team after receipt of the designated stipend. Below we explain some examples from design-build manuals and project RFPs:

Utah DOT (UDOT)

The Utah DOT will hold confidential meetings with proposers to discuss ATCs. However, after submitting proposals, the ATCs and other proposed solutions and ideas become the property of UDOT and can be used on the project. UDOT requires the experienced personnel who are involved in the ATC process to sign confidentiality agreements. Further, UDOT requires proposers to avoid public announcement or disclosure to third parties concerning any ATC until after pre-approval (including conditional pre-approval) has been obtained. The ATC confidentiality provisions of both "I-15; S Payson Interchange to Spanish Fork River" and "I-15; South Layton Interchange" best-value design-build projects are described as the following:

> "*Subject to the provisions of Government Records Access and Management Act (GRAMA), ATCs and all communications regarding ATCs will remain confidential until a decision is made to select a Proposer or cancel the procurement, at which time all confidentiality rights, if any, shall be of no further force and effect except as otherwise allowed under GRAMA and applicable law. By submitting a Proposal, Proposer agrees, if it is not selected, to the disclosure of its work product to the successful Proposer.*" (UDOT 2012)

Washington State DOT (WSDOT)

The WSDOT "Design-Build Project Delivery Guidance Statement – Alternative Technical Concepts" describes the procedures used by WSDOT for the ATC process. According to this guidance statement, proposers are allowed to have confidential meeting with WSDOT to discuss ATCs in the following manner:

> "*One-on-one meetings between WSDOT and each Proposer may be held to discuss the feasibility of ATC's. To the extent provided by law, all discussions at these meetings shall be strictly confidential, and all WSDOT employees or consultants shall sign a confidentiality agreement prior to participating. A representative from HQ Construction shall be invited to all one-on-one meetings with a Proposer.*
> *At the one-on-one meetings, it is appropriate for WSDOT to give the Proposer an indication of whether or not the ATC is likely to be approved, with the understanding that the official WSDOT determination cannot be made until the ATC is formally submitted. However, it is not appropriate for WSDOT to indicate in any manner to a Proposer that a particular ATC would favorably or unfavorably affect the technical score.*" (WSDOT 2012)

The proposers are not allowed to share or disclose any portion of an ATC to third parties (such as other governmental agencies that may have an interest in the ATC) without first gaining WSDOT's permission. As WSDOT states disclosure of ATCs to third parties "…will allow WSDOT an opportunity to terminate potentially controversial ATC's" (WSDOT 2012). In addition, WSDOT will own the submitted ATCs and concepts incorporated in proposals. WSDOT describes the ownership of intellectual properties as the following:

> "*…by submitting a Proposal in compliance with the ITP, all unsuccessful Proposers acknowledge that upon payment of the designated Stipend, all ATCs that are incorporated into a Proposal, as well as any ATCs that were approved by WSDOT but not included in the Proposal, shall become the property of WSDOT without restriction on use.*"

10.2.3 Opportunity for efficiency enhancement: State DOTs should consider ATCs as a learning device and an educational tool to engage state engineers in the process.

The ATC submission and review process enables state DOT engineers to discuss innovative solutions with design-build teams. The meetings during the ATC process can be considered as a learning experience for engineers of the state DOT. Engineers and designers of the state DOT have the opportunity to discuss new ideas with proposers and the design-build team's ability to put those ideas into work. Being exposed to these new ideas (new way of thinking) can result in new ways of doing things which is equal to deployment of innovation. In other words, ATCs are unique learning experiences that can be utilized by the engineers of the state DOT on similar situations. Interviews with Colorado, Florida, and Utah state DOTs highlighted the educational benefits of ATCs for engineers of the state DOT. For instance, the use of Diverging Diamond Interchange at Pioneer Crossing and Interstate 15 (I-15) in Utah County enabled UDOT to realize several benefits. The new interchange design and innovations in design can be utilized on similar projects.

The Missouri DOT, which has used the ATCs on 10 design-bid-build projects, describes the intellectual and learning benefits of ATCs as the following:

> "*The ATC process, irrespective of the approach taken, is an opportunity for MoDOT and our industry partners to participate in a cooperative effort to find a best value solution to our projects.* ***By opening the project to innovative means, methods and materials that we either did not consider or that we had considered but determined infeasible, we allow each interested contractor to propose alternatives that best fit their operations which allows them to be in their ideal competitive position for the project****. By engaging the transportation stakeholders, we not only provide the ability to reduce a specific project's costs or completion time,* ***but we also have the ability to implement any developed alternative system-wide for other applicable projects****…this new partnership in the design process*

allows the ability to engage contractors more extensively and provides an avenue for their ideas to be moved forward to ***assist us in creating more efficient designs***." (MoDOT 2013)

10.3 Challenges and Opportunities Utilization Table

We conducted fact-finding interviews with seven design-build contracting experts in State DOTs that currently have vibrant design-build programs. These experts evaluated the identified challenges, and answered with either “yes” meaning that they have experienced similar challenges or “no” meaning that the challenge was not experienced or was not applicable for their respective state DOT. A summary of this assessment is provided in Table 10.6.

These experts also evaluated the identified opportunities for efficiency enhancement of the ATC process in design-build projects in their own State DOT. Each opportunity is marked as “standard practice”, “utilized in few projects”, “not considered”, “considered for future implementation”, or “not allowed by the State law”. A summary of this assessment is provided in Table 10.7.

Table 10.6
Challenges Related to Utilizing Alternative Technical Concepts (ATCs) on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Evaluation and use of ATCs**							
	Difficulty in maintaining confidentiality and fairness (unbiased evaluation) among the bidders	No	No	No	No	No	-	No
	Determination of an "equal or better" design solution in comparison to base design	Yes	Yes	Yes	Yes	Yes	-	Yes
	Excessive resource requirements of the ATC review process	Yes	Yes	Yes	Yes	Yes	-	Yes
	Significant impacts on NEPA permits, ROW, utilities, and other critical areas	No	No	No	No	No	-	No
	Conflicts with Title 23 CFR 636.209(b) (supplement not substitute base proposals)	No	No	No	No	No	-	No

Table 10.7
Opportunities to Enhance Efficiency of Utilizing Alternative Technical Concepts (ATCs) on Design-Build Projects
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Opportunities	**Evaluation and use of ATCs**							
	State DOTs should provide a standard process to receive, evaluate, and approve ATCs for design-build projects that benefit from innovation.	Standard Practice	Standard Practice	Utilized on a few projects /Considered for Future Use	Utilized on a few projects /Considered for Future Use	Standard Practice	-	Standard Practice
	State DOTs should maintain confidentiality during the ATC review process and hold one-on-one meetings with design-build teams.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	-	Standard Practice
	State DOTs should consider ATCs as a learning device and an educational tool to engage state engineers in the process.	Considered for future use	Considered for future use	Considered for future use	Not Considered	Considered for future use	-	Not Considered

10.4 Implementation Recommendation Considerations for GDOT

GDOT should consider ATCs as a learning device and an educational tool to engage state engineers in the process.

State DOTs have realized significant benefits through considering ATCs as a learning opportunity and an educational tool. The ATC submission and review process enables state DOT engineers to discuss innovative solutions with design-build teams. The meetings during the ATC process can be considered as a learning experience for engineers of the state DOT. Engineers and designers of the state DOT have the opportunity to discuss new ideas with proposers. The design-build team is at best position to make new design solutions to work since they are at risk for the successful implementation of new ideas. Being exposed to these new ideas can result in new way of thinking and new ways of doing business that facilitate the deployment of innovation. In other words, ATCs are unique learning experiences that can be utilized by the engineers of the state DOT on similar situations. Interviews with Colorado, Florida, and Utah state DOTs highlighted the educational benefits of ATCs for engineers of the state DOT.

The following state DOTs have implemented this potential best practice:

- Colorado –CDOT encourages design-build teams to recommend alternatives as ACCs (alternative to basic configuration) and ATCs (alternatives to technical requirements). CDOT has used ATCs and ACCs on several projects and believes that the proposed alternatives can result in significant innovations with the potential to be used on future projects.
- Florida – FDOT believes that ATCs provide the design-build team with additional flexibility to test innovative ideas on design-build projects. The office of design in FDOT has initiated “invitation for innovation” to further involve the DOT engineers in development and implementation of innovative solutions in highway design and construction.

- Michigan – MDOT has utilized ATCs on some design-build projects and consider it as an innovative tool with the potential to be used on future projects.
- Utah – UDOT considers ATCs as beneficial tools for engaging DOT engineers in innovation. For instance, the Diverging Diamond Interchange at Pioneer Crossing and I-15 is an example of an innovative solution that can be considered for future use in design-build and design-bid-build projects.

CHAPTER 11

DESIGN OVERSIGHT, DESIGN ACCEPTANCE, AND QUALITY ASSURANCE/QUALITY CONTROL

11.1 Design Oversight and Design Acceptance

Traditional and innovative project delivery systems have different approaches to design oversight and acceptance. This difference is the result of changes in assigning the responsibility of design in design-build projects compared to design-bid-build projects. In design-bid-build, state DOTs or design consultants appointed by state DOTs are responsible for design management, design oversight, and design acceptance to ensure that the project design is finished on time, on budget, and according to the specifications and criteria determined by the state DOT. State DOTs often assign an experienced engineer from inside the department or an independent designer/consultant as the design manager of the project. The state DOT design manager should have in-depth knowledge and expertise in design criteria and procedures described in the state DOT design manual, current FHWA and AASHTO guides, and other necessary standards (FDOT 2011c). The design manager in a design-bid-build project has the overall responsibility of managing key components of design process. The design manager coordinates design review to ensure the smooth progress in design development from multiple disciplines. Design oversight and design acceptance are two key responsibilities of the design manager that significantly influence the overall performance of the project in several areas, such as scope, quality, cost, and schedule of the project (Chan et al. 2005; Chan and Yu 2005).

In design-bid-build projects, the design manager directs the actions of different design professionals throughout the process of design development beginning with scope and concept development moving to detailed design development (DBIA Design-Build Manual of Practice 2012c). The project design manager is heavily involved in all activities of the design phase, which will require extensive communication and coordination with other divisions within the state DOT as well as with outside agencies. The Construction Project Management Handbook, developed for the federal transit administration (FTA), defines design management as the following (Gannett Fleming, Inc. 2009):

> "*Design management is the oversight of the design efforts phase activities…as part of your initial assessment of the Agency's current capacity and capabilities and the scope of the project, the determination will need to be made as to whether the design management will be performed by either you, an independent in-house individual, or by a program management consultant (PMC) that is procured for the task of design management.*"

The state DOT design manager is the engineer of record on design-bid-build projects that performs several tasks throughout the process of developing projects, as the following (Jacobs Engineering Group, Inc. 2009; FDOT 2011c; VDOT 2011a):

- Help the project management team establish project cost estimate and schedule
- Finalize the scope of the project considering the project budget
- Provide oversight on preliminary engineering and initial data collection
- Coordinate and establish agreements with other agencies
- Monitor permits and final approvals
- Review all design submissions
- Release final documents for construction
- Communicate with contractors
- Coordinate and oversee design review meetings, constructability reviews, and plan checks
- Evaluate and accept the quality of deliverables
- Verify adherence of the design consultant to the QA/QC plan
- Manage change orders and claims

The role of the owner in the process of design will be substantially different in design-build projects. Design and construction activities are closely integrated in design-build projects and both are the ultimate responsibility of the design-build team (DBIA Design-Build Manual of Practice

2012c). In design-build projects, the state DOT is involved in the design process but only at the capacity of design oversight and design acceptance. The design manager of the design-build team is the engineer of record that is responsible for managing the dynamics of design development throughout the project development. The state DOT should maintain its oversight and acceptance role through establishing project scope, developing preliminary design package, and identifying performance requirements for the design-build project. The state DOT needs to prepare a proper preliminary design package as part of the RFP that provides specific expectations of the state DOT from the design-build team (WSDOT 2008). More specifically, the project scope should contain enough information regarding the project environmental impacts, ROW, and utilities. The preliminary design package is the final delivery milestone of the state DOT prior to contract award (MN/DOT 2010).

In design-build projects, design management is the responsibility of the design manager of the design-build team that is considered “master integrator”. The role of the design manager of the design-build team is to coordinate and manage the design process from the contractor side (DBIA Design-Build Manual of Practice 2012c). During the design development phase, the design manager needs to ensure that all major features of design progress are in accordance with pre-specified requirements. The project requirements can include conformance with several specifications, such as performance expectations of the state DOT, certain quality specifications, major engineering and value engineering (VE) decisions, environmental permits, and ROW limits. The design manager of the design-build team has to check drawings and specification and verify that the comments of the state DOT are addressed at different design milestones (WSDOT 2008; MN/DOT 2010). Design management for design-build is complicated due to the fact that design and construction are inherently two different functions. The design process is integrated in nature (WBDG 2012), while the construction process is sequential (Hendrickson 2008). Managing the interface between design and construction is a new role that the design manager of the design-build team should play (DBIA 2012d).

The state DOT should leave design management responsibilities to the design manager of the design-build team and should just focus on significant tasks of design oversight and design acceptance. However, the translation from the design management role in design-bid-build projects to the design oversight and design acceptance role has not been without challenge for most state DOTs.

11.1.1 Challenges of Design Oversight and Design Acceptance

11.1.1.1 Loss of Control over Design

One of the major challenges of design oversight and design acceptance for design-build projects is the slow shift in the culture of state DOTs and design-build teams (Gransberg and Windel 2008; Gransberg et al. 2008). Most state DOTs have faith in traditional concepts to define responsibilities of the owner and the design-build team in the design-build environment. The culture of engineers and designers in most state DOTs is the "catch and punish" culture (Postma et al. 2002) that limits the flexibility of the design-build team to develop innovative design solutions within the acceptable range of design criteria. Postma et al. (2002) described the "philosophical shift required to implement design-build in public agencies" in an evaluation report for the Utah I-15 design-build project (the first design-build project by the Utah DOT), as the following:

> "*Traditional and well-established practices are not easily modified.* ***Employees become comfortable with long established practices that have served them well so that even when consensus is reached to implement an innovative concept, institutional inertia must be overcome****. Successful deployment of the design/build concept is certainly dependent on a shift in agency philosophy…*

…this shift in control and accountability is not readily accepted by all agency employees. Outsourcing design responsibilities may be difficult in an agency that has traditionally handled such work with in-house staff. ***Agency design personnel may not feel confident that consultant design firms have the expertise to perform at the same quality level.*** *Allowing the contractor and designer to collaborate on the design may raise concerns that quality may be sacrificed for profit.*"

One of the major issues for the state DOT is to trust that the design manager of the design-build team does not sacrifice quality to maximize the profit of the contractor. This concern can be addressed through a rigorous approach towards design oversight and design acceptance by the state DOT to ensure all expectations of the state DOT in terms of design quality will be addressed by the design manager of the design-build team. However, changing the philosophy of the state DOT is difficult. Accepting a more "proactive role" for the design-build team and a less "controlling and oversight role" for the state DOT is not easy and represents a significant challenge for the state DOT (Postma et al. 2002; Gransberg and Windel 2008).

11.1.1.2 Prescriptive design solutions and enforcement of unnecessarily strict design oversight by state DOTs

The slow shift in the culture of state DOTs comes from their major concern regarding the loss of control over design and the proper level of design control in design-build projects. In design-build, the state DOT does not have the traditional checks and balances since the owner's ability to monitor and control the design details is limited (AGC 2011; Sader 2003). The fear is that transferring responsibilities to design-build teams may compromise the integrity of the design process, which could eventually degrade the ultimate quality of the constructed product (NSPE Position Statement 1726, 1995). The fear from the loss of control over design is a major barrier to smooth implementation of design management. For instance, Niece (2009) noted the following issues regarding the risk of using design-build:

> "*…under traditional design*-bid-build*, the owner has full control over the details of the plans and specifications and does not publish them for bids until it is satisfied that they reflect its functional requirements and aesthetic preferences.* ***With design-build, the owner gives up some of this control, as the contract is awarded before the design is complete****…*"

> "*…****if the owner insists on controlling every detail of the facility, it may be better off sticking to traditional design-bid-build****…*"

Some state DOTs have decided to overcome the fear of the loss of control over the project design through providing prescriptive design solutions and enforcing unnecessarily strict design oversight practices that can prohibit or limit design innovation in design-build projects (FHWA 2006a; AASHTO 2008). The major challenge for the state DOT is to find the right balance in the level of design oversight efforts that encourages innovative design solutions and adequately mitigates design risks (Niece 2009). This issue is also critical for design-build teams since their lump-sum design-build contracts are based on tying the proposed price to certain design assumptions (AGC 2011). Hence, design-build teams are typically defensive of their proposed design solutions and respective design assumptions. This defensive behavior may provide some difficulty for state DOTs in proper execution of design oversight in design-build contracts. For instance, it would be difficult for the state DOT to accept design solutions that jeopardize the environmental permits and ROW limits. At the same time, the design-build team may not be comfortable with repeated and lengthy formal design reviews conducted by the state DOT personnel. There may be some legitimate resistance from design-build teams if state DOTs want to insist a particular design solution that was not explicitly required as part of owner's requirements in the design-build contract. If state DOTs do not like a particular design solution or in contrary, would like to implement a specific design solution in a design-build project, then this inclusion or exclusion should be clearly identified in the design-build contract.

11.1.1.3 Limited number of professional design specialists in state DOTs to expedite the process of design oversight and design acceptance

Another major concern for state DOTs and design-build teams is staff cutbacks and the lack of resources within public agencies. Design oversight and design acceptance tasks typically require substantial expertise in the area of highway design and construction. A survey of 34 transportation agencies conducted by Gransberg and Molenaar (2008) concluded that 92% respondents utilized agency design engineers to review and approve the design deliverables of the design-build team. The lack of professional review workforce in state DOTs can cause delay in the process of design review. More specifically, when state DOTs decide to perform extensive reviews, the lack of resources can cause bottlenecks and delays in the design review and acceptance process.

