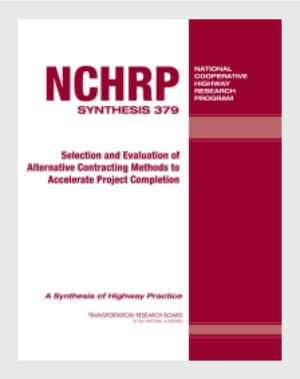

Selection and Evaluation of Alternative Contracting Methods to Accelerate Project Completion

DETAILS

67 pages | | PAPERBACK

ISBN 978-0-309-41953-6 | DOI 10.17226/23075

AUTHORS

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP SYNTHESIS 379

Selection and Evaluation of Alternative Contracting Methods to Accelerate Project Completion

A Synthesis of Highway Practice

CONSULTANTS
STUART D. ANDERSON
and
IVAN DAMNJANOVIC
Texas A&M University
College Station, Texas

SUBJECT AREAS
Materials and Construction

Research Sponsored by the American Association of State Highway and Transportation Officials
in Cooperation with the Federal Highway Administration

TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.
2008
www.TRB.org

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Academies was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communications and cooperation with federal, state, and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

NOTE: The Transportation Research Board of the National Academies, the National Research Council, the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the individual states participating in the National Cooperative Highway Research Program do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

NCHRP SYNTHESIS 379

Project 20-5 (Topic 38-12)
ISSN 0547-5570
ISBN 978-0-309-09807-6
Library of Congress Control No. 2008925356

COPYRIGHT PERMISSION

NOTICE

The project that is the subject of this report was a part of the National Cooperative Highway Research Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council. Such approval reflects the Governing Board's judgment that the program concerned is of national importance and appropriate with respect to both the purposes and resources of the National Research Council.

The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration, U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical committee according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

Published reports of the

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

are available from:

Transportation Research Board
Business Office
500 Fifth Street, NW
Washington, DC 20001

and can be ordered through the Internet at:
http://www.national-academies.org/trb/bookstore

Printed in the United States of America

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. On the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. Charles M. Vest is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, on its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academys p urposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both the Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. Charles M. Vest are chair and vice chair, respectively, of the National Research Council.

The **Transportation Research Board** is one of six major divisions of the National Research Council. The mission of the Transportation Research Board is to provide leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal. The Board's varied activities annually engage about 7,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation. **www.TRB.org**

www.national-academies.org

FOREWORD

By Staff
Transportation
Research Board

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire highway community, the American Association of State Highway and Transportation Officials—through the mechanism of the National Cooperative Highway Research Program—authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-5, "Synthesis of Information Related to Highway Problems," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, *Synthesis of Highway Practice.*

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

By Gail Staba
Senior Program Officer
Transportation
Research Board

This synthesis summarizes the state of practice in the process of selection of alternative contracting methods that can potentially accelerate project completion. It also identifies driving factors for selecting one type of alternative contracting technique over another. In this study accelerated project completion is defined as earlier completion date through faster construction, expedited project development, shorter duration of project closeout, or a combination of these attributes of project completion. Based on a survey results, five alternative contracting methods are perceived to show the highest potential for accelerating project completion. These methods are listed in order of highest relative potential to accelerate project completion as follows:

- Design–Build
- Incentives and Disincentives
- Cost-Plus-Time Bidding
- Interim Completion Dates
- No-Excuse Incentives

From the perspective of survey respondents, the selection of these methods is driven primarily by the requirement to meet a critical completion date.

Information for the study was based on the "Primer on Contracting" published by the FHWA on behalf of the AASHTO Subcommittee on Construction. Additional information was obtained through a review of literature and a survey of the members of the AASHTO Subcommittee on Construction in all 50 states, the District of Columbia, and Puerto Rico.

Stuart D. Anderson, and Ivan Damnjanovic, Texas Transportation Institute, Texas A&M University, College Station, Texas, collected and synthesized the information and wrote the report. The members of the topic panel are acknowledged on the preceding page. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

CONTENTS

SELECTION AND EVALUATION OF ALTERNATIVE CONTRACTING METHODS TO ACCELERATE PROJECT COMPLETION

SUMMARY

To promote accelerated project delivery, a number of state transportation agencies (STAs) have utilized alternative contracting methods (ACMs). Common concerns STAs have with implementation of these methods are their effectiveness in delivering projects faster and their impact on other important project performance measures such as cost, quality, and safety. The goals of this study were to summarize the state of practice of selecting ACMs that can accelerate project completion and to identify driving factors for selecting one method over another. In this study, accelerated project completion was defined as earlier completion date through faster construction, expedited project development, shorter duration of project closeout, or a combination of these.

The study methodology included three sequential efforts. The first effort was selection of methods typically implemented to accelerate project completion. Initially, 17 methods were identified from the *Primer on Contracting for the Twenty-first Century*, prepared by AASHTO's Subcommittee on Construction. Next was a comprehensive review of the current literature regarding ACMs, focusing on the 17 methods and their potential to reduce schedule duration. Finally, a website-based electronic survey including quantitative and qualitative questions was developed and sent to the members of the AASHTO Subcommittee on Construction in all 50 states, the District of Columbia, and Puerto Rico. Thirty agencies responded to the survey. Among the 17 ACMs addressed in the survey, two methods were not identified as being used, and three new methods were added by STAs.

Based on an assessment of the advantages, critical selection factors, and potential for schedule reduction, five ACMs show the highest potential for accelerating project completion. These methods are listed here in order of highest relative potential:

- Design–build,
- Incentives and disincentives,
- Cost-plus-time bidding,
- Interim completion dates, and
- No-excuse incentives.

From the perspective of survey respondents, the selection of these methods is driven primarily by the requirement to meet a critical completion date. All five methods reduce schedule duration, and three reduce duration more than 10% of the planned value (cost-plus-time incentive/disincentive and design–build). Cost performance for all five methods generally varied ±5% from budget. Thus, these data do not support a conclusion that project acceleration using the contracting methods studied in this report either substantially increases or decreases costs. Further study may be necessary. There is some indication in the literature that these five methods often increase cost; the data in this survey do not necessarily support the literature. Further, the data indicate that quality is not adversely impacted with implementation of these five methods, contrary to what the literature often indicates and counter to some of the cited disadvantages from survey responses.

Most STAs do not have systematic processes for the selection of specific ACMs that accelerate project completion. STAs that do have selection processes generally provide guidance

for use of certain contracting methods without any systematic decision support tool. Only a small number of STAs analyze the benefits of using contracting methods that accelerate project completion.

General conclusions regarding the implementation of ACMs to accelerate project completion are as follows:

- Some states have given special attention to alternative contracting by setting up specific groups within their agencies that focus on implementation and use of these methods.
- Few systematic selection processes are used to guide the selection and implementation of ACMs.
- Those processes that have been identified do not necessarily focus exclusively on project acceleration but consider time as a factor in the selection process.
- Few agencies perform a systematic analysis of the benefits derived from the use of contracting methods to accelerate project completion.
- Every contracting method has advantages and disadvantages to consider.
- Selecting a contracting method is complex because there are numerous interrelated factors to be considered.

Although specific recommendations were not requested in the survey, the authors are suggesting, based on the general findings, areas where improvements in the evaluation and use of ACMs to accelerate project completion may be of interest to the industry:

- STAs may consider establishing a business unit if increased use of ACMs is desired. Eleven states already have moved in this direction. A potential benefit may be an effort to increase the use of higher-impact methods such as design–build and incentives/disincentives, or perhaps to develop guidance for implementation of various methods to accelerate ACMs.
- STAs could consider the development and use of a systematic process as a decision support tool to aid in the selection of ACMs with the specific objective of project acceleration. This tool could aid decision makers in selecting contracting methods that better fit the project requirements, conditions, and objectives.
- STAs can be encouraged to document implementation results and analyze the results to identify the benefits associated with the use of ACMs to accelerate project completion. Demonstrating benefits with respect to measures such as schedule, cost, quality, and safety can promote more appropriate use of ACMs.

These suggestions may lead to improved use of ACMs to accelerate project completion.

CHAPTER ONE

INTRODUCTION

BACKGROUND

To promote accelerated project delivery, reduce overall cost, and assure that the constructed facilities meet quality and safety standards, many state transportation agencies (STAs) have started implementing alternative contracting methods (ACMs). The implementation of alternative contracting in the Federal-Aid Highway Program began in the early 1980s. At that time, FHWA allowed the states to evaluate incentive/disincentive (I/D) provisions for early contract completion through National Experimental Project and Evaluation No. 24. This program resulted in a change in FHWA policy, which had previously prohibited participation in bonus payments for early completion.

In 1988, a TRB task force was formed to evaluate innovative contracting practices. This task force requested that FHWA establish a project to evaluate and validate the findings of *Transportation Research Circular 386*, *Innovative Contracting Practices* (1991). In response, FHWA initiated Special Experimental Project No. 14 (SEP-14)—Innovative Contracting ("Briefing . . . " 2007). This experimental program has allowed the states to evaluate promising contracting techniques that do not fully comply with FHWA's construction contracting statutory requirements but still provide for open competition.

The primary innovative practices originally approved for evaluation under SEP-14 were cost-plus-time bidding, lane rental, design–build contracting, and warranty clauses. After a number of evaluation projects utilizing cost-plus-time bidding and lane rental contract provisions, FHWA declared these techniques to be operational May 4, 1995. Later that same year, FHWA published an Interim Final Rule (August 25, 1995) for warranties. This policy allowed the states to use warranty contract provisions for specific construction products or features on National Highway System projects.

After allowing the states to evaluate the design–build project delivery method on an experimental basis for more than 10 years, FHWA issued a December 10, 2002, Final Rule making design–build contracting an allowed project delivery method (U.S. DOT 2002). On October 6, 2004, FHWA established Special Experimental Project No. 15 to encourage tests and experimentation in the use of public–private partnership (PPP) projects ("New . . . " 2004). This program is intended to increase project management flexibility, foster innovation, improve efficiency, and support new project revenue streams. In an August 14, 2007, Final Rule, FHWA issued revised design–build regulations to comply with Section 1503 of SAFETEA-LU. The revised regulation allows states to issue requests for proposals, award contracts, and issue notices to proceed for preliminary design work before the conclusion of the National Environmental Policy Act process. This regulation could accelerate the delivery of large transportation projects pursued under PPPs.

STAs likely have different approaches to selecting ACMs. For example, based on its previous experiences, enabling legislation, and specific needs, an STA would select the method that would be the most beneficial to meeting a project's objectives. However, this process is not always conducted in a methodological manner. The selection process often can be myopic and governed by arbitrary decisions to implement one method over another without a comprehensive assessment of advantages and disadvantages.

Many factors guide the selection of ACMs. Although some factors are easily identified and assessed, others are less so. Even though such assessment can be difficult to conduct, some STAs have experienced personnel who can qualitatively compare ACMs, as well as identify factors that govern the decision to use them. Such personnel can help evaluate the role of these factors in selecting ACMs.

STUDY GOALS AND OBJECTIVES

The overall goals of this study were to summarize the state of practice in selecting ACMs that can accelerate project completion as well as to identify driving factors for selecting one type of alternative contracting technique over another. In this study, accelerated project completion is defined as earlier completion date through faster construction, expedited project development, shorter duration of project closeout, or a combination of these.

The goals were achieved by accomplishing the following objectives:

1. Identify and describe ACMs, including their relationship to accelerated project completion;

2. Identify and evaluate driving factors for the selection of specific ACMs;
3. Identify advantages and disadvantages of ACMs along with problems with implementation and lessons learned;
4. Assess the characteristics and performance of ACMs with respect to their application in highway industry; and
5. Assess the use of systematic processes in the selection and evaluation of ACMs.

STUDY METHODOLOGY

The study methodology was based on three sequential efforts. The first effort focused on the selection of contracting methods typically implemented with the intent to accelerate project completion. Initially, 17 methods were identified from the AASHTO *Primer on Contracting for the Twenty-first Century* (*Primer* . . . 2006). Next, a comprehensive review of the current literature regarding ACMs was conducted. This review focused on the 17 methods and also considered their potential to reduce schedule duration. Finally, an electronic survey including quantitative and qualitative questions was developed and conducted using a website-based survey instrument.

Selection of Methods

The contracting methods studied were taken from the *Primer*, which describes 43 different methods related to contracting. The selection of the methods that were the subject of this synthesis was conducted through an iterative process, described in Table 1.

As indicated, the final selection of contracting methods was derived from different sources. Table 2 categorizes the 19 contracting methods believed to accelerate project completion that were considered in the study.

Literature Review

A comprehensive literature review included printed and online resources such as Transportation Research Information

TABLE 1
SELECTION OF CONTRACTING METHODS

Steps	Description
1	Initially, selected 15 of 43 contracting methods, *Primer on Contracting for the Twenty-first Century* (*Primer*… 2006) thought to accelerate project completion by synthesis authors.
2	Divided the identified methods into three categories: *1*: Directly related to accelerating project completion *2*: Indirectly related to accelerating project completion *3*: May be related to accelerating project completion
3	Requested panel agreement for the first category and their inputs/comments regarding the other two categories.
4	Obtained the panels a greement for the 15 identified contracting methods together with two additional methods suggested by the Panel, making the total 17.
5	Added three other contracting methods based on experience of STAs after receiving the surveys, making the total 19.
6	Consolidated design–build–warrant method with the traditional design–build method based on the panel's suggestions.

Note: Consolidating design–build–warrant with the traditional design–build method reduced the number "Recommended by Authors" to 14.

TABLE 2
CATEGORIZATION OF CONTRACTING METHODS

Recommended by Authors			Recommended by Panel	Indicated by STAs
1	2	3		
Cost-Plus-Time Bidding	Active management payment	Design–build–maintain	Contractor overhead costs	Design sequencing
Design–Build	Construction manager at risk	Early contractor involvement	Alliancing	Lump-sum bidding
Incentives/Disincentives	Flexible notice to proceed	Public–private partnerships		Liquidated savings
Interim Completion Dates	Quality factors			
Lane Rental				
Multi-Parameter Bidding				
No-Excuse Incentives				

Note: The contractor overhead costs method is an expanded version of the unabsorbed home office overhead costs method that is included in the *Primer* (2006). Design–build–warrant is included in the design-build method.

Services, *Transportation Research Records*, and the ASCE and STA websites. Among the documents reviewed, some described the state of practice, and others provided an initial evaluation of the application of ACMs. In addition, several other publications contained information about the comparison of these methods and their impact on measures such as schedule, cost, and quality. Several articles summarized research describing legal issues in regard to applying certain methods in certain states. Guidelines and selection criteria were among other valuable information extracted from STA websites. Analyzing these references provided insight into ACMs, created sound knowledge of existing implementation issues and legal barriers, and established a platform for evaluation of the survey data. A list of existing references regarding each of these alternative contracting techniques is included in Appendix C.

Questionnaire

The electronic survey was designed to gather information on aspects of applying ACMs. The electronic survey distinguished two categories of questions: (1) questions related to the general approach agencies take in application of ACMs and (2) questions related to the experience agencies have with particular methods. These categories are depicted in Figures 1 and 2. As shown in Figure 1, information about the overall application of ACMs was collected in the first part of the survey. The questions posed to STA personnel concerned data collection process, potential implementation barriers, and previous experience, as well as the existence of a separate business unit to manage alternative contracting. The first part of the survey ends with questions about tracking life-cycle performance of the projects. The second part of the survey (see Figure 2) is related to application of specific methods, including enabling legislation, selection influencing factors, implementation problems, advantages and disadvantages, lessons learned, and impacts of each method on project performance.

The survey was designed to include both questions with preselected answers and open-ended questions. Preselected answers were used only when there was some certainty that the suggested answers adequately represented the range of likely answers. The option to add an answer was provided. Open-ended questions were used when there was uncertainty as to the anticipated answer. The survey allowed respondents to add up to two additional contracting methods their agencies had implemented beyond the initial methods covered in the survey. A version of the questionnaire is provided in Appendix A.

STATE TRANSPORTATION AGENCY PARTICIPATION

The survey was distributed to the members of the AASHTO Subcommittee on Construction in all 50 states, the District of Columbia, and Puerto Rico. Two follow-up requests were made to nonrespondents asking them to participate in the survey. Other follow-up requests were made to selected survey respondents to collect documents regarding application of particular methods or processes implemented by STAs.

Thirty STAs responded to the survey, as shown in Figure 3. Some STAs may not have responded to the survey owing to differing interpretations of the term "alternative contracting method." For example, one STA staff person did not view cost-plus-time and lane rental as ACMs, only as contract stipulations that are bid to expedite the work. To clarify responses further, the last request for participation included a list of the 17 methods covered in the survey with their descriptions taken from the *Primer*.

ANALYSIS APPROACH

The analysis approach focused first on the frequency of implementation. The expectation was that those methods likely to accelerate project completion would have the highest implementation frequency. Based on this assumption, three categories of implementation were established to represent the collected data. Frequencies were calculated when quantitative answers were provided. Histograms were developed to show these data. In the case of open-ended questions, answers were categorized where possible. When more than one agency provided a similar response, frequency of citing the similar response was noted. Open-ended question responses were summarized in tabular format with supporting text as well as with written text capturing key thoughts provided by STAs. Along with the data extracted from surveys, existing literature was used as supporting evidence in the analysis.

REPORT ORGANIZATION

This report is composed of five chapters. The first chapter introduces the subject area and covers scope, objectives, and study methodology. Chapter two discusses organizational barriers and the use of enabling legislation as a precursor to describing the different contracting methods used by STAs. This chapter also presents perceived advantages and disadvantages of each contracting method. Chapter three presents key influencing parameters in selection of these contracting methods and their impact on project duration, cost, and quality. Implementation problems and lessons learned are highlighted. Chapter four covers issues regarding existing systematic processes for selection of ACMs. Finally, chapter five summarizes the information presented in previous chapters and offers conclusions and recommendations in regard to implementation of ACMs to assist in accelerating project completion.

The appendices provide important supplemental information. Appendix A contains a section of the survey questionnaire on ACMs. Appendix B lists state governmental contacts and the ACMs used in their states. Appendix C provides a bibliography for the ACMs discussed in this study. Finally, Appendix D offers lists of states with legislation for PPP and design–build.

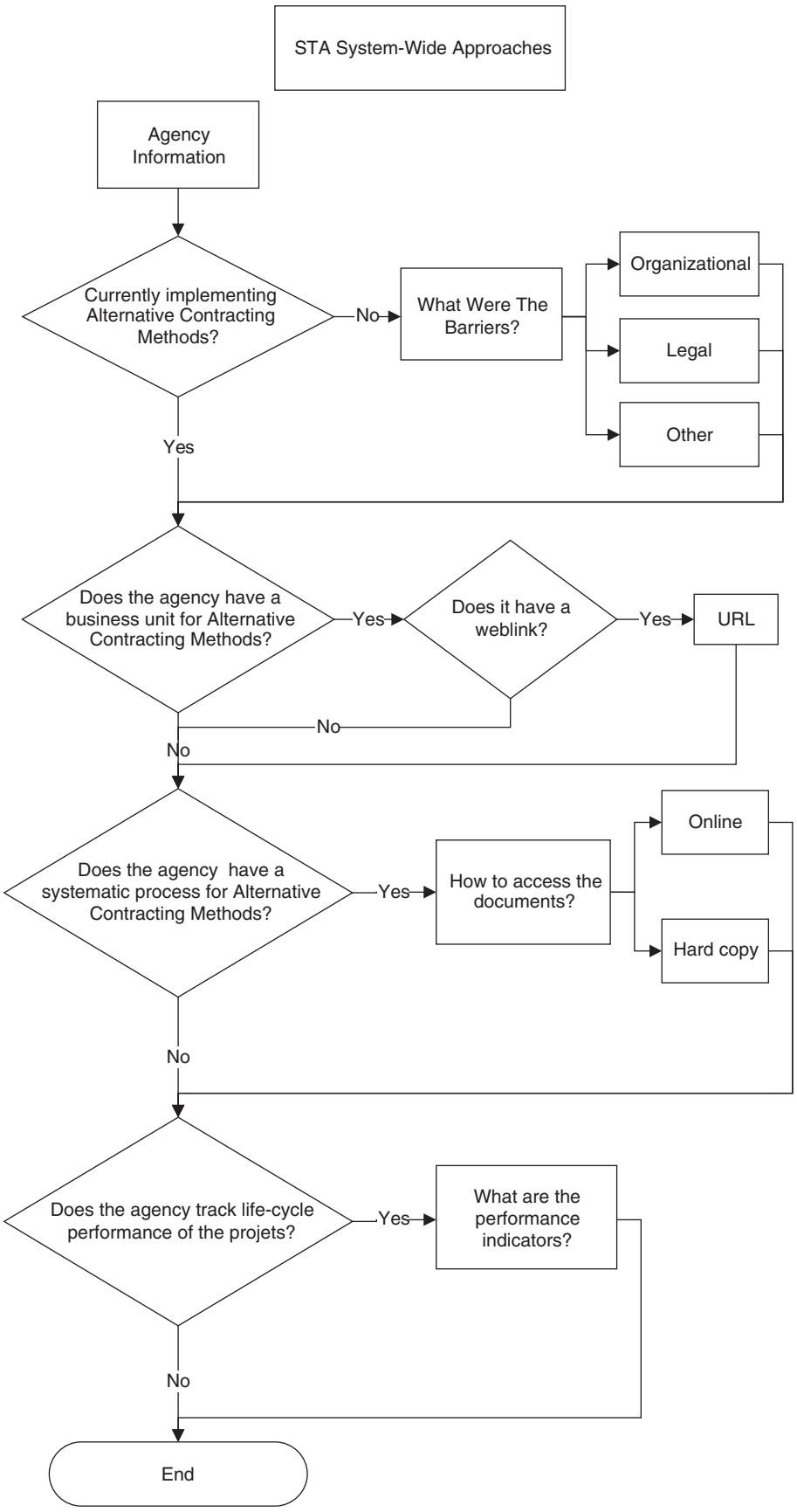

FIGURE 1 Overall application of alternative contracting methods by state transportation agencies.

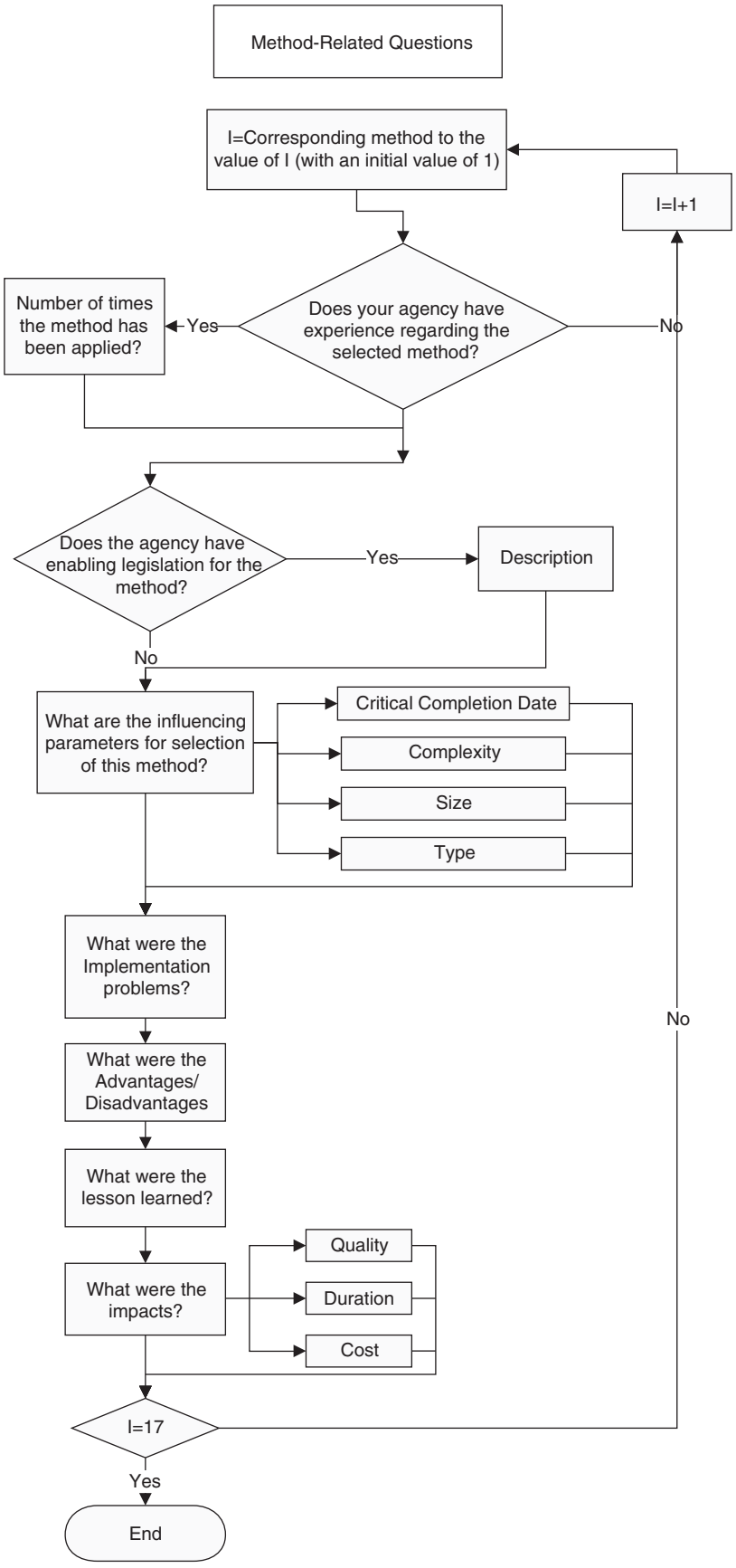

FIGURE 2 Questions related to methods of using alternative contracting methods.

