



# TECHSUMMARY *January 2021*

State Project No. DOTLT1000287 / LTRC Project No. 19-3PF

## Synthesis on the Best Practices for State DOTs to Determine Project Delivery Time, Project Management, and Ratio of Consultant to In-House Design

### INTRODUCTION

Delivering a successful outcome of a transportation construction project requires overcoming the overwhelming risks that are inherent in these types of projects. One of the primary concerns of project managers is delivering project outcomes on time and within budget. In general, construction projects frequently fail to meet owners' expectations in terms of cost, schedule, and quality performance. Previous research has reported that between 40% and 50% of construction projects consistently fall behind the baseline schedule. When a construction project is delayed, it is either accelerated or is extended beyond the scheduled completion date, causing cost overruns.

Over the past years, there has been an inexorable increase in the number of transportation projects in the United States. On any given day, a state Department of Transportation (DOT) has hundreds of small-to-large projects underway, with the common purpose of assuring that millions of individual travelers experience a transportation network that works smoothly. Therefore, transportation agencies are experiencing unprecedented pressure to deliver projects successfully. An obvious response to this pressure is to improve the project delivery process through the implementation of available successful project management practices, as well as through contracting out the work to private sector companies and even to other levels of government, such as county transportation agencies. Contracting out, of course, is not new, and many state DOTs have been engaged in it for years. Understanding these practices plays a vital role in the successful delivery of transportation projects.

### OBJECTIVES

The overall objective of this project was to synthesize the best practices for project delivery processes of departments of transportation (DOTs) by looking at all factors of project delivery including time estimation, project management, and suggested ratios of in-house versus consultant design.

### SCOPE

This study focused on tools, techniques, and processes required to deliver a transportation project effectively and investigated the impact of design outsourcing on project quality, schedule, and cost.

### METHODOLOGY

This research project identified and summarized effective strategies and best practices to accurately estimate the cost and schedule of transportation projects during the planning, scoping, and design phases of the project. A literature review was conducted as well as a survey of other DOT's practices. The data from the survey was analyzed and further interviews were conducted with individual state DOTs if needed.

### CONCLUSIONS AND RECOMMENDATIONS

The overall objective of this project was to synthesize the best practices of departments of transportations' project delivery processes by looking at all factors of project delivery. The study utilized a comprehensive literature review to determine the project management dimensions in transportation projects. Then, an online survey was conducted, followed by a series of interviews to collect the perspectives of the experts and professionals in state DOT agencies across the nation. A total of 96 survey participants completed the surveys, and 6 follow-up interviews were conducted to collect the required information.

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A review of publicly available manuals and guidelines on state DOT websites revealed a lack of manuals or guidelines for project management dimensions in DOT agencies. No manual has guidelines for every identified project management dimension, and some agencies are greatly lacking in this area. Based on the collected and reviewed documents, most state DOTs have a dearth of manuals on the project management dimensions of quality control, outsourcing, workforce qualifications, and O&M.

The results of the surveys and interviews also revealed project management strategies that are widely implemented in state DOT projects, such as workforce qualifications, quality management, environmental planning, safety, and document management. On the other hand, strategies such as scope verification, risk management, and repair prevention strategies are not well-implemented in transportation projects, even though they have a significant impact on project performance.

Based on the survey results, the most frequent project management practices in transportation projects were identifying the major project components and ROW clearance needs in the scoping phase; developing the project scope and communication plan in the planning phase; enhancing communication and design estimation in the programming and preliminary design phase; analyzing constructability and budget control in the design phase; holding a pre-construction meeting with a defined agenda, promoting a safe working environment, and complying with civil rights regulations in the construction phase; and assuring personnel certification training, independent QA inspections and material testing, and inspections of ongoing construction activities in the inspection and testing phase.

Every state DOT agency uses many different tools and methods for cost estimation and management; however, the results of the survey and follow-up interviews demonstrated that these methods are usually based on similar projects and historical data. The review of estimates and early identification of project risks and uncertainties were identified as the best cost estimation practices in DOT projects.

Finally, regarding the outsourced services versus in-house activities in DOT projects, the results showed that estimating a single number would not be a good approach. Although the surveys and interviews proved that DOT projects use around 40% of the project budget for contracting out some parts of the projects and use consultants, this value significantly depends on the project's characteristics. The collected data from both surveys and interviews illustrated that the outsourced to in-house ratios could be very different. For example, based on the survey results, the ratio of outsourced to in-house service is higher for bridge projects than for roadway and highway projects, and the ratio for highway projects is higher than it is for roadway projects. In addition, based on the collected information from the interviews, the DOT agencies prefer to use more outsourcing in larger and more complex projects, especially in ones located in an urban area. Last but not least, the results indicated that the main reasons for state DOT agencies to contract out parts of projects are (1) insufficient in-house personnel, (2) lack of required particular expertise in the agencies, and (3) time constraints of the project activities.

For further investigation, the best ratio of in-house versus consultant services should be calculated, based on the DOT workforce and project. Such analysis requires a data set of a DOT agency's workforce and capabilities, type of project, and a budget review of the project to estimate outsourced activities. By using this information, a decision matrix can be developed to help DOT agencies expand their workforce if it is required, or use the matrix as a guideline for budget considerations regarding outsourced services.

Based on the results of this study, the research team developed a list of the best project management practices for DOT agencies to adopt for highway, bridge, and roadway projects. The list of best practices, which were mentioned by at least half of the respondents, are presented in Figure 1.

<b>Planning Phase</b>	<b>Preliminary Design Phase</b>
<ul style="list-style-type: none"> <li>• Recognition of project complexity</li> <li>• Budget control</li> <li>• Document estimate basis and assumptions</li> <li>• Identification of risks</li> <li>• Conceptual estimation</li> <li>• Risk analysis</li> <li>• Estimate review</li> <li>• Computer software</li> <li>• Buffers</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of risks</li> <li>• Consistency</li> <li>• Creation of project baseline</li> <li>• Delivery and procurement method</li> <li>• Risk analysis</li> <li>• Recognition of project complexity</li> <li>• Verification of scope completeness</li> <li>• Estimate review</li> <li>• Document estimate basis and assumptions</li> <li>• Validation of costs</li> <li>• Value engineering</li> <li>• Buffers</li> <li>• Identification of changes</li> </ul>
<b>Design Phase</b>	<b>Construction Phase</b>
<ul style="list-style-type: none"> <li>• Plan specification and estimate</li> <li>• Communication</li> <li>• Computer software</li> <li>• Estimate review</li> <li>• Consistency</li> <li>• Identification of risks</li> <li>• Document estimate basis and assumptions</li> <li>• Identification of changes</li> <li>• Value engineering</li> </ul>	<ul style="list-style-type: none"> <li>• Establishment of contractor use areas</li> </ul>

Figure 1. Recommendations of best practices for construction phases