11.1.1.4 Fear of shrinking public engineering workforce despite the design-build project delivery system

While some agencies struggle with the lack of resources, others may resist adopting the design-build project delivery system because of the fear that design-build teams will replace the public engineering workforce (Gransberg and Molenaar 2008). In fact, Gransberg and Molenaar (2008) explored that the slow pace of adopting design-build by some transportation agencies can be rooted to political reasons and negative perceptions regarding the replacement of conventional public engineering workforce by the private sector. The state DOT personnel, especially those involved in engineering and design reviews, may feel that their job is done by consultants and designers that are not from the agency. This is a critical issue especially for state DOTs that are new to the design-build environment. However, assigning the responsibility of design to the design-build team and outsourcing inspection and review responsibilities to independent consultants, does not mean a reduction in the agency's workforce. The fear that the state DOT will need less professional design workforce is only an assumption. The change would be in roles and responsibilities to make the state DOT more efficient in the role of design oversight and design acceptance rather than managing and controlling every individual component of the design development process.

11.1.1.5 Difficulty in stipulating the process for design oversight and design acceptance

In design-build, design is the responsibility of the design-build team and the designer does not directly work for the state DOT. The ultimate responsibility of both design and construction phases is on the design-build team. Thus, design management is the responsibility of the design-build team in design-build projects. The major problem is that the state DOT is uncertain whether the design management strategy proposed by the design-build team can produce a design solution that would comply with specific project requirements. The state DOT may not feel comfortable to rely on the plan proposed by the design-build team to conduct design management.

For a long time, state DOTs have conducted design management on design-bid-build projects. Hence, they have become very comfortable with all aspects of design management process in the traditional project delivery. However, most state DOTs do not have a comprehensive plan to specifically describe the expectations of the state DOT from the design-build team for design management services. Research has shown that existing design oversight and design acceptance processes (i.e., multiple and lengthy design reviews and checks and balances that are frequently used in the traditional design-bid-build project delivery system) are not aligned with the accelerated schedule of design-build projects (Gransberg et al. 2008; Gransberg and Molenaar 2008; AGC 2011). Specially, the traditional view towards design oversight and design acceptance does not match the reality of the design-build project environment where the design-build team must have a design manager that is the engineer of records for the project.

Research has shown that several state DOTs do not have a clear understanding of this critical issue that design management is no longer the responsibility of the state DOT and should be allocated to the design-build team. State DOTs are different in terms of their levels of involvement in the design management of design-build projects. During the design development phase, the involvement of the state DOT can span a spectrum that ranges from no involvement to high involvement through several formal review milestones (Gransberg et al. 2008). In a survey conducted by Gransberg and Loulakis (2012), nearly 70% of state DOTs favored a hands-off approach as an appropriate way for design oversight and design acceptance. It is found out that most state DOTs prefer over-the-shoulder and/or design reviews requested by design-build teams as their major design oversight method. Further, in approximately 71% of design-build projects examined in that research, state DOTs are minimally involved in the design development phase with conducting not more than one design review (Gransberg et al. 2008). These reviews are often performed by the state DOT design engineers.

We performed a scan of design-build project RFPs and identified that only a handful of state DOTs request design management plans in their RFQs/RFPs (samples are presented in Section 11.2.2.2

Opportunity for efficiency enhancement: State DOTs should either stipulate required quality management plan in the project RFP or solicit proper quality management plan from the design-build team.). The challenge that may arise from the failure to request or identify proper design management plans in the RFP is that, the state DOT would have to perform more reviews during the design process and repeatedly interrupt the design-build team (with unnecessary reviews) to ensure the conformance of the proposed design with the project requirements, such as NEPA studies, ROW limits, design specifications, and utilities.

11.1.1.6 Fear of jeopardizing quality or sacrificing quality for profit in design-build projects

The quality of transportation projects is a major concern for state DOTs. Traditionally, design management has been the responsibility of the state DOT (Gransberg et al. 2008). In design-build, however, the state DOT performs verification and testing for compliance with RFP requirements, and by doing so, the state DOT does not assume responsibility for any design or construction issues (Gransberg et al. 2008; FHWA-HRT-12-039 Techbrief 2012). The failure to stipulate a proper plan in the RFP that describes the expectations of the state DOT from the design-build team to conduct design management may result in an assumption that design-build could jeopardize the final quality of the project. In fact, opponents of design-build noted that design-build results in lower quality facilities because it reduces the integrity of the design process. For instance, studies by Turochy et al. (2006) and Turochy and Parker (2007) reported conflicting conclusions with the FHWA "Design-Build Effectiveness Study" (2006) which concluded that design-build projects have equal quality compared to design-bid-build projects. Turochy and Parker (2007) express the following concern:

> "*…the consistent indications of less variable and more favorable contractor test results, relative to specification limits, are compelling reasons to consider limiting the use of contractor-performed tests to quality control…*"

According to the FHWA design-build effectiveness study and similar other studies, the issue that contractors would pressure designers to sacrifice quality for higher profit is an unproven assumption. Design-build projects have equal quality compared to design-bid-build projects (FHWA 2006a). As design-build gains more popularity in the public sector (Mortenson Company 2010), the positive perceptions towards design-build continue growing. For instance, the most recent National Society of Professional Engineers (NSPE) Position Statement 1726 states the following:

> "*NSPE is neither an advocate nor opponent of the design-build project delivery system. NSPE recognizes that more than one project delivery system may meet project requirements such as safety, function, time from conception to completion, capital and life cycle costs, environmental quality, and appearance. Accordingly,*

NSPE acknowledges that Owners may have the freedom to choose among an array of project delivery systems, including design-build." (NSPE 2010)

It is necessary to address the fear that design-build results in lower quality. One of the best ways to overcome this negative perception is to explicitly outline the expectations of the state DOT from the design-build team for performing design management. Also, the interface between the state DOT and the design-build team should be clearly defined throughout the design development process (i.e., the process used for design review, design oversight, and design acceptance), A good plan for design management, design oversight, and design acceptance adds credibility and assurance for all parties involved in the design-build project including the contractor, the state DOT, and the public (Pantazides 2005).

To overcome these challenges, the state DOT should attempt to expedite the cultural shift toward the integrity of design-build within the Department and establish best practices in design oversight and design acceptance. We propose the following opportunities that if implemented, can enhance the efficiency of design oversight and design acceptance in design-build.

11.1.2 Opportunity for efficiency enhancement of Design Oversight and Design Acceptance

11.1.2.1 Opportunity for efficiency enhancement: State DOTs should facilitate the required cultural shift regarding design oversight and design acceptance of design-build projects and provide opportunities for state DOT engineers to think of design-build projects as learning experience and not a threat.

Prior to awarding the design-build contract, the state DOT manages the development of design processes to prepare a proper design package included in the RFQ/RFP, considering several important areas, such as ROW identification, utilities coordination, and NEPA permitting. The problem begins after awarding the contract when the state DOT still wants to continue to have the same level of control on design management similar to design-bid-build projects. This can delay the project delivery schedule and hinder innovation in design-build projects. The design-build team is, in fact, responsible for managing the project design and therefore, needs to have control over the project design to better manage the integration of design and construction. The role of the state DOT during design-build project execution is to oversee and review design packages produced by the design-build team and approve design deliverables in a timely fashion.

The state DOT should facilitate the cultural shift within the Department to understand that design development is contractually allocated to the design-build team and design management is one of the new roles that the design-build team should play. The engineering services division of the state DOT should understand that they can no longer have the same degree of control on each and every individual component of the project design. Instead, the state DOT should play the role of design oversight and design acceptance to control how the design-build team plans to achieve the performance requirements. Making this cultural shift especially for state DOTs that are accustomed to the traditional project delivery environment may necessitate substantial efforts and training. By enabling the cultural shift to the design-build environment where the state DOT personnel control the process rather than the product, the state DOT can facilitate the formation of a learning culture inside the Department. As a result, the engineers and personnel of the state DOT involved in different phases of the project development would think of each design-build project as a learning experience not a threat to their positions. Each design-build project can provide invaluable opportunity for the state DOT engineers to learn from their peers on the private sector. There are several examples that the state DOT engineers learn a new design in a design-build project that helps them utilize better design solutions in future design-bid-build projects. For instance, the use of “Diverging Diamond Interchange” in the “Pioneer Crossing” design-build project in Utah, is an example of a new design proposed by the design-build team (Scholfield 2012). UDOT engineers can benefit from such innovative designs and use similar concepts on other projects. Similarly, several ATCs and innovative design solutions were proposed on the Maryland Inter County Connector (ICC) program. The Maryland State Highway Administration can utilize design innovations, such as various alignment changes, new footing types and foundation changes, and new interchange designs, proposed in Contracts A, B and C of the ICC program, on similar design-build and design-bid-build projects (Coblentz 2012).

The main drivers of the culture shift in state DOTs are commitment and support of the leadership to encourage innovation and facilitate the implementation of novel approaches in project delivery (Postma et al. 2002). The support from the leadership, who appreciates the change of this philosophy, can enhance the implementation of innovative approaches. Further, the leadership can establish specific taskforces and urge employees to better get involved in delivery of design-build projects. We have identified the “Dallas Fort Worth” design-build project by the Texas DOT (TxDOT) as one of the best practices in changing the culture of the state DOT (TxDOT 2012):

Texas DOT (TxDOT) “Dallas Fort Worth” Design-Build Project

Through partnering and close collaboration, the design-build team and the TxDOT handled several challenges in the Dallas Fort Worth design-build project. The partnering and collaboration, however, would not happen without substantial efforts from TxDOT officials and specially, the district engineer who tried hard to change the culture of the TxDOT personnel to a more collaborative team environment. The major challenge was to shift the way TxDOT personnel operated on conventional design-bid-build projects and establish new concept regarding design oversight. It was imperative to the success of the project that TxDOT employees realized the difference in design oversight and design acceptance roles in design-build compared to traditional in-house design or design performed in collaboration with consultants. For instance, design engineers of TxDOT had to accept new roles that required them to supervise the design process instead of managing integration of design and construction processes. TxDOT personnel were required to perform the acceptance of design deliverables rather than the control of the design process. Without this change in the culture of the state DOT personnel and shift in traditional roles, tensions can occur on the course of the project design.

Although the shift in the way that TxDOT operated required substantial cultural change, it facilitated the flow of information and resulted in an integrated approach to design and construction. For instance, the design team decided to start preliminary planning and engineering activities while TxDOT attorneys were working on the "legal sufficiency review" prior to initiation of the development agreement, which took 6 months. Overlapping these tasks provides significant time saving for the TxDOT in this mega design-build project.

11.1.2.2 Opportunity for efficiency enhancement: Whenever appropriate, state DOTs should co-locate the project design team and state DOT engineers to facilitate coordination and communication and improve the flow of information on large and complex projects.

Co-location of the project team is a concept often utilized in integrated project delivery to facilitate collaboration among the project team members (AGC 2011). Co-locating project participants, such as the contractor, the designer, sub-contractors, and the owner representatives, in large and complex projects promotes sharing physical offices and results in facilitated flow of information. Regarding the benefits of co-location, the "Integrated Project Delivery Guide for Public and Private Owners" (2010) notes the following:

> "*When key project participants can be co-located, opportunities for collaboration and innovation increase. Project commitments are more likely to be met when one becomes closer to one's teammates.*"

Co-location during both design and construction phases of the project brings together the right people at the right time, establishing team and enhancing relationships among all project stakeholders. Co-location of those responsible for designing, detailing, and constructing the project and the owner is beneficial for the project. These activities are more productive in a collaborative environment (IPD Guide for Public and Private Owners 2010). We describe an example of co-location from the Texas DOT.

Texas DOT Dallas Forth Worth Design-Build Project

Co-location of agency and design-build team personnel on the "Dallas Fort Worth" design-build project is an example of how a project team was able to solve project issues in a timely manner with the minimum required resources. Gathering all project participants, such as the TxDOT engineers, designers, and the contractor personnel helps bring down existing barriers and improves collaboration among the project participants (TxDOT 2012). For instance, during the design development phase, several design-related issues, such as request for information (RFIs), possible flaws, and design changes were solved because of the presence of TxDOT engineers. Co-location also facilitated over-the-shoulder reviews and expedited traditional review processes for this project. The project team was able to identify and resolve construction issues and other design related issues in a timely manner. Hence, informal interactions among all project participants and trust established in relationships between the design-build team and the TxDOT staff proved to be invaluable for this complex design-build project.

11.1.2.3 Opportunity for efficiency enhancement: State DOTs should either explicitly stipulate what their expectations are from the design-build team regarding design management or solicit design management plan from the design-build team.

To better deal with the dynamics of the design-build environment, state DOTs typically utilize two approaches for design management. Several state DOTs, such as New York, Virginia, and Washington, clearly stipulate the required design management responsibilities in the project RFQ and/or RFP. These state DOTs shortlist proposers based on the qualifications of their design management staff. By requesting for design manager as one of the key personnel in the design-build team, these state DOTs ensure that shortlisted proposers will be qualified to properly manage the design process and integrate design and construction activities.

On the other hand, other state DOTs, such as Florida and North Carolina evaluate technical proposals based on the proposer's approach to design management. The state DOT should either outline a desirable design management plan in the RFP package or require the design-build team to submit its own design management plan. The state DOT can require the design-build team to comply with the approved design management plan. Further, the state DOT can require proposers to submit a schedule for design review milestones. The state DOT can then prepare for review workloads and assign review responsibilities to subject matter experts. To ensure that agreements are in place prior to the contract award, the state DOT should consider using evaluation criteria with regard to the proposed design management plan.

The first approach requires the design-build team to comply with design management responsibilities in the RFP. However, the second approach requires submission of a proper design management plan by the design-build team. The choice of identifying and evaluating design management plans remains with the state DOT. This decision depends on the needs and requirements of the project. For instance, for large and complex projects with critical scope, environmental, and design risks that require significant design efforts, state DOTs may decide to propose an extensive design management plan (e.g. similar to in-house design management in design-bid-build) for the project. On the other hand, for small and less complex projects, state DOTs may decide to evaluate the proposed design management plans and entrust the implementation of those plans on the qualifications of proposers. Below, we present several examples related to stipulating design requirements in RFQ/RFP forms from Washington, New York, and Virginia state DOTs.

Washington State DOT (WSDOT)

Regarding stipulating the design management responsibilities in the project RFP, the WSDOT Design-Build Manual indicates that a proposal should include the following plans (WSDOT 2004b):

> "*The Proposer's concept of design management, including a description of the plan for coordination of civil/structural, utilities, railroads, traffic maintenance, third party liaison, constructability and maintainability, community relations and environmental mitigation [plans should be provided]. A brief narrative description of the proposed plan for furnishing the design work for the project shall be provided. This plan shall include at least the following items:*

- *The proposed location of the design office(s)*
- *A description of the work, which the Proposer anticipates will be performed by the Proposer's own direct labor force and those categories that will be performed by sub-consultants.*
- *A description of how the Proposer's design personnel will interface with the Proposer's construction personnel and WSDOT personnel.*"

Further, the "WSDOT Design-Build Quality Management Plan Outline" (2008) describes responsibilities of the project design manager under the design-build team organization as the following:

a. "*Direct and manage all design development, plan releases, specification releases, and QC.*

b. *Provide adequate staff to meet schedule.*

c. *Maintain a current status listing of the design section's work, expected audit dates, outstanding audit findings, and current document checking/review status.*

d. *Maintain budget and schedule; report on these on a monthly basis.*

e. *Certify that the Released for Construction (RFC) plans meet all project criteria and the contract."*

WSDOT categorizes project manager, construction manager, and design manager as level "A" personnel in the RFP of the "I-405/I-5 to SR 169" design-build project. Regarding the qualifications of the design manager, the Instructions to proposers (ITP) noted the following criteria:

"*The Design Manager shall be responsible for ensuring that the overall Project design is completed and design criteria requirements are met. The Design Manager shall be on site whenever design activities are being performed and shall be available as needed during construction activities.*

Required Licensure: Shall be a registered professional engineer in the State of Washington prior to award of the Contract." (WSDOT 2007)

WSOT required proposers to submit a narrative for the "SR 99 Bored Tunnel Alternative" design-build project addressing the following:

- "*The Proposer's concept of design management including a discussion of the organizational structure of the design team, the roles and responsibilities of the key staff, and the total staffing required for design*
- *A description of Proposer's approach to addressing constructability, durability, maintainability, and environmental protection in the design process*
- *A description of how design personnel will interface with the construction organization*
- *The plan for the completion of the preliminary engineering, including limits on work prior to notice to proceed 2 (NTP) and managing changes generated from the environmental process*
- *The plan for integration of WSDOT personnel, with respect to:*
    - *Preliminary design and continuation of the environmental process*

- *Completion of design efforts including field generated change*[s]" (WSDOT 2010a)

Similarly, WSDOT required proposers to submit a quality management plan for the "SR 520 Pontoon Construction" design-build project that explained design manager responsibilities. Kiewit-General (joint venture), the successful bidder, proposed an extensive quality management plan that defined design manager responsibilities as the following:

- "*Overall responsibility for ensuring the design provided to Kiewit-General satisfies the requirements of the contract*
- *Review, respond, and track all the comments provided by WSDOT regarding their design*
- *Review and respond to all formal design reviews (FDRs) submitted to designer by Kiewit-General or WSDOT*
- *Periodically review quality incidents, non-conformance reports (NCR), and non-conformance issues (NCI) logs to ensure contract requirements are being met in regard to the design*
- *Implement recommendations made by executive oversight committee based on quarterly audits of the quality management program*
- *Direct and manage all design development, plan releases, specification releases, and QC*" (Kiewit-General 2012)

The New York State DOT (NYSDOT)

The "Kendrick Road Bridge" design-build project RFP noted that the Department evaluates the understanding, approach, capabilities, commitments, and organization of the proposer's management approach with respect to scheduling and completion of the project on time and on budget, and the management of the project, with emphasis on quality, design, and construction.