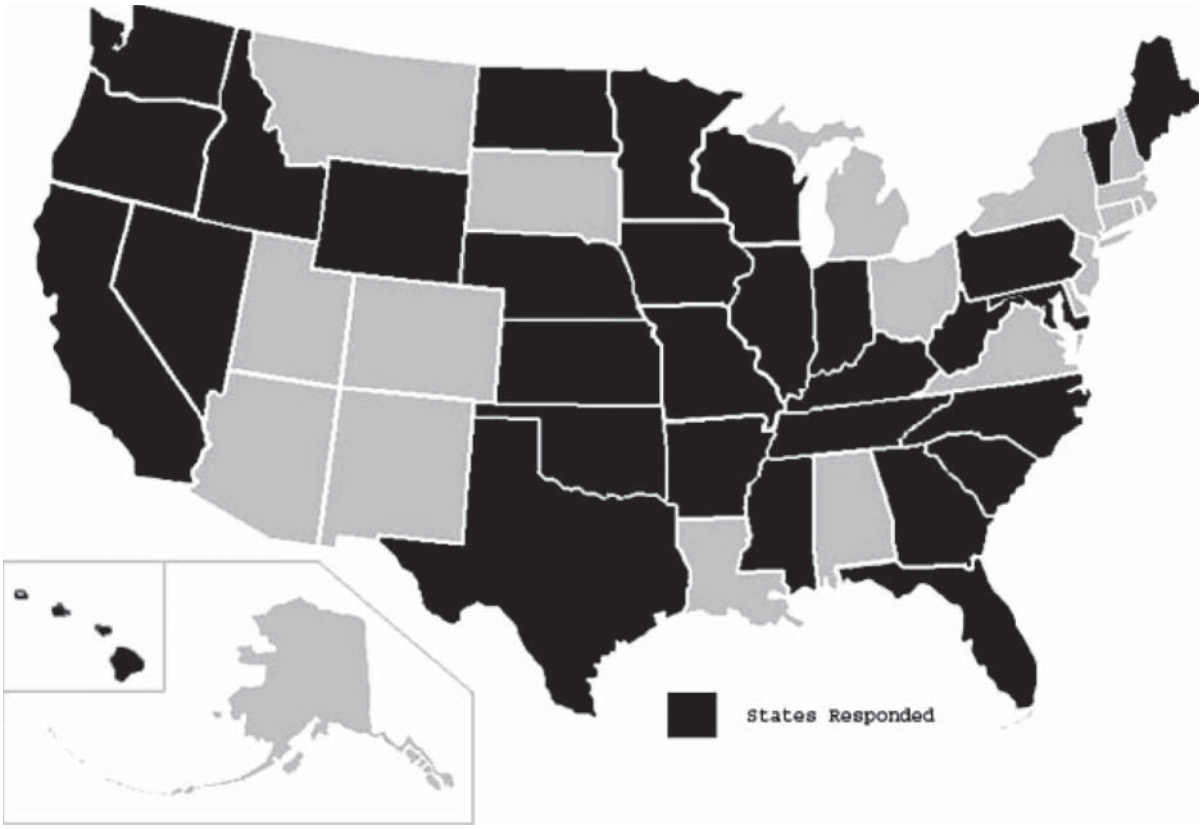

FIGURE 3 States that responded to the survey.

CHAPTER TWO

OVERVIEW OF ALTERNATIVE CONTRACTING METHODS INTENDED TO ACCELERATE PROJECT COMPLETION

INTRODUCTION

Following the introduction of SEP-14 in the 1990s, the use of ACMs in the highway sector substantially increased. These nontraditional contracting methods were documented in the first edition of the *Primer*. Since then, the *Primer* has been regularly updated to reflect new methods as they are developed and implemented by highway agencies around the world. The fifth edition of the *Primer* lists 43 ACMs (2006).

Through the process outlined in Table 1, 17 listed methods were identified as contributing to accelerated project completion. Although some of the selected methods are frequently used by STAs, such as design–build or lane rental, a number of the suggested methods are new and have been implemented only experimentally. Methods such as alliancing and construction manager at risk come from different industries and would likely require modifications to fit the needs of STAs. Regardless of the implementation frequency, to capture a palette of different methods intended to accelerate project completion, the survey included all 17 methods.

ORGANIZATIONAL ISSUES RELEVANT TO ALTERNATIVE CONTRACTING METHODS

Thirty STAs stated that they have used ACMs to accelerate project completion. This represents 100% of the total responses. Survey respondents were also asked to list potential barriers for implementation. Figure 4 summarizes the responses by potential barrier.

Lack of prior expertise was cited as a barrier by 46% of the respondents, suggesting that it was the single most important barrier to implementation. Lack of enabling legislation was cited as a barrier by 30% of the respondents. The remaining 24% identified other issues as barriers to implementation. Table 3 lists the other barriers identified by respondents. Shortage of staff is an issue of concern as many agencies have lost personnel as a result of downsizing and outsourcing many functions. If there is a lack of qualified personal and organizational structure to support the use of ACMs, it is likely that new methods will not be implemented. Indeed, existing alternative methods may not find statewide application without a support structure in place.

Lack of funding was another barrier to more aggressive implementation of ACMs mentioned by the survey respondents. It is generally perceived that the methods to accelerate project completion need additional funding, as project delivery time is tied to more aggressive utilization of resources, hence increased cost. Also, the issue of lack of funding is closely tied to problems such as shortage of staff and lack of support structure.

Enabling legislation allows an STA to expand the number of alternative methods in its toolbox of contracting methods. Florida has the most comprehensive legislation related to alternative contracting. Florida's 2007 Statute 337.025 allows up to $120 million for ACMs in contracts annually. This statute, first passed in 1997, permits the Florida DOT (FDOT) to implement almost any ACM. As a result, Florida has a long history of implementing ACMs. Most other states either reported that legislation was not required for most of the ACMs included in this study or did not mention that enabling legislation was an issue.

The survey respondents have typically listed enabling legislation as a barrier for two types of ACMs: design–build method and PPPs. A summary of the comments related to these two methods is shown in Tables 4 and 5, respectively. As shown in Table 4, the legislation for design–build contracting seems to limit the number of projects and the dollar size of projects that are allowed to use this method. This indicates that design–build remains an emerging ACM that has not yet been fully embraced by all STAs. In 2002, FHWA promulgated regulations governing the use of design–build on federal aid projects.

The use of PPPs is relatively new and poorly understood. There are number of different PPP arrangements that can be, by their nature, very different. Any partnership between public and private sectors in the delivery of a transportation facility can be classified as a PPP. For example, both build–operate–transfer and build–transfer–operate arrangements are considered PPPs; however, they have quite different risk-sharing implications. Ambiguity in the terminology might have affected the survey responses. As shown in Table 5, only five survey participants indicated that there is enabling legislation for PPPs in their states.

According to a survey done by Nossaman Guthner Knox & Elliot, 32 states have specific legislation for design–build projects and 23 states have legislation for PPP projects. The list of these states together with the corresponding legislative statutes is included in Appendix D.

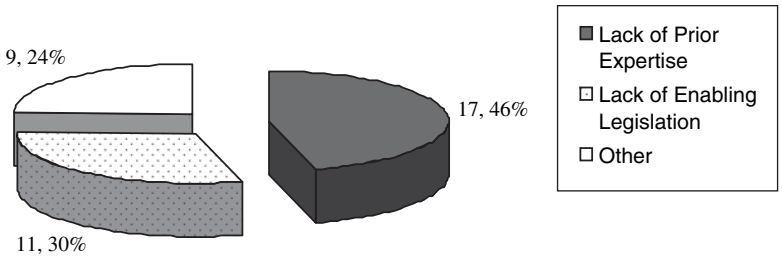

FIGURE 4 Potential barriers to implementation of alternative contracting methods reported by respondent states.

Survey respondents identified specific cases in which legislation was used to promote an individual contracting method. For example, in 1999, the California Department of Transportation (DOT) (Caltrans) received authorization through Assembly Bill 405 to conduct a pilot program with six projects to evaluate the design sequencing method as a tool to accelerate project completion. The program was expanded to 12 projects in 2000, and a second phase was approved in 2004. Minnesota DOT (MnDOT) used legislation to promote early contractor involvement. The MnDOT respondent stated, "We did constructability reviews by contractors early on in the design process on two projects that are being built this year. We will be evaluating this method in the future."

Eleven responding highway agencies have set up an organizational unit to focus on ACMs: California, Florida, Hawaii, Indiana, Minnesota, Missouri, Nebraska, North Carolina, Oregon, Wisconsin, and Washington. Virginia has an organizational unit in this area, but this DOT did not participate in the survey. The purpose of this type of organizational approach is to advance the use of innovative contracting methods within the state.

APPLICATION OF ALTERNATIVE CONTRACTING METHODS

As shown in Table 2, 16 ACMs were selected, 14 by the authors with panel agreement and two added by the panel. The design–build–warrant method was included in the survey, but later combined with the traditional design–build method. Three other methods were added by the survey respondents: design sequencing (California), lump-sum bidding (Wisconsin and Florida), and liquidated savings (Florida). A total of 19 methods are discussed in the remaining sections of this chapter.

TABLE 3
OTHER ORGANIZATIONAL BARRIERS TO USE OF ALTERNATIVE CONTRACTING METHODS

Barriers	Frequency Cited
Shortage of staff, structure	3
Lack of adequate funding	2
Adherence and familiarity with known and proven methods	1
Employee union opposition	1
Inexperience of contracting community	1
Lack of demand considering the type of projects	1
Lack of leadership for innovative actions	1
Size of contracts	1

Note: Several STAs listed more than one barrier.

The survey was used to determine the level of application of each method. The STA respondent was first asked to state whether the method had been implemented in the state. If the answer was yes, the respondent was asked to identify the number of times the method had been implemented. The methods were then separated into three categories based on the number of STAs that have implemented them. This categorization approach was taken to clearly highlight those methods that have widespread implementation and are perceived to have high impact on project completion time. The four categories are:

- Methods with high implementation frequency—16 or more STAs use these methods.
- Methods with medium implementation frequency—6 to 15 STAs use these methods.
- Methods with low implementation frequency—1 to 5 STAs use these methods.
- Methods not used.

As previously mentioned, the respondents have also reported the application frequency if the method was implemented. Figure 5 summarizes the application frequency of the methods. Clearly, the I/D method has the highest implementation frequency; all respondents reported implementing the method and 90% have reported using the method more than 10 times. Interim Completion is the second most frequently implemented ACM as reported in the survey. Ninety percent of all respondents reported using this method and 70% have used the method more than 10 times. Just one STA has implemented Practical Methods for UHOOC, a method that has a very high implementation frequency in that STA.

A description of these methods, as defined by the *Primer*, together with their extent of use and the perceived advantages and disadvantages of each method, is presented based on responses from surveys and support from the existing literature when appropriate. The perceived advantages and

TABLE 4
ENABLING LEGISLATION FOR DESIGN–BUILD

State	Legislation
Arkansas	Legislation was passed in 2003, but no projects have been done.
Florida	Major design–build contracts (cost more than $10 million) are allowed under Statute 337.11(7) and are not included in the $120 million statutory cap. Minor design–build contracts less than $10 million in cost are allowed under Statute 337.025.
Georgia	Needed legislation to allow qualification-based selection. Several jobs were done strictly based on low bid prior to the legislation.
Hawaii	Falls under competitive sealed proposal process.
Maine	In 1997, the legislature approved a bill to allow design–build for a specific project (Sagadahoc Bridge); in 2001, the legislature approved another bill allowing design–build to be used at the discretion of the Commissioner of the Maine DOT.
Minnesota	Special legislation in 2001 allowing best value.
Mississippi	Allows for two projects less than $10 million and one more than $50 million per year.
Missouri	Allows for three design–build projects as a pilot.
North Carolina	Allow 25 projects per year.
Oregon	Oregon Revised Statutes, Chapter 279, allows best value contracting.
South Carolina	Challenged in court and had legislation clarified to allow design–build.
Texas	Transportation Code, Section 223.203.
Virginia	Code of Virginia Reference § 33.1–12.
Washington	Legislation authorizes Washington State DOT (WSDOT) to utilize design–build on projects more than $10 million and also five pilot projects between $2 and $10 million.
West Virginia	Recently passed legislation will allow this agency to perform three design–build projects. The first one has been awarded recently.

TABLE 5
ENABLING LEGISLATION FOR PUBLIC–PRIVATE PARTNERSHIPS

State	Legislation
California	Passed Assembly Bill 680 in 1989 to allow the department to pursue four PPP projects. Only two projects reached construction.
Florida	Statute 334.30, as amended in 2004, allows financial assistance from the private sector to advance projects programmed in the adopted 5-year work program using funds provided by PPPs or private entities to be reimbursed from Department of Transportation funds for the project as programmed in the adopted work program.
Missouri	Allowed to pilot three projects.
Virginia	Law passed in 1995.
Washington	Substitute House Bill 1541, passed in 2005, allows solicited and unsolicited projects after a process for evaluation is developed by WSDOT, based on a timetable in the law.

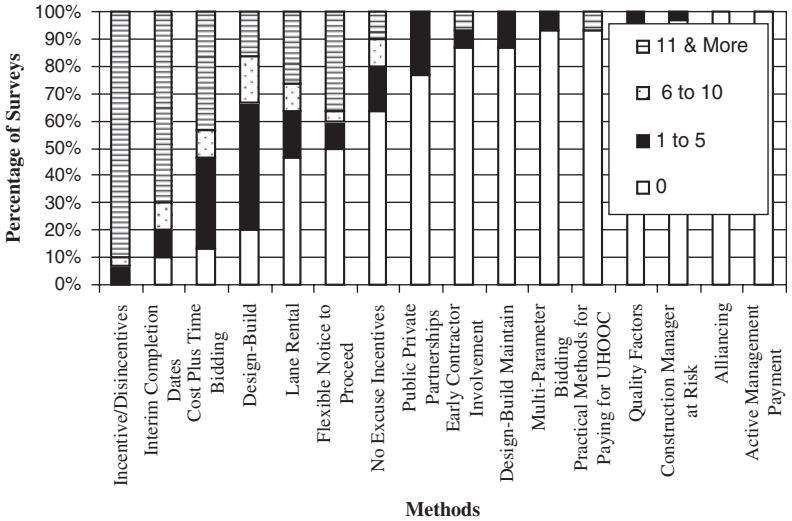

FIGURE 5 Frequency of application of alternative contracting methods.

disadvantages are categorized as schedule-related, cost-related, and other. When a perceived advantage or disadvantage was cited by more than one respondent, the frequency of citation is shown in parentheses after the statement. Because these contracting methods were applied to different types of projects and under different sets of constraints, it is possible to have contradictory views regarding perceived advantages and disadvantages of the implemented techniques.

In practice, the combination of these alternative methods is also used to achieve specific goals. For example, to maximize contractor benefits while minimizing road user disturbance, I/Ds are used with lane rental. Similarly, to ensure being on schedule, I/Ds are combined with cost-plus-time bidding. Further, to promote application of innovative construction methods and ensure the quality of the project while minimizing road user costs (RUCs), I/D or warranties, and sometimes both, are often used with the design–build method.

A discussion of implementation follows, organized by the categories of use: high, medium, low, and none. For each ACM a summary includes a general description of that method extracted from the *Primer* and more specific data on frequency of use. In tabular form, the perceptions of advantages and disadvantages of the method that were reported by the STAs, if any, are categorized as schedule-related, cost-related, and other, and literature support is provided where relevant.

Methods with High Implementation Frequency

Five ACMs were used by 16 or more STAs (Table 6). These are I/Ds, interim completion dates, cost-plus-time bidding, design–build, and lane rental.

Incentives/Disincentives

> I/D provisions for early completion are intended to motivate the contractor. They allow a contracting agency to compensate a contractor a certain amount of money for each day identified that critical work is completed ahead of schedule and assess a deduction for each day the contractor overruns the I/D time. The contracting agency specifies the time required for critical work and uses this provision for those critical projects where traffic inconvenience and delays are to be held to a minimum. I/D amounts are based on estimates of such items as traffic safety, traffic maintenance, and RUC (*Primer* . . . 2006, p. 18).

All 30 agencies responding to the survey have used I/Ds. Two agencies (6.7%) applied this method fewer than five times, one (3.3%) used I/Ds five to 10 times, and 27 (90.0%) applied this method more than 10 times.

Based on survey input, a summary of the perceived advantages and disadvantages of implementing I/Ds is presented in Table 7. The main advantage of I/Ds is that they promote faster project completion. Another potential advantage might be a reduction in construction engineering inspection costs owing to shorter construction schedules. Respondents cited several disadvantages. There is some indication that construction costs would increase when incentives were used. However, this increase in cost may be acceptable if accompanied by a reduction in RUC as a result of early project completion. Other disadvantages relate to the potential for reduced quality if an accelerated schedule is deemed more important. There may be an increase in problems owing to utility conflicts, potential for contractor change orders, and contracting adjustments to bidding practices to neutralize the potential impact of disincentives.

This method, like many of the methods that accelerate project completion, has administrative challenges for STAs. For example, conflicts over delays caused by unforeseen circumstances may require onsite timely decision making to avoid potential for change orders. There may be increased requirements for field inspections to verify completion dates. Finally, clear contract language needed concerning I/D clauses may require more time for preparing and reviewing contract documents.

Perceptions that appear in Table 7, extracted directly from the survey response, indicate that conflicting ideas exist

TABLE 6
ALTERNATIVE CONTRACTING METHODS BY LEVEL OF USE

High Use (≥16)	Medium Use (6–15)	Low Use (1–5)	No Use (0)
Incentives/Disincentives	Flexible notice to proceed	Early contractor involvement	Alliancing
Interim Completion Dates	No-excuse incentives	Design–build maintain	Active management payment
Cost-Plus-Time Bidding	Public–private partnerships	Multi-parameter bidding	
Design–Build		Contractor overhead costs	
Lane Rental		Quality factors	
		Construction manager at risk	
		Lump-sum bidding	
		Design sequencing	
		Liquidated savings	

TABLE 7
PERCEIVED ADVANTAGES AND DISADVANTAGES OF INCENTIVES/DISINCENTIVES

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• Project acceleration (4) (Arditi et al. 1997) • Contractor strives to complete the project on time (7) • Early project completion (4) (Arditi and Yasamis 1998; Jaraiedi et al. 1995)	• Not a guarantee that work will be completed sooner
Cost-Related	• Reduced construction and construction engineering inspection costs (Shr et al. 2004)	• Increased cost, however must be balanced with saving to public • On smaller projects where traffic volume is low, the justifiable road user costs, which are used to calculate incentives/disincentives, may be so low that the contractor simply adds money to their bid to cover the cost of disincentives, never planning to meet the desired milestone dates.
Other	• Enhanced safety	• Lack of funding • Negligence toward other projects to get the incentives • Unforeseen problems • Schedule may win over quality (2) • Increase in contractor disputes regarding extra work • Risk of bidding in the full disincentive if not enough competition or unrealistic schedule • Coordination of utilities • Bids can be adjusted to neutralize any disincentive • If the program is oversaturated with time-critical projects, then the DOT and contractor personnel become burned out

Note: Numbers in parentheses indicate the frequency of citation of the advantage or disadvantage.

regarding the application of a single innovative contracting method. This apparently contradictory input is likely as a result of differences in project specifications, the STA experience implementing the method using these specifications, and the respondents' own opinions.

Interim Completion Dates

> Interim completion dates are a means of encouraging early completion of a specific phase of a contract such as a ramp, an interchange, or another component of a larger construction contract. The particular phase or component should be selected with great caution as this will impact the scheduling of the overall project (*Primer* . . . 2006, p. 19).

Of the 30 participating agencies, three (10.0%) indicated they have never used this method, three (10.0%) applied this method fewer than five times, and three (10.0%) have used interim completion dates five to 10 times. The majority of agencies (21 or 70.0%) have implemented this method more than 10 times.

Table 8 presents a summary of the perceived advantages and disadvantages of implementing interim completion dates. The main schedule advantage is that interim completion dates provide opportunities to open certain portions of a project earlier and help maintain the planned schedule. One respondent believed that project acceleration can be achieved using this method. The STA would have to set aggressive milestone dates to achieve this acceleration. However, interim completion dates do not ensure that the project will be completed on time, and this is indicated as a disadvantage. There are opposing views on the cost impact. User costs may be reduced if project segment completion can occur early, especially for those segments sensitive to traffic.

Cost-Plus-Time Bidding

> Cost-plus-time bidding, more commonly referred to as the A+B method, involves time, with an associated cost, in the low bid determination. Under the A+B method, each bid submitted consists of two components: (1) the "A" component is the traditional bid for the contract items and is the dollar amount for all work to be performed under the contract; and (2) the "B" component is a "bid" of the total number of calendar days required to complete the project, as estimated by the bidder. Calendar days are used to avoid any potential for controversy that may arise if work days are used. The bid for

TABLE 8
PERCEIVED ADVANTAGES AND DISADVANTAGES OF INTERIM COMPLETION DATES

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• Project acceleration • Contractor strives to complete the project on time • Keep project on schedule • Owner control to structure the timing of the work • Portions of project are opened earlier (5)	• Not a guarantee that work will be completed on time (2)
Cost-Related	• Reduced construction and construction engineering inspection costs • Decrease in user costs	• Increased cost (2)
Other	• Meet critical dates for environmental controls • Enhanced safety • Proactive approaches by contractors • Decrease in user inconvenience • Keep the focus on the impact to the traveling public • Accommodates local traffic flow/opens critical phases of the project • Reduce interference of traveling public	• Increase in contractor disputes and claims (3) • Risk of bidding in the full disincentive if not enough competition or unrealistic schedule • Adding work to the interim completion date by change order (2) • Requires more care in monitoring the projects critical path

Note: Numbers in parentheses indicate the frequency of citation of the advantage or disadvantage.

award consideration is based on a combination of the bid for the contract items and the associated cost of the time, according to the formula:

$$\text{Bid Award Cost} = A + (B \times \text{Road User Cost/Day})$$

This formula is used only to determine the lowest bid for award and is not used to determine payment to the contractor. The contractor's estimate for the completion of critical work becomes the contract time, and an I/D provision is usually used to keep the bidding playing field level. For critical projects that have high road-user delay impacts, the A+B bidding method can be an effective technique to significantly reduce these impacts. After a 5-year evaluation period under SEP-14, A+B bidding was declared operational on May 4, 1995, and is no longer considered to be experimental (*Primer* . . . 2006, p. 13).

Four agencies out of 30 (13.3%) indicated that they have never used A+B bidding. Ten agencies (33.3%) applied this method fewer than five times, and three (10.0%) used it five to 10 times. Thirteen agencies (43.4%) implemented the A+B method more than 10 times.

The perceived advantages and disadvantages of implementing cost-plus-time bidding are described in Table 9. A major advantage is acceleration of the construction schedule. Schedule reduction is often improved through the use of incentive schemes along with this method. The cost of these projects tends to be higher and thus a disadvantage. Further, it is difficult to determine realistic RUC for the time element. Other disadvantages may include increased attention to agency decision making when possible changes are uncovered, such as utility conflicts, and ensuring that quality is not compromised in pursuit of incentives when incentives are used in conjunction with A+B bidding.

Design–Build

The design–build concept allows the contractor maximum flexibility for innovation in the selection of design, materials, and construction methods. With design–build procurement, the contracting agency identifies the end result parameters and establishes the design criteria. The prospective bidders then develop design proposals that optimize their construction abilities. The submitted proposals may be rated by the contracting agency on factors such as design quality, timeliness, management capability, and cost (*Primer* . . . 2006, p. 14).

Among 30 participating agencies, 12 (40.1%) indicated that they have never used design–build, 10 (33.3%) applied this method fewer than five times, and four (13.3%) used design-build five to 10 times. Four agencies have implemented this contracting method more than 10 times (13.3%).

Table 10 describes the perceived advantages and disadvantages of implementing design–build. The most substantial advantage is project time savings. This is likely because the contractor is overlapping design and construction, but may also be because the designer is designing for a known contractor rather than for open bidding. Respondents stated that there seems to be a reduction in in-house administration costs; however, there may be a risk of increased costs owing to increased risk exposure for the design–build contractor. There is some agreement that design–build may reduce change orders and also claims. However, agency loss of control over the design was considered a disadvantage.

Some agencies have combined the conditions of a warranty clause with a design–build contract. As noted in the *Primer*, "This technique seems to work well with intelligent transportation system projects that incorporate technological features

TABLE 9
PERCEIVED ADVANTAGES AND DISADVANTAGES OF COST-PLUS-TIME BIDDING

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• Project acceleration (Herbsman and Ellis 1992; Anderson and Russell 2001; Battelle 2003) • Shortest project duration (Herbsman 1995) • Ability to earn incentives	• When used, two different sets of rules govern the time charges • Pay extra to be later than original contract time
Cost-Related	• Reduced construction and construction engineering inspection costs (Shr et al. 2004; El-Rayes 2001) • Limits user costs • Induce best value	• Hard to develop costs for time charges that are realistic • Higher costs than traditional bidding • Balancing construction costs and user costs • Additional inspection and testing personnel onsite (Battelle 2003)
Other	• Enhanced safety • Limits public inconvenience and traveling public • Contributes to contractor creativity (Battelle 2003) • Requires the contractor to take full advantage of their resources	• Focusing on achieving incentives will affect the quality of work • Leads to claims • Requires more attention of owner; that is, an increased level of resources (Battelle 2003) • Utility conflicts may cause delays • Adds a layer of risk on the contractor • Ensuring fair competition amongst bidders • Requires a good set of contract documents • Limit the number of contractors (Battelle 2003)

Note: Numbers in parentheses indicate the frequency of citation of the advantage or disadvantage.

TABLE 10
PERCEIVED ADVANTAGES AND DISADVANTAGES OF DESIGN–BUILD

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• Project acceleration and time saving (5) (FDOT 2007; Konchar and Sanvido 1998; Construction Industry Institute 1997) • Sooner construction completion (2) (Songer and Molenaar 1996, 1997; Molenaar and Songer 1998)	
Cost-Related	• Reduced construction and construction engineering inspection costs (Paek et al. 1992) • Reduced in-house administrative costs	• Higher construction costs owing to increased risk exposure for the design–builder • Uncertainty over cost of risk assigned to design–builder
Other	• Reduced change orders (2) • Reduced construction claims (2) • Contractors in control • Inclusion of innovative ideas and a shortened design and construction duration • Shifting design errors to contractor • Contractor innovation • Improved quality (Battelle 2003) • Resource leveling	• Agency was not involved in all phases leading to a loss of owner's control over the project design and funding (4) • Fewer bidders because of the involved risk • Shifting the majority of the QC functions from DOT to contractor. (Palaneeswaran and Kumaraswamy 2000) • Low safety measures (Ernzen et al. 1999); more minor accidents versus fewer major accidents) • Warranties can be difficult to enforce. Many factors go into long-term performance and this may lead to exceptions in warranties.

Note: Numbers in parentheses indicate the frequency of citation of the advantage or disadvantage.

where the contracting agency would benefit from a limited warranty for workmanship, materials and system functionality" (2006).

Among the 30 participating agencies, 24 (80.1%) indicated that they have never used this method. Four agencies (13.3%) applied this method fewer than five times, one (3.3%) used it five to 10 times, and one (3.3%) applied this method more than 10 times. The perceived advantages and disadvantages were the same as the design–build method, with the additional perceived advantage that quality may be improved by using a warranty.

Lane Rental

The objective of the lane rental concept is "to encourage contractors to minimize road-user impacts during construction" (*Primer* . . . 2006, p. 20). Under this concept, "a provision for a rental fee assessment is included in the contract" (*Primer* . . . 2006, p. 20). In other words, in this contracting method the lanes are "rented" to the contractor for the time period needed to construct the project. Estimated project duration is submitted by the contractor with other bid documents. If the contractor finishes the project during the specified time period, a rental fee is not charged; however, if the contractor requests additional days to finish the project, a rental fee is applied: "The lane rental fee is based on the estimated cost of delay or inconvenience to the road user during the rental period. The fee is assessed for the time that the contractor occupies or obstructs part of the roadway and is deducted from the monthly progress payments" (*Primer* . . . 2006, p. 20). Agencies have approached the amount of rental fee rates in the bidding process in different ways:

> The rental fee rates are stated in the bidding proposal in dollars per lane per time period, which could be daily, hourly, or fractions of an hour. For many early lane rental projects, neither the contractor nor the contracting agency gave an indication as to the anticipated amount of time for which the assessment would apply, and the low bid was determined solely on the lowest amount bid for the contract items. However, Indiana and Florida have included the lane rental bid in the determination of the low bid similar to A+B bidding (*Primer* . . . 2006, p. 20).

Fourteen of the 30 responding agencies (46.6%) indicated that they have never used lane rental. Five (16.7%) applied this contracting method fewer than five times, and three (10.0%) used lane rental five to 10 times. Eight agencies (26.7%) applied lane rental more than 10 times.

A summary of the perceived advantages and disadvantages of implementing lane rental is provided in Table 11. The most substantial benefit of lane rental is reduced impact on traffic during construction. This reduced impact in turn may reduce RUC.

Methods with Medium Application Frequency

As shown in Table 6, three ACMs were used by more than five but fewer than 16 STAs. These are flexible notice to proceed, no-excuse incentives, and PPPs.

Flexible Notice to Proceed

> For small, noncritical projects, such as certain rural bridge replacement projects, the North Carolina DOT (NCDOT) establishes the number of calendar days required to complete the project once work starts. The contractor is given a window of up to 6 months to start work. Contractors seem to like this flexibility as it allows them to utilize their resources better. NCDOT also recently used this concept in letting a large number of guardrail projects where they were concerned about enhancing the competition from a limited number of guardrail contractors (*Primer* . . . 2006, p. 17).

Fifteen agencies (50.0%) indicated that they have never used this method. Three (10.0%) have applied this method fewer than five times; one (3.3%) used the method between five and 10 times, and 11 (36.7%) used this method more than 10 times.

A summary of the perceived advantages and disadvantages of implementing flexible notice to proceed is provided in Table 12. The major advantage is that the contractor can improve efficiencies in scheduling the work and can coordinate it with other work. This approach may lead to more and better bids.

No-Excuse Incentives

> The Florida DOT has used No-Excuse Bonus contracts to give the contractor an incentive to complete the contract work

TABLE 11
PERCEIVED ADVANTAGES AND DISADVANTAGES OF LANE RENTAL

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• Project acceleration (Herbsman and Glagola 1998; Lee et al. 2005)	• Not necessarily shorten overall time of construction
Cost-Related	• Limits user costs	• Difficult to calculate rental rate • Increases construction costs
Others	• Enhanced safety • Reduce traffic impact (9)	• Work at night (2) • Worker safety issues • Leads to claims and dispute • Extra documentation and coordination

Note: Numbers in parentheses indicate the frequency of citation of the advantage or disadvantage.

TABLE 12
PERCEIVED ADVANTAGES AND DISADVANTAGES OF FLEXIBLE NOTICE TO PROCEED

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• Contractors can systematically schedule their work resulting in efficiencies (6) (Anderson and Ullman 2000)	• No specific start date for work to begin
Cost-Related	• None identified	• None identified
Other	• Agency reduced overhead • Get better bids • Get more bids • Encourages competition (Federal Highway Administration and American Association of State Highway and Transportation Officials 2005)	• Fuel adjustments and asphalt binder adjustments could cost the DOT more depending on the fluctuation in prices.

Note: Numbers in parentheses indicate the frequency of citation of the advantage or disadvantage.

> on time. The contractor is given a "drop-dead date" for completion of a phase of work or the entire project. If the work is completed in advance of this date, the contractor will receive a bonus. There are no excuses, such as weather delays, for not making the completion date. On the other hand, there are no disincentives (other than normal liquidated damages) for not meeting the completion date (*Primer* . . . 2006, p. 21).

Among the 30 responding agencies, 19 (63.3%) indicated that they have never used this method. Five (16.7%) used this method fewer than five times, and three (10.0%) used no-excuse incentives five to 10 times. This method was used by three agencies (10.0%) on 10 or more projects.

Table 13 describes perceived advantages and disadvantages of implementing no-excuse incentives. The main advantage is faster project completion. However, faster completion may lead to higher costs to cover the risks of unexpected delays.

Public–Private Partnerships

The National Council on Public–Private Partnerships defines a public–private partnership as a

> contractual agreement between a public agency (federal, state, or local) and a private sector entity. Through this agreement, the skills and assets of each sector (public and private) are shared in delivering a service or facility for the use of the general public. In addition to the sharing of resources, each party shares in the risks and rewards potential in the delivery of the service and/or facility ("Public–Private . . ." 2008).

In addition, the *Primer* notes that

> Under the concession approach, a private firm or consortium will design, finance, build (or re-build), operate, and maintain a large-scale transportation project over a long period (typically from 30 to 99 years). For toll-road projects, the project agreement generally includes long-term tolling provisions. In lieu of tolling, the owner also has the option of reimbursing the private firm through predetermined payments over the life of the concession (*Primer* . . . 2006).

Among the 30 participating agencies, 23 (76.7%) indicated that they have never used this method. Seven agencies (23.3%) applied this method fewer than five times. This method has not been applied more than five times.

A summary of the perceived advantages and disadvantages of implementing PPPs is described in Table 14. Time savings is considered possible through the use of this method. PPPs are viewed as one way to increase funding for infrastructure improvements. However, the agency may have less control over the design and construction of the project.

TABLE 13
PERCEIVED ADVANTAGES AND DISADVANTAGES OF NO-EXCUSE INCENTIVES

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• Project acceleration • Faster project completion (2)	• None identified
Cost-Related	• Reduced construction and construction engineering inspection costs	• Increased cost owing to possible risks involved for the contractor
Other	• Enhanced safety • Proactive approaches by contractors • Contractors take more risks	• Negligence toward other projects to get the incentives • Owner's risks • Project claims • Quality

Note: Numbers in parentheses indicate the frequency of citation of the advantage or disadvantage.

TABLE 14
PERCEIVED ADVANTAGES AND DISADVANTAGES OF PUBLIC-PRIVATE PARTNERSHIPS

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• Time savings (Federal Highway Administration 2005)	• None identified
Cost-Related	• None identified	• None identified
Others	• Provide private investment for needed infrastructure (2) (Federal Highway Administration 2005) • Helps inject additional funds into infrastructure im provements (Federal Highway Administration 2005)	• Fewer qualified companies • Less control as an agency

Note: Numbers in parentheses indicate the frequency of citation of the advantage or disadvantage.

Methods with Low Frequency Use

As shown in Table 6, nine ACMs were used by fewer than six STAs. These are early contractor involvement, design–build–maintain, multi-parameter bidding, unabsorbed home office overhead (UHOO), quality factors, construction manager at risk, design sequencing, lump-sum bidding, and liquidated savings.

Early Contractor Involvement

> The British Highways Agency is piloting a hybrid design–build project delivery method known as early contractor involvement (ECI). The Highways Agency selects a contractor/consultant though a purely qualifications-based procurement process. This procurement typically takes place very early in the project delivery process (the equivalent of a state DOT's planning or environmental review process). The contractor/consultant then assists the contracting agency with the development of preliminary designs and environmental reviews, and eventually the final design and construction of the project. [Also, assistance can come in the form of constructability reviews.] The primary advantage of this system is the ability of the owner to incorporate the design–build contractor's knowledge and innovations at a very early point in the project development process. Several contractual incentives based on a target-price system are available to encourage cost-effective design, innovation, and high quality in design and construction (*Primer* . . . 2006, pp. 15–16).

It is important to note that a number of variants of this method exist, which contributes to ambiguity of the term and could have affected the survey responses. The literature review indicates that none of the states use this method in the original form as used in the United Kingdom and defined in the *Primer*. This is believed to be because responding states interpreted this method to be constructability review, which is not related to accelerating project completion.

Twenty-six of the 30 participating agencies (86.6%) indicated that they have never used early contractor involvement. Two agencies (6.9%) applied this method fewer than five times, and two (6.7%) applied this method more than 10 times. This high level of reported use is probably the result of misinterpretation of this method by some states.

A summary of the perceived advantages and disadvantages of implementing early contractor involvement is described in Table 15. Early contractor involvement may result in lower-cost projects. Contractor input and experience may result in preparing a better set of plans and sequence of construction.

Design–Build–Maintain (Operate)

> Several states have initiated design–build–maintain projects. The Transportation Corridor Agencies in California used this concept on several toll-road projects including the San Joaquin Hills Corridor, Eastern Transportation Corridors, and Foothill Transportation Corridors. These three corridors provide more than 60 mi of new freeways at a cost of approximately $2.5 billion. California Assembly Bill 680 provided the legal authority

TABLE 15
PERCEIVED ADVANTAGES AND DISADVANTAGES OF EARLY CONTRACTOR INVOLVEMENT

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• None identified	• None identified
Cost-Related	• Project may be completed for a lower cost	• None identified
Other	• Obtain varied insights on how to build project better • Better set of plans and sequence of construction	• Takes additional effort/time from DOT and contractor personnel • Difficult to incorporate the comments into the plans

> and financing for several toll roads that will use the plan, design, finance, construct, and lease-back method of procurement and ownership. This concept has also been utilized on toll-road projects in Colorado, Texas, and Virginia (*Primer* . . . 2006, p. 14).

Twenty-six agencies out of 30 (86.7%) indicated that they have never used this method. Four (13.3%) agencies applied this method fewer than five times. This method has not been applied more than five times.

The only discussion comment for this method concerned obligating the contractor to a project after the project is complete, which was considered a disadvantage.

Multi-Parameter Bidding

> Similar to cost-plus-time bidding, this concept requires bidders to bid the cost for completing the work (A), the time for completing critical work (B), which is optional, and the level of quality or performance that would be achieved over a specified period of time (Q). A warranty bond or a method of making payment in future years would be necessary to implement this contracting approach (*Primer* . . . 2006, p. 21).

Among 30 participating agencies, 28 (93.3%) indicated that they have never used this method, and two (6.7%) applied this method fewer than five times. No advantages and disadvantages were identified for this method.

Alternative Methods for Paying UHOO Costs

"Agencies are often faced with the problem of determining the amount of compensation for overhead paid to contractors due to owner-caused delays" (*Primer* . . . 2006, p. 22). One area is UHOO.

> If a state has the legal authority to pay unabsorbed home office overhead, typically an agency can (1) pay overhead and indirect cost charges as claimed by the contractor, (2) conduct a lengthy and costly audit of the contractor's financial records to establish acceptable compensation levels for these claims, or (3) negotiate with the contractor for a mutually acceptable compensation level. All three of these approaches are inconvenient, costly, and time consuming (*Primer* . . . 2006, p. 22).

Following are other methods for paying contractor overhead costs.

Caltrans, together with its contractor community, developed a new contractual method to more accurately and efficiently provide its construction contractors with timely overhead compensation. Based on this method, an overhead special provision and a time-related overhead (TRO) bid item are used in selected contracts. This overhead payment is based on two different time elements of the contract: (1) the original duration of the work and (2) performance of the work completed under a contract change order. As a result, a pilot program for this special provision was started for the contracts with an estimate of more than $5 million beginning in August 2000 and ending in 2003.

Reasonable differences were observed regarding the number of notices of potential claims for additional overhead compensation between TRO and non-TRO projects. In addition, the data analysis showed that the TRO project participant spent more time in devising alternatives to different time influencing factors on their projects and as a result minimizing the need for time extension of the contract. From a financial view point, implementation of the TRO provision and the corresponding bid item were perceived to be advantageous for the department as it limits the magnitude of the time extensions of the contracts.

From a qualitative perspective, the TRO provision was perceived to be advantageous as well. This is because of its potential to increase the level of active project management, reduce the number of overhead compensation claims, and set limitations for the post-acceptance efforts of resident engineers, construction engineers, auditors, and other experts. However, application of the TRO provision appears to be costly where the execution of construction contracts results in granting significant time extensions (California Department of Transportation 2000).

Among 30 participating agencies, 28 (93.3%) indicated that they have never used this method. Two agencies (6.7%) have applied this method more than 10 times. A summary of the perceived advantages and disadvantages of implementing UHOO is described in Table 16.

TABLE 16
PERCEIVED ADVANTAGES AND DISADVANTAGES OF ALTERNATIVE METHODS FOR PAYING CONTRACTOR OVERHEAD COSTS

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• Can reduce time extensions requested by contractors	• None identified
Cost-Related	• None identified	• None identified
Other	• A way to compensate the delay damage. Not allowed from 2004 (2) (California Department of Transportation 2000) • Contractors bid the time-related overhead (California Department of Transportation 2000)	• Time-consuming analysis • Potential for imbalanced bids

Note: Numbers in parentheses indicate the frequency of citation of the advantage or disadvantage.

Quality Factors

Quality factors may be used to advantage when administering contracts. "Several states have specifications and policies that allow for the use of past performance information, construction quality and contract progress in the contract administration process" (*Primer* . . . 2006).

Among 30 participating agencies, 28 (93.3%) indicated that they have never used this method. Two agencies (6.7%) applied it fewer than five times; it has not been applied more than five times by respondents. The STAs that have used this method indicated that the process is new and they have not yet determined what the advantages and disadvantages are.

Construction Manager at Risk

> The vertical building industry has been using a contracting technique called construction manager at risk for many years. Under this procedure, an owner selects a design and construction management consultant on the basis of qualifications, experience, fees for management services, and prices for the target cost of construction as well as an estimated ceiling price. The consultant then proceeds with the preliminary design. At some point in the design process (typically at the 60%–90% design completion) the owner and the consultant will agree on a guaranteed maximum price for the construction of the project. Many owners favor this contracting technique as it gives them greater control of the design process, yet it still provides for innovation and constructability recommendations during the design phase (*Primer* . . . 2006, p. 11).

Construction manager at risk has been applied by one agency fewer than five times. There were no other reported applications of this method. Although the Arizona DOT (ADOT) did not participate in the survey, comments from a panel member familiar with the ADOT construction program indicated that they have used this method.

Based on the survey, a summary of the perceived advantages and disadvantages of implementing construction manager at risk is described in Table 17. There may be some schedule savings owing from the potential to start construction before completion of design using this method. Contractor involvement in the design process may also reduce cost through preparing more constructible designs.

Design Sequencing

With design sequencing, the agency sequences design activities in a manner that will allow the start of each construction phase when the design for that particular phase is complete, instead of requiring the design for the entire project to be complete before allowing construction to begin. The agency delivers the remainder of the design by predetermined dates after construction has started. To implement design sequencing, the agency develops plans and an estimate to a level sufficient to define the project scope and to allow the contractor to select anticipated subcontractors. The bid documents must contain all anticipated items necessary for the complete design, regardless if final quantities have been determined. Owing to the potential for agency-caused delays in releasing subsequent design sequences, design-sequenced projects typically do not incorporate other time-saving contracting techniques, such as A+B bidding or I/D provisions (*Primer* . . . 2006).

Design sequencing was not initially considered to be an ACM for purposes of the survey. Because it was added by a respondent, the discussion is limited. There may be more states applying this method that did not participate in the survey. The perceived advantages and disadvantages of implementing design sequencing are described in Table 18 and based solely on the response from Caltrans.

Lump-Sum Bidding

In lump-sum bidding, a contractor is provided with a set of bid documents that do not contain detailed quantity tables. The contractor develops quantity take-offs from the plans and estimates a lump-sum price based on this take-off (*Primer* . . . 2006).

This contracting method was submitted by two agencies and is an addition to the list of predetermined ACMs. Because lump-sum bidding was not on the survey instrument, there may be more states implementing this method. The perceived advantages and disadvantages of lump-sum bidding are summarized in Table 19.

TABLE 17
PERCEIVED ADVANTAGES AND DISADVANTAGES OF CONSTRUCTION MANAGER AT RISK

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• Project acceleration (3D/I)	• None identified
Cost-Related	• Reduced design costs, construction, and construction engineering inspection costs • Preconstruction reviews (American Institute of Architects and Associated General Contractors of America 2004)	• None identified
Other	• None identified	• None identified

TABLE 18
PERCEIVED ADVANTAGES AND DISADVANTAGES OF DESIGN SEQUENCING

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• Faster project delivery (National Association of State Highway and Transportation Unions 2007; California Performance Review n.d.)	• None identified
Cost-Related	• None identified	• None identified
Other	• None identified	• Agency retains many risks (California Performance Review) • Potential for construction inefficiency owing to conflicting or overlapping work between the initial sequence and subsequent sequences • Unforeseen site conditions or third-party conflicts during construction may affect ability of a design-sequenced project to generate time savings

TABLE 19
PERCEIVED ADVANTAGES AND DISADVANTAGES OF LUMP-SUM BIDDING

Category	Perceived Advantages	Perceived Disadvantages
Schedule-Related	• During construction, reduces the time spent by field inspectors on measuring quantities and preparing invoices, allowing staff to concentrate on monitoring the quality of the work (Florida Department of Transportation 2001)	• For contracts with multiple lump-sum items, there is the potential for front-end loading
Cost-Related	• Streamlines unit items into bundled items, reducing the administrative burden (e.g., traffic control can be a single pay item, rather than multiple items that must be priced and tracked separately) (Florida Department of Transportation 2001)	• Contractors may add more contingency to bid prices, particularly if there is uncertainty in the estimated quantities for the lump-sum items • Potential that the agency will pay the lump-sum price when total quantities underrun estimated amounts • Changes that affect lump-sum price require more effort than simply adjusting the quantity of a unit-priced item
Other	• During design development, reduces the effort spent by design staff on obtaining detailed computations or quantity take-offs (Florida Department of Transportation 2001) • Creates a built-in incentive for contractors to control costs and work more efficiently • Eliminates requirements for detailed quantity measurements by the DOT, allowing for faster processing of payments, which can lead to improved coordination and cooperation among all the project parties	• The contractor's focus on cost and schedule may compromise quality

Liquidated Savings

Liquidated savings is a process by which the agency pays the contractor a modest incentive for each calendar or working day that the contract is completed ahead of schedule. Liquidated savings tend to be used on projects with limited scope and budget, for which other incentive methods would not be justifiable or affordable. The incentive amount is based on the direct savings to the agency in inspection and contract administration costs.

The advantages and disadvantages of implementing liquidated savings are described in Table 20.

Methods Not Used

None of the survey respondents indicated that alliancing and active management payment methods were used by their agencies. Each method has a general description, extracted here from the *Primer*.

Alliancing

> Alliancing is a form of project delivery that was developed by British Petroleum in the early 1990s. The alliance is formed by the owner, designer, construction contractor, and suppliers to deliver a specific project, based on best value, before the start of

TABLE 20
PERCEIVED ADVANTAGES AND DISADVANTAGES OF LIQUIDATED SAVINGS

Category	Advantages	Disadvantages
Schedule-Related	• Reduces contract administration time, allowing transfer of staff to other projects • Encourages contractors to reduce construction time ("Innovative . . ." 2005)	• None identified
Cost-Related	• None identified	• None identified
Other	• None identified	• Contract changes can lead to disputes regarding incentive payments ("Innovative. . ." 2005) • Incentive amount may not be significant enough to motivate contractors to accelerate ("Innovative…" 2005)

any design work. The alliance takes collective responsibility for project delivery and collective ownership of all project risks, and it shares the risks and rewards of actual project performance. Some key features of alliancing include

- Target pricing with payments based on open book costs;
- All parties in risk and reward;
- All parties win or all parties lose;
- Open and honest relationships; and
- Litigation prohibited by contract (*Primer* . . . 2006).

Active Management Payment

The British Highways Agency has developed a contracting and payment technique called active management payment mechanism (AMPM), which they are evaluating on design–build–finance–operate contracts. The Highways Agency is moving towards a lane availability concept that provides contractors with an incentive to maximize the availability of open lanes. The agency will measure the average speed through the work zone and the actual traffic flow. Incentives will be based on measured travel speed and the measured volumes in comparison with theoretical percentages of roadway capacity.

ADOT implemented a variation of the AMPM concept on the State Route 68 design–build project. ADOT used a contractual provision that required the design–build contractor to measure speed consistency and performance through a 13-mile construction work zone. The contract provided for a $400,000 travel time budget item that would be drawn against if the target travel time average was exceeded. Contractual incentives and disincentives were implemented for performance above or below the contractual standard.

The design–builder [used] an electronic license plate reader system developed by the British company Computer Recognition Systems. This system used a central computer to track speed consistency and performance by correlating license plates numbers of cars that entered and exited the limits of the construction project (*Primer* . . . 2006, p. 8).

ADOT did not participate in the current survey.

SUMMARY

This chapter presented a summary of the methods thought to accelerate project completion and considered in the survey, including perceived advantages and disadvantages. Based on the number of STAs implementing the methods, methods are classified in three categories: high application level (more than 16 STAs have implemented the method), medium application level (6 to 16 STAs), and low application level (fewer than 6 STAs). Two methods were not implemented by the respondents' agencies. The initial assessment indicates that lack of experience, organizational structure, and enabling legislation play an important role in selection and implementation of ACMs. The next chapter presents parameters that influence the method selection process, performance outcomes by each method, and implementation problems, with lessons learned from each method.

CHAPTER THREE

EVALUATION OF ALTERNATIVE CONTRACTING METHODS

INTRODUCTION

Many factors guide STAs in selecting a contracting method to accelerate project completion. This chapter identifies those factors that dominate this decision. The impact of ACMs was captured to some extent by measuring schedule performance. However, with schedule acceleration, project cost is likely to increase, and many will argue that quality may be problematic with an accelerated project schedule. In addition to discussing the performance of the ACMs in terms of project duration, this chapter reviews the effects of the methods on cost and quality performance parameters, as well as implementation problems and lessons learned in practice. This evaluation provides additional insights into the current state of practice of each ACM assessed in this study.