Design management is one of the most critical sub-factors in the technical evaluation of the proposed management approach. The design management evaluation criteria are described, as the following:

> "*...evaluates how well the Proposer understands and is organized for the integration of design and construction, design quality control, and design review for the Project; evaluates the control of the design progression for the overall project to support the construction schedule; evaluates the means of reporting on the design progress; evaluates the means of tracking quality control reviews and the resolution of comments on the design; and evaluates the means of resolving design exceptions and changes from the Project Requirements in the RFP; and resolution of non-conformance issues in the design.*" (NYSDOT 2011)

In addition, the proposers were required to include their design management concept in their proposals according to the following description:

> "*The Initial Project Management Plan shall describe the Proposer's design management concept. The description shall, at a minimum, include the structure of the Proposer's design organization. The Initial Project Management Plan shall describe the Proposer's approach to design deliverables, including definition, packaging, submission, review, approval and issue for construction, together with the names of the key individuals involved in the process. The Initial Project Management Plan shall also describe any fast track design item(s) that may be proposed.*" (NYSDOT 2011)

Virginia DOT (VDOT)

VDOT stipulated design management responsibilities in the RFP of "Virginia Capital Trail – Varina Phase" design-build project as the following (VDOT 2012c):

> "*The Design Manager shall maintain close communication with Design-Builder's Project manager and shall ensure the Project is completed in accordance with the requirements of the Contract Documents. The Design Manager shall perform all of the design oversight reviews. VDOT will participate in these reviews. Under this procedure, the Design Manager shall provide VDOT with draft design plans for review and approval to confirm that the design work complies with the requirements of the Contract Documents, especially Section 2.4 of the General Conditions of Contract and the Standard and Reference Documents listed in Section 2.1.1 herein prior to initiation of construction activities on the Project. Additionally, The Design Manager shall include a completed Design Build Certification of Plan Correctness Form when submitting plans for Right of Way Approval or Construction Approval.*"

11.2 Quality Assurance/Quality Control (QA/QC)

It is critical for state DOTs to achieve quality standards on delivered projects since quality of a project is a reflection of the performance of the state DOT. Various issues can affect the quality of a project, such as selection of the qualified design-build team, critical project risks, and contractor performance (Jacobs Engineering Group Inc. 2009). Thus, Managing the ultimate quality of transportation projects is a major concern for state DOTs. The quality of design deliverables and final constructed products is assured through the quality assurance (QA) and quality control (QC) processes that include various components, such as agency acceptance and independent assurance (Hughes 2005; Gransberg et al. 2008). The Transportation Research Circular E-C137 (2009) defines the QA/QC terms as the following:

- "*Quality Assurance: All those planned and systematic actions necessary to provide confidence that a product or facility will perform satisfactorily in service*
- *Quality Control: Those QA actions and considerations necessary to assess and adjust production and construction processes so as to control the level of quality being produced in the end product*
- *Agency Acceptance: The process of deciding, through inspection, whether to accept or reject a product, including what pay factor to apply. (Where contractor test results are used in the agency's acceptance decision, the acceptance process includes contractor testing, agency verification, and possible dispute resolution.)*
- *Independent Assurance: A management tool that requires a third party, not directly responsible for process control or acceptance, to provide an independent assessment of the product or the reliability of test results, or both,*

obtained from process control and acceptance. The results of independent assurance tests are not to be used as a basis of product acceptance."

Table 11.1 below provides a brief explanation of QA/QC terms used in highway project delivery from the "Transportation Research Circular E-C137: Glossary of Highway Quality Assurance Terms" (2009).

Table 11.1

Quality Assurance and Quality Control Adopted from Transportation Research Circular E-C137: Glossary of Highway Quality Assurance Terms (2009)

Quality Assurance	Quality Control
• Making sure the quality of a product is what it should be • Responsibility of the state DOT • Includes quality control • Doing the right things • Motivate good quality control practices	• Making the quality of a product what it should be • Responsibility of the contractor • A part of quality assurance • Doing things right • Motivated by quality assurance and acceptance procedures

Traditionally, design QA/QC has been the responsibility of the state DOT (Gransberg et al. 2008). In design-build, the design-build team assumes the responsibility for developing and finalizing the project design. The design manager of the design-build team has a critical role in tailoring the project design to the needs and requirements of the owner. The design manager should also make sure that the proposed design is buildable and construction can commence without major hurdles. Furthermore, the design-build team is responsible for constant quality checks to ensure that design and construction of the project meet the minimum quality requirements of the contract. In design-build, design and construction quality are ultimately the responsibility of the design-build team. Conversely, the role of the state DOT during the post-award period is more of an oversight and acceptance role. To maintain such oversight and acceptance position over project quality, state DOTs have to utilize certain controlling tools in the post-award period. The major control tools that state DOTs have, are design and constructability reviews and design checks, monitoring/verification of quality assurance and quality control (QA/QC) processes, agency acceptance, and independent assurance for compliance with RFP requirements (Transportation Research Circular E-C137 2009; FHWA-HRT-12-039 Techbrief 2012a).

State DOTs usually perform design and constructability reviews and check design submittals for acceptance before construction can begin in project phases. The review of design plans is the major controlling tool that state DOTs utilize to ensure that the quality of the design is acceptable and the design-build team has followed quality standards for the project design. State DOTs also review and monitor the design-build team's design and construction QA/QC process to ensure that the design-build team has followed the QA/QC plan which is agreed upon in the contract. In addition to constant quality checks and monitoring QA/QC processes, FHWA also recommends that state DOTs perform inspection and testing for acceptance of the delivered products (23 CFR 637). Further, it is recommended that state DOTs either directly hire a third-party firm or mandate the design-build team to hire an independent firm for assurance of design and construction QA/QC plans. Independent assurance can help state DOTs evaluate the effectiveness and proficiency of QA/QC and agency acceptance through an unbiased evaluation of project quality (Transportation Research Circular E-C137 2009). It is important to note that the independent third-party firm should not be involved in the QA/QC process.

Several state DOTs have decided to transfer QA/QC responsibilities to design-build teams or in some instances share QA/QC responsibilities with design-build teams. Involvement of design-build teams in QA/QC and transfer of responsibilities is due to the single point of responsibility. The critical difference with design-bid-build is that by performing acceptance, verification, and independent assurance, the state DOT does not assume the responsibility for any design or construction issues in design-build projects (Gransberg et al. 2008; FHWA-HRT-12-039 Techbrief 2012a). However, the lack of experience of state DOTs in procurement of design-build projects and slow shift in adoption of new processes for the design-build project delivery system are major issues that hinder implementation of QA/QC in design-build projects. Further, state DOTs still struggle with difficulties in establishment of proper QA/QC plans for design-build projects and allocation of responsibilities in design-build contracts.

11.2.1 Challenges of Quality Assurance/Quality Control

11.2.1.1 Difficulty in identifying a proper QA/QC plan for a design-build project

FHWA has prescribed policies, procedures, and guidelines under the Title 23 CFR 637 to assure the quality of materials and construction in all federal-aid highway projects on the national highway system. The regulation (23 CFR 637) requires that state DOTs develop a QA plan for the national highway system (Hughes 2005). A comprehensive survey of 43 state highway agencies, conducted by Hughes (2005) for NCHRP synthesis 346, found out the following:

> "*…the responses indicated that the type of QA program varies not only among, but also within, agencies depending on the material and construction area specified. This creates what can be considered a spectrum of QA programs. At one end are QA programs that rely primarily on materials and methods provisions. At the other end of the spectrum are QA programs in which agencies use contractor test results as part of the acceptance decision. In between are various combinations of QC and acceptance provisions where the agency assumes a greater or lesser role in QC, leaving the complementary lesser or greater role for the contractor.*"

The results of the NCHRP synthesis 376 by Gransberg et al. (2008), which studied QA/QC processes in design-build projects, are to a great extent similar to those of the NCHRP synthesis 346 by Hughes (2005). Both NCHRP 346 and 376 found out that there is a lack of consistency in QA plans for highway projects. Results of surveys conducted by Hughes (2005) and Gransberg et al. (2008) show that there is no consensus among state DOTs and even within a state DOT, regarding the assignment of quality management responsibilities to the parties involved in the contract.

The tasks of performing QA/QC in design-build projects are similar to the tasks of performing QA/QC in design-bid-build projects. The difference is in the allocation of these tasks. Depending on the quality management strategy identified in the contract, QA/QC processes can be fully transferred or shared between the state DOT and the design-build team. The three typical organizational structures for performing QA/QC are the following (Gransberg et al. 2008):

1. Design-build team is responsible for both QA/QC
2. Design-build team is responsible for QC and state DOT is responsible for QA
3. Design-build team is responsible for QC and state DOT and design-build team share the responsibility for QA

Similarly the "DBIA Design-Build Manual of Practice" (2012c) describes the typical QA/QC organizations for design-build projects as the following:

> "*Quality programs on large projects will generally require adherence or structure similar to applicable ISO standards, similar to other sectors. Typically, the Quality Control (QC) Program is a sole responsibility of the design-builder. However, in the transportation sector, many owners employ quality professionals ranging from inspectors to testers and specialty testing laboratories, so they are tempted to self-*

perform the Quality Assurance (QA) Program. There are a number of approaches to quality programs ranging from:

- *Owner control of QA for both design and construction*
- *Design-builder control of QA for both design and construction*
- *Owner and contractor shared control of QA for design and construction*"

We performed a domestic scan of design-build project solicitation documents and conducted interviews with design-build officials in several state DOTs to determine which quality management strategy has been utilized the most by these state DOTs. We identified that Colorado, Michigan, Texas, Virginia, and Washington State DOTs usually transfer both the QA/QC to the design-build team (first QA/QC plan). On the other hand, the North Carolina DOT usually retains the QA responsibility and transfers the QC responsibility to the design-build team (second QA/QC plan). The Florida DOT usually transfers QA/QC responsibilities to the design-build team (first QA/QC plan), unless the project requires particular QA/QC oversight by the state DOT (third QA/QC plan).

Lack of proper QA/QC plans on design-build projects can result in costly errors and omissions that cause changes and delays or even litigation (Gransberg et al. 2008; DBIA Design-Build Manual of Practice 2012c). Furthermore, failure to identify or request a formal QA/QC plan with guaranteed participation of both the state DOT and the design-build team can affect the project development process. The "DBIA Design-Build Manual of Practice (2012c)" notes that "…*failure to implement a QA process for the design and construction documents is a high-risk proposition and will inevitably result in problems*". Without proper QA/QC plans, the design-build team will face difficulties in procurement of the most efficient subcontractor and supplier bids and promoting maximum efficiency in the field. Finally, changes will happen more often during the construction process because of the failure of the design-build team to comply with quality standards of the project RFP.

11.2.1.2 Difficulty in identifying critical roles and responsibilities for performing major QA/QC tasks

In addition to the lack of a consistent approach for QA/QC plans, state DOTs often fail to properly describe and assign core responsibilities for QA/QC in design-build RFPs (Gransberg et al. (2008); Gransberg and Molenaar (2008)). State DOTs only depend on brief descriptions of quality management plans by design-build teams. A scan of RFQs and RFPs of design-build projects by Gransberg et al. (2008) clarified that only 8% of design-build RFPs examined in that study even mentioned QA/QC procedures after contract award. In approximately half of design-build procurement documents studied in that research, the approach of the state DOT to quality management was not described in appropriate details and state DOTs simply relied on qualifications evaluation portion of the award process for quality management.

Although several state DOTs have allocated the QA/QC responsibility to design-build teams, still transferring such responsibilities, such as design QA/QC is not widely utilized by state DOT engineers and employees (Gransberg and Windel 2008). The major barrier can be traced back to the slow shift in culture of state DOT employees that can be explained by the following expression emphasized by Postma et al. (2002) in the evaluation of the "I-15 reconstruction project" procured by UDOT:

> "*...the same is true with* [regard] *to construction inspection by a design/build partner. Concern that '****the fox is guarding the hen house****' is often an issue…*"
> (Postma et al. 2002)

Among the core responsibilities for QA/QC, independent assurance and agency acceptance are mainly the responsibility of the state DOT (FHWA 2012a). According to 23 CFR 637.207(b), responsibilities of the agency regarding quality acceptance do not change under design-build (FHWA 2012a). State DOTs are responsible for verifying the compliance of construction quality with the project RFP. Regarding quality acceptance, the FHWA-NHI-08-067 has the following explanation (FHWA 2012a):

> "*All acceptance activities must be carried out by the agency or their designated agent (i.e., consultant under direct contract with the agency), independent of the contractor.*"

Similarly, independent assurance, which assures the state DOT of the validity and reliability of quality processes used by the design-build team, is the responsibility of the state DOT. Independent assurance provides the state DOT with an independent assessment of the product or the reliability of test results, or both, obtained from QC and acceptance (TRB Circular E-C137 2008). Proper assignment of quality assurance (QA) and quality control (QC) responsibilities to design-build teams is one of the major challenges of state DOTs in executing quality management for design-build projects.

Although the state DOT can transfer the responsibility of QA/QC to the design-build team, the responsibility for acceptance does not change in design-build (23 CFR 637.207(b)). The state DOT is required to perform all the acceptance activities or hire a consultant to perform the acceptance responsibilities. The state DOT should perform verification sampling and testing on construction and workmanship and validate QC data that is provided by the design-build team (FHWA 2012a). The design-build contract documents should also identify the acceptable quality level of each work item along with requirements for appropriate corrective actions. The challenge is to properly administrate quality acceptance procedures and achieve accepted levels of quality on design-build projects that have the QA/QC responsibilities transferred to the design-build team.

11.2.1.3 Time-consuming reviews after contract award that hinder innovation and expedited delivery

A major component of design QA/QC is design reviews conducted by the state DOT to ensure that the project design progresses according to design standards of the state DOT and is in conformance with NEPA permits, ROW limits, and other important requirements. Especially in projects that the design-build team is responsible for QA/QC activities, design reviews are the main controlling tools of the state DOT. For instance, regarding the importance of preliminary design submittals and design reviews, the Washington State DOT (WSDOT) may require the design-build team to submit preliminary design submittals prior to the final design submittal for formal and informal reviews. For instance, the WSDOT Design-Build Quality Management Plan (2008) states the following:

> "*The intent of the Preliminary Design submittal is to provide a formal opportunity for WSDOT, the Contractor, various design team disciplines, and other approved project stakeholders to review the construction documents in order to ensure that: The design is progressing appropriately and proceeding in the right direction; the plans reflect Contractor requirements for construction; design features are coordinated; and there are no fatal flaws within a given discipline or between disciplines. The contents of the preliminary submittal for each discipline shall be as mutually agreed by members of the applicable Task Force*."

Typically, state DOTs use three types of reviews or controlling measures to ensure that all design documents are compatible with project functional and technical requirements (WSDOT Design-Build Quality Management Plan 2008). The three review types are the following:

- On-going verbal discussion and resolution on design and construction issues
- Informal and over-the-shoulder reviews during the design process
- Formal design reviews on preliminary and final design submittals

The major issues in post-award quality management are proper execution of QA/QC activities and design reviews. More specifically, design reviews and QA/QC activities can be time-consuming and costly for the state DOT. Especially for large and complex projects, review of design submittals can require significant review workforce from the state DOT. At the same time, while the state DOT is performing design checks and reviews on design-build team submittals, the design-build team may have difficulty proceeding with construction.

Post-award quality management can also relate to "loss of control" and "slow shift in culture" issues. To have more control over the design process, the engineers and reviewers of the state DOT may prefer to perform time-consuming and unnecessarily precise reviews on individual components of the project design. Inefficient and unnecessarily strict design reviews can be cumbersome, time consuming and costly for design professionals and hinder fast-tracking and expedited project delivery.

To overcome challenges in post-award quality management of design-build projects, the state DOT needs to perform more efficient and timely design reviews. In addition, state DOTs should identify proper QA/QC plans for design-build projects and properly allocate QA/QC responsibilities to achieve the expected level of quality in design-build projects.

11.2.2 Opportunities for efficiency enhancement of QA/QC

11.2.2.1 Opportunities for efficiency enhancement: State DOTs should consider transferring QA/QC responsibilities to the design-build team and retain quality acceptance and independent assurance responsibilities for the state DOT.

Quality assurance of design-build projects is a complicated process that requires extensive coordination and communication among the project stakeholders. In design-build, the design-build team usually has higher control over construction methods and techniques. Because of the single point of responsibility and more control over the project construction, the role of the design-build team is prominent in QA processes. Design-build enables state DOTs to show higher level of flexibility to design-build teams and let them choose appropriate construction methods and techniques. The added flexibility can result in efficiencies that could have not been achieved using traditional methods that are usually stipulated in construction contracts. Flexibility in QA/QC plans is consistent with recommendations of EDC related to accelerating technology deployment in highway construction. By allowing for more flexibility, the design-build team can use design and construction methods that are best suited for the project.

The transfer of QA/QC responsibilities should not include acceptance and independent assurance. More specifically, transfer of QA responsibilities should be in accordance with the 23 CFR 637.207 (a) and (b), which states the following:

> *(a)* "*Each State DOT's quality assurance program shall provide for an acceptance program and an independent assurance (IA) program*
>
> *(b) In the case of a design-build project funded under title 23, U.S. Code, the State DOT's quality assurance program should consider the specific* contractual *needs of the design-build project. All provisions of paragraph (a) of this section are applicable to design-build projects. In addition, the quality assurance program may include the following:*
>
> > *(1) Reliance on a combination of contractual provisions and acceptance methods;*
> >
> > *(2) Reliance on quality control sampling and testing as part of the acceptance decision, provided that adequate verification of the design-builder's quality control sampling and testing is performed to ensure that the design-builder is providing the quality of materials and construction required by the contract documents.*

> *(3) Contractual provisions which require the operation of the completed facility for a specific time period.* [Dec. 10, 2002]"

DBIA describes independent assurance as "fresh set of eyes" that can help the state DOT maintain or enhance the quality of the work, reduce errors and omissions and reduce costs. DBIA describes involvement of third-party firms as the following:

> "*The owner participant should engage themselves in the quality program with care. A best practice is to have the owner maintain an independent oversight role through Owner Independent Assurance (OIA) and Owner Independent Verification (OIV) in addition to design-builder's QC/QA program for design and construction. This approach allows owners to refrain from interfering in the design-builder's responsibility to deliver a quality project on time and to avoid resumption of risk related to quality and delays.*" (DBIA Design-Build Manual of Practice 2012c)

The third-party firm who is responsible for independent assurance and peer review of the work should evaluate the delivered products considering the following (DBIA Design-Build Manual of Practice 2012c):

- Verification of the owner's criteria, program of requirements and being "fit for purpose"
- Compliance with standard industry practices and applicable codes
- Review of constructability-related issues in the project design
- Review and monitoring of common "garden variety" mistakes and coordination
- Review of errors between drawings or between disciplines

The third-party responsible for independent assurance has the ability to stop the work and even close the jobsite due to lack of quality measures. For instance, if the QC data provided by the contractor are not acceptable by the state DOT (not validated) or verification sampling and testing show non-compliance with contract requirements, the independent third-party should have the ability to close the jobsite and stop construction commencement. Regarding non-conforming material and workmanship in design-build projects, the FHWA QA/QC guidelines state that following:

> "*Whether discovered by the design-builder or the agency, materials or workmanship that do not meet the specified level of quality should be properly documented, including the nature of the non-conformance, location, extent, and disposition (e.g., removed and replaced, reworked, accepted based on engineering judgment, etc.). The authority to approve the final disposition of non-conforming materials or workmanship cannot be assigned to the design-builder. The agency's role in approving the disposition of non-conforming work should be clearly identified in the contract.*" (FHWA-HRT-12-039 Techbrief 2012a)

State DOTs have different approaches for transferring design and construction QA/QC responsibilities to design-build teams. Regardless of the approach chosen for QA/QC, the state DOT should clearly stipulate the roles and responsibilities for QA/QC in the project RFP. In addition, the state DOT should consider evaluating design-build proposals based on proper allocation of QA/QC responsibilities and qualifications of the design-build team organization. We found out practices by Florida, Virginia, and Washington State DOTs as good examples in this area.

Florida DOT (FDOT)

The Florida DOT transfers QC responsibility to the design-build team but retains verification testing and independent assurance. Regarding QA plans in design-build, FDOT "Design-Build Guidelines" (2011b) state the following:

"*The Design-Build firm shall use the latest construction quality control (CQC) Specifications for their Price and Technical Proposals. The Department will provide verification testing and inspection services in accordance with the latest CQC Specifications.*"

"*The Design-Build Firm is subject to the Independent Assurance (IA) procedures. The Department's IA procedure will be used for comparison tolerances and actions. IA will be performed on Quality Control and Quality Assurance personnel.*"

Design-Build projects require the Design-Build Firm to perform QC level materials sampling as well as QC level inspection. The Construction Engineering Inspection (CEI) is expected to perform predominantly verification testing (VT) sampling, testing and inspection and infrequent QC inspection. The scope of service should reflect this approach since conventional scopes stress QC level involvement. Since the environmental permit agencies do not allow Design-Build Firms to perform permit testing such as turbidity, the CEI will be expected to perform these tests and these should be covered by the scope. The scope should address specific QC tasks that must be performed by the CEI. Department independent assurance (IA) will be performed by the District Materials Office as usual. Inspection-In-Depth (IID) from the State Materials Office will be very infrequent or not at all."

Virginia DOT (VDOT)

VDOT assigns both design and construction quality assurance and quality control responsibilities to the design-build team. However, contract requirements can vary from project to project, and therefore, project specific contract requirements will take precedent. VDOT has developed a guide that details minimum requirements for Quality Assurance (QA) and Quality Control (QC) for

Design-Build (DB) projects. VDOT requires the design-build team to implement a Quality Assurance and Quality Control Plan (QA/QC Plan) under the design-build contract. The QA/QC requirements for design-build projects defines the organization, work processes, and systems necessary to provide confidence and objective evidence that the facilities, components, systems, and subsystems that make up the Project meet the contract requirements (VDOT minimum requirements for QA/QC 2012). Section 3 of the VDOT minimum requirements for QA/QC (2012) describes the staff roles and responsibilities for QA/QC process as the following:

> "*Design-Build Team Project Manager: Responsible for the overall Project design, construction quality management, and contract administration for the Project.*
>
> *Quality Assurance Manager (QAM): Overall responsibility for the development of and adherence to the Design-Build QA/QC Plan. QAM cannot have any involvement on construction operations for the Project. QAM reports to Design-Build Team Project Manager; [does] not report to production forces.*
>
> *Design-Builder Design Manager: Responsible for the design portion of the Design-Build QA/QC Plan and for ensuring production of Construction Documentation in accordance with the QA/QC Plan. The Design-Builder Design Manager reports to Design-Builder project manager.*
>
> *Design QA and QC: Responsible for QA or QC for design elements of the Project. Design QA and QC teams report to the design manager of the design-build team.*
>
> *Design-Builder Construction Manager: Responsible for the construction portion of the Design-Build QA/QC Plan and for ensuring construction of the work in accordance with the QA/QC Plan. The construction manager of the design-build team reports to the project manager of the design-build team.*

QA and QC Testing and Inspection Technicians: Responsible for QC testing and/or inspection of items of work for conformance with QC plans and specifications. QA and QC Testing Technicians report to production forces of the contractor." (VDOT 2012a)

Washington State DOT (WSDOT)

The Washington State DOT has developed "Design-Build QMP" (2008) that describes the overall policies, program, organizational responsibilities, procedures, and the means of ensuring that all items of work are in conformance with the contract drawings and specifications for design-build projects. Design-build teams are required to comply with the requirements of this quality management plan (QMP) outline in development of the quality management plan to be submitted with design-build proposals or submitted and agreed upon after contract award. The project quality organization includes the following key quality management positions:

1) "*Project Manager: Responsible for the overall management and implementation of the project including the Quality Management Plan.*
2) *Construction Quality Assurance Manager: Responsible for quality assurance of the construction.*
3) *Design Quality Assurance Manager: Responsible for quality assurance of the project design.*
4) *Construction Manager: Responsible for quality control inspection and testing of the construction work.*
5) *Design Manager: Responsible for design development and quality control of the design work.*
6) *Materials Approval Engineer: Responsible for the approval of materials in accordance with the WSDOT Construction manual.*

7) *Quality Testing Supervisor: Responsible for overseeing all materials testing on the project.*"

The responsibilities of the above key positions are described in the "Design-Build QMP" (2008) and can change based on the needs and requirements of the contract. WSDOT has the ability to share or transfer all the QA responsibilities on the design-build projects. For instance, WSDOT decided to form a joint quality assurance (QA) team with Kiewit-General for the "SR520 Pontoon Construction" design-build project. The quality management plan submitted by Kiewit-General described the responsibilities of the design and construction quality assurance managers as the following (Kiewit-General 2011):

- "*Design QA Manager:*
    - *Overall responsibility for implementing the design portion of the quality management plan. Through audits, the design QA manager shall be responsible for verifying and validating the QA and QC procedures.*
    - *Certify that all design documents have been subjected to all required QC checking procedures.*
    - *Provide a monthly certificate of compliance to accompany the monthly invoice that the design meets the quality requirements of the quality management plan.*
- *Construction QA Manager:*
    - *Overall responsibility for implementing the construction portion of the quality management plan including implementing, monitoring, and adjusting the processes to assure acceptable quality.*
    - *Coordinate with WSDOT's quality verification testing, inspection, and independent assurance (IA) requirements.*

- *Oversee QA testing and inspection and coordinate and schedule resources to provide for appropriate QA inspection and testing for all construction efforts.*

- *Quality assurance team:*

    - *Oversee and address all issues relating to inspection, substandard material quality, inadequate QA and QC processes that need to be adjusted, out of tolerance test results, disparities between QA and quality verification (QV) test data, and any other issues that WSDOT and Kiewit-General may have regarding quality of the project*".

11.2.2.2 Opportunity for efficiency enhancement: State DOTs should either stipulate required quality management plan in the project RFP or solicit proper quality management plan from the design-build team.

The state DOT should clearly stipulate the required quality management plan in the project RFQ/RFP and/or solicit proper quality management plan from design-build teams to better deal with the challenges of quality management in design-build projects and allocate QA responsibilities to contract parties. Further, the state DOT can shortlist proposers based on their quality management organization and qualifications of their quality management staff. By requesting for proper quality management plans from design-build teams, the state DOT can ensure that shortlisted proposers will be qualified to properly manage QA process and achieve the required level of quality in both design and construction. Regarding the implementation of QA/QC plans, the "DBIA Design-Build Manual of Practice" (2012c) states the following:

> "*A well implemented quality assurance program will help the design-build team meet the standard of care for contract program requirements, coordination,*

constructability, performance, compliance with life safety and building codes and building operation and maintenance."

The state DOT should either outline a desirable quality management plan in the RFP package or require the design-build team to submit its own quality management plan. Either way, the project quality management plan should be in accordance with FHWA and CFR regulations and design and construction quality manuals of the state DOT. Further, the state DOT should require the design-build team to comply with the approved quality management plan and oversee coordination and communication among all responsible design and construction disciplines. To ensure that agreements are in place prior to the contract award, the state DOT should consider using qualifications and proposal evaluation criteria with regard to the proposed quality management plan. We have identified the practices of Florida, Virginia, and Washington State DOTs as best practices in soliciting proper quality management plans for design-build projects.

Washington State DOT (WSDOT)

The Washington state DOT requires, proposers to submit their proposed quality management approach as part of their approach to management of the project. WSDOT evaluates the management approach of the proposer as part of their technical proposal. WSDOT describes the requirements for quality management approach in the RFP of "SR 99 Bored Tunnel Alternative" design-build project as the following (WSDOT 2010a):

"*Submit a narrative of the Quality Management Approach for design and construction. The Quality Management Approach should summarize the Quality Management Plan that will be used on the Project. Contents of the Quality Management Approach should include, at a minimum, the following:*

- *Quality Management: Include a statement of the Proposer's Quality Policy. Outline the Proposer's Quality Organization. Identify the key positions in this* *organization and those positions with stop work authority. Include an estimate of the number of staff members that will be utilized in each position. Include required certifications and appropriate accreditations for each position.*

- *Quality Process for Design: Outline the quality control and quality assurance process for design. Address the specific processes or steps to ensure: a process for independent checking of design Work, the design meets the requirements of the contract, environmental protection, constructability of the design, and all elements of the completed Project will be fit for use for the intended function, including durability and maintainability.*
- *Quality Process for Fabricated Items: Describe the specific role of the production, Quality Control, and Quality Assurance organizations within the Design-Builder's quality process for fabricated items.*
- *Quality Process for Construction: Describe the specific role of the production, Quality Control, and Quality Assurance organizations within the Design-Builder's construction quality process.*

Include in the Quality Management Approach a discussion with regard to the consideration of life-cycle-cost in the design and construction of the project.

Clearly identify those commitments of the Quality Management Approach that exceed RFP requirements."

Similarly for the "I-405/I-5 to SR 169 Stage 1 – Widening" design-build project, WSDOT required proposers to submit a quality management plan separate from design-build proposals that included the following:

- "*For design, identify the Quality Control (QC) procedures to be utilized to verify, independently check, and review all design* *drawings, specifications, and other documentation prepared as a part of the contract. Discuss how the Proposer will establish a Quality Assurance (QA) program to confirm that QC procedures are being followed. Include the integration of constructability reviews in the design process.*

- *For construction, identify the QA procedures to be utilized to verify, independently check, and review all construction activities, specifications, and acceptance documentation required as part of the contract.*
- *Describe how the check and review processes will be documented to verify and ensure required procedures were followed.*
- *An organizational chart and narrative for the QA Organization including:*
  - *Anticipated QA staff positions;*
  - *Reporting structure of the QA Organization addressing the person(s) responsible for the over-all performance of the QA Organization;*
  - *Identify the Key Positions in the organizational chart;*
  - *Present a flowchart that depicts the QC and QA processes for typical design and construction submittals; [and]*
  - *Present a flow chart that depicts the QC and QA processes for design and construction that includes the review and approval of shop and working drawings and the responses to changes to Released for Construction documents.*

- *Describe how the Proposer will deal with instances of nonconformance with the Contract Documents, and how it will prevent the unintended use or non-disclosure of the non-conforming Work.*

- *Explain how the Proposer will ensure non-conformances do not become repetitive. Describe the process of how they become elevated.*

- *Describe the approach to resolving all nonconformance and punch list items to achieve timely Physical Completion.*" (WSDOT 2007)

Regarding the evaluation of proposed quality management plans in the "I-405/I-5 to SR 169 Stage 1 – Widening" design-build project, WSDOT states the following:

"*A Quality Management Approach that describes how the Proposer's team will meet the WSDOT Values and Project Goals and the minimum requirements of the RFP will receive a Good rating. The Quality Management Approach may receive a Very Good or Excellent rating if the Proposer includes features in its Quality Management Approach that are over and above the minimum requirements to promote the WSDOT Values and Project Goals and the Technical Review Team evaluates those features as beneficial to the Project.*

A partial list of items that will be evaluated are listed in order of descending importance:

- *How the Proposer will ensure the design meets the intent of the contract and the expectations of the owner. The discussion should include a description of how the Proposer intends to involve WSDOT* *including, as appropriate, over-the-shoulder reviews, design schedule, discipline task forces and plan submittals.*

- *How the Proposer will coordinate with the WSDOT team to resolve non-conformance reports, corrective action reports, and other construction quality issues.*
- *The requested flow charts.*
- *Resource allocation for the Design and Construction QA staff commitment.*
- *The coordination of design and construction.*
- *The method of communicating changes or revisions, either by the designer or in the field, after release for construction plans [have] been issued.*" (WSDOT 2010a)

Florida DOT (FDOT)

The standard design-build RFP of FDOT describes the requirements for quality management plan in "Section V: Project requirements and provisions for work" in two parts as the following (FDOT 2013a):

1. *Design*

"*The Design-Build Firm shall be responsible for the professional quality, technical accuracy and coordination of all surveys, designs, drawings, specifications, geotechnical and other services furnished by the Design-Build Firm under this contract.*

The Design-Build Firm shall provide a Design Quality Management Plan, which describes the Quality Control (QC) procedures to be utilized to verify, *independently check, and review all design drawings, specifications, and other documentation prepared as a part of the contract. In addition, the QMP shall establish a Quality Assurance (QA) program to confirm that the Quality Control procedures are followed. The Design-Build Firm shall describe how the checking and review processes are to be documented to verify that the required procedures were followed. The QMP may be one utilized by the Design-Build Firm, as part of their normal operation or it may be one specifically designed for this Project. The Design-Build Firm shall submit a QMP within fifteen (15) working days following issuance of the written Notice to Proceed. A marked up set of prints from the Quality Control review will be sent in with each review submittal. The responsible Professional Engineers or Professional Surveyor[s] that performed the Quality Control review, as well as the QA manager will sign a statement certifying that the review was conducted.*"

2. *Construction*

"*The Design-Build Firm shall be responsible for developing and maintaining a Construction Quality Control Plan in accordance with Section 105 of Standard Specifications* [Standard Specifications for Road and Bridge Construction (2010)] *which describes their Quality Control procedures to verify, check, and maintain control of key construction processes and materials.*

The sampling, testing and reporting of all materials used shall be in compliance with the Sampling, Testing and Reporting Guide (STRG) provided by the Department. The Design-Build Firm will use the Department's database(s) to allow audits of materials used to assure compliance with the STRG. The Department has listed the most commonly used materials and details in the Department's database. When materials being used are not in the Department's *database list, the Design-Build Firm shall use appropriate material details from the STRG to report sampling and testing. Refer to the 'Access Instruction for LIMS* [Laboratory Information Management System]*' for more information on how to gain access to the Department's databases*."

Virginia DOT (VDOT)

The Virginia DOT requires design-build teams to submit a QA/QC plan for design and construction. The proposed quality management plan should meet the minimum requirements of VDOT for design-build QA/QC (VDOT 2012a). The QA/QC plan submitted by the design-build team shall clearly describe the following:

1. "*How the Design-Builder shall provide QA and QC for both the design and construction elements of the Project, including but not limited to, sampling, testing, inspection, management control, change management, document control, communication requirements, and non-compliant work corrective action plans to ensure that the work conforms to the contract requirements;*
2. *How the Design-Builder's QA/QC program for both the design and construction elements shall be completed by a subcontractor, supplier, vendor, agent, or other entity with contractual obligations to complete design or construction elements of the Project;*
3. *How the Design-Builder's QA/QC organizations function, including the expected minimum number of full-time equivalent employees with specific QA or QC responsibilities with an organizational chart showing lines of authority and reporting responsibilities; [and]*
4. *The relationship between the QA and QC organizations and the design and construction organizations' interface to ensure that the decisions made by*

> *QA/QC personnel are not based upon the impact such decisions may have on the Project's schedule, contractor's performance or project profitability*."