INFLUENCING FACTORS FOR SELECTING ALTERNATIVE CONTRACT METHODS

Based on the literature review, the most frequently cited influencing parameters for selection of ACMs include:

- Project size—typically assessed in terms of the estimated cost of a project in dollars;
- Project type—typically assessed in terms of preservation (seal coats, thin overlays), rehabilitation (thick overlays), reconstruction projects (full replacement), and new construction;
- Project complexity—typically assessed in terms of project location, such as urban or suburban, in combination with a number of different components that defines project complexity, such as a combination of pavement and structures construction, utility conflicts, railroad crossings, significant traffic control requirements, and so forth; and
- Critical completion date—typically assessed in terms of requirements to complete a project faster as influenced by issues such as level of traffic disruption or meeting a target date (e.g., completion before a holiday or within one construction season).

In addition to these four critical influencing factors, the respondents were also given the opportunity to add factors that STA respondents think govern their agency's decisions to select a specific ACM with the intent to accelerate project completion. Following this, each respondent was asked to identify one or more of the factors as a driver in selecting each contracting method. There was no attempt to identify weights for these factors. The data were analyzed by determining the frequency at which a factor was cited by the survey respondents. This approach aided in identifying those factors that had the most substantial influence on selecting ACMs. The most important factor of interest was the critical completion date factor, which would likely rank highest for those methods that impact project acceleration the most. The structure of the sections that follow is based on the high-, medium-, and low-frequency characterization of project implementation, as discussed in chapter two.

Methods with High Implementation Frequency

The data for each of the four selection factors were summarized based on the percentage of respondents citing the factor. As shown in Figure 6, 80% of survey respondents identified critical completion date as the driving factor in selecting contracting methods, except for lane rental. Project complexity was cited as the next most influential factor with responses clustered from 50% to 65%. Moreover, these projects are also associated with high traffic volumes where there is a need to minimize traffic disruption. Lane rental is often used in high traffic volume situations where the agency desires to limit interruption of traffic. These projects are frequently located in urban areas and often characterized by complex construction phasing. Although critical completion date is a driver for the use of lane rental, project complexity appears to be more important in selecting this method.

The data in Figure 6 indicate that project size is not the governing factor for many high-frequency used methods. For example, project size was cited to be a critical factor in selecting the design–build method but only a marginal factor in selecting interim completion date method. This finding is consistent with other data indicating that design–build projects tend to be tied to specific legislation, limiting application of this method to large-scale projects exceeding certain dollar amounts. Alternatively, I/Ds can be used on projects of almost any size; thus, project size was not cited as a highly ranked factor in its selection.

The survey respondents did cite some other factors influencing the contract method selection process. Two factors cited most frequently include projects with a high impact on traffic during construction and those with a potential to affect

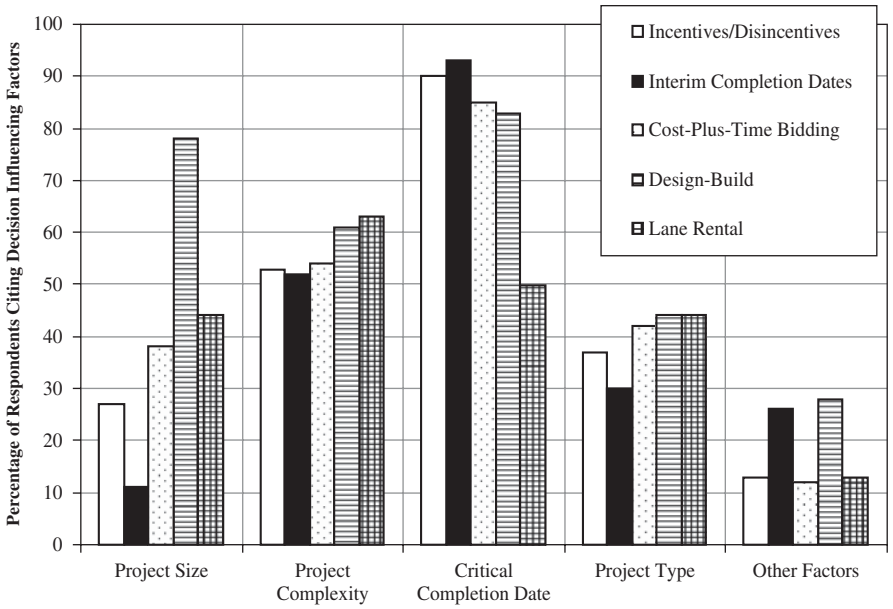

FIGURE 6 Selection factors for methods with high implementation frequency.

local businesses or other property owners. The concept of including these factors is to limit RUC and public inconvenience.

Methods with Medium Implementation Frequency

Among methods with medium frequency of use, the selection of the no-excuse incentive was heavily influenced by the critical completion date factor. On the other hand, the selection of PPPs and flexible notice to proceed was governed by factors other than critical completion. For the PPP contract method, the critical influencing factor was, as expected, project size. PPP projects have typically been high-cost projects where outside funding and financing is required. The critical factor for flexible notice to proceed was project type. As anticipated, critical completion date was not an influencing factor in the selection of the flexible notice to proceed contracting method. In addition to project type, a significant number of survey respondents listed other factors influencing their decision to select this method. Some respondents stated that they use flexible notice to proceed on smaller, less complex projects and those that are not time critical. Figure 7 summarizes the participants' responses for this category of ACMs.

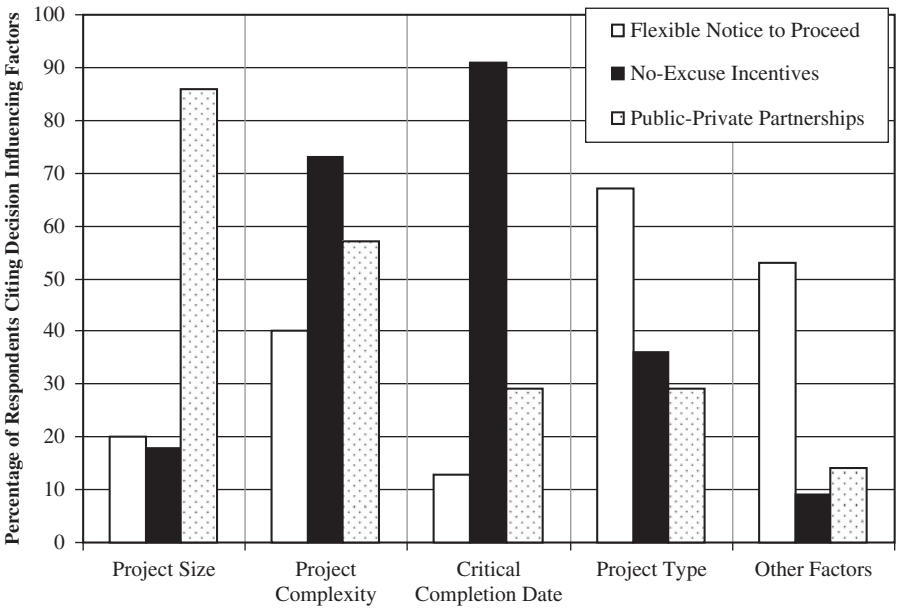

FIGURE 7 Selection factors for methods with medium implementation frequency.

Methods with Low Implementation Frequency

Among the ACMs that have low implementation frequency, a number of different factors influence the selection process, as shown in Figure 8. Because these methods were implemented fewer than five times, the results may be partially biased as a result of the small sample size. For example, early contractor involvement may be most influenced by project complexity, whereas construction manager at risk is most influenced by project type. The benefit of early contractor involvement is likely the highest when projects are complex in terms of scope and location. Contractor experience and expertise can aid the design team in preparing more cost-effective traffic control plans, construction staging plans, and perhaps more realistic construction schedules. Construction manager at risk is likely used on reconstruction projects, and when considering project complexity this contract method may offer an agency benefits similar to the early contractor involvement method. Critical completion date was a factor in the selection of both of these methods, as 50% of the respondents cited it. Multi-parameter bidding and liquated savings are also driven by the critical completion date selection factor. Again, the sample size is too small to substantiate this finding. Further, the survey respondents indicated that selection of lump-sum and UHOO contracting methods was not governed by critical completion date factor.

PERFORMANCE

A qualitative evaluation of the performance of each method was assessed through the survey. This evaluation methodology was selected because it would be difficult for a STA to provide quantitative measures of actual performance for each method. This is because most STAs currently do not document actual project performance against planned project performance in this area. The survey considered three typical project performance parameters (criteria): schedule, cost, and quality.

The schedule criterion was measured by assessing the average reduction in project duration (relative to estimated or projected duration) using the following categories: (1) increase in project duration, (2) no reduction in duration, (3) 5% or less reduction in duration, (4) 6% to 10% reduction in duration, and (5) greater than 10% reduction in duration.

The cost criterion was measured by assessing percent under or over the anticipated total project budget using the following categories: (1) more than 5% over budget; (2) 1% to 5% over budget; (3) on budget; (4) 1% to 5% under budget; and (5) more than 5% under budget.

Finally, the quality criterion was measured by assessing whether quality was lower, the same, or better when compared with a typical project that did not implement ACMs.

Schedule Performance Impact

Figures 9–11 summarize the impact each ACM has on project duration based on the frequency categorization provided previously. Clearly, some contracting methods reduce project duration more than others**,** as the data in these figures show. The extent to which each method reduces duration varies depending on the method.

The data in Figure 9 show that cost-plus-time bidding, design–build, and I/D provide the largest reduction in schedule, with more than 80% of the agencies stipulating a schedule reduction. The degree of reduction varies with each method. Design–build reduces project duration the most, with 65% of the respondents stating that this method reduces project duration by more than 10%. Although cost-plus-time bidding and

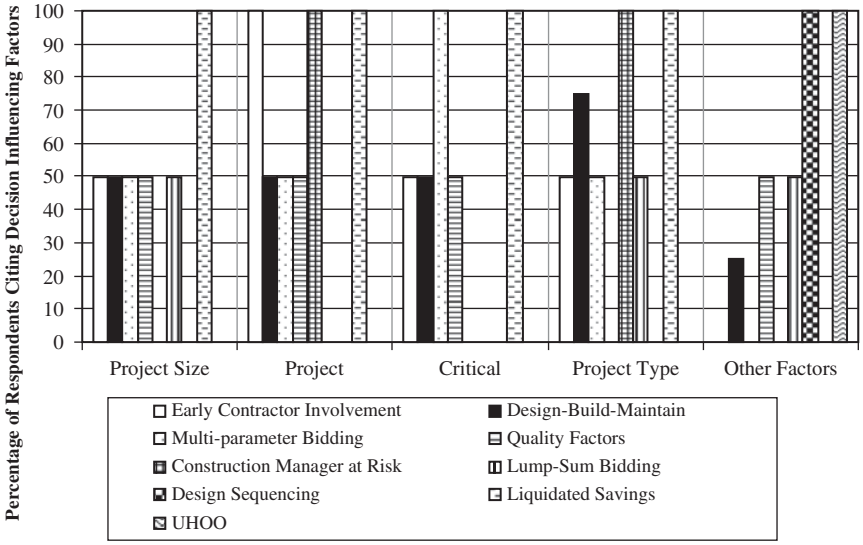

FIGURE 8 Selection factors for methods with low implementation frequency.

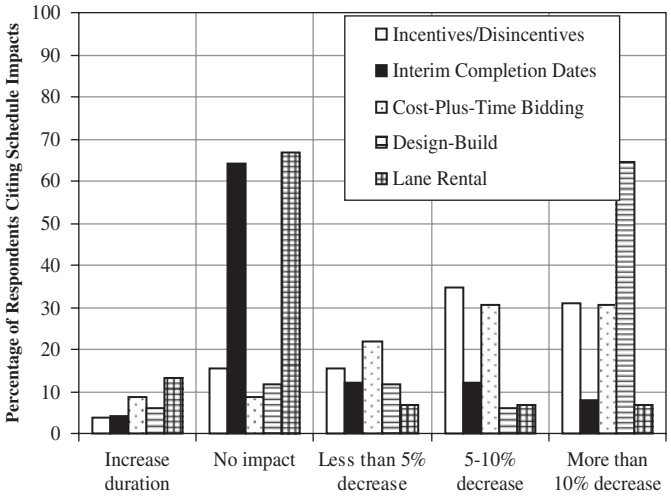

FIGURE 9 Schedule impacts for methods with high implementation frequency.

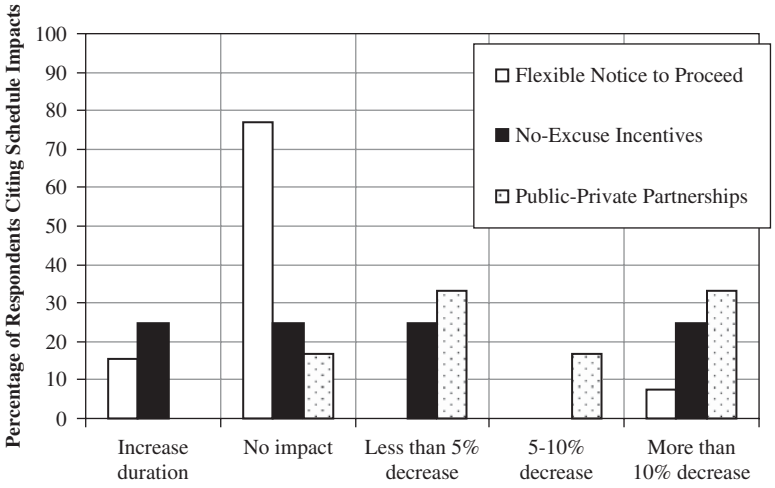

FIGURE 10 Schedule impacts for methods with medium implementation frequency.

I/D reduce project duration, the extent of reduction varies. Approximately 30% of the respondents stated that these two contracting methods reduce project duration between 5% and 10%. Both interim completion dates and lane rental can aid in reducing project duration, but their impact is not as substantial as other methods. A time reduction greater than 5% was cited by 20% and 13% of the respondents for the interim completion dates and lane rental contracting methods, respectively. However, most respondents (65%) stated that there was no impact on duration. Based on the data represented in Figure 9, cost-plus-time bidding, design–build, and I/D are the most likely contracting methods to facilitate project acceleration.

As shown in Figure 10, PPPs and no-excuse incentives have the next highest impact on reducing project duration. The PPP contract method reduces project duration to some extent, based on 50% of the responses (greater than 5% reduction). The final contracting method with some impact on reducing project duration is flexible notice to proceed. However, this method appears to have no impact or even increased project duration, as indicated by the responses in Figure 10. In summary, the data suggest that these three methods can facilitate project acceleration and may be advantageous when considered within the context discussed in chapter two and the implementation problems and lessons learned presented later in this chapter.

As shown in Figure 11, only early contractor involvement has the potential for schedule reduction; the other methods do not reduce project duration from the perspective of the STA.

Cost Performance Impact

The majority of projects let under these ACMs were reported completed within 5% of the budgeted cost. The methods that

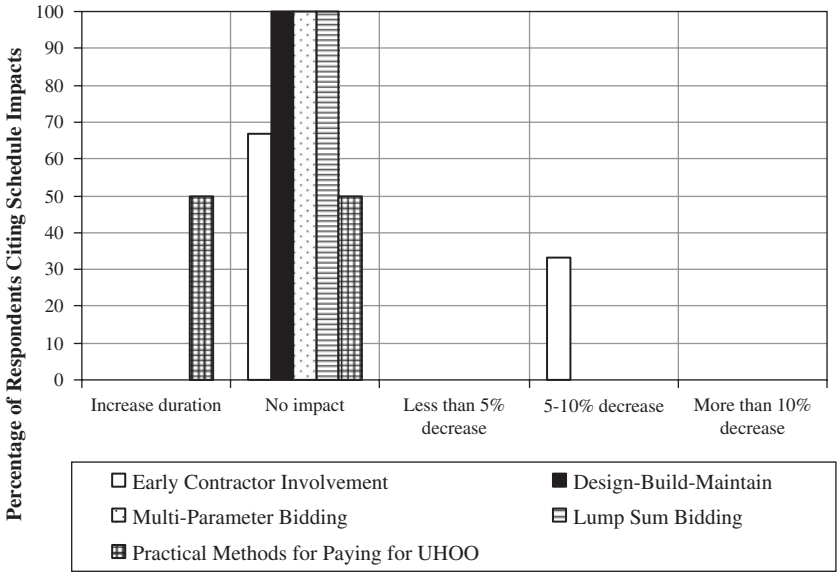

FIGURE 11 Schedule impacts for methods with low implementation frequency.

finished within budget most frequently were those whose main feature was to reward contractors for achieving certain milestones of project completion within a specified time frame. These contracting methods were also used by more agencies, indicating experience may be a factor. When they did not meet the budget, they were more often over budget than under, which is not unexpected with a method that offers contractors the opportunity to gain bonuses. Cost-plus-time bidding was the only method that was over budget more frequently than on or under budget. Figures 12–14 summarize these results.

Among those agencies that used the design–build method, almost half reported finishing projects either under or at their budget. Of those, more cited having a budget savings; one agency even reported a savings of 25%. Although their use was reported much less frequently, PPP and early contractor involvement produced projects consistently on or under budget. This suggests that when there is a sense of ownership for the contractor, there may be a greater chance of financial success for the project. In addition, one agency reported budget savings with the construction manager at risk. As with other methods that encourage project ownership, this is somewhat expected. Of the remaining methods in which only one agency reported experience, only design sequencing finished above its budget. Although most other ACMs produced positive results by those who used them, more implementation experience is needed within the transportation industry to determine if they are truly cost-effective in meeting cost performance targets.

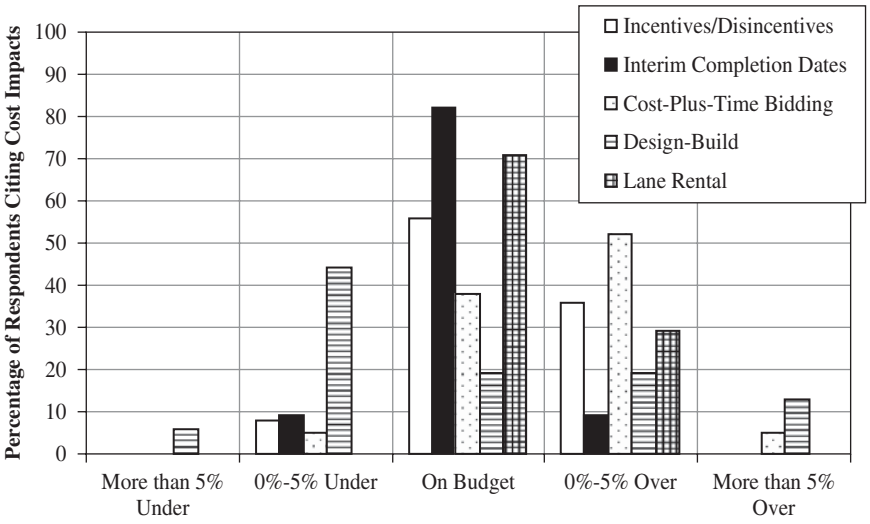

FIGURE 12 Cost impacts for methods with high implementation frequency.

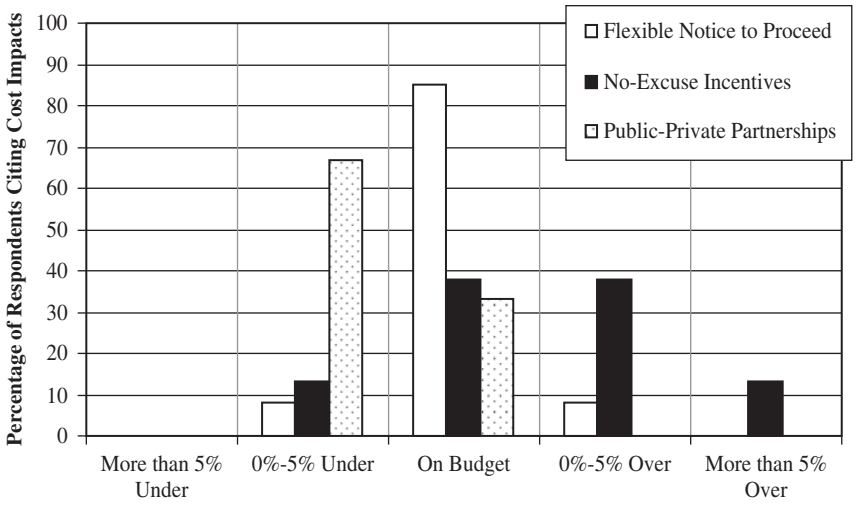

FIGURE 13 Cost impacts for methods with medium implementation frequency.

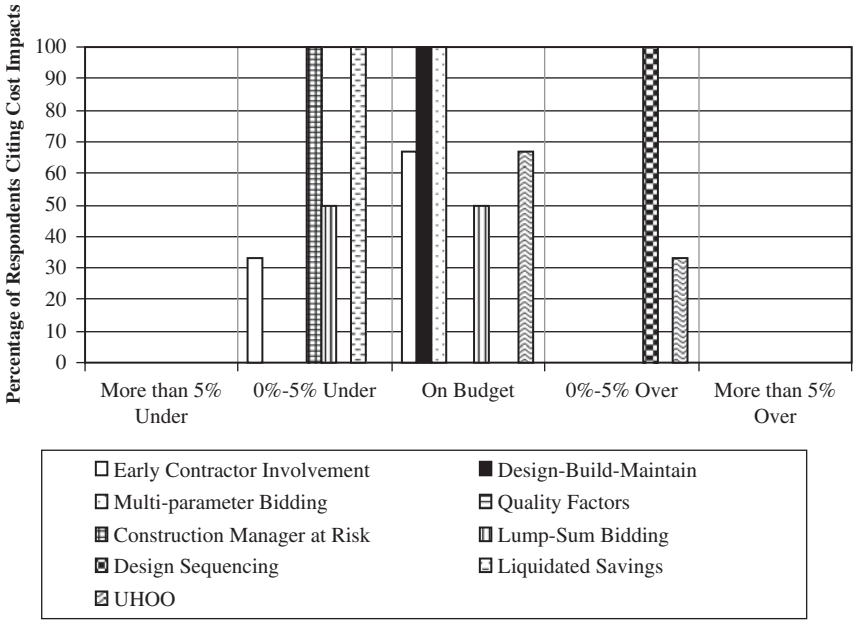

FIGURE 14 Cost impacts for methods with low implementation frequency.

Quality Performance Impact

According to the survey data, quality was not generally affected by the use of ACMs. The majority of respondents stated that quality was the same for the contracting methods evaluated as compared with typical projects. This result seems to counter the perception that accelerating project completion negatively impacts quality, which was cited as a perceived disadvantage for some contracting methods (see chapter two).

IMPLEMENTATION ISSUES

Implementing ACMs that are different from the traditional design–bid–build approach using estimated quantities and fixed-unit prices often results in unexpected problems. Identifying and addressing these problems provided STAs with valuable lessons. These problems and lessons were captured in the survey as well as through the literature review. They are summarized for the various contract methods covered in this study.

Incentives/Disincentives

Problems encountered with the I/D method were the result of conflicts between the agency and contractor over delays caused by unforeseen circumstances and how those delays should be handled. Several agencies cited using change orders and modifying the contract language to address these issues. In addition, it was recommended that this method be

used for projects in which there is not likely to be additional work beyond the scope of the contract. About one-third of the respondents reported having used this method without any problems.

The data suggest that I/D may only be advantageous when project milestone dates are critical and monetary values for I/Ds are large enough to motivate the contractor to meet the dates. Capping incentive values may be advisable. A realistic and detailed schedule is important when establishing incentives that are tied to completion dates. Further, the agency needs very specific and clear contract language regarding the award of incentives on projects. Well-written contract documents are critical and may reduce the potential for delays.

Interim Completion Dates

Nearly half of the agencies that responded stated they did not have problems with the implementation of interim completion dates. The problems that were encountered were similar to those experienced with the I/D method. There were complaints of disagreements over delays, missed milestones owing to weather, right-of-way issues, extra work and changes, and requests for additional funds to help accelerate the project to attain proposed deadlines. There were also reports of difficulty in coordination between related projects and predicting accurate dates from which to gauge project progress.

Like many other ACMs, the contract language needs to be clear and concise with respect to the scope associated with meeting a particular milestone date or phase of a project. Some agencies believe milestones should be expressed in number of days rather than as specific dates. Use of I/Ds may further motivate the contractor to meet the milestone date.

Lane Rental

The problems that occurred in contracts with lane rental provisions were primarily related to monitoring and costs. Monitoring contractor progress becomes difficult when a large portion of the work is being done at night. In addition, trying to predict the contractor's schedule and procedures was reportedly a challenge. The common cost problem encountered was in calculating the delay cost incurred by road users, which is the basis for the rental fee. One agency reported a reduction in utilization of this method owing to lane rental, resulting in little benefit to them.