Further, VDOT "Minimum Requirements for QA/QC" (2012a) indicates the importance of separate QA and QC programs for the project as the following:

> "*To further ensure organizational independence, the Construction QA organization shall be distinct and separate from the construction production forces staff. For design, the Design QA or QC functions may be performed by the same design organization. If design QA responsibilities are retained by the design organization, the QA plan must show that the original designer is not responsible for the quality assurance of his/her own design work. All key personnel performing QA or QC functions shall be exclusively designated to such [functions] and shall not be assigned to perform conflicting duties or production work.*"

Further, the design-build team shall submit its QA/QC Plan for both design and construction to VDOT for review and approval at the first meeting held after the Design-Builder's receipt of Department's Notice to Proceed or the date set forth in the Notice to Proceed ("Date of Commencement"), unless the parties mutually agree otherwise in writing, as set forth in the Design-Build or P3 Comprehensive Agreement. Along with the QA/QC Plan submittal, the Design Manager and Quality Assurance Manager ("QAM") shall provide a presentation of the QA/QC Plan for both design and construction utilizing Project related scenarios. We performed a scan of VDOT design-build project RFPs and identified that the above mentioned QA/QC requirements on several design-build projects, such as "Route 29/ Charlottesville Bypass", "Sycolin Road Overpass of the Route 7/15 Bypass in Leesburg", "Virginia Capital Trail – Varina Phase", and "Route 29 Bridge over Little Rocky Run".

Michigan DOT (MDOT)

The Michigan DOT requires design-build teams to prepare quality manual for the project that describes the proposers plan for design and construction quality management of the project. The manual should be prepared in accordance with quality management requirements set forth in section 2 of Book 2 "Project Requirements". For instance, the RFP of "M-59 at Crooks Road" design-build project describes the quality management goals of the project as the following:

> "*Design Phase: The Design-Builder shall develop and implement a design quality management approach that:*
>
> - *Exhibits sound Design Quality Control and Quality Assurance review processes.*
> - *Ensures the Released for Construction Documents meet the requirements of the Contract.*
> - *Provides quality measures and encourages continuous improvement of the design deliverable products.*
>
> *Construction Phase: The Design-Builder shall develop and implement a quality management approach that:*
>
> - *Promotes quality in the work product.*
> - *Coordinates the design with the construction and promotes communication between Key Personnel and MDOT throughout the process.*
> - *Changes during construction to Released for Construction documents are reviewed by the Project designers and are appropriately recorded.*"

In addition to the above requirements for design and construction quality management, MDOT required the design-build team to submit a design quality manual after the contract award according to the following criteria:

> "*Design Quality Manual (DQM) requirements:*
>
> *The Design-Builder's Design Quality Manual (DQM) shall show how design processes will be managed to achieve quality and shall be organized by functional areas of Quality Control and Quality Assurance. Staffing of the functional areas shall be at the Design-Builder's discretion, unless otherwise dictated by the Contract requirements.*
>
> *All written procedures shall clearly describe the purpose of the process, overview of the process, responsibilities, steps of the process, and records resulting from the process.*
>
> *The DQM shall graphically depict the lines of responsibility and interfaces to describe the Design-Builder's organization.*
>
> *The DQM shall describe all verification resources, such as design verifiers and checkers that the Design-Builder will use.*
>
> *The DQM shall depict how the Design-Builder's design technical experts are incorporated into the construction phase of the Project.*"

Further, the design-build team is required to "*...provide a continuous quality process beginning during planning and continuing through design and construction. The Design-Builder shall provide to MDOT documentation for quantity verification of testing rates and materials certifications.*" The quality management requirements of design-build projects procured by MDOT were similar for the "Ambassador Bridge Plaza – Gateway Completion", "I-69, from Lapeer Co. Line to Miller Road", "I-94, from East of Sargent

Road to Washtenaw County Line", and "I-96 from Wacousta to M-43" design-build projects.

11.2.2.3 Opportunity for efficiency enhancement: Whenever appropriate, state DOTs should take advantage of informal or over-the-shoulder design review while requiring design-build teams to submit milestone design developments for formal review.

Prior to contract award, the state DOT should stipulate reasonable and proper review schedules in the proposed design management strategy and require the design-build team to comply with review schedules and milestones (David Frommer, AIA 2007). The state DOT may also request that the design-build team submit a schedule for formal review of design submittals. Furthermore, to efficiently utilize the department resources and expedite the delivery schedule of design-build projects, the state DOT should perform more efficient over-the-shoulder reviews. Informal and verbal reviews while design activities are under progress, are more suited to the fast-track environment of design-build projects. However, the state DOT should focus more on reviewing the QA/QC processes rather than precisely checking every individual component of design. This strategy is especially more efficient in projects where QA/QC activities are transferred to the design-build team and independent consultants. The state DOT should also offer their comments on preliminary or final design submittals in a timely manner. A compilation of practices by the "Transportation Design-Build Users Group[3]" on current design-build practices for transportation projects states the following regarding proper design review strategies:

> "*There is no consensus regarding the appropriate level of design reviews or design requirements to be met before the design-builder is allowed to start construction.*

[3] The Transportation Design-Build Users Group includes representatives from: the Design-Build Institute of America's Owner Council, the AASHTO Joint Technical Committee on Design-Build, and the AASHTO/FHWA/Industry Transportation Construction Management Working Group.

Approaches range from Florida DOT's oversight of the design for compliance with AASHTO standards, without any review of details, on occasion allowing construction to proceed without plans, to Utah DOT's 'over-the-shoulder' participation of the design reviews conducted by the design-builder, to the detailed design reviews required for the [Orange County Transportation Corridor Agencies (TCA)] TCA projects, including specific approvals associated with release for construction." (Transportation Design-Build Users Group 2009)

To efficiently implement design reviews, the state DOT should also develop a review plan prior to contract award and require the design-build team to accept the review plan contents. The review plan should help the state DOT to properly allocate personnel and resources for efficient design reviews; for instance, depending on the project requirements, the Texas DOT may propose the following typical review plan presented in Table 11.2 (TxDOT 2011):

Table 11.2

A Sample of Review Plan and Descriptions by Texas DOT

Review Plan	Description
Contact List	Listing of key project design and construction staff responsible for review
Design Exceptions	Protocol for review and approval of design exceptions by various government entities (TxDOT, FHWA, U.S. Army Corps of Engineers, Federal Aviation Administration, etc.)
Critical Path	Major milestones and required submittals listed as activities on project critical path method (CPM) schedule

Table 11.2 (cont'd)

Review Plan	Description
Distribution List	Define responsible person and the number of copies for simultaneous distribution of submittals for review. Note that not all parties will need all summary and quantity sheets for review.
Numbering and File Naming Convention System	Tracking system for identifying submittals for review, revise/resubmit, and final. Establish file naming convention system.
Defined Review Times	Contractual time for submittal review (normally 10 working days)
Technical Working Group (TWG)	Define TWG members, establish meeting times, duration, record meeting minutes

Below, we explain the current state of practice regarding design reviews and post-award quality management on design-build projects.

Washington State DOT (WSDOT)

The WSDOT "Quality Management Plan for Design-Build Projects" states that design reviews often involve several professionals and engineers from the state DOT, such as the design discipline leads, appropriate construction personnel, and other approved project stakeholders (e.g., affected local government and utilities). These professionals shall have input on the design as it is developed through. Regarding the review workforce, WSDOT states the following:

> "*Reviewers include WSDOT, qualified representatives from local government and utility owners (when their infrastructure or agreements with WSDOT within the project limits are involved), and representatives of the appropriate disciplines, such as: construction, environmental, geotechnical, drainage, roadway, structures, utilities, traffic, and right-of-way.*" (WSDOT 2008)

WSDOT typically performs design reviews at three different levels:

- On-going discussion and resolution of design and construction issues through weekly or bi-weekly Task Force Meetings and Core Meetings, as well as unscheduled ad hoc follow-up meetings. The Task Force meetings also include technical coordination discussions, as needed, which address the design approach, suitability, and conformance with contract requirements.
- Formal design reviews performed on the Preliminary and Final Design submittals.
- Informal WSDOT and other approved project stakeholder Over-the-Shoulder reviews.

Formal design reviews involve preparing written comments on preliminary and final design submittals.

A sample of design review exhibit that WSDOT recommends for use in design-build projects is presented below in Table 11.3:

Table 11.3

A Sample Design Review Exhibit Recommended by WSDOT for Use in Design-Build Projects

Reviewer	Type of Review	Role
WSDOT Personnel	WSDOT Design Review	Review plans for conformance with the discipline criteria and contract requirements.
Construction Engineering Manager, Construction Manager, Superintendents, and/or the Construction Project Engineer	Constructability Review (CR)	Review documents for overall constructability including: • Aspects that affect the construction site, materials, and equipment; • Ability to construct the work (practicality of tolerances, required access, and inter-discipline conflicts); • Adequacy of information on plans and specifications to construct the work.
Design Leads	Inter-Discipline Coordination Review (IDCR)	Review plans to coordinate design responsibility and design details between and within disciplines. Review the documents for interferences, compatibility between design disciplines, clarity, and completeness. Verify there are no conflicts, omissions, or misalignments with adjacent work.
Environmental Compliance Manager	Environmental Compliance Review	Review documents for compliance with project environmental commitments, mitigation requirements, and permits.
Utility Owners	Utility Review	Review plans for conformance with respective standards and requirements.
Local Governments	Local Government Review	Review plans for conformance with respective standards and other issues of local government concern.

The design-build quality management plan (QMP) requirements of the "SR 99 Bored Tunnel Alternative" design-build project is an example of stipulating the design quality management requirements in the project RFP. Proposers were required to comply with the quality management plan described in the project RFP. Particularly, WSDOT states the following regarding design reviews:

> "*The QMP shall define the timing, content, and format of all design reviews. The Design-Builder shall provide a 14 Calendar Day review period (beginning one Calendar Day after receipt of the submittal) for WSDOT Review and Comment on all design submittals. WSDOT reserves the right to extend the review time by up to seven Calendar Days for submittals that are received between November 15th and January 1st and for submittals with overlapping review periods.*
>
> *The Design-Builder shall address all comments made by WSDOT in each submittal, and shall include comment resolutions in subsequent submittals.*
>
> *The Design-Builder shall schedule and maintain minutes of all resolution meetings with the appropriate WSDOT staff to document and resolve the Design-Builder's responses to the comments. It is intended that all comments will be resolved at these meetings. If agreement is not reached on any specific comment, it shall be resolved as described in the QMP*." (WSDOT 2008)

In addition, WSDOT describes the procedures for informal and over-the shoulder reviews by the design task forces while the design-build team is performing their work as the following:

> "*The QMP shall also include processes and procedures for how regular (weekly) scheduled coordination meetings between WSDOT, the City of Seattle, adjacent contract teams and the Design-Builder will be used to support quality goals. These meetings, combined with over-the-shoulder reviews, shall be an integral part of the process to discuss and resolve design issues outside of the formal review process. The QMP shall define how over-the-shoulder reviews with WSDOT and its designers during the course of the development of each design package will be*

> *included. The over-the-shoulder reviews are not Hold Points that restrict the progress of design. They are reviews of the design as it progresses, and opportunities for WSDOT to provide comments and feedback on the design*." (WSDOT 2008)

WSDOT is using the above approach for design quality management of the "SR 99 Bored Tunnel Alternative" design-build project. The contract requires the design-build team to provide three design submittals at 30%, 60%, and 100% design. WSDOT, local authorities, and other project stakeholders will then perform reviews on each submittal package. These reviews are considered as formal reviews to ensure conformance of the project design with criteria in various disciplines, local government concerns, and other project requirements. In addition, WSDOT will use informal over-the-shoulder reviews and communication during taskforce meetings for review of design packages before milestone submittals.

Maryland State Highway Administration (MSHA)

MSHA requires the lead design division to periodically audit the work performed by the design-build team, the designer, and the QA firm to ensure that it is in conformance with the contract requirements. The design-build team should fully cooperate with MSHA design management team in conducting design audits. The QA and review activities performed by MSHA do not remove the responsibility of the design-build team for designing and constructing all elements of the work in conformance with its design quality control plan and all requirements of the contract (MSHA 2013).

MSHA performs two formal milestone reviews as semi-final plan submittal (65% completion) and then final plan submittal (100% completed). The design-build team must notify the lead design project manager 14 days prior to the date of all intended submissions. The design-build team is often allowed to break the project into useable segments and proceed with construction in a particular segment if approved. The review timeline in design-build projects is typically set at 21 calendar days. The design-build team is required to satisfy the review comments made by MSHA and then if approved, they can proceed with construction (Transportation Design-Build Users Group 2009).

Virginia DOT (VDOT)

According to the minimum requirements for QA/QC, prior to submitting the design documents, the design-build team is responsible to review the final drawings, specifications, and other design submittals using architects and engineers experienced in the appropriate disciplines(s). The design-build team should also ensure that each contract submission is certified by the appropriate design or technical manager. Contract submissions should be reviewed in accordance with the Design QA/QC Plan. In addition, the design-build team should confirm that the QA/QC procedures were followed and properly documented (VDOT Design-Build and P3 QA/QC 2012). Submittals are accepted for portions of the project as determined by the design-build team to expedite construction (Transportation Design-Build Users Group 2009). VDOT "Design-Build and P3 QA/QC Procedure" (2012a) states that the following criteria should be included in the reviews:

- "*Conformity of the final drawings, specifications, and other design submittals with the Contract.*
- *Assurance that all materials, equipment and elements of the Work provided for in such documents meet the Contract requirements and have been designed to perform satisfactorily for the purpose intended.*
- *The technical and grammatical accuracy, appearance, and organization of such documents;*
- *Verification that such documents have been checked and signed by the drafter, designer, and reviewers;*
- *Where required under the Contract, generally accepted architectural or engineering practices or applicable law, verification that such documents*

have been stamped, signed and dated by the responsible Virginia registered engineer or architect;

- *Assurance that such documents fully provide suitable evidence for constructability, compatibility of materials and conformity to acceptance criteria for inspections and tests as provided in the Contract Documents; and*
- *Documentation is provided, where required and/or appropriate, to demonstrate that life-cycle costs and maintenance requirements have been considered in the design*."

We have identified typical milestone design submittals and design review periods for some state DOTs that are presented below in Table 11.4.

Table 11.4

Typical Design Review Periods in Design-Build Projects for Some state DOTs

Transportation Agency	Milestone Design Submittal	Typical Design Review Period
Colorado DOT	60% and 100%	14-21 calendar days
Michigan DOT	30%, 60%, and 100%	10-15 calendar days
Maryland State Highway Administration	65% and 100%	21 calendar days
North Carolina DOT	25% and 100%	15 calendar days
Texas DOT	Varies from project to project (e.g., 30%, 60%)	10 to 14 calendar days
Utah DOT	30%, 60%, and 100%	7 to 14 calendar days
Virginia DOT	Preliminary design submittal (depending on the project) and 100%	21 calendar days
Washington State DOT	30%, 60%, and 100%	14 calendar days

11.3 Challenges and Opportunities Utilization Table

We conducted fact-finding interviews with seven design-build design oversight and quality management experts in State DOTs that currently have vibrant design-build programs. These experts evaluated the identified challenges, and answered with either “yes” meaning that they have experienced similar challenges or “no” meaning that the challenge was not experienced or was not applicable for their respective state DOT. A summary of this assessment is provided in Table 11.5. These experts also evaluated the identified opportunities for efficiency enhancement of the design oversight, design acceptance, and quality management in design-build projects in their own State DOT. Each opportunity is marked as “standard practice”, “utilized in few projects”, “not considered”, “considered for future implementation”, or “not allowed by the State law”. A summary of this assessment is provided in Table 11.6.

Table 11.5
Challenges Related to Design Oversight, Design Acceptance, and Quality Management on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Challenges	**Design Oversight and Design Acceptance**							
	Loss of Control over Design	No	No	Yes	No	No	Yes	Yes
	Prescriptive design solutions and enforcement of unnecessarily strict design oversight by state DOTs	No	No	Yes	No	Yes	Yes	No
	Limited number of professional design specialists in state DOTs to expedite the process of design oversight and design acceptance	No	Yes	No	Yes	Yes	Yes	Yes
	Fear of shrinking public engineering workforce despite the design-build project delivery system	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Difficulty in stipulating the process for design oversight and design acceptance	Yes	No	Yes	Yes	Yes	No	No
	Fear of jeopardizing quality or sacrificing quality for profit in design-build projects	No	No	No	No	No	No	No
	Quality Assurance/Quality Control (QA/QC)							
	Difficulty in identifying a proper QA/QC plan for a design-build project	Yes	No	Yes	Yes	Yes	No	No
	Difficulty in identifying critical roles and responsibilities for performing major QA/QC tasks	Yes	No	Yes	Yes	Yes	Yes	Yes
	Time-consuming reviews after contract award that hinder innovation and expedited delivery	No	No	Yes	No	No	No	No

Table 11.6
Opportunities to Enhance Efficiency of Design Oversight, Design Acceptance, and Quality Management on Design-Build Projects
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Design Oversight and Design Acceptance**							
	State DOTs should facilitate the required cultural shift regarding design oversight and design acceptance of design-build projects and provide opportunities for state DOT engineers to think of design-build projects as learning experience and not a threat.	Standard Practice	Standard Practice	Considered for future use	Standard Practice	Standard Practice	Standard Practice	-
	Whenever appropriate, state DOTs should co-locate the project design team and state DOT engineers to facilitate coordination and communication and improve the flow of information on large and complex projects.	Utilized on a few projects	Utilized on a few projects	Not considered	Utilized on a few projects	Utilized on a few projects	Utilized on a few projects	Utilized on a few projects
	State DOTs should either explicitly stipulate what their expectations are from the design-build team regarding design management or solicit design management plan from the design-build team.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice
	Quality Assurance/Quality Control (QA/QC)							
	State DOTs should consider transferring QA/QC responsibilities to the design-build team and retain quality acceptance and independent assurance responsibilities for the state DOT.	Standard Practice	Standard Practice	Standard Practice	Utilized on a few projects/ Considered for future use	Utilized on a few projects/ Considered for future use	Standard Practice	Standard Practice
	State DOTs should either stipulate required quality management plan in the project RFP or solicit proper quality management plan from the design-build team.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice
	Whenever appropriate, state DOTs should take advantage of informal or over-the-shoulder design review while requiring design-build teams to submit milestone design developments for formal review.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice

11.4 Implementation Recommendation Considerations for GDOT

GDOT should facilitate the required cultural shift regarding design oversight and design acceptance of design-build projects and provide opportunities for state DOT engineers to think of design-build projects as a learning experience and not a threat.