This method appears best suited for use with projects having larger traffic volumes. The length of closure is an important consideration as well as the number of closures. The agency may consider varying the rental fee based on time of day with higher rates during the day and reduced rates at night. As with many other methods, clearly written contract language is required for the lane rental portion of the project work.

Cost-Plus-Time Bidding

Of the implementation problems reported by those who had experience with the cost-plus-time bidding (A+B) method, the primary issues were lack of bids, delays, and accurately defined costs. One agency reported having to assure contractors they would be judicious in their use of this contract method to encourage bids. Others reported experiencing problems with resolving delays and charging disincentives. Some STAs warned that some methods employed by contractors to reduce project time were in conflict with contract terms. In addition, some indicated difficulty in determining the RUC and value of reducing delay time. There was, however, also a positive response within the industry, as several agencies reported they have not experienced any major problems with this method.

Based on agency use of A+B bidding, STAs considering this method for a project will benefit from identifying potential sources of delay. For example, if relocating utilities during construction is likely, then this contracting method may not be the best choice, as the potential for delay is high. Delays could affect the schedule duration and lead to contract disputes, especially if incentives and disincentives are also used. Also, A+B may not be the best choice for large and complex projects owing to the potential for delays that may result from difficult traffic control and construction staging approaches. Further, the contract documents should be well written and with specific language related to the time component and changes resulting from possible delays. Contractors may take advantage of poorly prepared contract documents.

Design–Build

Based on the responses received, implementation of the design–build method is hampered mainly by legislation and problems developing and administering the contract. Some respondents reported that they were hampered by the lack of legislation to allow for funding or limits in the level of funds that could be designated for this type of contract. They cited difficulties in providing a clear project scope for potential bidders, as well as internal issues such as adapting their own procedures and tracking project progress and quality. One agency recommended obtaining right-of-way before the design–build team began work on construction. Another agency reported the need for developing standard procedures to maintain consistency throughout its state for design–build projects. In addition, there was cited a lack of experience among agencies in the use of this method. One agency reported that it was difficult for its agency personnel to let the responsibility for quality assurance/quality control rest solely with the design–build contractor. Finally, pricing the risk to the design–build contractor was problematic for agencies when developing their engineers' estimate for a design–build project.

Keys to successfully implementing a design–build contract, as cited by the STAs, are writing a clear, well-defined scope of

work and determining the scope before issuing a request for proposal (RFP). If too much engineering is completed, this may reduce the opportunity for contractor innovation. The agency needs some assurance that the scope of the project is what they will receive when construction is completed, and they will have to adopt different procedures for design–build projects, such as how to oversee the design while not owning design responsibility. Further, state agencies will have to learn how to estimate the cost of risk associated with the design–build project wherein the contractor assumes more risk from basing their proposal on preliminary design concepts.

Among the six agencies that reported having used a design–build–warrant contract, two had experienced issues similar to those with the design–build method itself, and the third had experienced problems specific to the warranty. As with design–build, there were internal problems with agency staff and normal agency procedures, and there was advice to obtain right-of-way before the design–build team started construction. Specific to the inclusion of the warranty provision, there were problems caused by the change of ownership and the existing pavement condition. The lessons learned using this version of the design–build contract were cited as the same as the design–build contract without warranty provisions.

Flexible Notice to Proceed

The majority of agencies who have used flexible notice to proceed have had successful implementation and have not experienced any notable difficulties. Only one agency reported an issue with this method. This agency noted that because the work start date is not known at the onset of the contract, it is difficult to anticipate when field personnel resources will be needed by the STA.

If completion dates are to be maintained when using a flexible start date, the STA will need to have procedures to develop construction sequencing and appropriate durations to ensure that completion dates are realistic.

No-Excuse Incentives

Some agencies that have included no-excuse incentives in contracts reported having similar experiences with I/D and cost-plus-time bidding. This is not unexpected, because the three contracting methods rely on the time required to complete the project as a basis for payment. In addition to delay-related issues, agencies noted a need for improving contract language and strengthening the meaning of "no excuse."

Public–Private Partnerships

Seven agencies reported having used PPPs. One state has only recently adopted them and is currently working on guidance for their use. Another commented on how different PPPs are from other methods, but stated they were committed to trying PPPs. The major problem reported was difficulty in obtaining multiple proposers. The reluctance of contractors to bid PPP contracts is understandable, because the contract is frequently based on an unsolicited proposal from one entity. Other potential proposers are then at a disadvantage when asked to compete, because the initial proposer has had more time to prepare the proposal. Another difficulty cited with using PPPs is the use of non-compete clauses that are necessary to protect the franchisee's investment. STAs may avoid problems by clearly defining the buyout provisions at the beginning of the agreement. Also, the agency could plan and specify competing improvements throughout the corridor where PPPs are implemented.

Early Contractor Involvement

Four agencies reported having used early contractor involvement in past contracts. Respondents experienced similar difficulties in gaining effective contractor input at an early stage in the design process. When contractors meet as a group to provide input on the design as related to construction, they make few comments. Further, there were some legal concerns with ensuring contractors had not obtained an advantage through their early participation in the project.

One successful approach was to engage contractors on a one-on-one basis rather than in a group setting. This approach seemed to increase contractor input on construction-related issues with the design. This approach was focused on conducting constructability reviews.

Construction Manager at Risk

Only one agency reported using construction manager at risk. They acknowledged their agency had let only a few of these contracts, but they are developing guidelines for future use of this method. Also, it appears that construction managers are not familiar with this DOT's procedures, processes, and specifications. Some education may be required as construction manager at risk is implemented further.

Alternative Methods for Paying UHOO Costs

Two agencies used alternative methods for paying UHOO costs. One agency noted the problem is that payment must always go through a dispute or claim process. Another cited difficulty in determining the cost to include in the engineers' estimate. Its solution was to establish an initial procedure and make adjustments once bid data had been obtained.

Design–Build–Maintain

Agencies appear less experienced with the design–build–maintain method than with the related design–build and

design–build–warrant contracts. One agency reported that it is only in the early stages of their first project. Another received a negative response from contractors.

Quality Factors

From the few responses received, it appears that quality factors are not yet widely used. One agency stated that its use is new to them and they had not yet had time to identify problems with this method; another reported that they are exploring the establishment of a quality index for future use in bid selection. One problem reported was the need to work with consultants. If the consultants were unfamiliar with the method, the agency believed conflicts and communication issues might result.

Design Sequencing

Only one agency reported using design sequencing. The problems it experienced stemmed from the need to create new procedures, because there has been little experience with this method. Further, this method may not work well on large and complex projects. Document control is very important.

SUMMARY

This chapter identified factors that influence the selection of different ACMs. Six contracting methods clearly reduce project duration more than other methods based on the critical completion date factor. These methods include interim completion dates, I/D, cost-plus-time bidding, and design–build in the category of high implementation frequency, no-excuse incentive in the category of medium frequency of implementation, and multiple-parameter bidding in the category of low frequency of implementation. Further, the performance of the ACMs relative to schedule, cost, and quality was presented. Again, those methods that had the most substantial impact on reducing project duration were similar to those methods that were selected based on critical completion dates. In most cases, the cost of those projects using the six methods reportedly were on budget or increased slightly. Quality was not affected by acceleration. Finally, the chapter identified problems associated with implementation for each method and provided some lessons learned based on STA implementation efforts. The next chapter reports on systematic processes used by STAs to select ACMs for accelerated project completion.

CHAPTER FOUR

SYSTEMATIC PROCESSES FOR SELECTION OF CONTRACTING METHODS

INTRODUCTION

The data and literature review show that several STAs have conducted studies to develop a comprehensive description of ACMs, define their selection criteria, and evaluate previous experience. In a study performed by the Center for Transportation Research and Education, Iowa State University, for the MnDOT, several performance measures such as cost and value were compared between A+B bidding, design–build, lane rental, and traditional contracts. These performance parameters were compared on nine different projects. As a result of this study, 15 recommendations for improving management practices in the use of innovative contracting methods were identified ("Performance. . ." 2006). In a similar effort, Trauner Consulting Services (1996) conducted a study for the South Dakota DOT in which several time-based innovative contracting methods with high applicability likelihood were identified.

The Ohio DOT uses a manual regarding selection criteria of innovative contracting methods: A+B, design–build, incentives/disincentives, lump-sum incentives, workday, lane rental, and window contracts. The manual also reviews their purpose and benefits, suitable projects, and selection criteria (Ohio Department of Transportation 2006).

Utah Local Technical Assistance Program (LTAP), affiliated with Utah State University, is a center that assists several local agencies, such as Utah DOT, by means of different services. The LTAP website research section contains documents related to innovative contracting methods. ACMs on this site include A+B, lane rental, design–build, warranty and job order contracting, together with their corresponding benefits and selection criteria ("Utah Local Technical Assistance Program" 2007).

FDOT conducted a number of internal and external studies for assessment of ACMs, one of FDOT's most important concerns. The methods covered are A+B, lane rental, bid averaging method, no-excuse, bonus, I/D, and construction manager at risk ("Alternative Contracting Methods" 2000).

Caltrans has also sponsored research regarding innovative procurement practices under a contract with Trauner Consulting Services. The research study cited later presents several ACMs based on the system of delivery, procurement, and contract management; the ACMs are further described by their advantages and disadvantages, selection criteria, and project types (Trauner Consulting Services 2007).

The Pennsylvania DOT (PennDOT) has an *Innovative Bidding Toolkit* (2002), which classifies innovative bidding practices into time-based, quality based and other methods. The toolkit defines and analyzes methods based on their applicability, benefits/risks, typical project profiles and other considerations.

SYSTEMATIC PROCESSES

Based on the responses from the survey and follow-up literature review, only a few STAs have a systematic process for selection of ACMs, including a process to select methods to accelerate project completion. Twenty-three states, or 88%, indicated they had no systematic processes to select ACMs. Conversely, just three states responding—California, Minnesota, and Pennsylvania—have developed a systematic selection process.

Our survey asked the question, "Does your agency have a systematic process to measure benefits of alternative contracting methods?" Again, 26 of 28 STAs responding to this question stated they did not have a systematic method to measure benefits of ACMs to accelerate project completion. Additional website reviews determined that Utah and Ohio do have a systematic process in place. These five STAs—California, Minnesota, Ohio, Pennsylvania, and Utah—have business units dedicated to innovative contracting.

Minnesota

The MnDOT document "Innovative Contracting Guidelines" (2005) outlines the benefits and drawbacks of different ACMs and provides corresponding guidelines for selection. The document considers project specifications and characteristics as the preliminary basis for decision making. In addition, other supporting documents such as implementation processes are provided on this website. The criteria for selection are as follows.

A+B Bidding

A+B bidding is best focused on projects that have significant impact on motorists, businesses, emergency services, or

other groups affected by the project. Good candidates are mill and overlay projects, concrete overlays, detour projects, new construction and reconstruction projects, bridge painting, intersection upgrades, and bridge rehabilitation projects. Poor candidates are traffic management systems, steel fabrication, concrete rehabilitation, signal systems, landscaping and signing projects. Applicability and implementation issues for A+B bidding are illustrated in Figure 15. In the first step, the project is evaluated using eight different project characteristics to determine if it is a good candidate for A+B bidding. For example, for the first characteristic, two important aspects are assessed: Will all rights-of-way be secured prior to letting date? If not, do the staging plans allow the contractor to sequence work around the conflicts and is a right-of-way time determination schedule in the special provisions? Following similar assessment for all eight project characteristics listed in Figure 15, the results are analyzed. If the answer is yes to most of the questions, the project may be suitable for A+B. If the answer is no to some of the questions, the project may still be a good candidate for A+B after careful consideration of the items with a no response.

Lane Rental

Lane rental may be used to advantage on projects that have significant impact on motorists' user costs. Good candidates are mill and overlay projects, grading projects with intermittent temporary lane closures, guardrail projects, signing projects, striping applications, bridge painting, crack sealing, and traffic management projects. Poor candidates are concrete rehabilitation, detour projects, projects with long-term permanent lane closures, bridge re-deck or overlays, new construction projects, and long-term projects that would be difficult for contractors to accurately bid the number of lane-rental hours. Applicability and implementation issues for lane closure method are illustrated in Figure 16. In the first step, and similar to the A+B bidding selection process, the project is evaluated to determine whether it is a good candidate for lane closure. This process includes evaluation of five different project characteristics. For example, for the first characteristic, contractor bidding, the following question is asked: Can the contractor accurately predict the duration of activities that will impact a lane? Following similar assessment for other project characteristics listed in Figure 16, the results are

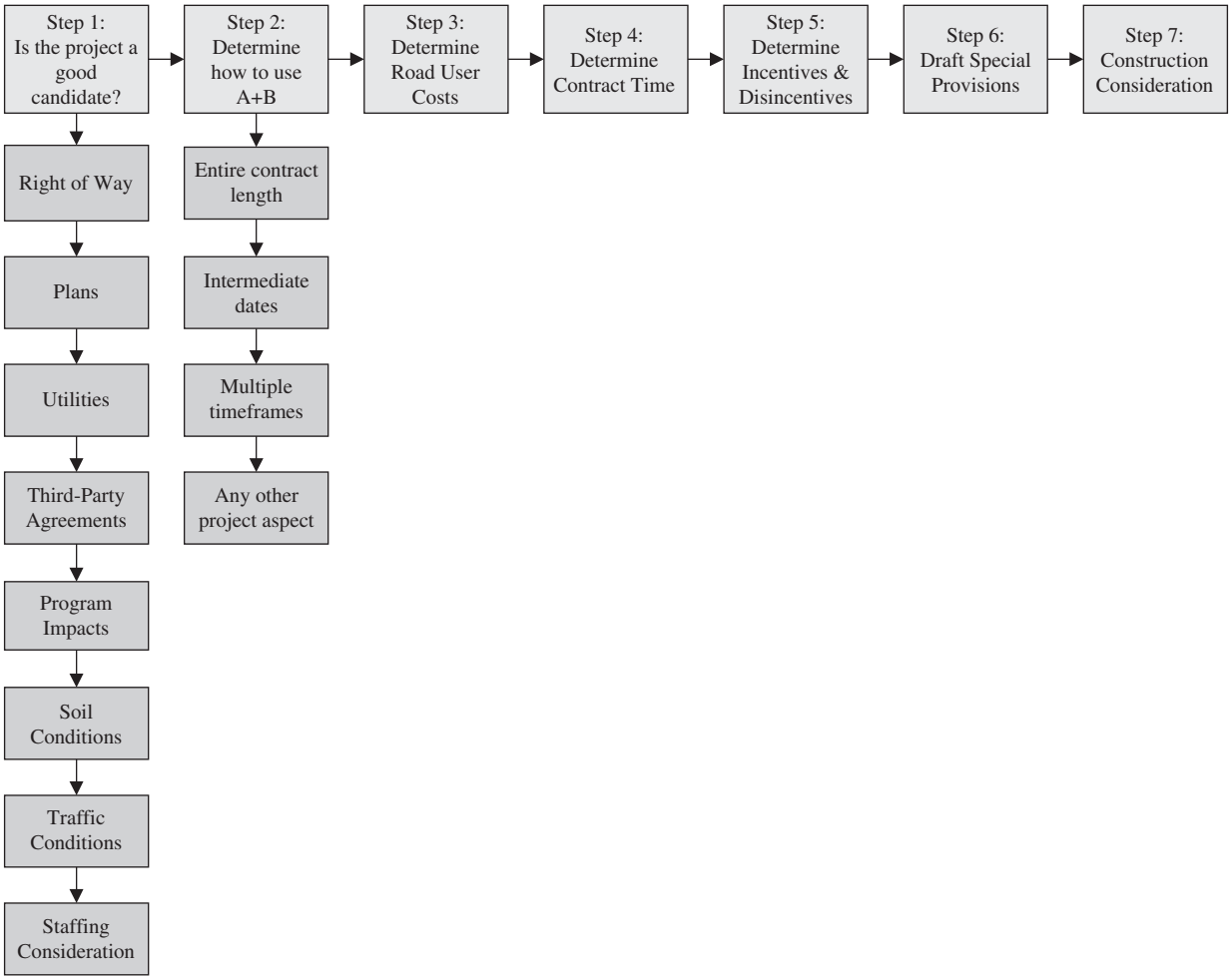

FIGURE 15 A+B implementation process.

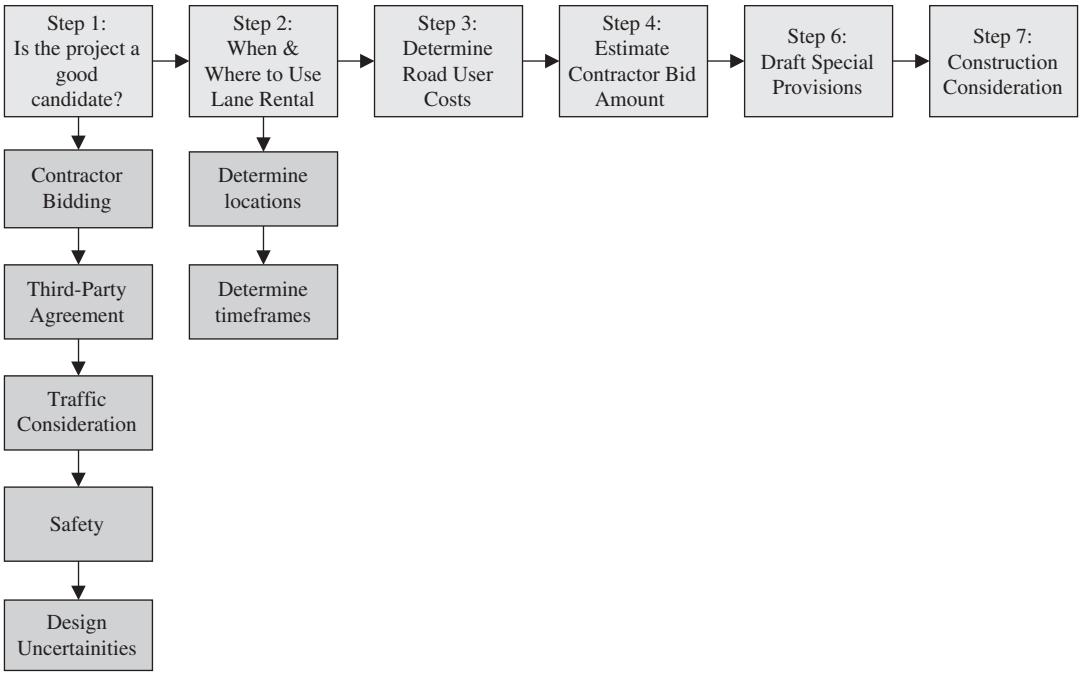

FIGURE 16 Lane rental implementation process.

analyzed. If the answer is yes to most of the questions, the project may be suitable for lane rental. If the answer is no to some of the questions, the project may still be a good candidate for lane rental after careful consideration of the items with a no response.

Incentives/Disincentives

This method can be used in a wide variety of projects, but is best applied to expedite work and reduce project duration. It is similar to A+B contracting in that it works well with urban reconstruction and bridge-related projects. Good candidates are projects with high road-user or business impacts such as urban reconstruction projects, bridge replacement projects, detour projects, urban pavement rehabilitation projects and interstate projects with major traffic impacts, A+B projects, bridge rehabilitation projects, and projects with commitments to open a roadway as quickly as possible. Poor candidates are new construction projects with minimal impact to road users, projects where right-of-way or utilities are not clearly defined, traffic management systems, steel fabrication, and landscaping.

Liquidated Savings

Just like the I/D method, liquidated savings can also be used in a wide variety of projects but is best applied to expedite the work to reduce project duration. Good candidates are smaller urban and rural rehabilitation and reconstruction projects, smaller bridge rehabilitation projects, and projects with reduced contract administration time; poor candidates consist of large construction projects, projects with minimal traffic impacts, and projects with minimal staffing concerns.

No-Excuse Incentives

This method is suitable primarily for unique projects. Several benefits are associated with this approach, such as reduced construction time, increased contractor concern for the project's schedule, and better coordination between the owner, contractor, and subcontractors. Potential drawbacks include increased cost, lower quality of work, and necessity of FHWA SEP-14 approval.

Design–Build

This method is typically awarded after MnDOT has completed 30% of design, the environmental process is complete, and right-of-way is in the process of being secured. This program is tailored to large construction projects but can be modified for smaller projects. Good candidates for this method are projects that need to be fast-tracked for public safety or political reasons, projects that allow for innovation in the design and construction efforts, projects with funding sunset dates where traditional design–bid–build delivery might succeed, projects where in-house staffing cannot meet the project's demands, and emergency projects with tight time constraints.

Utah

As previously mentioned, UDOT is one of the few STA that has developed a process for selection of ACMs. Such a process is documented at the Utah Innovative Contracting website (Utah Local Technical Assistance Program 2007), which contains a summary of the advantages and disadvantages of

ACMs and their selection criteria. The methods covered in this document are A+B bidding, lane rental, and design–build.

A+B Bidding

Utah has established two sets of criteria for the selection of A+B bidding, each based on the inclusion or exclusion of I/D provisions. To consider A+B bidding with I/D provisions there must be a need, such as construction creating considerable safety or economic concerns to the community or it must be in the best interest of the public to accelerate project completion. In addition, if the cost the contractor will incur to finish the project early and receive the maximum incentive is equal or less than the value of benefits the road users will receive, or if the potential for project acceleration can be maximized by traffic control phasing, A+B bidding with I/D provisions may be considered. There should be minimum potential for utility and right-of-way issues and design uncertainties for inclusion of I/D provisions.

A+B bidding without I/D provisions may be considered for projects in which project completion by a specific date is not a necessity or when there is a desire to complete the project early, but road user costs are not significant.

Lane Rental

The requirements for consideration of a lane rental contract primarily revolve around minimizing the economic impact and inconvenience of lane closures and traffic restrictions to road users. They may be implemented when alternate routes and detours are unreasonable or the cost of minimizing road closures is less than the value of doing so. They may also be utilized if lane closures can be minimized by the expertise of the contractor or the scheduling flexibility allowed by the traffic control plan, or when there is minimal potential for conflicts and design uncertainties.

Design–Build

The Design Build Selector is a process developed for selecting projects that are suitable for the design–build contracting method. This tool, which is available through the National Science Foundation, University of Colorado, and Georgia Institute of Technology is designed to aid owners and agencies in correctly selecting the design–build contracting method for their projects by gathering information about the project and performing a preliminary evaluation to determine the suitability of design–build. The flowchart illustrating the Design Build Selector process is shown in Figure 17.

Ohio

The Ohio DOT has developed the *Innovative Contracting Manual* for selection of ACMs (2006). This manual provides the user with a comprehensive background on ACMs as well as their benefits, selection criteria, and the types of projects suitable for their implementation. According to this manual, projects that meet any of the following criteria may use an ACM:

- Interstate or freeway projects consisting of major reconstruction; major widening; minor widening; new bridge/bridge replacement; bridge rehabilitation, repair, and widening; or interchange upgrade.
- Projects in heavily populated and traveled areas, those that require total road closure, or those that have considerable effects on emergency response, school transportation, and businesses.
- Projects that correct a deficiency in an important part of the existing highway system or those involving rehabilitation and/or reconstruction of a road identified by the Office of Planning Congestion Model.
- Projects that apply for an exception from the Maintenance of Traffic Exception Committee.

These criteria have been further described in Table 21, Innovative Contracting Methods Matrix. The following descriptions and criteria are taken from the Ohio DOT manual.

Incentive/Disincentive

I/D provisions are used to encourage the contractor to complete work or a portion of the work early by providing monetary incentives for the time the work is completed on time or early and charging a disincentive for any time delay beyond the specified completion date in an effort to minimize the impact on road users. The allowable time for completion is determined by the Owner and the I/D amounts are determined according to traffic maintenance, traffic safety, and road user costs.

Criteria for Selection Inclusion of I/D provisions can be considered if construction will create a sizeable impact or delay to road users. In addition, they recognize that it is important that the department maintains a good understanding of the time required for completion of the work covered by the I/D.

Project Types Ohio will allow utilization of I/D on projects that are time-sensitive, small projects involving bituminous resurfacing or bridges, medium-sized projects that involve Interstate resurfacing or minor rehabilitation, and large projects that involve corridor reconstruction or rehabilitation of an Interstate.