State DOTs have realized several significant benefits through facilitating the cultural shift so that state DOT engineers and employees understand that design development is contractually allocated to the design-build team and design management is one of the new roles that the design-build team should play. By enabling the cultural shift to the design-build environment where the state DOT personnel control the process rather than the product, the state DOT can facilitate the formation of a learning culture inside the Department. As a result, the engineers and personnel of the state DOT involved in different phases of the project development would think of each design-build project as a learning experience not a threat to their positions. Each design-build project can provide invaluable opportunity for the state DOT engineers to learn from their peers on the private sector.

The following state DOTs have implemented this opportunity:

- Colorado – CDOT has been able to overcome challenges regarding design oversight and design acceptance by facilitating the cultural shift toward a more administrative role for the state DOT. CDOT believes by making the required cultural shift and maintaining administrative role, the design-build team has more flexibility in developing and implementing innovative ideas, which are great learning experiences, on design-build projects.
- Florida – FDOT has made the cultural shift a long time ago and design-build has become the standard way of doing business for FDOT. By establishing trust between the state DOT and design-build teams, FDOT is able to maintain control over design, preserve quality on design-build projects and at the same time, transfer the responsibility of design to the design-build team.

- Utah – UDOT prefers to have an administrative role and at times partner with the design-build team to achieve an acceptable design solution. Despite some design challenges in accelerated design-build projects, UDOT has made the required cultural shifts and is utilizing design-build more frequently.

Whenever appropriate, GDOT should take advantage of informal or over-the-shoulder design review while requiring design-build teams to submit milestone design developments for formal review.

State DOTs have realized significant benefits through utilizing expedited informal (over-the-shoulder) or milestone formal design reviews. Informal and verbal reviews while design activities are under progress are more suited to the fast-track environment of design-build projects. The state DOT should focus more on reviewing the QA/QC processes rather than precisely checking every individual component of design. This strategy is especially more efficient in projects that QA/QC activities are transferred to the design-build team and independent consultants. The state DOT should also offer their comments on preliminary or final design submittals in a timely manner. Through interviews with several state DOTs and review of design-build solicitation documents, the research team has identified that most state DOTs spend 7 to 21 calendar days to review design submittals. To efficiently implement design reviews, the state DOT should also develop a review plan prior to contract award and require the design-build team to accept the review plan contents.

The following state DOTs have implemented or considered this potential best practice:

- Colorado – CDOT recommends informal and over-the-shoulder reviews prior to official design submittals to expedite the review for faster design acceptance. CDOT also requires 60% and 100% milestone submittals for formal reviews.
- Florida – FDOT takes advantage of efficient reviews. These reviews are usually conducted prior to formal review and help the design-build team achieve performance requirements of the contract. Intensive and time-consuming reviews require extensive time and effort.

FDOT avoids time-consuming design reviews to the extent possible and requires design-build teams to submit milestone review schedules.

- North Carolina – NCDOT utilizes informal and over-the-shoulder reviews and also formal 25% and 100% design reviews.
- Utah – UDOT utilizes over-the-shoulder reviews during design development since it enables them to expedite design reviews, especially when the designer, contractor, reviewers are present at the project location. UDOT also requires the design-build teams to submit 50% and 90% design packages according to the pre-established schedule.
- Virginia – VDOT utilizes informal reviews prior to formal design submittals. VDOT usually requires a preliminary and final (100%) design submittal for formal reviews.
- Washington – WSDOT utilizes informal and over-the-shoulder reviews and also requires 30%, 60%, and 100% milestone submittals for formal reviews.

CHAPTER 12

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The rapidly rising demand for the nation's infrastructure investment is placing increasing pressure on USDOT and state DOTs to meet the growing needs of transportation system. There have been significant efforts at the national and state levels to deliver transportation projects faster and more efficiently through the use innovative project delivery systems. Innovative project delivery systems, such as design-build, can help state DOTs accelerate delivery of transportation projects and save time and resources to better serve the needs of the public.

Design-build project development is a complex process that involves a myriad of issues in various critical areas, such as design-build project selection, procurement process, environmental analysis and permitting, right-of-way (ROW) acquisition, utilities relocation, alternative technical concepts (ATCs), design oversight, design acceptance, and quality management. Although design-build helps state DOTs accelerate delivery of projects and transfer the responsibility of design and construction to the design-build team, there is still a need to identify the challenges to efficient, on-schedule, and on-budget delivery of projects. Hence, state DOTs need an in-depth analysis in critical areas of the project development process to identify the challenges in design-build. The analysis should also involve proposing opportunities to enhance efficiency of the state DOT in delivery of design-build projects. Identifying the challenges and opportunities in critical areas of the project development process can help state DOTs achieve higher level of efficiency in delivery of design-build projects.

As part of this research project, a comprehensive review of academic and professional literature was conducted, in order to analyze and document the emerging trends in using the design-build project delivery system across the U.S. A scanning process was conducted on state DOT websites regarding documented state of practice related to the design-build project delivery system. The results of the scanning process indicated emerging trends regarding improvements in design-build practices and widespread use of design-build in several states. Further, it was concluded that several state DOTs across the U.S. are experimenting with new ways to deliver design-build projects faster and more efficiently. The scanning also led to the conclusion that few state DOTs such as Florida, Colorado, Michigan, North Carolina, Virginia, Utah, and Washington that are at the forefront of utilizing the design-build project delivery system are improving their processes to accelerate delivery of design-build projects, utilize innovation in design and construction, and improve collaboration among all project stakeholders. Following the nation-wide scanning process, several structured interviews were conducted with representatives from four state DOTs, Michigan, North Carolina, Utah, and Washington, to further enhance understanding regarding optimizing delivery of design-build projects. The interviewed state DOTs highlighted the importance of accelerating delivery of design-build projects and enhancing efficiency of their respective departments in delivery of design-build projects.

The findings of literature review and in-depth state DOT scanning led to identifying challenges and opportunities for efficiency enhancement in critical areas of design-build project delivery. These challenges and opportunities are identified, analyzed, and discussed in the following seven critical areas:

- Project delivery system selection
- Procurement
- Environmental analysis and permitting
- ROW acquisition
- Utilities coordination and relocation
- Alternative technical concepts (ATCs)
- Design oversight, design acceptance, and quality assurance/quality control

The primary findings of this study are categorized under these critical areas. The discussions under the critical areas involve various challenges to design-build project delivery and strategies to overcome these challenges. These challenges relate to a variety of legal and statutory barriers or issues that can delay the project delivery schedule, increase the project delivery cost, and hinder flexibility of the design-build team to implement innovate design and construction solutions. In addition to the challenges to efficient delivery of design-build projects, efficiency enhancement opportunities are identified under each area as well. Examples of actual design-build projects are provided along with references from project RFQs/RFPs, design-build guides and manuals, and professional and academic literature for further clarification of challenges that can happen during development of design-build projects and strategies to overcome the challenges. Followed by this analysis, a second round of interviews was conducted with design-build program officials and technical professionals in various offices including contact management, design, environmental, right-of-way (ROW), and utilities. The results of this analysis along with follow-up interviews in seven critical areas are presented below:

Table 12.1
Challenges Related to Project Delivery System Selection
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Assessment of the Appropriateness of the Design-Build Project Delivery System for a Project**							
	Legal (statutory), internal (funding, resources, and leadership), and external (market-place conditions) barriers for utilizing design-build project delivery system	No	No	No	No	No	No	No
	Difficulty in identification and evaluation of major factors that drive the selection of design-build projects	No	No	No	No	No	No	No
	Lack of standard processes for selecting the project delivery system	No	No	Yes	Yes	No	Yes	No
	Risk Identification							
	Lack of a standard approach for identifying project risks and developing risk registers for design-build projects	No	No	Yes	Yes	No	Yes	No
	Coordination and communication problems among subject matter experts from several offices and technical areas for risk identification	No	No	No	No	No	No	No
	Risk Assessment and Allocation							
	Lack of standard risk assessment processes for qualitative and quantitative risk analysis	No	No	Yes	Yes	No	Yes	No
	Lack of standard risk allocation models for avoiding, mitigating, transferring, or sharing risks that were traditionally managed by state DOTs	No	Yes	Yes	Yes	No	Yes	No

Table 12.2
Opportunities to Enhance Efficiency of Project Delivery System Selection
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Opportunities	**Assessment of the Appropriateness of the Design-Build Project Delivery System for a Project**							
	State DOTs should develop, maintain, use, and update a standard design-build selection tool that systematically evaluates the appropriateness of design-build for transportation projects.	Standard practice	Not considered	Not considered	Not considered	Standard practice	Not considered	Not considered
	Risk Identification							
	State DOTs should develop, maintain, use, and refine a proper risk identification tool for design-build projects.	Standard practice	Standard practice	Utilized on a few projects /Considered for Future Use	Not considered	Standard practice	Not considered	Standard practice
	Risk Assessment and Allocation							
	State DOTs should develop, maintain, use, and refine proper risk assessment methods for design-build projects.	Standard practice	Standard practice	Utilized on a few projects /Considered for Future Use	Not considered	Standard practice	Not considered	Standard practice
	State DOTs should develop, maintain, use, and refine proper risk allocation matrices for design-build projects.	Standard practice	Standard practice	Utilized on a few projects /Considered for Future Use	Not considered	Standard practice	Not considered	Standard practice

Table 12.3
Challenges Related to Procurement of Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Challenges	**Proposal Evaluation (basis of award)**							
	Limitations of evaluating design-build proposals based on price consideration only (limitations of low-bid as the basis of award)	No	No	No	No	No	No	No
	Difficulty in the evaluation of design-build proposals based on price and technical considerations (difficulty of implementing best-value as the basis of award)	No	No	No	No	Yes	Yes	No
	Possibility of litigations and bid protests in best-value design-build projects	No	No	No	No	Yes	Yes	No
	Proposer Evaluation (single-phase vs. two-phase procurement process)							
	Inherent limitations of the single-phase selection approach for evaluating design-build proposers	No	No	No	No	No	No	No
	Industry concerns related to preparing design-build proposals that require extensive technical proposals as part of a single-phase procurement process	Yes	Yes	No	Yes	Yes	Yes	Yes
	Extensive time and resource requirements to prepare and evaluate RFQs/RFPs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Possibility of litigations and bid protests in two-phase design-build projects	No	Yes	No	No	No	Yes	No
	Selection of Procurement Methods							
	Lack of a consensus in definitions and the actual practice of various procurement methods among state DOTs	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 12.4
Opportunities to Enhance Efficiency of Procurement of Design-Build Projects
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Proposal Evaluation (basis of award)**							
	State DOTs should balance the need between innovation and technicality offered by best-value procurement and efficiency and transparency that can be gained through low-bid procurement.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	Proposer Evaluation (single-phase vs. two-phase procurement process)							
	State DOTs should balance the need between qualified bidders and competitive proposals offered by two-phase selection and expedited procurement and reduced resource requirements offered by single-phase selection.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	Selection of Procurement Methods							
	State DOTs should develop and use standard contract templates for RFQ and RFP processes.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should use consensus evaluation instead of individual evaluations, and pass/fail and adjectival scoring instead of point scoring for the assessment of design-build proposals.	Utilized on a few projects /Considered for Future Use	Not considered	Utilized on a few projects	Utilized on a few projects /Considered for Future Use	Utilized on a few projects /Considered for Future Use	Utilized on a few projects /Considered for Future Use	Utilized on a few projects
	State DOTs should consider shortlisting 3-5 bidders and paying stipends to unsuccessful bidders, in order to enhance the chance of receiving high-quality proposals in the competitive bid environment.	Standard practice	Utilized on a few projects*	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should consider paying stipends to non-winning teams and should clearly describe their approach towards acquiring the ownership right of proposers in the RFP.	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice

*FDOT has changed their standard practice from shortlisting 3-5 teams to a long list without any limit on the number of participating design-build teams. However, the qualified teams will carry the qualifications score to the proposal evaluation phase.

Table 12.5
Challenges Related to Environmental Analysis and Permitting on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Identification of Environmental Resources and Coordination with Environmental Agencies**							
	Regulatory concerns with incomplete design in design-build projects	Yes	-	Yes	No	Yes	Yes	Yes
	State DOT relationships with regulatory agencies	Yes	-	Yes	Yes	No	No	Yes
	Improper identification of resources	Yes	-	Yes	Yes	No	Yes	Yes
	Impact of Environmental Permitting on project schedule	No	-	No	Yes	No	No	Yes
	NEPA and Quantification and Mitigation of Environmental Impacts							
	Conventional prescriptiveness constraints of NEPA	Yes	-	No	No	Yes	No	Yes
	Mitigation of NEPA impacts while not limiting innovation	Yes	-	No	No	Yes	No	No
	Permit agency concerns about pressure from design-build teams	No	-	Yes	Yes	No	No	Yes
	Post-Award Environmental Management in Design-Build Contracts							
	Re-evaluation of the NEPA document triggered by proposed design changes	Yes	-	No	Yes	No	Yes	Yes
	Permit modification triggered by proposed design changes	Yes	-	Yes	No	No	No	Yes

Table 12.6
Opportunities to Enhance Efficiency of Environmental Analysis and Permitting on Design-Build Projects
Has your state DOT utilized these opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Identification of Environmental Resources and Coordination with Environmental Agencies**							
	State DOTs should partner with, fund positions, or co-habitat with regulatory agencies	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should examine alternative solutions during the concept phase by clearing additional areas for each environmental special study to allow for innovation	Standard practice	-	Standard practice	Standard practice	Utilized on a few projects	Standard practice	Standard practice
	State DOTs should be flexible to utilize several strategies for acquiring environmental permits	Standard practice	-	Standard practice	Not considered	Not considered	Not considered	Standard practice
	NEPA and Quantification and Mitigation of Environmental Impacts							
	State DOTs should add flexibility to the NEPA document and special studies by identifying alternative mitigation strategies, maximum impacts, and performance mitigation measures	Standard practice	-	Standard practice	Standard practice	Utilized on a few projects	Standard practice	Standard practice
	State DOTs should establish programmatic agreements with federal and environmental agencies to streamline the environmental planning and permitting process and to provide flexibility in the NEPA document	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Utilized on a few projects
	State DOTs should acquire time-consuming and high-risk permits early on and leave non-critical permits to be attained by the design-build team	Not considered	-	Standard practice	Not considered	Standard practice	Not considered	Standard practice
	State DOTs should consider advertising and awarding projects prior to the completion of NEPA to expedite project schedule	Considered for future use	-	Not considered	Utilized on a few projects	Not considered	Not considered	Utilized on a few projects

Table 12.6 (cont'd)

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Post-Award Environmental Management in Design-Build Contracts**							
	State DOTs should consider allowing the design-build team to accept the risk of NEPA re-evaluations (schedule and cost risks) by requiring the design-build team to complete the re-evaluation or to provide required documentation for NEPA re-evaluation.	Standard practice	-	Not considered	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should consider allowing the design-build team to accept the risk of obtaining or modifying environmental permits (schedule and cost risks) by requiring the design-build team to complete the permit application and/or modification or to provide required documentation for the permit modification.	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should consider providing incentives to the design-build team to encourage reduction in the environmental impacts of the project.	Standard practice	-	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice
	State DOTs should require the design-build team to have an environmental management plan and an environmental compliance manager to oversee the environmental impacts of the project and ensure compliance with permit requirements.	Standard practice	-	Not considered	Not considered	Standard practice	Standard practice	Standard practice

Table 12.7
Challenges Related to ROW Acquisition on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Challenges	**Identification of ROW Impacts and Determination of a ROW Acquisition Strategy for Design-Build Projects**							
	Identification of ROW impacts based on incomplete design plans	No	No	Yes	No	Yes	No	-
	Management of third party ROW needs	No	Yes	Yes	No	Yes	No	-
	Execution of ROW Acquisition Tasks							
	ROW acquisition as the critical path to a project's schedule	No	No	Yes	No	Yes	Yes	-
	Management of ROW acquisitions for a large number of parcels	No	No	No	No	Yes	Yes	-

Table 12.8
Opportunities to Enhance Efficiency of ROW Acquisition on Design-Build Projects
Has your state DOT utilized these opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Identification of ROW Impacts and Determination of a ROW Acquisition Strategy for Design-Build Projects**							
	State DOTs should coordinate project ROW needs with utilities, environmental mitigation requirements, tolling infrastructure, and other project needs that may affect ROW	Standard practice	Standard practice	Standard practice	Not considered	Standard practice	Standard practice	-
	State DOTs should identify project goals and select a ROW acquisition strategy that helps achieve them	Not considered	Not considered	Considered for future use	Utilized on a few projects	Standard practice	Utilized on a few projects	-
	Execution of ROW Acquisition Tasks							
	State DOTs should utilize effective ROW management tools	Not considered	Utilized on a few projects	Standard practice	Not considered	Standard practice	Standard practice	-
	State DOTs should utilize advance acquisitions	Utilized on a few projects	Standard practice	Utilized on a few projects	Utilized on a few projects	Standard practice	Utilized on a few projects	-
	State DOTs should maintain ownership of ROW acquisition	Standard practice	Standard practice	Standard practice	Utilized on a few projects	Standard practice	Utilized on a few projects	-
	State DOTs should transfer responsibility for ROW acquisition to the design-build team	Not considered	Not considered	Considered for future use	Standard practice	Standard practice	Standard practice	-

Table 12.9
Challenges Related To Utilities Coordination and Relocation on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Challenges	**Identification of Utilities**							
	Insufficient or inaccurate identification of utility locations	Yes	Yes	No	Yes	Yes	-	-
	Disputes on determination of utility compensable property rights	No	Yes	No	No	No	-	-
	Coordination of Utilities							
	Reluctance of utility owner to work with design-build teams	No	Yes	No	No	Yes	-	-
	Deficiency in addressing utility impacts on environmental resources and ROW needs	No	Yes	No	No	Yes	-	-
	Relocation of Utilities							
	Unclear determination of responsibility for utility relocations	No	Yes	No	No	Yes	-	-
	Uncontrollable impact of utility relocations on the project schedule	No	Yes	No	No	Yes	-	-
	Unfamiliarity of design-build teams with utility relocation work	No	Yes	No	No	No	-	-

Table 12.10
Opportunities to Enhance Efficiency of Utilities Coordination and Relocation on Design-Build Projects
Has your state DOT utilized these opportunities on design-build projects?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Opportunities	**Identification of Utilities**							
	State DOTs should conduct utility engineering and subsurface utility engineering activities early in the project development process	Utilized on a few projects	Standard practice	Considered for future use	Standard practice	Standard practice	-	-
	Coordination of Utilities							
	State DOTs should consider obtaining Memorandums of Understanding (MOUs) or Master Utility Agreements (MUAs) with utilities as major pre-bid utility coordination tasks	Not considered	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should consider including utility coordination in design-build contracts	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should partner with utility owners and encourage design-build teams to partner with utility owners to create solutions that minimize or avoid relocations	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should coordinate anticipated utility relocations with other project disciplines, especially ROW and environmental planning and permitting	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should ensure that contract language is clear to design-build teams on their required role in utility coordination	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	Relocation of Utilities							
	State DOTs should consider including utility relocations in the design-build contract	Standard practice	Standard practice	Standard practice	Standard practice	Standard practice	-	-
	State DOTs should consider providing incentives to utility owners to expedite relocations by reimbursing them for normally non-reimbursable relocations	Not considered	Not considered	Not considered	Not considered	Standard practice	-	-

Table 12.11
Challenges Related to Utilizing Alternative Technical Concepts (ATCs) on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Challenges	**Evaluation and use of ATCs**							
	Difficulty in maintaining confidentiality and fairness (unbiased evaluation) among the bidders	No	No	No	No	No	-	No
	Determination of an "equal or better" design solution in comparison to base design	Yes	Yes	Yes	Yes	Yes	-	Yes
	Excessive resource requirements of the ATC review process	Yes	Yes	Yes	Yes	Yes	-	Yes
	Significant impacts on NEPA permits, ROW, utilities, and other critical areas	No	No	No	No	No	-	No
	Conflicts with Title 23 CFR 636.209(b) (supplement not substitute base proposals)	No	No	No	No	No	-	No

Table 12.12
Opportunities to Enhance Efficiency of Alternative Technical Concepts (ATCs) on Design-Build Projects
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	**Florida**	**Michigan**	**N. Carolina**	**Utah**	**Virginia**	**Washington**
Opportunities	**Evaluation and use of ATCs**							
	State DOTs should provide a standard process to receive, evaluate, and approve ATCs for design-build projects that benefit from innovation.	Standard Practice	Standard Practice	Utilized on a few projects /Considered for Future Use	Utilized on a few projects /Considered for Future Use	Standard Practice	-	Standard Practice
	State DOTs should maintain confidentiality during the ATC review process and hold one-on-one meetings with design-build teams.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	-	Standard Practice
	State DOTs should consider ATCs as a learning device and an educational tool to engage state engineers in the process.	Considered for future use	Considered for future use	Considered for future use	Not Considered	Considered for future use	-	Not Considered

Table 12.13
Challenges Related to Design Oversight, Design Acceptance, and Quality Management on Design-Build Projects
Has your state DOT experienced these challenges?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Challenges	**Design Oversight and Design Acceptance**							
	Loss of Control over Design	No	No	Yes	No	No	Yes	Yes
	Prescriptive design solutions and enforcement of unnecessarily strict design oversight by state DOTs	No	No	Yes	No	Yes	Yes	No
	Limited number of professional design specialists in state DOTs to expedite the process of design oversight and design acceptance	No	Yes	No	Yes	Yes	Yes	Yes
	Fear of shrinking public engineering workforce despite the design-build project delivery system	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Difficulty in stipulating the process for design oversight and design acceptance	Yes	No	Yes	Yes	Yes	No	No
	Fear of jeopardizing quality or sacrificing quality for profit in design-build projects	No	No	No	No	No	No	No
	Quality Assurance/Quality Control (QA/QC)							
	Difficulty in identifying a proper QA/QC plan for a design-build project	Yes	No	Yes	Yes	Yes	No	No
	Difficulty in identifying critical roles and responsibilities for performing major QA/QC tasks	Yes	No	Yes	Yes	Yes	Yes	Yes
	Time-consuming reviews after contract award that hinder innovation and expedited delivery	No	No	Yes	No	No	No	No

Table 12.14
Opportunities to Enhance Efficiency of Design Oversight, Design Acceptance, and Quality Management on Design-Build Projects
Has your state DOT utilized the following opportunities on design-build projects?

		State DOT						
		Colorado	Florida	Michigan	N. Carolina	Utah	Virginia	Washington
Opportunities	**Design Oversight and Design Acceptance**							
	State DOTs should facilitate the required cultural shift regarding design oversight and design acceptance of design-build projects and provide opportunities for state DOT engineers to think of design-build projects as a learning experience and not a threat.	Standard Practice	Standard Practice	Considered for future use	Standard Practice	Standard Practice	Standard Practice	-
	Whenever appropriate, state DOTs should co-locate the project design team and state DOT engineers to facilitate coordination and communication and improve the flow of information on large and complex projects.	Utilized on a few projects	Utilized on a few projects	Not considered	Utilized on a few projects	Utilized on a few projects	Utilized on a few projects	Utilized on a few projects
	State DOTs should either explicitly stipulate what their expectations are from the design-build team regarding design management or solicit design management plan from the design-build team.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice
	Quality Assurance/Quality Control (QA/QC)							
	State DOTs should consider transferring QA/QC responsibilities to the design-build team and retain quality acceptance and independent assurance responsibilities for the state DOT.	Standard Practice	Standard Practice	Standard Practice	Utilized on a few projects/ Considered for future use	Utilized on a few projects/ Considered for future use	Standard Practice	Standard Practice
	State DOTs should either stipulate required quality management plan in the project RFP or solicit proper quality management plan from the design-build team.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice
	Whenever appropriate, state DOTs should take advantage of informal or over-the-shoulder design review while requiring design-build teams to submit milestone design developments for formal review.	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice	Standard Practice

Suggested Future Research

This research project was aimed at challenges and opportunities for enhancing efficiency of GDOT in delivery of design-build projects. Design-build is still relatively new in the transportation sector and several state DOTs are still experimenting with this innovative project delivery system. The areas in which further study is recommended for possible research consideration at the state and national levels are:

1. Evaluation and use of innovative project delivery systems such as CM/GC: This study will investigate appropriateness of CM/GC for transportation projects and how its use can improve efficiency of the state DOT. State DOTs are increasingly considering the use of CM/GC or CM@Risk for transportation projects. CM/GC provides state DOTs with an innovative project delivery system that is able to achieve benefits similar to design-build in terms of early contractor involvement in preconstruction. CM/GC also helps the state DOT retain the design responsibility and have higher control over the design process. However, CM/GC contracts are often awarded in an open-book fashion and their procurement involves considering qualifications of the contractor for award. Research is required to help the state DOT establish appropriate processes for selection of CM/GC projects and procurement of the contractor.
2. Alternative Technical Concepts (ATCs): State DOTs are increasingly considering the use of Alternative Technical Concepts (ATCs) submitted by design-build Teams. ATCs have huge potential for accruing sizable benefits in terms of cost savings, increased constructability, and schedule reduction. The construction and consulting industry have constantly expressed their concerns regarding the protection of their proprietary as well as sensitive business practices when proposing ATCs for design-build projects. State DOTs need to work with design-build Teams to develop transparent procedures that treat all proposers fairly and provide their management with a documented process of ATC

approval process and its incorporation into the contract award process. There is a need for research that explores various issues related to the use of ATCs by State DOTs. The research should identify various methods by which State DOTs have successfully implemented ATCs. It should document the methods that promote transparency of the selection process, protect the design-build Team's right to confidentiality, and assist the State DOT in selecting the proposal that represents the best-value. The product of this research can be a guidebook that presents the procurement procedures that can minimize the overall industry concerns and costs for developing and proposing ATCs, yet encourages both competition and innovation. This guidebook should summarize the ATC evaluation and approval methods that support transparency and objectivity in the ATC evaluation process.

3. Quality Management for design-build project delivery system: There is a lack of clear guidance on how to properly develop and administer design quality management activities in the context of design-build project delivery system. State DOTs are faced with the challenge of determining the required level of design development needed to properly articulate the scope of work in the RFP. It will be prudent to investigate the design development process before and after the procurement process and identify the roles and responsibilities required to develop a proper design quality management plan. The most important component of this study will be the identification of the possible forms that the Department's design quality management plan can take place. This could lead to the development of a guidebook that can be used by State DOTs as the template for the development of design quality management policies and procedures.

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APPENDIX I

Below are the questionnaires prepared prior to the interview with the representative from each State DOT. These questionnaires include a series of questions concerning the state of practice of design-build in the respective State DOTs as well as a series of questions directly related to the topic of this research project.

Colorado DOT (CDOT)

Background Questions

1. Briefly describe the history of Colorado statutory regulations as it pertains to design-build procurement (e.g., using the Two-Phase Selection Method)? Did it always include the Best Value? Has it always given the current level of flexibility to the Chief Engineer for the procurement method selection?

Questions about the Selection of Procurement Methods

2. Describe how the Colorado DOT makes decision about the procurement method selection for design-build projects (i.e., Single Phase, Two-Phase Best Value, or Modified design-build)? What factors are important in this selection process?
3. Where can we obtain RFQs and RFPs for recent design-build projects that were procured under the above methods?
4. Describe how the dynamics of the RFQ and the RFP may be different with respect to the various selection methods.
5. Does the dynamics of Pre-qualification change based on the choice of procurement method? Is Pre-qualification always done before issuing RFPs in Low Bid design-build projects?
6. How does Colorado DOT make decision about short-listing?

7. Has CDOT used design-build-finance? Does the dynamics of RFQ and RFP change for design-build-finance projects? How is the proposed financing alternative evaluated for design-build team Selection?
8. Describe how CDOT makes decision about the stipend amount.
9. Describe the conditions under which CDOT typically uses the Best and Final Offer (BAFO).

Questions about CDOT Organization Structure for Design-Build Procurement

10. What is the organizational structure in Colorado DOT for design-build project procurement? Which CDOT units are involved in different steps of design-build project procurement (e.g., RFQ and RFP developments, Bidding, Proposal Evaluation, and Short-listing)?
11. Is there a process map or organization chart for design-build project procurement?
12. How does DOT manage the design-build procurement documents internally for design-build projects (e.g., RFQ and RFP preparation, advertisement, evaluation and selection)?
13. How does the administrative burden and speed of implementing the project procurement change based on the Department's choice of procurement method?

Questions about Right-of-way (ROW) Acquisition, Utilities Coordination, and NEPA Approval

14. For Federal-aid or State projects, can the letting process be initiated before the final titles to ROW, utility agreements and NEPA approval are acquired? Can CDOT accept the respective risk and let the project early?
15. Have there been any benefits realized from past design-build projects for which the design-build team handled ROW Acquisition, Utilities Coordination, and/or NEPA Approval processes?

16. How does the dynamics of procurement method selection change considering the transfer of ownership and control of ROW Acquisition, Utilities Coordination, and/or NEPA Approval?

Questions about ACCs (Alternative Configuration Concepts) and ATCs (Alternative Technical Concepts)

17. Describe the differences between ACCs and ATCs. Where can we obtain ACC and ATC examples in recent Colorado design-build projects?
18. Does CDOT provide the design-build teams with the opportunity to propose ACCs and ATCs for any of the design-build procurement methods? If yes, have there been any benefits realized from incorporating ACCs and ATCs in the past design-build projects by the CDOT? Also, are there any limits on the number of ACCs and ATCs proposed by design-build teams?
19. Does the CDOT hold the Intellectual Property right for ACCs and ATCs that are proposed by non-winning design-build teams? Is the policy different for cases that the stipends are paid versus the cases that stipends are not paid?
20. How does the dynamics of ROW Acquisition, Utilities Coordination, and NEPA Approval change considering design changes proposed as ACCs and ATCs?

Administrative Efficiency

21. Briefly describe CDOT level of effort with plan reviews. Has this proven successful? If not, what changes would you consider to achieve optimal efficiency?

Miscellaneous Questions

22. Does CDOT use performance-based specifications for any part of the RFP package? If yes, what are the performance measures?

23. How do you see the next-generation design-build procurement and contracting in Colorado? What are the emerging trends that should be considered in the next-generation design-build procurement and contracting?

Florida DOT (FDOT)

Background Questions

1. How did the flexibility in Design Build procurement method (e.g., using the Best Value Selection Method) end up in the Florida statutory regulations?
2. How was the Best Value Selection adopted as an alternative procurement method besides the Low Bid Selection Method?

Questions about the Selection of Procurement Method

3. How does the Florida DOT make decision about the procurement method selection for design-build projects (i.e., selecting Low Bid Design-Build (LBDD), Adjusted Score Design-Build Bid Process (ASDB), Design-Build Hybrid, Design-Build Maximum Price or Design-Build with Options)? What factors are important in this selection process? How?
4. Would you please provide us with a few examples of RFQs and RFPs for recent design-build projects that were procured under the above methods?
5. How does the dynamics of RFQ and RFP change based on the choice of procurement method?
6. How does the dynamics of Pre-qualification change based on the choice of procurement method? Is Pre-qualification always done before issuing RFPs in Low Bid design-build projects?
7. How does the Florida DOT make decision about short-listing?
8. How does the dynamics of RFQ and RFP change for design-build-finance projects? How is the proposed financing alternative evaluated for design-build team Selection?

Questions about FDOT Organization Structure for Design Build Procurement

9. What is the organizational structure in Florida DOT for design-build project procurement? Which FDOT units are involved in different steps of design-build project procurement

(e.g., RFQ and RFP developments, Bidding, Proposal Evaluation, Long-listing and Short-listing)?

10. Is there any process map or organization chart for design-build project procurement?
11. How does FDOT manage procurement documents internally for design-build projects (e.g., RFQ and RFP preparation, advertisement, evaluation and selection)?
12. How do the administrative burden and speed of project procurement change based on the choice of procurement method?

Questions about Right-of-way (ROW) Acquisition, Utilities Coordination, and NEPA Approval

13. For Federal-aid or State projects, can the letting process be initiated before the final titles to ROW, utility agreements and NEPA approval are acquired? Can the FDOT accept the respective risk and let the project early?
14. Have there been any benefits realized from past design-build projects for which the design-build team handled ROW Acquisition, Utilities Coordination, and/or NEPA Approval processes?
15. How does the dynamics of procurement method selection change considering the transfer of ownership and control of ROW Acquisition, Utilities Coordination, and/or NEPA Approval?

Questions about alternative technical concepts (ATCs)

16. Have there been any benefits realized from incorporating ATCs in the past design-build projects by the FDOT?
17. Are there any limits on the number of ATCs proposed by design-build teams?
18. How are the Intellectual Property issues addressed for ATCs that are proposed by non-winning design-build teams? Is the policy different for cases that the stipends are paid versus the cases that stipends are not paid?

19. How does the dynamics of ROW Acquisition, Utilities Coordination, and NEPA Approval change considering design changes proposed as ATCs?

Miscellaneous Questions

20. Does FDOT use performance-based RFPs? If yes, what are the performance measures?
21. How do you see the next-generation design-build Procurement and Contracting in Florida? What are the emerging trends that should be considered in the next-generation design-build Procurement and Contracting?

Michigan DOT (MDOT)

Background Questions

1. Is there any specific legislation that authorizes the use of the design-build Project Delivery System by MDOT? Has MDOT developed any design-build manual or guide?
2. How flexible are Michigan regulations for Innovative Project Delivery Systems? Is there any cap for number of projects or the total dollar amount that can be awarded each year for design-build or other Innovative Project Delivery Systems?

Questions about Procurement Methods and Design-Build Contracting

3. What are the criteria and weights for quality-based selection process? Is there any template for selection process or is it case-by-case?
4. Does MDOT have a template for proposal evaluation criteria? What kind of qualitative assessment is used for design-build project selection (i.e., relative weights)?
5. We noticed that MDOT has completed 2 pilot design-build-finance projects. Did MDOT use warranties or performance-based contracting for these 2 projects, in order to ensure the described benefits? Are there any other benefits besides expediting project delivery, e.g., quality improvement and costs saving?
6. How to compare the different level designs with varying costs in the Best and Final Offer procurement method? What are the evaluation criteria of the proposal?

Questions about NEPA Process

7. Can MDOT let a design-build contract in advance of NEPA approval?
8. In case that MDOT requires the design-build team to obtain the environmental permits for projects, who is responsible for the costs associated with the permits and mitigation?
9. Is design-build team required to complete any activities from proposed changes that require additional public involvement or a NEPA re-evaluation? How does this work with CFR

requirements (23 CFR Chapter 1, Section 636.109(b)(6)) which prohibit the contractor from being involved in the decision making process of the NEPA document?