Lump-Sum Minus Incentive

Similar to I/D, lump-sum minus incentive provides a large lump-sum incentive to a contractor for work completed early or on time. If the specified completion date is not met, the large lump sum is reduced by the disincentive amount. The

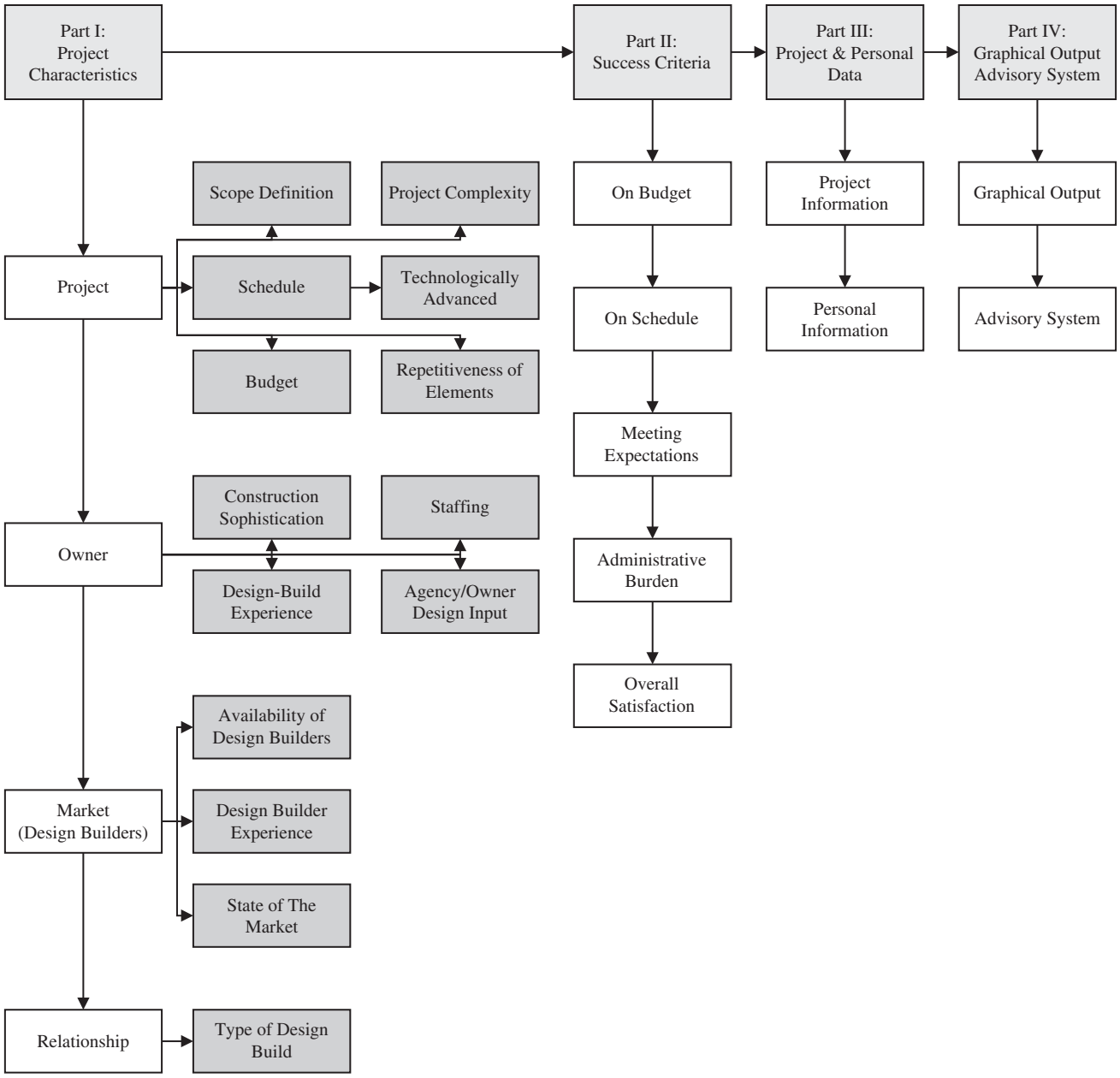

FIGURE 17 Design–build selector flowchart.

reduction continues for each time period beyond the completion date until the work is completed or the incentive is zero. If the work has still not been completed, the contractor will then be charged liquidated damages. This incentive provision does provide extensions for delays resulting from weather without penalty.

Criteria for Selection Selection of lump-sum minus incentives is allowed for projects that are high profile, have a high dollar value, may result in considerable delays and other impacts to road users and the community, or in which the incentive time may not be sufficient for project completion. In addition, it is desirable that there are no utility, right-of-way, or other issues that may lead to delays.

Project Types Utilization of lump-sum minus incentive provisions is allowed on projects that are time-sensitive, small projects involving bituminous resurfacing or bridges, medium-sized projects that involve Interstate resurfacing or minor rehabilitation, and large projects that involve corridor reconstruction or rehabilitation of an Interstate.

A+B Bidding

A+B bidding, or cost-plus-time-bidding, is a bidding method in which contractors include an additional bid component, the B component, based on the time they estimate for project completion. This allows competitive bidding of the schedule.

TABLE 21
INNOVATIVE CONTRACTING METHODS MATRIX

Type	A+B and D/B Contracts	I/D Contracts	Lump-Sum Incentives Contracts	Work Day Contracts	Lane Value Contracts	Window Contracts
New Construction-Relocation	Yes	Yes	Yes	No	No	No
Major Reconstruction	Yes	Yes	Yes	No	Yes	No
Major Widening	Yes	Yes	Yes	No	Yes	Yes
Minor Widening	Yes	Yes	Yes	Yes	Yes	Yes
New Bridge/Bridge Replacement	Yes	Yes	Yes	Yes	Yes	No
Two-Lane Resurfacing and Overlays	Yes	No	No	Yes	Yes	Yes
Four Lane Resurfacing and Overlays	Yes	Yes	Yes	Yes	Yes	No
Bridge Rehab., Repair and Widening	Yes	Yes	Yes	Yes	Yes	Yes
Bridge Painting	Yes	Yes	Yes	Yes	Yes	Yes
Crack Sealing	Yes	No	No	No	No	Yes
Culvert Construction, Reconstruction or Repair	Yes	Yes	Yes	Yes	Yes	Yes
New Interchange	Yes	Yes	Yes	Yes	Yes	No
Intersection Upgrade	Yes	Yes	Yes	Yes	Yes	Yes
Guardrail, RPM and Striping	Yes	No	No	No	No	No
Signals and Signage	Yes	No	No	No	Yes	Yes

Source: Trauner Consulting Services.

It also encourages minimization of construction time for high-priority projects by offering the contractor a bonus for early project completion and a penalty for late project completion.

Criteria for Selection The selection criteria for A+B bidding includes projects in which construction creates considerably high road user delays, safety or other negative impacts on the community, or that has received high public interest in its expedited completion and for which the department seeks to use the contractor's knowledge and experience to achieve this. In addition, it is desirable to have a project for which there are no right-of-way or utility issues or design uncertainties that may create delays.

Project Types There are no restrictions on the type of project for utilization of A+B bidding.

Lane Value Contract (Lane Rental)

Lane value contracts allow the department (Ohio) to transfer the high costs incurred by users as a result of the closure or restriction of high-priority ramps and lanes by charging contractors a disincentive for the time required to complete the work. The disincentive encourages the contractor to expedite work in high-priority areas so that the lane or ramp can be reopened as soon as possible.

Criteria for Selection For utilization of a lane value contract, the project should be considered complex and be located in a high traffic area.

Project Types As described earlier in the selection criteria, the project should be considered complex and be located where there is high traffic volume such that it is imperative to minimize traffic interruptions.

Unauthorized Lane Use

Unauthorized lane usage allows the department (Ohio) to impose a disincentive for each hour (or smaller increment) that the contractor closes a lane beyond the pre-approved time frame or into an area where closures are not allowed so that unplanned traffic disruptions are kept to a minimum. The disincentive amount is based on the road user costs resulting

from the delays caused by lane closures; the disincentive can be different for different segments or ramp configurations.

Criteria for Selection Unauthorized lane use should be limited to high-profile projects that may cause considerable delays to road users and that have the potential to create significantly escalating road user costs if the specified road closure times are not strictly adhered to.

Project Types Unauthorized lane use should be reserved for complex projects in high traffic areas where unobstructed traffic flow is imperative.

Design–Build Projects

Under a design–build contract, a single entity is responsible for both the design completion and construction phases of the project. This allows for initiation of construction activities before final completion of the design, as well as establishes a single point of contact for the department for quality, cost, and schedule control. Because both the designer and constructor are working together as a single responsible party, there is a reduction in change orders and claims resulting from errors and omissions. In addition, the contractor has a greater opportunity to implement innovative designs and techniques and use innovative materials to increase the likelihood of early project completion.

Criteria for Selection Projects selected for design–build should have a well-defined scope with no ambiguity in the design and performance requirements. They should not have utility or right-of-way issues or other concerns such as hazardous materials or environmental problems that create a greater level of project complexity. Rehabilitation projects should only be undertaken when the boundary between the components of the roadway to be rehabilitated and that to be left as is can be clearly identified. Other projects that can be considered are those that will require an extensive design phase in which innovations or cost and schedule savings can be made, those for which the department lacks the expertise for optimal design, or those that must be completed within a limited time frame.

Project Types The types of projects to which the design–build method is suited are small projects including resurfacing, culvert replacements, and noise walls; medium-sized projects that involve Interstate reconstruction, rehabilitation, widening, and the construction or replacement of simple bridges; and large projects that involve corridor reconstruction.

California

Trauner Consulting Services studied ACMs in California and presented the results in the report "Innovative Procurement Practices" (California Department of Transportation 2007). The report divides contracting methods into three major categories: project delivery systems, procurement practices, and contract management methods.

Project delivery systems refer to the overall procedure of designing, constructing, and/or maintaining a facility. A graphical presentation of these methods is shown in Figure 18. Procurement practices cover the procedures by which agencies evaluate and select designers, contractors, and all other engaged parties (see Figure 19). Contract management methods address different procedures used to manage construction projects on a daily basis and include the following methods:

- I/D provisions for early completion.
- Liquidated savings.
- Flexible notice to proceed dates.
- Lane rental.
- Active management payment mechanism.

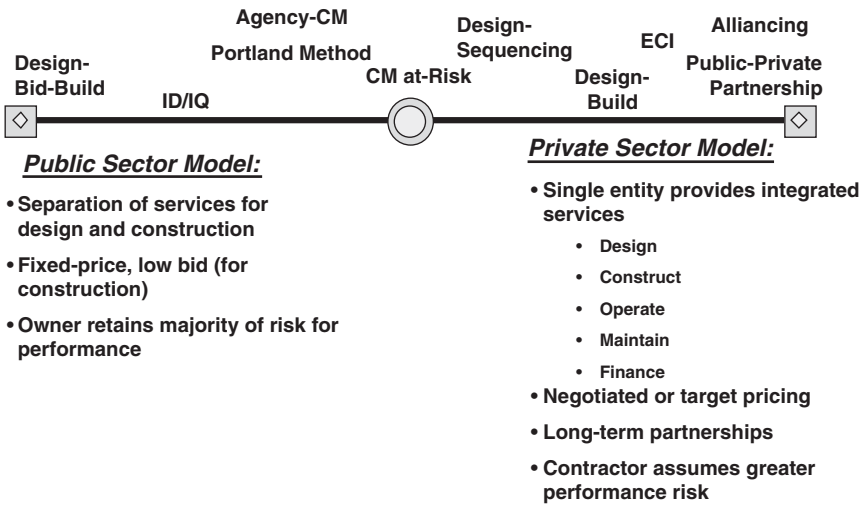

FIGURE 18 Range of delivery systems for public and private sectors (Trauner Consulting Services).

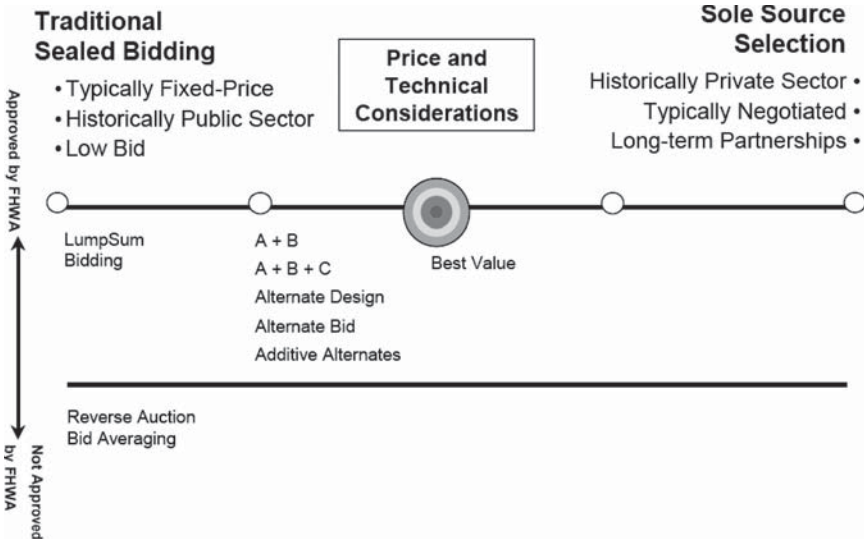

FIGURE 19 Procurement methods (Trauner Consulting Services).

- No-excuse incentives.
- Shared risk contingency management.
- Warranties.

Each of these categories is further divided based on the agency's previous experiences. The document also contains a description of the methods, their advantages and disadvantages, and their selection criteria. A summary is presented in Table 22.

Pennsylvania

PennDOT has published an *Innovative Bidding Toolkit* (2002), which classifies innovative bidding practices in three major categories: time-based methods, quality-based methods, and other methods. Time-based methods are mainly used to accelerate project completion or achieve an on-time completion. Quality-based methods are those that are used to ensure that a product meets its given requirements for quality. In this synthesis, an analysis of the first two methods based on their applicability, benefits/risks, typical project profiles, and other considerations is included.

Time-Based Methods

This section includes four different approaches: design–build–modified turnkey, A+Bx bidding, lane rental, and I/D for early completion.

Design/Build-Modified Turnkey

- *Purpose*—In this similar approach to design–build, the owner is in charge of setting up the preliminary engineering, whereas the design–build team finalizes the design and does the construction. The main objective of this ACM is to achieve lower costs while reducing project durations. The method is done in three sequential stages starting with preparation of partial design package by PennDOT, selection of the design–build contractor based on the required criteria, and finally project completion.
- *Benefits/Risks*—The major benefit of this method is to accomplish the project with a lower cost and duration. In addition, increased owner control over the initial design phase can be included as one the primary benefits of this approach. In contrast, considering that in this method the construction starts before the designs are finalized, the availability of a responsible designer during the progress of the project can be treated as a significant risk.
- *Typical Project Profiles*—This approach is well suited for any type of highway or bridge construction projects, especially when it comes to those with a well-defined scope of work, non-controversial in nature, or emergency projects.
- *Other Considerations*—The flexibility of this delivery method allows for innovation in design, but at the same time transfers a greater responsibility to the contractor. This approach can also be implemented with other innovative contracting methods such as warranties or I/D.

A+Bx Bidding

- *Purpose*—In this approach, to provide incentive for project acceleration, the duration of the contract is included in the bid amount by assigning a monetary value to the duration of the project.
- *Benefits/Risks*—The main benefit of applying this method is to reduce the inconvenience to the traveling public by providing the contractor with an incentive to accelerate the project.

TABLE 22
SUMMARY OF THE METHODS

Project Objectives, Types, and Selection Criteria	Project Delivery Methods										Procurement Practices									Contract Management Methods							
	Design–Bid–Build	Incentives/Disincentives	Agency–Constr. Mgt.	Constr. Manager at Risk	Portland Method	Design Sequencing	Design–Build	Early Contractor Involvement	Project Alliancing	Contract Maintenance	Lump Sum Bidding	A+B Bidding	A+B+C Bidding	Alternate Design	Alternate Bid	Additive Alternates	Best-Value	Reverse Auction	Bid Averaging	Incentives/Disincentives	Liquidated Savings	Flexible Notice to Proceed	Lane Rental	Active Mgt. Payment Mech.	No-excuse Incentives	Shared-Risk Contingency	Warranties
Project Objectives																											
Accelerate delivery		x	x	x	x	x						x	x							x	x				x		
Reduce procurement time		x								x																	
Promote innovation			x	x	x		x	x	x	x			x	x			x										x
Enhance quality/performance			x	x	x		x	x	x	x			x		x		x									x	x
Early cost certainty				x	x		x	x	x																		
Staffing considerations		x	x	x			x			x	x																
Single point of responsibility							x																				
Reduce construction cost/improve cost–benefit ratio											x			x	x	x	x	x	x							x	
Reduce life-cycle cost													x	x	x		x										x
Minimize road user impacts																						x	x	x			
Minimize disputes							x	x	x																x	x	
Project Types/Selection Criteria																											
Large project with multiple phases			x	x	x		x	x	x							x	x			x						x	
Emergency project		x					x													x					x		
Repetitive/well-defined work item	x	x				x					x																
Time-sensitive project			x	x		x	x					x	x							x	x				x		
Local community or political interests																				x	x	x	x	x	x		
Flexible traffic management																							x	x			
High traffic volumes or high RUC												x	x				x			x	x		x	x	x		
Specialized resources or expertise required			x	x	x		x	x	x	x				x	x		x										
Significant risks or unknowns remain					x			x	x																	x	
Performance criteria can be developed							x			x				x													x
Well-defined project conditions, with minimal third-party conflicts/uncertainties	x			x	x	x					x	x	x	x	x	x		x	x	x					x		x

Source: Trauner Consulting Services.

- *Typical Project Profiles*—Areas that are sensitive to high traffic volumes, such as business or tourist areas, are the best candidates for application of this delivery method. It can also be used for projects where construction leads to increased safety concerns or affects an environmentally sensitive area. In addition, A+Bx is the best approach for simple bridge replacement projects.
- *Other Considerations*—This method needs to be combined with I/D to prevent exceeding the time bid for the project. RUC should be considered as the basis for determining incentive values. A well-defined scope of work is needed for application of this method.

Lane Rental

- *Purpose*—Similar to A+Bx, this delivery method assigns a monetary value to the time a lane or shoulder will be closed to the traveling public as the result of project construction. In this method, the lane is rented by the

contractor during the construction of the project and the rental fee is determined by estimating the cost of delay or the imposed inconvenience to the users during this period. Similar to the previous method, lane rental uses RUC as the basis of determination.
- *Benefits/Risks*—The benefit from this method is primarily realized by providing the contractor with the incentive to minimize its lane usage and the inconvenience to the traveling public. However, failure to define the critical terms such as "lane opening/closure" may be counted as a challenging risk factor for this method.
- *Typical Project Profiles*—Typical projects for this method include multiple lane roads with a high volume of traffic or where the availability of alternate routes or detours is a major issue. It is also appropriate for politically sensitive areas, major roadways, bridges, or interchanges.
- *Other Considerations*—This method can be considered with other innovative provisions such as I/D to maximize the contractor's benefits while minimizing the inconvenience to the traveling public.

Incentive/Disincentive for Early Completion

- *Purpose*—This provision is generally used to put emphasis on project objectives.
- *Benefits/Risks*—The main benefits gained from applying this method include project acceleration, and reduction in environmental impacts and inconvenience to the traveling public and area businesses.
- *Typical Project Profiles*—I/D provision needs be considered for the projects with high sensitivity to traffic or where construction causes an increase in RUC or has a significant impact on the neighboring businesses.

Quality-Based Methods

This section includes two different methods: design–build RFP and warranties. This part will include the first method only, owing to its relevance to the study.

Design–Build–Request for Proposal

- *Purpose*—In contrast to the traditional design–bid–build system, in this delivery method, one entity provides the owner with engineering and construction services. A general criteria is set by the owner in the RFP process.
- *Benefits/Risks*—The primary objective of applying this delivery approach is to ensure a reduction in project duration from the start of the design phase until project completion. Using RFP for procurement allows for multiple design solutions and flexibility for innovations in the use of materials and systems.
- *Typical Project Profiles*—There is a threshold of $25 million for projects to be considered for the RFP process, except for the case in which a project is complex and the owner is seeking innovation and multiple design solutions.
- *Other Considerations*—A nominal fee is paid to each contractor to ensure the adequate participation of qualified bidding contractors.

Commonalities and Differences

There are number of common features among these five systematic processes used to select ACMs. Typically the selection process involves steps such as identification of suitable projects, evaluation of advantages and disadvantages, and development of selection criteria. However, most of them consider neither quantitative assessment nor systematic identification of the factors affecting selection process. This synthesis study ties the previous practices with the survey data. Table 23 summarizes application criteria for typically used ACMs.

Current Research Efforts on Selection Processes

In addition to the published literature and documents available online, the following current research projects evaluate issues related to accelerating project delivery.

Accelerating Transportation Program and Project Delivery: Conception to Completion, Source Organization: NCHRP 20-73

This project is intended to provide examples and other guidance in regard to best practices for program acceleration and project delivery while maintaining quality. In this research, delivery acceleration strategies, techniques, and practices at program and project levels, from conception to completion, are being reviewed and evaluated.

Methods for Implementing Innovative Transportation Project Delivery Systems, Source Organization: University of Wisconsin, Madison

The objective of this project is to provide a reference regarding application of non-traditional delivery methods such as design–build and construction manager at risk, which are intended to accelerate project completion while maximizing quality and minimizing cost. Therefore, project goals include: (1) evaluating ACMs' impacts on project performance from three different perspectives, time, cost, and quality; (2) offering recommendation regarding the appropriate level of design for design–build, construction manager at risk, and other procurement methods; (3) evaluating ACM's impacts on small businesses; (4) evaluating potential subjectivity in ACMs; (5) providing government agencies with guidance regarding the steps and changes to initiate the application of ACMs; and (6) discovering the implementation barriers regarding ACMs and proposing recommendations to resolve those issues.

TABLE 23
COMMONALITIES AND DIFFERENCES

Methods	Applicability Criteria				
	Minnesota	Utah	Ohio	Pennsylvania	California
A+B bidding	1) Significant impact on motorists, businesses, emergency services	1) High road user costs 2) Safety concern 3) Applicability of phasing traffic control 4) Free of utility conflicts 5) Public interest to complete the project ASAP	1) Having traffic restrictions 2) Having safety concerns 3) Free of utility conflicts 4) Public interest to complete the project ASAP	1) Business or tourist areas 2) Detour may impact an environmentally sensitive area 3) Safety concerns 4) Simple bridge replacement projects	1) Time-sensitive projects 2) High traffic volumes or high RUC 3) Well-defined project conditions, with minimal third party conflicts or uncertainties
Lane rental	1) Significant impact on motorists	1) High road user costs 2) Impracticality of alternative routes and detours 3) Free of third-party conflicts 4) Contractor expertise to minimize lane closure	1) Complex project 2) High traffic volume projects	1) Multiple lane roads with high traffic volumes 2) Alternative routes or detours unavailable 3) Politically sensitive areas 4) Project with high profiles or major roadways, bridges, or interchanges	1) Local community/political interests 2) Flexible traffic management 3) High traffic volumes/high RUC
I/D	1) Expedite work to reduce project duration		1) Having a good understanding of construction time 2) Project results in significant delay or impact to the road users		1) Small- to medium-size jobs 2) Large projects with multiple phases 3) Emergency projects 4) Time-sensitive projects 5) Local community/political interests 6) High traffic volumes/high RUC 7) Well-defined project conditions, with minimal third-party conflicts/uncertainties
Liquidated savings	1) Expedite work to reduce project duration				
No-excuse incentive	1) Unique projects				
Design–build	1) Large construction projects		1) Clearly defined scope 2) Free from utility conflicts 3) Emergency projects or with tight time constraint 4) Projects requiring expertise 5) Projects with room for innovation	1) Projects exceed a $25 million threshold	1) Projects exceed a $25 million threshold
Liquidated savings	1) Expedite work to reduce project duration				

Innovative Contracting for Major Transportation Projects, Source Organization: NCHRP 20-24(43)

This report summarizes the issues that were presented and delivered at a workshop held at the AASHTO 2005 annual meeting in Nashville, Tennessee. The materials developed in the workshop included information regarding the application of ACMs for transportation projects with a focus on design–build, best-value procurement, and construction warranties to accelerate construction time while minimizing costs and maximizing quality and customer satisfaction.

Evaluation of ODOT Project Delivery System, Source Organization: Oregon Department of Transportation

A $500 million bond to finance projects over a six-year period was created by the Oregon Transportation Investment Act (OTIA) to overcome the increasing pressure faced by the Oregon DOT with regard to delivering high-quality construction projects while reducing cost and schedule time. This led the Oregon DOT to identify different innovative contracting practices such as design–build to accelerate project completion. On the other hand there are other delivery methods that could help the Oregon DOT to overcome aggressive funding timelines. The focus of this research is to assess methods implemented for the delivery of OTIA projects as well as the Statewide Transportation Improvement Program and discuss specifically the resource requirements and implications of implementing three project delivery models, including standard Oregon DOT design–bid–build, outsourced design–build, and outsourced design–bid–build. The research is intended to provide the Oregon DOT with the necessary tools to identify the best project delivery for a specific project.

A Guidebook for the Evaluation of Project Delivery Methods, Source Organization: TCRP G-08

Transit projects in the United States have traditionally been performed through the design–bid–build contracting method; however, a lack of a comprehensive reference for alternative contracting left transportation agencies' interest in application of alternative project deliveries unanswered. This guidebook is intended to fill the aforementioned gap and provide the transit agencies with tools to identify and assess the benefits and drawbacks of different alternative delivery methods for major capital projects and evaluate the pros and cons of including operations and maintenance in the contract.