10. Do minor changes to the preliminary design that differ from approved special studies trigger a NEPA re-evaluation (e.g., increases or reductions in stream/wetland impacts, minor alignment shifts, or temporary construction permits)?
11. Does MDOT allow phased construction and permitting to expedite the project delivery?

Questions about Alternate Bids

12. Is Michigan Alternate Bids the same as what other State DOTs call alternative technical concepts (ATCs)? Is Alternate Bid pre-approved and confidential?
13. What are the benefits, if any, realized and documented from incorporating Alternate Bids in the past design-build projects by the MDOT? How were these benefits measured?
14. Who is responsible for the risk created by proposed Alternate Bids that require a NEPA re-evaluation?
15. How does the dynamics of ROW Acquisition, Utilities Coordination, and NEPA Approval change considering design changes made through Alternate Bids?

Questions about Right-of-way (ROW) Acquisition, Utilities Coordination, and other Third Party Coordination

16. Who is responsible for finalizing the utility agreements? Are utility agreements a part of design-build team's responsibilities and services or is MDOT primarily responsible?
17. Has MDOT shifted the responsibility of handling the utilities coordination and relocation to the design-build team? Have there been any benefits realized from past design-build projects for which the design-build team handled the utilities coordination and relocation processes?

18. Has MDOT required design-build teams to acquire ROW for the construction of the design provided in the Costing Plans? If so, what costs are included in this (e.g., acquisition services, purchase price, etc.)?
19. How do the dynamics of procurement method change considering the transfer of ownership and control of ROW Acquisition and Utilities Coordination process?
20. How often do design-build teams make major modifications to the design which results in re-evaluation of the NEPA document, or additional third party agreements or coordination? Does MDOT build time into the schedule to allow for any of these changes, or does the final completion date of the project typically inhibit these types of changes?

Questions about MDOT Organization Structure for Design-Build Procurement

21. How many DOT employees does it take to manage a typical project?
22. What is the level of administrative requirements for the procurement of design-build projects? Is there any opportunity to save time and enhance efficiency?

Miscellaneous Questions

23. Does MDOT document the lessons learned and efficiencies gained from the design-build projects upon the completion of project?
24. Does MDOT identify and document the best practices for enhancing efficiency in terms of time and cost savings in design-build projects?
25. Has MDOT used performance-based contracting for design-build projects? How does MDOT define, establish and measure performance?
26. How do you see the next-generation design-build Procurement and Contracting in Michigan? What are the emerging trends that should be considered in the next-generation design-build Procurement and Contracting?

North Carolina DOT (NCDOT)

Background Questions

1. What was the driving force for the legislation to increase the allowed number of design-build projects over the years?
2. What benefits were realized and presented to the legislators, in order to enhance the legislators' confidence for design-build Project Delivery System? How were these benefits defined, measured and reported?
3. How is the success of the project selection process demonstrated?

Questions about Procurement Methods and Design-Build Contracting

4. What are the criteria and weights for quality-based selection process? Is there any template for selection process or is it case-by-case?
5. Why does NCDOT not use Design-Bid-Build method for Modified design-build projects? Is it just to expedite the delivery?
6. Does NCDOT have a template for proposal evaluation criteria? What kind of qualitative assessment is used for design-build project selection (i.e., relative weights)? Would you please elaborate the process of combining qualitative analysis and quantitative analysis of cost and schedule?
7. Can we have statistics on actual design-build variations used for past, ongoing and active design-build projects?

Questions about NEPA Process

8. Can NCDOT let a design-build contract in advance of NEPA approval?
9. NCDOT appears to frequently require the design-build team to prepare all environmental permits for projects. Who is responsible for the costs associated with the permits and mitigation?

10. We noticed in an RFP that the design-build team is required to complete any activities from proposed changes that require additional public involvement or a NEPA re-evaluation. How does this work with CFR requirements (23 CFR Chapter 1, Section 636.109(b)(6))) which prohibit the contractor from being involved in the decision making process of the NEPA document?
11. In your RFPs, references to the base design typically refer to what was shown at public involvement meetings. Is this considered the threshold for a NEPA Re-Evaluation? Do minor changes to the preliminary design that differ from approved special studies trigger a re-evaluation (e.g., increases or reductions in stream/wetland impacts, minor alignment shifts, or temporary construction permits)?
12. Does NCDOT allow phased construction and permitting to expedite the project delivery?

Questions about alternative technical concepts (ATCs)

13. What are the benefits, if any, realized and documented from incorporating ATCs in the past design-build projects by the NCDOT? How were these benefits measured?
14. Are there any limits on the number of ATCs proposed by design-build teams?
15. Who is responsible for the risk created by proposed ATCs that require a NEPA re-evaluation?
16. How does the dynamics of ROW Acquisition, Utilities Coordination, and NEPA Approval change considering design changes made through ATCs?

Questions about Right-of-way (ROW) Acquisition, Utilities Coordination, and other Third Party Coordination

17. How often do design-build teams make major modifications to the design which results in revising an Interchange Modification Report (IMR), re-evaluation of the NEPA document, or additional third party agreements or coordination? Does NCDOT build time into the

schedule to allow for any of these changes, or does the final completion date of the project typically inhibit these types of changes?

18. Who is responsible for finalizing the utility agreements? Are utility agreements a part of design-build team's responsibilities and services or is NCDOT primarily responsible?
19. Has NCDOT shifted the responsibility of handling the utilities coordination and relocation to the design-build team? Have there been any benefits realized from past design-build projects for which the design-build team handled the utilities coordination and relocation processes?
20. Has NCDOT required design-build teams to acquire ROW for the construction of the design provided in the Costing Plans? If so, what costs are included in this (e.g., acquisition services, purchase price, etc.)?
21. How do the dynamics of procurement method change considering the transfer of ownership and control of ROW Acquisition and Utilities Coordination process?

Questions about NCDOT Organization Structure for Design-Build Procurement

22. How many DOT employees does it take to manage a typical project?
23. What is the level of administrative requirements for the procurement of design-build projects? Is there any opportunity to save time and enhance efficiency?

Miscellaneous Questions

24. Does NCDOT document the lessons learned and efficiencies gained from the design-build projects upon the completion of project?
25. Does NCDOT identify and document the best practices for enhancing efficiency in terms of time and cost savings in design-build projects?
26. Has NCDOT used performance-based contracting for design-build projects? How does NCDOT define, establish and measure performance?

27. How do you see the next-generation design-build Procurement and Contracting in North Carolina? What are the emerging trends that should be considered in the next-generation design-build Procurement and Contracting?

Utah DOT (UDOT)

Background Question

1. Briefly describe the history of Utah statutory regulations as it pertains to using design-build Project Delivery System. Does the regulation mandate or encourage using any specific procurement method?

Questions about Procurement Methods and Design-Build Contracting

2. Would you please provide an example, which describes specific goals, respective values and evaluation criteria for a project?
3. Is there any template to facilitate the selection of appropriate Project Delivery Systems for projects?
4. Is there any template for selecting appropriate procurement methods for design-build projects? Is Low Bid a one-step or two-step selection process?
5. Is there any template for technical proposal evaluation? What are the evaluation criteria? What scoring or rating measures are used in the evaluation? How does UDOT combine technical and price evaluations in Best Value selection? How is the adjustment conducted to transform time and technical merit into price? Is there a minimum weight for price evaluation in the overall proposal evaluation? How does UDOT aggregate different opinions for technical proposal evaluation?
6. Does UDOT shortlist for all design-build projects? Does UDOT pay stipends to shortlisted design-build teams? Based on past design-build RFPs in Utah, do design-build contractors have to accept stipends in exchange of transferring their proprietary information to Utah DOT? Or can they waive stipends?

Questions about NEPA Process

7. How does UDOT manage the NEPA process with design-build projects?

8. In cases where UDOT advertises design-build projects before finalizing NEPA process, how does UDOT evaluate and assume the NEPA risk?
9. Has UDOT shifted the responsibility of handling the environmental permitting process to design-build teams? Have there been any benefits realized from past design-build projects for which the design-build team handled environmental permitting process?
10. How do the dynamics of procurement method change considering the transfer of ownership and control of environmental permitting?

Questions about alternative technical concepts (ATCs)

11. Have there been any benefits realized and documented from incorporating ATCs in the past design-build projects by the UDOT? What were these benefits? How were these benefits measured?
12. Are there any limits on the number of ATCs proposed by design-build teams?
13. How does the dynamics of ROW Acquisition, Utilities Coordination, and NEPA Approval change considering design changes made through ATCs?
14. Are alternative proposals the same as Alternative Technical Concepts (ATCs) or Alternative Configuration Concepts (ACCs)?

Questions about Right-of-way (ROW) Acquisition and Utilities Coordination

15. Can UDOT proceed with the award of a design-build contract or issue notice to proceed with preliminary design prior to the completion of ROW acquisition and/or utilities agreements?
16. Who is responsible for finalizing the utility agreements? Are utility agreements a part of design-build team's responsibilities and services or is UDOT primarily responsible?
17. Has UDOT shifted the responsibility of handling the utilities coordination and ROW acquisition process to the design-build team? Have there been any benefits realized from

past design-build projects for which the design-build team handled the utilities coordination and ROW acquisition processes?

Questions about UDOT Organization Structure for Design-Build Procurement

18. Which Division or Office in UDOT is in charge of (or oversees) design-build Project Selection? Are all design-build projects procured and managed at the regional office? Does Contracts, Estimates and Agreements Manager work under the Innovating Contracting Office? Is there any need for coordination with other UDOT offices for advertising RFQs?
19. How many DOT employees does it take to manage a typical project?
20. What is the level of administrative requirements for the procurement of design-build projects? Is there any opportunity to save time and enhance efficiency?

Miscellaneous Questions

21. Does UDOT document the lessons learned from the design-build projects upon the completion of project?
22. Does UDOT identify and document the best practices for enhancing efficiency in terms of time and cost savings in design-build projects?
23. How do you see the next-generation design-build Procurement and Contracting in Utah? What are the emerging trends that should be considered in the next-generation design-build Procurement and Contracting?

Virginia DOT (VDOT)

Background Questions

1. Briefly describe the history of Virginia statutory regulations as it pertains to design-build procurement (e.g., using the Best Value Selection Method instead of the Low Bid Method). Did it always include the Best Value?

Questions about the Selection of Procurement Method

2. Describe how the Virginia DOT makes decision about the procurement method selection for design-build projects (i.e., Single Phase or Two-Phase Best Value, Low Bid, Best and Final Offer (BAFO)). What factors are important in this selection process?
3. Describe how the dynamics of the RFQ and the RFP may be different with respect to the various selection methods (RFP may be more prescriptive when using low-bid vs. a best value).
4. Does the dynamics of Pre-qualification change based on the choice of procurement method? Is Pre-qualification always done before issuing RFPs in Low Bid design-build projects?
5. How does Virginia DOT make decision about short-listing?
6. Has VDOT used design-build-finance? Does the dynamics of RFQ and RFP change for design-build-finance projects? How is the proposed financing alternative evaluated for design-build team Selection?
7. In the best value proposal evaluation, does the 30%-70% balance between the weights of Technical Proposal and Price Proposal (as mentioned in the design-build manual) always remain the same?
8. Where can we obtain RFQs and RFPs for recent design-build projects that were procured under the above methods?

Questions about VDOT Organization Structure for Design-Build Procurement

9. What is the organizational structure in Virginia DOT for design-build project procurement? Which VDOT units are involved in different steps of design-build project procurement (e.g., RFQ and RFP developments, Bidding, Proposal Evaluation, Long-listing and Short-listing)?
10. Is there a process map or organization chart for design-build project procurement?
11. How does DOT manage the design-build procurement documents internally for design-build projects (e.g., RFQ and RFP preparation, advertisement, evaluation and selection)?
12. How do the administrative burden and speed of implementing the project procurement change based on the Department's choice of procurement method?

Questions about Right-of-way (ROW) Acquisition, Utilities Coordination, and NEPA Approval

13. For Federal-aid or State projects, can the letting process be initiated before the final titles to right of way, utility agreements and NEPA approval are acquired? Can VDOT accept the respective risk and let the project early?
14. Have there been any benefits realized from past design-build projects for which the design-build team handled ROW Acquisition, Utilities Coordination, and/or NEPA Approval processes?
15. How does the dynamics of procurement method selection change considering the transfer of ownership and control of ROW Acquisition, Utilities Coordination, and/or NEPA Approval?

Questions about alternative technical concepts (ATCs)

16. Does VDOT provide the Offerors with the opportunity to propose Alternative Technical Concepts for any of the design-build procurement methods? If yes, have there been any

benefits realized from incorporating ATCs in the past design-build projects by the VDOT? Also, are there any limits on the number of ATCs proposed by design-build teams?

17. Does the VDOT hold the Intellectual Property right for ATCs that are proposed by non-winning design-build teams? Is the policy different for cases that the stipends are paid versus the cases that stipends are not paid?
18. How does the dynamics of ROW Acquisition, Utilities Coordination, and NEPA Approval change considering design changes proposed as ATCs?

Administrative Efficiency

19. Briefly describe VDOT level of effort with plan reviews. Has this proven successful? If not, what changes would you consider to achieve optimal efficiency?

Miscellaneous Questions

20. Does VDOT use performance-based specifications for any part of the RFP package? If yes, what are the performance measures?
21. How do you see the next-generation design-build Procurement and Contracting in Virginia? What are the emerging trends that should be considered in the next-generation design-build Procurement and Contracting?

Washington State DOT (WSDOT)

Background Questions

1. Briefly describe the history of Washington statutory regulations as it pertains to using design-build Project Delivery System. Did the regulation always mandate Best Value procurement?
2. Are the pilot projects reported or not?

Questions about Innovative Project Delivery Systems

3. What are the primary factors for selecting design-build as the project delivery system for a project? Who finalizes the decision on the use of design-build Delivery System?
4. Has WSDOT used Design-Build-Finance? Does the dynamics of RFQ and RFP change for Design-Build-Finance projects? How is the proposed financing alternative evaluated for design-build team Selection?
5. Describe the reasons why the state legislature decided to revise the old Public/Private Initiatives in Transportation (PPIT) program (1992-2004) codified as chapter 47.46 Revised Code of Washington (RCW)? What were the lessons that WSDOT learned from implementing the old Public/Private Initiatives in Transportation (PPIT) program?
6. What are the lessons learned from implementing the new public-private partnership (PPP) law ("Transportation Innovative Partnerships Act of 2005" codified as 47.29 RCW)?

Questions about the Selection of Procurement Method

7. Does WSDOT utilize other procurement methods such as Low Bid besides Best Value?
8. What are the special funding considerations for using design-build Project Delivery System?
9. Can the utility agreements be acquired after the release of RFP?
10. Should FHWA grant approval for projects higher than $50 million?

Questions about WSDOT's Experience with the Design Build Project Delivery System

11. How many design-build projects has WSDOT procured so far?
12. Has WSDOT always done shortlisting under the Two-Phase Best Value method?
13. In how many projects have you done shortlisting and the Two-Phase Best Value selection?
14. Have you always paid stipends when you shortlisted?
15. How would WSDOT make decision about the criteria for short-listing?
16. In how many projects had WSDOT done shortlisting and paid stipends when the Two-Phase Best Value selection was used?
17. Does WSDOT document the lessons learned from the design-build projects upon the completion of project?
18. Does WSDOT identify and document the best practices for enhancing efficiency in terms of time and cost savings in design-build projects?

Questions about WSDOT Organization Structure for Design Build Procurement

19. What is the organizational structure in WSDOT for design-build project procurement? Which WSDOT units are involved in different steps of design-build project procurement (e.g., RFQ and RFP developments, Bidding, Proposal Evaluation, and Short-listing)?
20. How does WSDOT manage the design-build procurement documents internally for design-build projects (e.g., RFQ and RFP preparation, advertisement, evaluation and selection)?
21. How does the administrative burden change as the result of the Department's decision to use design-build Project Delivery System rather that Design Bid Build?

Questions about NEPA Process

22. For Federal-aid or State projects, can WSDOT accept the respective risk and let the project early? Has WSDOT ever let a design-build project before the NEPA approval is acquired?

23. Has WSDOT ever shifted the responsibility of handling the environmental permitting process to the design-build team? Have there been any benefits realized from past design-build projects for which the design-build team handled environmental permitting process?
24. How do the dynamics of procurement method change considering the transfer of ownership and control of environmental permitting?

Questions about Right-of-Way (ROW) Acquisition and Utilities Coordination

25. Has WSDOT ever shifted the responsibility of handling the utilities coordination and ROW acquisition process to the design-build team? Have there been any benefits realized from past design-build projects for which the design-build team handled the utilities coordination and ROW acquisition processes?
26. How do the dynamics of procurement method change considering the transfer of ownership and control of ROW Acquisition and Utilities Coordination process?

Questions about Alternative Technical Concepts (ATCs)

27. Have there been any benefits realized and documented from incorporating ATCs in the past design-build projects by the WSDOT? What were these benefits? How were these benefits measured?
28. Are there any limits on the number of ATCs proposed by design-build teams?
29. How does the dynamics of ROW Acquisition, Utilities Coordination, and NEPA Approval change considering design changes made through ATCs?

Administrative Efficiency

30. Briefly describe WSDOT level of effort with proposal and plan reviews. Has this proven successful? If not, what changes would you consider to achieve optimal efficiency?

Miscellaneous Questions

31. Does WSDOT use performance-based specifications for any part of the RFP package? If yes, what are the performance measures?
32. How do you see the next-generation design-build Procurement and Contracting in Washington? What are the emerging trends that should be considered in the next-generation design-build Procurement and Contracting?