SUMMARY

This chapter identified systematic processes STAs use to select the appropriate ACM. Based on the results from the survey and follow-up literature review, only a few STAs have such a systematic process for selection of ACMs. In this chapter, the focus is given to publicly available documents, including those used by Caltrans, and the Minnesota, Pennsylvania, Ohio, and Utah DOTs. Among the many different methods considered in this study, clearly I/D, design–build, A+B bidding, and lane rental are the most frequently used methods. This study found that the selection process is largely based on project characteristics including factors such as critical completion date, large user costs if projects are prolonged, and project size. This observation is consistent with the survey results where these project attributes were highly ranked by the respondents.

CHAPTER FIVE

CONCLUSIONS

INTRODUCTION

Over the years, a number of state transportation agencies (STAs) have utilized alternative contracting methods (ACMs) to promote accelerated project delivery. In particular, much of the focus in the past two decades has been on methods that promise faster project delivery through aggressive project schedules. The common concern STAs have with such schedules, other than their effectiveness, is their possible impact on measures such as cost, quality, and safety. The goals of this study were to summarize the state of practice of ACM selection and to identify driving factors for selecting one over another. In this study, accelerated project completion was defined as earlier completion date through faster construction, expedited project development, shorter duration to project closeout, or a combination of these attributes of project completion.

The stated goals of this study were achieved through the following:

- Identify and describe ACMs, including their relationship to accelerating project completion;
- Identify and evaluate driving factors for the selection of specific ACMs;
- Identify advantages and disadvantages of ACMs along with problems involved with and lessons learned from implementation;
- Assess the characteristics and performance outcomes of ACMs with respect to their application in the highway industry; and
- Assess the use of systematic processes in the selection and evaluation of ACMs.

CONCLUSIONS

The survey indicated that STAs use ACMs with the intent to accelerate project completion. Based on an assessment of the advantages, critical selection factors, and potential for schedule reduction, the following five ACMs have the highest potential for accelerating project completion. These methods are listed in order of highest relative potential to accelerate project completion:

- Design–build.
- Incentives and disincentives.
- Cost-plus-time bidding.
- Interim completion dates.
- No-excuse incentives.

From the perspective of survey respondents, the selection of these methods is driven primarily by the requirement to meet a critical completion date. All five methods reduce schedule duration, three more than 10% of the estimated duration (cost-plus-time, incentives/disincentives, and design–build). Cost performance for all five methods generally varied ±5% from budget. Thus, these data do not support the conclusion that project acceleration, using the contracting methods studied in this report, either substantially increases or decreases costs. Further study may be necessary to investigate this issue in greater depth. There is some indication in the literature that these methods often increase cost; the data in this survey do not necessarily support the literature. Quality is generally perceived as being the same as a typical project when these five contracting methods are implemented. This perception is different from what the literature indicates and is counter to some of the cited disadvantages from survey responses.

The selection of these five methods is influenced by other factors as well, with project complexity and project type the next critical factors to consider. Projects that are often subject to acceleration are those located in urban settings with many different project components. These projects typically are associated with high traffic volumes where there is a need to minimize traffic disruption. Rehabilitation and reconstruction are common types of projects accelerated. In general, successful implementation requires the evaluation of many project attributes, which vary depending on which contracting method is considered.

Two methods affect project completion but may not necessarily result in substantial acceleration: lane rental and public–private partnerships (PPPs). Project complexity drives the use of lane rental, especially where high traffic volumes are particularly burdensome. Project size is the major driver of PPPs. High-cost projects are typical of PPPs, where requirements for funding and financing are substantial concerns. However, the use of both of these methods is influenced by other factors, including critical completion dates, with PPPs cited more frequently than lane rental as reducing project duration. Both methods are perceived to meet budget targets and provide the same or better quality than typical projects using the traditional contracting method.

Several methods have the potential to accelerate project completion, but there were not a sufficient number of responses to confirm this. These methods are

- Early contractor involvement;
- Construction manager at risk;
- Design sequencing; and
- Liquidated savings.

Further study of these methods may be warranted as their use increases.

The remaining methods did not impact acceleration as there was no reported reduction in project duration. However, the number of responses for these contracting methods was quite low, so further study may be warranted.

Most STAs do not have systematic processes for the selection of specific ACMs that accelerate project completion. STAs that do have selection processes generally provide guidance for use of certain contracting methods without any systematic decision support tool. Only a small number of STAs analyze the benefits of using contracting methods that accelerate project completion.

Several general conclusions regarding the implementation of ACMs with the intent to accelerate project completion follow.

- Some states have given special attention to alternative contracting by setting up specific units within their agencies that focus on implementation and use of these methods.
- Legal issues still remain a barrier to implementation, especially with design–build contracting methods.
- There is often a lack of human resources to support alternative contracting, which may affect implementation.
- Some agencies no longer use certain methods such as cost-plus-time and lane rental.
- Very few systematic selection processes are used to guide the implementation of ACMs.
- Those processes that have been identified do not necessarily focus exclusively on project acceleration but consider time as a factor in the selection process.
- Very few agencies perform a systematic analysis of the benefits derived from the use of contracting methods to accelerate project completion.
- Every contracting method has its advantages and disadvantages, so care must be taken when selecting one for a particular project if project acceleration is the objective.
- Selecting a method for project acceleration is complex, with many interrelated factors.
- Project acceleration is influenced by issues beyond selecting the appropriate contracting method.

SUGGESTIONS

Although specific recommendations were not requested in the survey, the authors are suggesting, based on the general findings, that there may be potential areas where improvements in the evaluation and use of ACMs to accelerate project completion may be of interest to the industry. The following suggestions are made with respect to further study of alternative contracting, especially if project acceleration is a primary objective:

- STAs may consider establishing a business unit if an increase in the use of ACMs is desirable. Twelve states already have moved in this direction. A potential benefit of this approach may be an effort to increase the use of higher impact methods such as design–build and incentive/disincentive, or perhaps to develop guidance for implementation of various methods to accelerate ACMs;
- STAs could consider the development and use of a systematic process as a decision support tool to aid in the selection of ACMs with the specific objective of project acceleration. This type of tool could aid decision makers in the selection of contracting methods that better fit the project requirement, conditions, and objectives; and
- STAs can be encouraged to document implementation results and analyze the results to identify more specifically the benefits associated with the use of ACMs. Demonstrating benefits with respect to common performance measures such as schedule, cost, quality, and safety can promote more appropriate use of contracting methods to accelerate project completion.

These suggestions may lead to improved use of ACMs to accelerate project completion.

REFERENCES

American Institute of Architects and the Associated General Contractors of America, "Primer on Project Delivery," 2004 [Online]. Available: http://www.agc.org/galleries/default-file/AIA%20AGC%20Primer.pdf.

Anderson, S.D. and J.S. Russell, *NCHRP Report 451: Guidelines for Warranty, Multi-Parameter, and Best Value Contracting*, Transportation Research Board, National Research Council, Washington, D.C., 2001.

Anderson, S.D. and G.L. Ullman, *NCHRP Synthesis 293: Reducing and Mitigating Impacts of Lane Occupancy During Construction and Maintenance*, Transportation Research Board, National Research Council, Washington, D.C., 2000, 66 pp.

Arditi, D., C.J. Khisty, and F. Yasamis, "Incentive/Disincentive Provisions in Highway Contracts," *Journal of Construction Engineering and Management*, Vol. 123, No. 3, 1997, pp. 302–307.

Battelle, "Performance-Based Contracting for the Highway Construction Industry," Prepared for Koch Industries, Inc., 2003 [Online]. Available: http://www.battelle.org/transportation/final-report.pdf.

"Briefing: Special Experimental Project No. 14–Alternative Contracting (SEP-14)," Federal Highway Administration, Washington, D.C., 2007 [Online]. Available: www.fhwa.dot.gov.

California Department of Transportation, "Construction Program Procedure Bulletin: CPB 00-8 Contract Administration of Time Related Overhead (TRO)," 2000 [Online]. Available: http://www.dot.ca.gov/hq/construc/cpb/CPB008.pdf.

California Performance Review, *INF01 Use of Few Models for Project Delivery Results in Missed Opportunities for Lowering Cost and Speeding Delivery*, n.d. [Online]. Available: http://cpr.ca.gov/report/cprrpt/issrec/inf/inf01.htm [accessed June 13, 2008].

Chan, A.P.C., D. Scott, and E.W.M. Lam, "Framework of Success Criteria for Design/Build Projects," *Journal of Management in Engineering*, Vol. 18, No. 3, 2002, pp. 120–128.

Construction Industry Institute, "Project Delivery Systems: CM at Risk, Design-Build, Design-Bid-Build," The Construction Industry Institute, Austin, Tex., 1997, pp. 1–44.

"Design Sequencing," National Association of State Highway and Transportation Unions, Sacramento, Calif., 2007 [Online]. Available: http://www.nashtu.us/Design-Sequencing.htm [accessed June 25, 2008].

El-Rayes, K., "Optimum Planning of Highway Construction under A+B Bidding Method," *Journal of Construction Engineering and Management*, Vol. 127, No. 4, 2001, pp. 261–269.

El-Rayes, K. and A. Kandil, "Time-Cost-Quality Trade-Off Analysis for Highway Construction," *Journal of Construction Engineering and Management*, Vol. 131, No. 4, 2005, pp. 477–486.

El-Wardani, M., J.I. Messner, and M.J. Horman, "Comparing Procurement Methods for Design–build Projects," *Journal of Construction Engineering and Management*, Vol. 132, No. 3, 2006, pp. 230–238.

Federal Highway Administration and American Association of State Highway and Transportation Officials, "Best Practice/Policy, Florida," In *Workzone Best Practices Guidebook*, 2000 [Online]. Available: http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?id=89.

Herbsman, Z.J., "A+B Bidding Method—Hidden Success Story for Highway Construction," *Journal of Construction Engineering and Management*, Vol. 121, No. 4, 1995, pp. 430–437.

Herbsman, Z.J. and R. Ellis, "Multiparameter Bidding System—Innovation in Contract Administration," *Journal of Construction Engineering and Management*, Vol. 118, No. 1, 1992, pp. 142–150.

Herbsman, Z.J. and R. Ellis, *NCHRP Report 215: Determination of Contract Time for Highway Construction Projects*, Transportation Research Board, National Research Council, Washington, D.C., 1995, 49 pp.

Herbsman, Z.J. and C.R. Glagola, "Lane Rental—Innovative Way to Reduce Road Construction Time," *Journal of Construction Engineering and Management*, Vol. 124, No. 5, 1998, pp. 411–417.

"How Partnerships Work," The National Council for Public-Private Partnerships, Arlington, Va., 2007 [Online]. Available: http://ncppp.org/howpart/index.shtml#define.

Innovative Bidding Toolkit, Pennsylvania Department of Transportation, Harrisburg, 2002 [Online]. Available: ftp://ftp.dot.state.pa.us/public/pdf/pub448.pdf [accessed Apr. 8, 2008].

"Innovative Contracting Guidelines," Minnesota Department of Transportation, St. Paul, Dec. 2005 [Online]. Available: dot.state.mn.us/const/tools/documents/Guidelines_002.pdf [accessed Apr. 8, 2008].

Innovative Contracting Manual, Ohio Department of Transportation, Columbus, Apr. 10, 2006 [Online]. Available: www.dot.state.oh.us/construction/OCA/InnovativeContractingManual04102006.pdf [accessed Apr. 8, 2008].

Jaraiedi, M., R.W. Plummer, and M.S. Aber, "Incentive/Disincentive Guidelines for Highway Construction Contracts," *Journal of Construction Engineering and Management*, Vol. 121, No. 1, 1995, pp. 112–120.

Konchar, M.D. and V.E. Sanvido, "Comparison of U.S. Project Delivery Systems," *Journal of Construction Engineering and Management*, Vol. 124, No. 6, 1998, pp. 435–444.

Lee, E.B., J.T. Harvey, and D. Thomas, "Integrated Design/Construction/Operations Analysis for Fast-Track Urban

Freeway Reconstruction," *Journal of Construction Engineering and Management*, Vol. 131, No. 12, 2005, pp. 1283–1291.

Lee, E.B., D. Thomas, and L. Bloomberg, "Planning Urban Highway Reconstruction with Traffic Demand Affected by Construction Schedule," *Journal of Transportation Engineering*, Vol. 131, No. 10, 2005, pp. 752–761.

Molenaar, K.R., J.E. Triplett, J.C. Porter, S.D. DeWitt, and G. Yakowenko, "Early Contractor Involvement and Target Pricing in U.S. and UK Highways," *Transportation Research Record, Journal of the Transportation Research Board, No. 2040*, Transportation Research Board, National Research Council, Washington, D.C., 2007, pp. 3–10.

Molenaar, K.R. and A.D. Songer, "Model for Public Sector Design-Build Project Selection," *Journal of Construction Engineering and Management*, Vol. 124, No. 6, 1998, pp. 467–479.

"New Special Experimental Project (SEP-15) to Explore Alternative and Innovative Approaches to the Overall Project Development Process," Federal Highway Administration, Washington, D.C., 2004 [Online]. Available: http://www.fhwa.dot.gov.

Paek, J.H., Y.W. Lee, and T.R. Napier, "Selection of Design/Build Proposal Using Fuzzy-Logic System," *Journal of Construction Engineering and Management*, Vol. 118, No. 2, 1992, pp. 303–317.

Palaneeswaran, E. and M.M. Kumaraswamy, "Contractor Selection for Design/Build Projects," *Journal of Construction Engineering and Management*, Vol. 126, No. 5, 2000, pp. 331–339.

Primer on Contracting for the Twenty-first Century, 5th ed., American Association of State Highway and Transportation Officials, Washington, D.C., 2006 [Online]. Available: www.transportation.org/sites/construction/docs/Primer%20on%20Contracting%202006.pdf [accessed Apr. 1, 2008].

"Public–Private Partnerships Defined," National Council for Public–Private Partnerships, Washington, D.C. [Online]. Available: ncppp.org/howpart/index.shtml#define [accessed Apr. 1, 2008].

Sanvido, V. and M. Konchar, *Selecting Project Delivery Systems: Comparing Design–Bid–Build, Design–Build, and Construction Management at Risk*, The Project Delivery Institute, State College, Pa., 1999.

Shr, J.-F. and W.T. Chen, "Setting Maximum Incentive for Incentive/Disincentive Contracts for Highway Projects," *Journal of Construction Engineering and Management*, Vol. 130, No. 1, 2004, pp. 84–93.

Shr, J.-F., B. Ran, and C.W. Sung, "Method to Determine Minimum Contract Bid for A+B+I /D Highway Projects," *Journal of Construction Engineering and Management*, Vol. 130, No. 4, 2004, pp. 509–516.

Songer, A.D. and K.R. Molenaar, "Selecting Design–Build: Public and Private Sector Owner Attitudes," *Journal of Management in Engineering*, Vol. 12, No. 6, 1996, pp. 47–53.

Songer, A.D. and K.R. Molenaar, "Project Characteristics for Successful Public-Sector Design–build," *Journal of Construction Engineering and Management*, Vol. 123, No. 1, 1997, pp. 34–40.

Trauner Consulting Services Inc., "Criteria and Guidelines for Innovative Contracting, South Dakota Department of Transportation, 1-10," Philadelphia, Pa., 1996.

Trauner Consulting Services Inc., "Innovative Procurement Practices," California Department of Transportation, Sacramento, 2007.

"Utah Local Technical Assistance Program," Utah State University, Logan, 2007 [Online]. Available: www.utahltap.org/default.php [Apr. 8, 2008].

U.S. Department of Transportation, *Design–Build Contracting*, Final Rule, 23 CFR, Parts 627, 635, 636, 637, and 710, 2002 [Online]. Available: www.access.gpo.gov/su_docs/fedreg/a021210c.html.

APPENDIX A

Survey Questionnaire

NCHRP PROJECT 20-5 SYNTHESIS
TOPIC 38-12

SELECTION AND EVALUATION OF ALTERNATIVE CONTRACTING METHODS TO ACCELERATE PROJECT COMPLETION QUESTIONNAIRE

PURPOSE OF THE SYNTHESIS

Many state highway agencies have utilized alternative contracting methods such as incentive/disincentive, increased disincentive, design–build, best value procurement, lane rental, cost-plus-time bidding, and others. The primary motivation for their implementation is to accelerate project delivery, which often results in aggressive schedules. The common concern many state highway agencies have with aggressive schedules is their impact on other important project measures, such as cost, safety, quality, and others.

The purpose of this synthesis is to summarize the current state-of-practice and best practices for selecting and evaluating alternative contracting methods that can accelerate project completion. In other words, the purpose of this study is identifying what are the driving factors for selecting one type of alternative contracting technique over others, what are the risks and barriers involved with its implementation, as well as what are the anticipated and observed outcomes. Understanding these driving factors and barriers is of critical importance for developing systematic selection process.

OBJECTIVES

The overall goal of this synthesis is to identify best practices for selecting and evaluating alternative contracting techniques to accelerate project completion. Specific objectives pertaining to this goal are as follows:

- Identify driving factors for selection of specific alternative contracting methods;
- Assess what are the potential difficulties and barriers in implementation process; and
- Report the outcomes and learned lessons with their implementation.

INSTRUCTIONS

Please be concise with your answers. Because many questions are open-ended, follow-up telephone interviews will likely be necessary to confirm or enhance the understanding of the response. Please be sure you provide us with a contact person for this purpose.

Please enclose any information you believe is relevant to the answers provided in the questionnaire, including applicable procedures, policies, or other information that might be of interest to other state highway agencies.

THANK YOU IN ADVANCE FOR YOUR HELP AND COOPERATION WITH THIS PROJECT!

General Experience with Alternative Contracting Methods to Accelerate Project Completion

1) Responding Agency Information

Please complete the following request for information to aid in processing this questionnaire:

Agency:	
Address:	
City:	
State:	
Zip:	
Questionnaire Completed by:	
Current Position/Title:	
Date:	
Email:	
Telephone:	
Fax:	
Agency Contact (if different from above):	
Telephone:	
Email:	

2) Is your agency currently implementing or considering alternative contracting methods to accelerate project completion?

- [x] Yes
- [ ] No

3) If no, check appropriate box or if check other, explain:

- [ ] Traditional contracting methods are adequate for project completion schedule
- [ ] Agency expertise not available
- [ ] Legal or regulatory prohibitions against some methods
- [ ] Lack of training program
- [ ] Lack of staffing to oversee alternative contracting program
- [ ] Lack of political support
- [ ] Other

4) If other, please explain:

5) Does your agency have a business unit for alternate contracting methods?

- [x] Yes
- [ ] No

6) If Yes, does it have a WEB link?

7) Does your agency have a systematic process to measure benefits of alternate contracting method?

☑ Yes ☐ No

8) If this document is located online, please provide the website address:

9) If this document is not accessible online, can you send a hard copy?

☐ Yes ☐ No

10) What do you consider to be organizational barriers for implementing alternative contracting methods to accelerate project completion?

☐ Lack of Prior Expertise
☐ Lack of Enabling Legislation
☐ Other

11) If other, please explain:

12) Does your agency track the life-cycle performance of the projects selected for accelerated completion?

☑ Yes ☐ No

13) If yes, please indicate: 1) What performance indicators are being used?, and 2) How did alternate contracting method perform?

Evaluating Specific Alternative Contracting Method to Accelerate project Completion

Note: This section of the survey was repeated for each of the 17 methods described earlier.

14) Please indicate number of times your agency used "Cost Plus Time Bidding" to accelerate project completion (*Note: Click on the hyperlink to see a brief description of the method taken from AASHTO Primer on Contracting for the Twenty-first Century)

◉ 0 ○ Less than 5 ○ Between 5 and 10 ○ More than 10

15) Do you have any enabling legislation for this method?

◉ Yes ○ No

16) If yes please explain:

17) Identify the factors that influenced your agency to select this method:

- ☐ Project Size (Dollars)
- ☐ Project Complexity (Urban/Rural, Scope)
- ☐ Critical Completion Date
- ☐ Project Type (Preservation, Rehab, Reconstruction, New)
- ☐ Other Factors

18) If other, please explain:

19) Explain major problems your agency has encountered implementing this method and action taken to overcome them.

20) Identify and explain major advantages from implementing this method:

21) Identify and explain major disadvantages from implementing this method:

22) What are the lessons learned in the process of implementing this method?

23) Average size of the project (in $)

24) Average reduction in project duration (Relative to estimated or projected)

- ☐ <0%
- ☉ 0%
- ☐ 0-5%
- ☐ 5-10%
- ☐ >10%

25) Average cost (Relative to engr's est.)

- ☐ 0-5% Underbudget
- ☉ On-Budget
- ☐ 0-5% Overbudget
- ☐ Other

26) If other, please explain:

27) How has this method performed in terms of project quality?

- ☐ Lower Quality
- ☉ Same Quality
- ☐ Better Quality

28) If you have other performance measures, please explain:

APPENDIX B

State Contacts and Alternative Contracting Methods Used

State	Contact	Contact E-Mail	Business Unit	Alternate Contracting	Methods Used
Arkansas	Jerry Rogers	jerry.rogers@arkansashighways.com			Cost-Plus-Time Bidding Design–Build Incentives/Disincentives
California	Raymond Tritt	rtritt@dot.ca.gov	pd.dot.ca.gov/design/specproj/index.asp		Cost-Plus-Time Bidding Incentives/Disincentives Interim Completion Dates Public–Private Partnerships (PPPs) Practical Methods for Paying UHOOC Design Sequencing
Florida	Derek Fusco	Derek.Fusco@dot.state.fl.us	www.dot.state.fl.us/projectmanagementoffice/alt_contracts/default.htm	www.dot.state.fl.us/construction/altcontract.htm	Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Interim Completion Dates Lane Rental No-Excuse Incentives Construction Manager at Risk PPPs Flexible Notice to Proceed Design–Build–Warrant Design–Build–Maintain Quality Factors Lump-Sum Bidding Liquidated Savings
Georgia	David L. Graham	david.graham@dot.state.ga.us			Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Interim Completion Dates No-Excuse Incentives
Hawaii	Jamie Ho	jamie.ho@hawaii.gov			Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Lane Rental Flexible Notice to Proceed
Idaho	Doug Chase	doug.chase@itd.idaho.gov			Cost-Plus-Time Bidding Incentives/Disincentives Interim Completion Dates Lane Rental PPPs
Illinois	Roger Driskell	roger.driskell@illinois.gov			Cost-Plus-Time Bidding Incentives/Disincentives Interim Completion Dates Lane Rental
Indiana	Dennis A. Kuchler	dkuchler@indot.in.gov			Design–Build Incentives/Disincentives Interim Completion Dates Lane Rental

State	Contact	Contact E-Mail	Business Unit	Alternate Contracting	Methods Used
Iowa	John M. Smythe	john.smythe@dot.iowa.gov			Cost-Plus-Time Bidding Incentives/Disincentives Interim Completion Dates Lane Rental No-Excuse Incentives Flexible Notice to Proceed
Kansas	Abe Rezayazdi	Abe@ksdot.org			Incentives/Disincentives Interim Completion Dates Design–Build–Maintain
Kentucky	Greta Smith	greta.smith@ky.gov			Design–Build Incentives/Disincentives Interim Completion Dates Lane Rental Flexible Notice to Proceed
Maine	Eric C. Shepherd	eric.shepherd@maine.gov			Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Interim Completion Dates Design–Build–Warrant
Minnesota	Tom Ravn	Tom.ravn@dot.state.mn.us	www.dot.state.mn.us/const/tools/innovativecontract.html	www.dot.state.mn.us/const/tools/innovativecontract.html	Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Interim Completion Dates Lane Rental Multi-Parameter Bidding No-Excuse Incentives Early Contractor Involvement Flexible Notice to Proceed Design–Build–Warrant
Mississippi	Brad Lewis	blewis@mdot.state.ms.us			Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Interim Completion Dates Lane Rental No-Excuse Incentives Flexible Notice to Proceed
Missouri	David Ahlvers	David.Ahlvers@modot.mo.gov			Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Interim Completion Dates Lane Rental Public–Private Partnerships Flexible Notice to Proceed Design–Build–Warrant Design–Build–Maintain
Nebraska	Claude Oie	coie@dor.state.ne.us			Cost-Plus-Time Bidding Incentives/Disincentives Interim Completion Dates Lane Rental Early Contractor Involvement Flexible Notice to Proceed
Nevada	Gary Selmi	gselmi@dot.state.nv.us			Cost-Plus-Time Bidding Incentives/Disincentives Interim Completion Dates Flexible Notice to Proceed

State	Contact	Contact E-Mail	Business Unit	Alternate Contracting	Methods Used
North Carolina	Rodger Rochelle	rdrochelle@dot.state.nc.us	www.ncdot.org/doh/preconstruct/altern/default.html		Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Interim Completion Dates No-Excuse Incentives Flexible Notice to Proceed Design–Build–Maintain
North Dakota	Cal J. Gendreau	cgendrea@nd.gov			Cost-Plus-Time Bidding Incentives/Disincentives Interim Completion Dates Flexible Notice to Proceed
Oklahoma	George Raymond	graymond@odot.org			Cost-Plus-Time Bidding Incentives/Disincentives Interim Completion Dates Lane Rental No-Excuse Incentives Early Contractor Involvement Flexible Notice to Proceed
Oregon	John Riedl, P.E.	John.J.Riedl@odot.state.or.us			Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Interim Completion Dates Lane Rental
Pennsylvania	Pat Gardiner	jgardiner@state.pa.us			Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Interim Completion Dates Early Contractor Involvement
South Carolina	D.R. Shealy	shealydr@scdot.org			Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Interim Completion Dates No-Excuse Incentives Public–Private Partnerships Flexible Notice to Proceed Quality Factors
Tennessee	David Donoho	david.c.donoho@state.tn.us			Cost-Plus-Time Bidding Incentives/Disincentives Interim Completion Dates No-Excuse Incentives Flexible Notice to Proceed
Texas	Harry Pan	hpan@dot.state.tx.us			Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Interim Completion Dates Lane Rental Public–Private Partnerships Practical Methods for Paying UHOOC
Vermont	David J. Hoyne	david.hoyne@state.vt.us			Cost-Plus-Time Bidding Incentives/Disincentives Interim Completion Dates No-Excuse Incentives Flexible Notice to Proceed

State	Contact	Contact E-Mail	Business Unit	Alternate Contracting	Methods Used
Washington	Rick Smith	smithrick@wsdot.wa.gov			Cost-Plus-Time Bidding Design–Build Incentives/Disincentives Multi-Parameter Bidding Design–Build–Warrant
West Virginia	Darrell W. Allen	dwallen@dot.state.wv.us			Design–Build Incentives/Disincentives Interim Completion Dates Public–Private Partnerships Design–Build–Warrant

APPENDIX C

Bibliography of Alternative Contracting Methods

Methods	References
Cost-Plus-Time Bidding	Minnesota Department of Transportation (2007) Shr et al. (2004) El-Rayes (2001) Herbsman (1995) Herbsman and Ellis (1995)
Design–Build	Minnesota Department of Transportation (2007) El-Wardani et al. (2006) Ling et al. (2004) Chan et al. (2002) Palaneeswaran and Kumaraswamy (2000) Gransberg and Senadherra (1999) Sanvido and Konchar (1999) Molenaar and Songer (1998) Songer and Molenaar (1997) Songer and Molenaar (1996) Paek et al. (1992)
Incentives/Disincentives	El-Rayes and Kandil (2005) Lee et al. (2005a) Shr et al. (2004) Shr and Chen (2004) Arditi and Yasamis (1998) Arditi et al. (1997) Jaraiedi et al. (1995)
Interim Completion Dates	Washington State Dept. of Transportation (2007a)
Lane Rental	Minnesota Department of Transportation (2007) Lee et al. (2005b) Herbsman and Glagola (1998) Herbsman and Ellis (1995)
Multi-Parameter Bidding	Scott (2006) Anderson and Russell (2001) Herbsman and Ellis (1992)
No-Excuse Incentives	*Primer on Contracting . . .* (2006) Minnesota Department of Transportation (2005)
Early Contractor Involvement	Molenaar et al. (2007) Swainston (2006)
Alliancing	"Grafton Gully Project" (2006) Sakal (2005) Rowlinson et al. (2006)
Construction Manager at Risk	Sanvido and Konchar (1999) The American Institute of Architects and The Associated General Contractors of America (2004) Yakowenko (2004) 3D/International (2004)
Public–Private Partnerships	KCI Technologies (2005) The National Council for Public–Private Partnerships (2008) Federal Highway Administration (2005)
Flexible Notice to Proceed	Federal Highway Administration (2005); American Association of State Highway and Transportation Officials (2000) Anderson and Ullman (2000) Washington State Department of Transportation (2007b)

Methods	References
Design–Build–Warrant	Battelle, prepared for Koch Industries, Inc. (2003) Anderson and Russell (2001)
Active Management Payment	*Primer on Contracting . . .* (2006)
Practical Methods for Paying for UHOOC	California Department of Transportation (2000)
Design–Build–Maintain	
Quality Factors	
Design Sequencing	"Design Sequencing" (2007) California Performance Review (n.d.)
Liquidated Savings	Minnesota Department of Transportation (2007)

REFERENCES

3D/International, Inc., "CM at Risk" [Online]. Available: http://www.3di.com/toolbox/cmatrisk.pdf [accessed June 2007].

Arditi, D. and F. Yasamis, "Incentive/Disincentive Contracts: Perceptions of Owners and Contractors," *Journal of Construction Engineering and Management*, Vol. 124, No. 5, 1998, pp. 361–373.

Arditi, D., C.J. Khisty, and F. Yasamis, "Incentive/Disincentive Provisions in Highway Contracts," *Journal of Construction Engineering and Management*, Vol. 123, No. 3, 1997, pp. 302–307.

Anderson, S.D. and J.S. Russell, *NCHRP Report 451: Guidelines for Warranty, Multi-Parameter, and Best Value Contracting*, Transportation Research Board, National Research Council, Washington, D.C., 2001.

Anderson, S.D. and G.L. Ullman, *NCHRP Synthesis 293: Reducing and Mitigating Impacts of Lane Occupancy During Construction and Maintenance*, Transportation Research Board, National Research Council, Washington, D.C., 2000, 66 pp.

Battelle, "Performance-Based Contracting for the Highway Construction Industry," Prepared for Koch Industries, Inc., 2003 [Online]. Available: http://www.battelle.org/transportation/final-report.pdf.

California Department of Transportation, "Construction Program Procedure Bulletin: CPB 00-8 Contract Administration of Time Related Overhead (TRO)," 2000 [Online]. Available: http://www.dot.ca.gov/hq/construc/cpb/CPB008.pdf.

Chan, A.P.C., D. Scott, and E.W.M. Lam, "Framework of Success Criteria for Design/Build Projects," *Journal of Management in Engineering*, Vol. 18, No. 3, 2002, pp. 120–128.

"Design Sequencing," National Association of State Highway and Transportation Unions, Sacramento, Calif., 2007 [Online]. Available: http://www.nashtu.us/Design-Sequencing.htm [accessed June 25, 2008].

El-Rayes, K., "Optimum Planning of Highway Construction under A+B Bidding Method," *Journal of Construction Engineering and Management*, Vol. 127, No. 4, 2001, pp. 261–269.

El-Rayes, K. and A. Kandil, "Time-Cost-Quality Trade-Off Analysis for Highway Construction," *Journal of Construction Engineering and Management*, Vol. 131, No. 4, 2005, pp. 477–486.

El-Wardani, M., J.I. Messner, and M.J. Horman, "Comparing Procurement Methods for Design–build Projects," *Journal of Construction Engineering and Management*, Vol. 132, No. 3, 2006, pp. 230–238.

Federal Highway Administration and American Association of State Highway and Transportation Officials, "Best Practice/Policy, Florida," In *Workzone Best Practices Guidebook*, 2000 [Online]. Available: http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?id=89.

"Grafton Gully Project," Transit New Zealand, Wellington [Online]. Available: http://cmi.transit.govt.nz/html/ggp/intro.htm [accessed June 2007].

Gransberg, D.D. and S.P. Senadheera, "Design-Build Contract Award Methods for Transportation Projects," *Journal of Transportation Engineering*, Vol. 125, No. 6, 1999, pp. 565–567.

Jaraiedi, M., R.W. Plummer, and M.S. Aber, "Incentive/Disincentive Guidelines for Highway Construction Contracts," *Journal of Construction Engineering and Management*, Vol. 121, No. 1, 1995, pp. 112–120.

Herbsman, Z.J., "A+B Bidding Method—Hidden Success Story for Highway Construction," *Journal of Construction Engineering and Management*, Vol. 121, No. 4, 1995, pp. 430–437.

Herbsman, Z.J. and R. Ellis, *Determination of Contract Time for Highway Construction Projects*, Transportation Research Board, National Research Council, Washington, D.C., 1995.

Herbsman, Z.J. and C.R. Glagola, "Lane Rental—Innovative Way to Reduce Road Construction Time," *Journal of Construction Engineering and Management*, Vol. 124, No. 5, 1998, pp. 411–417.

Lee, E.-B., D. Thomas, and L. Bloomberg, "Planning Urban Highway Reconstruction with Traffic Demand Affected by Construction Schedule," *Journal of Transportation Engineering*, Vol. 131, No. 10, 2005a, pp. 752–761.

Lee, E.-B., J.T. Harvey, and D. Thomas, "Integrated Design/Construction/Operations Analysis for Fast-Track Urban

Freeway Reconstruction," *Journal of Construction Engineering and Management*, Vol. 131, No. 12, 2005b, pp. 1283–1291.

Ling, F.Y.Y., S.L. Chan, E. Chong, and L.P. Ping, "Predicting Performance of Design-Build and Design-Bid-Build Projects," *Journal of Construction Engineering and Management*, Vol. 130, No. 1, 2004, pp. 75–83.

KCI Technologies, Inc., Prepared for the Maryland State Highway Administration, "Current Practices in Public-Private Partnerships for Highways," 2005 [Online]. Available: http://www.mdta.state.md.us/mdta/servlet/dispatchServlet?url=/About/currentpractise.pdf.

Minnesota Department of Transportation, "Performance Effectiveness of Design–build, Lane Rental, and A+B Contracting Techniques," 2007 [Online]. Available: www.lrrb.org/pdf/200609.pdf.

Molenaar, K.R. and A.D. Songer, "Model for Public Sector Design–build Project Selection," *Journal of Construction Engineering and Management*, Vol. 124, No. 6, 1998, pp. 467–479.

Molenaar, K.R., J.E. Triplett, J.C. Porter, S.D. DeWitt, and G. Yakowenko, "Early Contractor Involvement and Target Pricing in U.S. and UK Highways," *Transportation Research Record, Journal of the Transportation Research Board, No. 2040*, Transportation Research Board, National Research Council, Washington, D.C., 2007, pp. 3–10.

Paek, J.H., Y.W. Lee, and T.R. Napier, "Selection of Design/Build Proposal Using Fuzzy-Logic System," *Journal of Construction Engineering and Management*, Vol. 118, No. 2, 1992, pp. 303–317.

Palaneeswaran, E. and M.M. Kumaraswamy, "Contractor Selection for Design/Build Projects," *Journal of Construction Engineering and Management*, Vol. 126, No. 5, 2000, pp. 331–339.

Primer on Contracting for the Twenty-first Century, 5th ed., American Association of State Highway and Transportation Officials, Washington, D.C., 2006 [Online]. Available: www.transportation.org/sites/construction/docs/Primer%20on%20Contracting%202006.pdf [accessed Apr. 1, 2008].

Sakal, M.W., "Project Alliancing: A Relational Contracting Mechanism for Dynamic Projects," *Lean Construction Journal*, Vol. 2, No. 1, 2005.

Sanvido, V. and M. Konchar, *Selecting Project Delivery Systems: Comparing Design–Bid–Build, Design–Build, and Construction Management at Risk*, The Project Delivery Institute, State College, Pa., 1999.

Scott, S., III, *NCHRP Report No. 561: Best-Value Procurement Methods for Highway Construction Projects*, Transportation Research Board of the National Academies, Washington, D.C., 2006.

Shr, J.-F. and W.T. Chen, "Setting Maximum Incentive for Incentive/Disincentive Contracts for Highway Projects," *Journal of Construction Engineering and Management*, Vol. 130, No. 1, 2004, pp. 84–93.

Shr, J.-F. B. Ran, and C.W. Sung, "Method to Determine Minimum Contract Bid for A+B+I /D Highway Projects," *Journal of Construction Engineering and Management*, Vol. 130, No. 4, 2004, pp. 509–516.

Songer, A.D. and K.R. Molenaar, "Selecting Design–Build: Public and Private Sector Owner Attitudes," *Journal of Management in Engineering*, Vol. 12, No. 6, 1996, pp. 47–53.

Songer, A.D. and K.R. Molenaar, "Project Characteristics for Successful Public-Sector Design–build," *Journal of Construction Engineering and Management*, Vol. 123, No. 1, 1997, pp. 34–40.

Swainston, "Early Contractor Involvement," *Queensland Roads*, Vol. 2, Sep. 2006, pp. 42–47.

Washington State Department of Transportation, "Alternative Project Delivery, Interim Completion Date," 2007a [Online]. Available: http://www.wsdot.wa.gov/Projects/delivery/alternative/InterimCompletion.htm [accessed June 2007].

Washington State Department of Transportation, "Alternative Project Delivery, Flexible Start Date," 2007 [Online]. Available: http://www.wsdot.wa.gov/Projects/delivery/alternative/FlexibleStart.htm [accessed June 2007].

Yakowenko, G., "Megaproject Procurement: Breaking from Tradition," *Public Roads,* Vol. 68, No.1, 2004.

APPENDIX D

States with Legislation for Public–Private Partnerships and Design–Build

Nossaman
Guthner Knox Elliott LLP

50-STATE SURVEY OF TRANSPORTATION AGENCY DESIGN-BUILD AUTHORITY

State	*Transportation Agencies with Authority*[1]	*Citation for Statutory Design-Build Authority*[2]	*DOT Procurement Process*
1. AK	Authorization for all agencies for projects using state funds	ALASKA STAT. § 36.30.200	Competitive sealed proposals if appropriate findings are made; otherwise, competitive sealed bids
2. AZ	Authorization for: State Transportation Board; pilot projects by DOT	ARIZ. REV. STAT. §§ 28-7361, 7363, 7364 and 7365	2 phase process: pre-qualification then proposal; award is to lowest score when price is divided by technical score; time valued adjustments may be made to score
3. CA	Authorization for transit agencies, certain cities and counties	CAL. PUB. CONT. CODE §§ 20209.5 and 20133	N/A
4. CO	Authorization for DOT	COLO. REV. STAT. §§ 43-1-1401 *et seq.*	2 phase process: pre-qualification then proposal; any appropriate basis for award if basis is described in RFP; preference to Colorado residents, however if this may cause denial of federal funds then department will suspend preference for residence 43-1-1406; adjusted scoring if commission approves; award is to proposal providing best value to department
5. DE	Public-private initiative authorization allowing authorization for Secretary to solicit design-build proposals	DEL. CODE ANN. tit. 2, § 2003	Proposals solicited through RFP; Department authorized to assess non-refundable proposal review fee not to exceed $50,000; each proposal weighed on its own merits and ranked according to selection criteria; only highest ranking proposal shall be selected.

---

1 This survey should not be construed as legal advice regarding design-build authorization in any state. Please contact nsmith@nossaman.com with any additions or corrections.

2 This survey identifies legislation specifically permitting agencies to enter into design-build contracts and exclusive development agreements, and also identifies legislation specifically permitting agencies to use a best value procurement process for construction contracts (thus allowing design-build procurements to proceed without concern about differing procurement requirements applicable to design and construction contracts). This survey does not necessarily address authorizing legislation for franchise agreements or similar public-private partnerships.

State	*Transportation Agencies with Authority*[1]	*Citation for Statutory Design-Build Authority*[2]	*DOT Procurement Process*
6. FL	Authorization for DOT for buildings, major bridges and rail corridor projects	FLA. STAT. ANN. § 337.11(7)	Governed by rules adopted by Department (specifically allows shortlisting, request for proposals and award based on technical criteria)
7. HI	Authorization for all governmental bodies to use competitive sealed proposal procurement process	HAW. REV. STAT. § 103D-303	Allows discussions with offerors within competitive range, award to most advantageous offer
8. ID	Legislation stating that State agencies are not prohibited from using design-build	IDAHO CODE § 67-2309	None itemized.
9. IL	Specific authorization for Regional Transportation Authorities	70 ILL. COMP. STAT. 3615/4.06(b)(2)	N/A
10. KS	Authorizes DOT to use design-build methodology for innovative pavement management demonstration projects.	KAN. STAT. ANN. §§ 68-214a, §§75-5801 et seq.	Multi-phase evaluation process.
11. KY	Authorizes all state agencies to enter into design/build contracts.	KY. REV. STAT. §§ 45A.180 *et seq.*	Three-phase multi-factor selection process.
12. LA	Authorization for DOT to implement a pilot program for one design-build project not to exceed $5 million	LA. REV. STAT. ANN. § 48:250.2	Pursuant to rules adopted by DOT
13. ME	Authorization for DOT	ME. REV. STAT. ANN. tit. 23, § 753-A	Low-bid award or best-value award. Best value award should be submitted to the department in two components – technical and sealed price proposal
14. MD	Authorization for capital projects Has been used for light rail	MD. CODE ANN., STATE FIN. & PROC. § 3-602(g)(1)	N/A

State	*Transportation Agencies with Authority*[1]	*Citation for Statutory Design-Build Authority*[2]	*DOT Procurement Process*
15. MA	Authorization for Department of Highways to enter into Development Agreement for Route 3 North Authorization for Mass Bay Transportation Authority	1999 Mass. Act 53 2000 Mass. Act 125	Pre-qualification, request for proposals, possibly oral presentation; award to developer who best meets the selection criteria for the benefit of the Commonwealth; selection of other than lowest-overall-cost is allowed if a written explanation of the reasons is given
16. MN	Authorization for streets, highways, bicycle paths, bicycle trails and pedestrian facilities, light rail transit facilities and DOT projects	MINN. STAT. ANN. § 473.3993 MINN. STAT. ANN. § 160.262 MINN. STAT. ANN. § 161.3410	DOT authorized to procure design-build contracts using either a two-step best value selection process or a low bid process, not to exceed 10% of DOT contracts each year; light rail contracts may be awarded on the basis of the RFQ or RFP without bids
17. MO	Authorization for the State Highways and Transportation Commission to enter into design/build contracts.	MO. REV. STAT. § 227.107	Rules not yet adopted.
18. MT	Authorization for DOT to use alternative procurement process	MONT. CODE ANN. § 60-2-111, 112, 135-137.	Award by means other than competitive bidding is allowed if special circumstances so require and are specified in writing. DOT may award up to $20 million in design/build contracts under the pilot program.
19. NV	Authorization for public bodies and DOT for projects that exceed $30,000,000 may also be used for projects over $5,000,000.00 that meet certain criteria.	NEV. REV. STAT. §§ 338.1711-338.1727 and 408.3875-408.3887	Request for preliminary proposals followed by issuance of request for final proposals to "finalists"; award based on most cost effective and responsive proposal using criteria and weight assigned to each factor. Preference for local contractors if not federally funded
20. NH	Projects authorized to use design-build by the State capital budget	N.H. REV. STAT. ANN. § 228:4(I)(f)	Selection to be based on objective standard, measurable criteria for evaluation.

State	*Transportation Agencies with Authority*[1]	*Citation for Statutory Design-Build Authority*[2]	*DOT Procurement Process*
21. NM	Authorization for Highway Department pilot program	N.M. STAT. ANN. §§ 13-1-111 and 13-1-119.1	Two-phase process: shortlisting followed by evaluation of technical cost proposals schedule. Phase Two: proposals evaluated on technical concepts or solutions, costs and scheduling; awarded to highest ranking firm. Note: Statute that allowed use of design-build for highway projects sunsetted on 7/1/03.
22. NC	Authorization for DOT Authorization for Turnpike Authority to use alternative procurement process	N.C. GEN. STAT. § 136-28.11;N.C. GEN. STAT. § 136-89.180 et seq. (enacted by 2002 N.C. Sess. Laws 133, H.B. 644)	None itemized. Requires determination by the Department of Transportation that delivery of the projects must be expedited and that it is not in the public interest to comply with normal design and construction contracting procedures
23. OH	Authorization for DOT and counties	OHIO REV. CODE ANN. §§ 5517.011; § 5543.22.	Requires design-build procurements to be competitively bid.
24. OR	Authorization for DOT tollway projects	OR. REV. STAT. §§ 383.005 et seq.	Department may award any (tollway) contract under a competitive process or by private negotiation or any combination of competition and negotiation; factors considered are: cost, design quality, structural integrity/maintenance, aesthetics, traffic, safety, small business participation, financial stability & experience
25. PA	Authorization for Department of General Services	62 PA. CONS. STAT. §§ 103 and 322(2)	N/A
26. SD	General authorization for public corporations	S.D. CODIFIED LAWS § 5-18-26 et seq.	Performance criteria on a project by project basis (assuming the DOT is a "public corporation")
27. TN	Authorization for municipal building authorities	TENN. CODE ANN. § 12-10-124	N/A
28. TX	Comprehensive development agreement authorization for TxDOT, Texas Turnpike Authority (a division of TxDOT), and regional mobility authorities	TEX. TRANSP. CODE ANN. ch. 227, 370 & 361.	May solicit proposals or accept unsolicited proposals. Selection is based on "best value".

State	*Transportation Agencies with Authority*[1]	*Citation for Statutory Design-Build Authority*[2]	*DOT Procurement Process*
29. UT	Authorization for transportation agencies including the DOT	UTAH CODE ANN. § 63-56-36.1; UTAH ADMIN. CODE R916-3	2 phase process, pre-qualification then proposals; after considering price and other identified factors, award is to proposal which is most advantageous to the state
30. VA	Authorization for limited number of DOT contracts; general authorization for other state agencies	VA. CODE ANN. §§ 2.2-4303, 2.2-4306 and 33.1-12	Award to be based on objective criteria adopted by Commonwealth Transportation Board; objective criteria to include requirements for pre-qualification and competitive bidding
31. WA	Authorization for DOT for projects over $10m; authorization for other public bodies for projects over $12m	WASH. REV. CODE §§ 39.10.051 (effective until July 1, 2007) and 47.20.780	DOT to "develop a process for awarding competitively bid highway construction projects."
32. WI	Authorization for specific bridge projects	WIS. STAT. ANN. §§ 84.11(5n) *et seq.*	2 phase competitive selection process; pre-qualification then proposals; evaluation criteria must include qualifications, quality, completion time and cost.

STATES WITH PUBLIC PRIVATE PARTNERSHIP ("PPP") AUTHORITY AS OF FEBRUARY 2004[3]

State[4]	*Statute*	*Comments*
1. **AL**	ALA. CODE § 23-1-81	Authorizes the Alabama DOT and County Commissions to license toll roads, toll bridges, ferries or causeways.
2. **AZ**	ARIZ. REV. STAT. §§ 28-7701 to 28-7758	Two pilot programs each allow up to two solicited and unsolicited proposals.
3. **AR**	ARK. STAT. ANN. § 27-86-201	1923 statute authorizing counties to grant franchises for toll bridges, turnpikes and causeways over or along any watercourse, lake, bay or swamp.
4. **CO**	COLO. REV. STAT. §§ 43-3-101 to 43-3-416 COLO. REV. STAT. §§ 43-1-1201 to 1209	Provides PPP authority to Colorado DOT for specific projects including turnpikes and HOT lanes. Allows solicited and unsolicited proposals for PPPs.
5. **DE**	DEL. CODE ANN. tit. 2, ch. 20	Authorizes solicited and unsolicited proposals.
6. **FL**	FLA. STAT. ANN. § 334.30 FLA. STAT. ANN. § 348.0004	Allows Florida DOT to receive or solicit proposals for PPPs; requires legislative approval for each facility. Allows Expressway Authorities to accept unsolicited proposals.

---

3 This survey should not be construed as legal advice regarding design-build authorization in any state. Please contact nsmith@nossaman.com with any additions or corrections.

4 The legislation authorizing the California Department of Transportation to enter into PPPs (AB 680) was repealed in 2004. Legislation authorizing the New Jersey DOT to enter into PPP's for up to 7 demonstration projects expired in 2002.

State[4]		*Statute*	*Comments*
7.	**GA**	GA. CODE. ANN. §§ 32_2_78 and 32_20_79	Allows Georgia DOT to accept unsolicited proposals for PPPs.
8.	**IL**	20 ILL. COMP. STAT. § 2705-450.	Allows PPPs for high speed rail and magnetic levitation transportation.
9.	**IN**	IN. CODE § 8-10-1.	Allows Indiana Port Comm. to enter into PPPs.
10.	**LA**	LA. REV. STAT. § 48:2020. LA. REV. STAT. § 48:2072.	Allows parishes, municipalities and Louisiana Transportation Authority to enter into PPPs.
11.	**MD**	MD. ANN. CODE § 8-204	According to an Attorney General opinion referenced in the annotations to this statute, the Maryland Transportation Authority has authority to construct toll roads using PPPs.
12.	**MA**	1999 MASS. Acts, ch. 53, § 6	Authorizes Route 3 North Project as a PPP.
13.	**MN**	MINN. STAT. ANN. §§ 160.84 – 160.93	Authorizes PPPs for toll facilities. Authorizes HOT lanes.
14.	**MO**	MO. REV. STAT. §§ 238:300 to 238:367	Creates a special purpose non-profit corporation known as a Transportation Corporation as a vehicle for PPPs.
15.	**NV**	NEV. REV. STAT. §§ 338.161-168.	Authorizes public bodies to accept unsolicited proposals to develop, construct, improve, maintain or operate transportation facilities. Excludes toll bridges and toll roads.
16.	**NC**	N.C. GEN. STATE. §§ 136-89.180 to 136-89.197	Authorizes North Carolina Turnpike Authority to construct toll facilities.
17.	**OR**	OR. REV. STAT. §§ 383.001 and 383.017.	Allows Oregon DOT to award PPPs for tollway projects.
18.	**SC**	S.C. CODE § 57-3-200	Allows South Carolina DOT to enter into PPPs.

Abbreviations used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation