Design-Build Effectiveness Study – As Required by TEA-21 Section 1307(f)

Final Report

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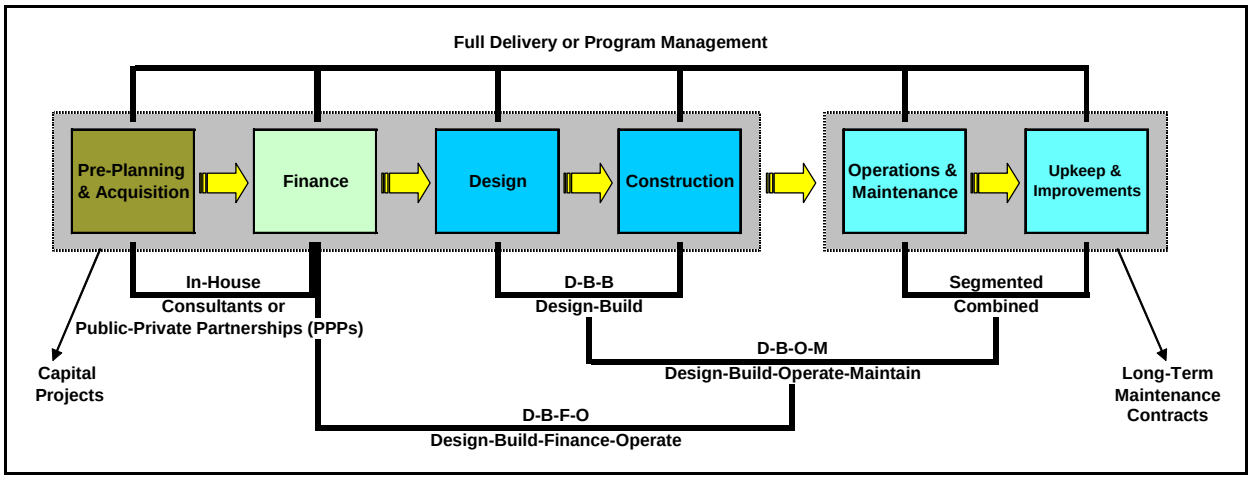
EXECUTIVE SUMMARY

BACKGROUND

Since 1990, a number of transportation agencies (as owners, sponsors, or contracting agencies of highway projects) have been experimenting with a wide variety of innovative project delivery strategies aimed at lowering the costs and time to produce highway construction and rehabilitation projects, while maintaining or improving project quality. One of these strategies is design-build (D-B) project delivery. Design-build is a method of project delivery in which the design and construction phases of a project are combined into one contract, usually awarded on either a low bid or best-value basis. This is in marked contrast to the more traditional design-bid-build (D-B-B) approach used in transportation agencies that outsource project design work, in which two different contracting efforts must be undertaken in sequence to procure architecture/engineering services on a negotiated-price basis and construction services on a lowest-responsible-bid price basis.

Exhibit 1 displays different types of project delivery approaches that combine various phases of the project life cycle. Many of these project delivery approaches extend far beyond the scope of design-build contracting by placing increasing functional responsibilities for highway infrastructure under a single contract vehicle.

Exhibit 1 Alternative Contractual Arrangements for Delivering Highway Infrastructure

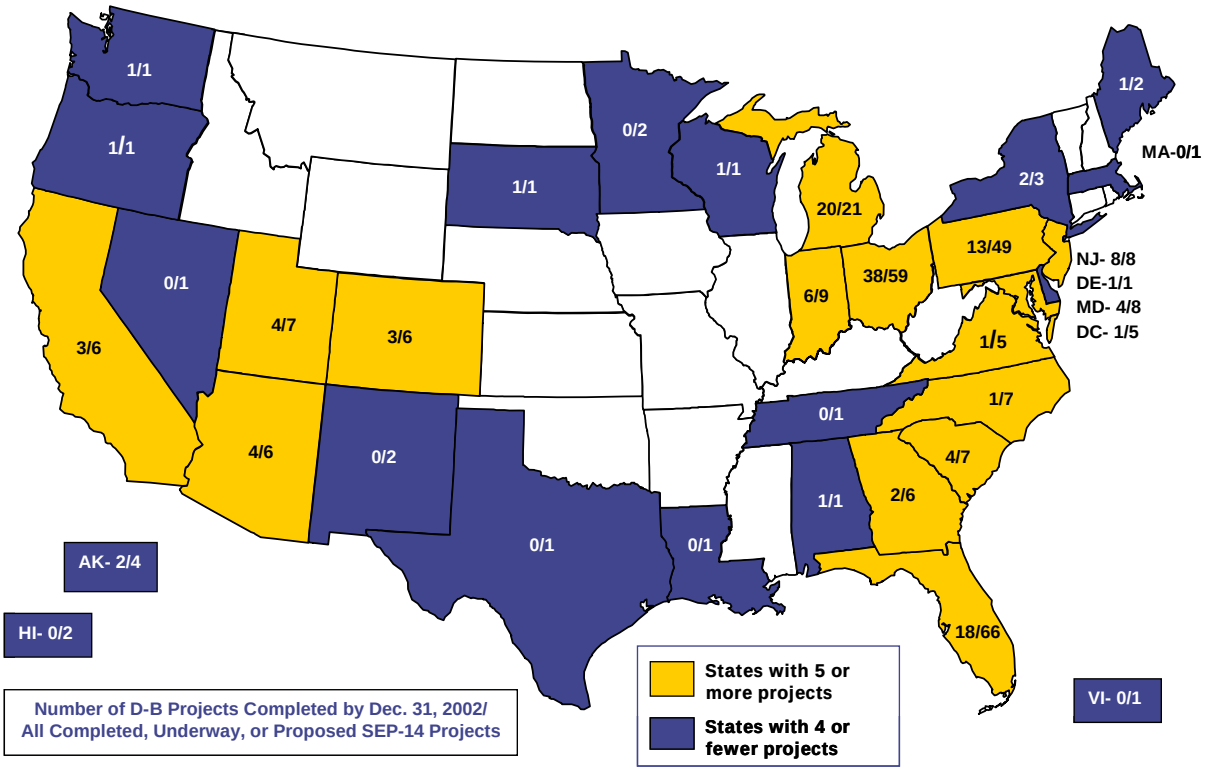


Source: Pakkala, Pekka. *Innovative Project Delivery Methods for Infrastructure—An International Perspective.* Finnish Road Enterprise, Helsinki, 2002, p. 32.

In 1990, Special Experimental Project Number 14 (SEP-14) – Innovative Contracting, was established by the Federal Highway Administration (FHWA) to enable state transportation agencies (STAs) to test and evaluate a variety of alternative project contracting methods that provided the potential to expedite highway projects in a more cost-effective manner, without jeopardizing product quality or contractor profitability. One of these methods was design-build, which remains a core element of SEP-14. Between 1990 and 2002, about 300 projects representing $14 billion were proposed for design-build contracting under SEP-14 by

transportation agencies in 32 states, the District of Columbia, and the Virgin Islands. Of this total, 140 projects representing $5.5 billion were completed by the end of 2002. Exhibit 2 shows the total number of design-build projects proposed, active, or completed by each of the states participating in the SEP-14 program.

Exhibit 2 SEP-14 Design-Build Projects by State
(total and those completed by December 31, 2002 by STAs, toll agencies, or local public agencies)



Source: Design-Build Projects Approved Under SEP-14, Federal Highway Administration, July 2003

DESIGN-BUILD CONTRACTING FINAL RULE

In 1998, the Transportation Equity Act for the 21st Century (TEA-21) became the new authorization legislation for the nation's surface transportation programs. Included in TEA-21 was Section 1307 (c), which required FHWA to develop and issue regulations describing the Agency's approval criteria and procedures. The Design-Build Contracting: Final Rule was published in the Federal Register on December 10, 2002 and became effective on January 9, 2003.[1]

[1] Federal Register, December 10, 2002, Volume 67, No. 237, pages 75902 - 75935

The following lists the most salient parts of FHWA's Design-Build Contracting Final Rule for consideration by both representatives of transportation agencies and firms interested in proposing on prospective projects using the design-build contracting approach:

- Allows but does not require use of design-build contracting approaches;
- Permits the use of design-build contracting on both qualified and non-qualified projects, where qualified projects are those over $50 million (or $5 million for Intelligent Transportation Systems (ITS) projects);
- Requires completion of the NEPA environmental clearance process prior to the release of the final request for proposals document;
- Allows responsive unsuccessful proposers to receive stipends as partial compensation for their proposal development costs;
- Eliminates minimum percentage participation by prime contractors on design-build teams;
- Allocates various forms of risk based on ability to manage and control these risks;
- Encourages consideration of value engineering and life cycle costing;
- Permits multiple notices-to-proceed to enable work to proceed on specific project sections when environmental, utility, permit, and right-of-way clearances have been completed for those sections;
- Defines requirements for avoiding conflicts of interest in the procurement process;
- Allows for public-private partnerships to submit design-build contract proposals under a competitive process, consistent with state and local laws as well as applicable non-procurement requirements such as Buy America, Davis-Bacon minimum wage, and right-of-way acquisition requirements; and
- Suggests using a two-phase selection procedure, consisting of (1) shortlisting qualified teams based on responses (containing technical and qualifications-based information) to a request for qualifications (RFQ), and (2) evaluating technical and price proposals submitted in response to a request for proposal (RFP).

STUDY RATIONALE AND FOCUS

Section 1307 (f) of TEA-21 required that a comprehensive national study be conducted to evaluate the effectiveness of design-build contracting, with the results subsequently reported to Congress. The five objectives specified in Section 1307 (f) for this study included the following:

1. Assess the effect of design-build contracting on project quality, cost, and timeliness;
2. Recommend the appropriate level of design for design-build procurements;
3. Assess the impact of design-build contracting on small businesses;
4. Assess the subjectivity used in design-build contracting; and
5. Recommend actions and changes to design-build contracting procedures.

This study focuses on completed design-build projects authorized under SEP-14. This is the first comprehensive study of the SEP-14 Program involving both program and project managers who have been directly responsible for Federal-aid highway projects delivered under the design-build contracting approach. Its findings and conclusions are based on the results of an extensive literature search, interviews with key stakeholders involved in the Federal-aid highway program and SEP-14, and an integrated set of surveys of transportation agency personnel responsible for design-build programs and projects developed under SEP-14.

- The program-level surveys reveal how the state transportation agencies participating in the SEP-14 Program view the application of design-build contracting on their programs and projects.
- The project-level surveys indicate how design-build project delivery is used and its consequences for a broad sample of SEP-14 projects completed before the end of calendar year 2002.
- The project survey also collected information on a limited sample of similar projects that were delivered using the traditional design-bid-build contracting method. This provided the opportunity to assess on a limited case-study basis differences in project performance between design-build and design-bid-build project delivery, including cost, duration, quality, and other factors related to competition and fairness.

RESULTS OF PRIOR STUDIES

This is not the first study of performance issues resulting from the application of design-build contracting to infrastructure projects. In the past ten years, a number of domestic and international studies have sought to determine how innovations in project delivery affect projects built by the private sector, defense agencies, and public infrastructure agencies. The following summarizes the key findings and conclusions from these prior studies:

- Prior research into the impacts of design-build relative to design-bid-build includes comprehensive studies of building projects, both domestic and in the United Kingdom, and more limited studies of horizontal (highway) projects.
- Both types of projects (buildings and highways) typically show a significant advantage for design-build in lowering the duration of the project, with a broad range of 4 percent to 60 percent reduction relative to design-bid-build.
- Both types of projects typically show a cost advantage for design-build, but by counting the exceptions the range is from an 18-percent reduction to a 23-percent increase in cost.
- There is little quantitative data on the quality of design-build versus design-bid-build, although what exists indicates the two approaches produce similar quality results.

SUITABILITY OF DESIGN-BUILD PROJECT DELIVERY

Projects of many sizes and complexities have used design-build project delivery over the years since the inception of the SEP-14 Innovative Contracting program. However, the overwhelming majority of SEP-14 program costs have been for projects over $100 million in cost. This reflects the perceptions of design-build program managers surveyed for this study who rated the following project types as most suitable for design-build project delivery:

- Road widening or new construction
- Road rehabilitation or reconstruction
- Bridge and tunnel projects

Least suitable among the project types was road resurfacing. The suitability rating for design-build contracting was highly correlated to the size of the project, wherein the suitability rating more than doubled when going from small projects to mega projects (projects over $100 million).

IMPACTS OF DESIGN-BUILD ON PROJECT DURATION, COST, AND QUALITY

On average, the managers of design-build projects surveyed in the study estimated that design-build project delivery reduced the overall duration of their projects by 14 percent, reduced the total cost of the projects by 3 percent, and maintained the same level of quality as compared to design-bid-build project delivery, as shown in Exhibit 3.

Exhibit 3 Summary of Estimated Impacts of Using Design-Build on Project Duration, Cost, and Quality

Duration Dimension	Value	Cost Dimension	Value	Quality Dimension	Value
Responses	62	Responses	48	Responses	61
Average	**-14.1%**	**Average**	**-2.6%**	**Average**	**0.0%**
Median	-10.0%	Median	0.0%	Median	0.0%
Mode	-0.1%	Mode	0.0%	Mode	0.0%
Maximum	50.0%	Maximum	65.0%	Maximum	10.0%
Minimum	-63.0%	Minimum	-61.8%	Minimum	-10.0%
Standard Deviation	**24.4%**	**Standard Deviation**	**20.5%**	**Standard Deviation**	**2.1%**

Source: D-B project survey: Q18, 45-60 responses

Impacts on Project Duration

Actual data for the surveyed design-build projects indicated an average drop of 1 percent between planned and actual total project duration. A comparison between the survey results for a subset of design-build projects and similar design-bid-build projects showed a 9 percent difference in total project duration and a 13-percent difference in construction phase duration

between the two types of project delivery approaches, with the design-build projects having the shorter durations. Program survey respondents perceived that design-build projects take more time to set up and procure, but once awarded, require less time for the contracting agency to administer in comparison to similar design-bid-build projects.

The results of the program and project surveys, including both project manager estimates and actual project documentation, supported the claim that the design-build approach can reduce the overall duration of a project, in certain cases significantly. Despite wide variations in changes to project duration among the surveyed design-build and design-bid-build projects, particularly for the construction phase, the results revealed that longer than planned contract development and evaluation timeframes and potentially longer construction timeframes could be more than offset by certain features of the design-build process.

These features included the following:

- Eliminating the need for a second procurement cycle by combining contracting for design and construction contracts.
- Integrating these functions during the project development lifecycle, while design-bid-build keeps them contractually separate.
- Producing improved designs that are more constructible and require fewer design "fixes" through change and extra work orders.
- Allowing parallel processing of activities occurring on different portions of a project while design-bid-build keeps them sequential.

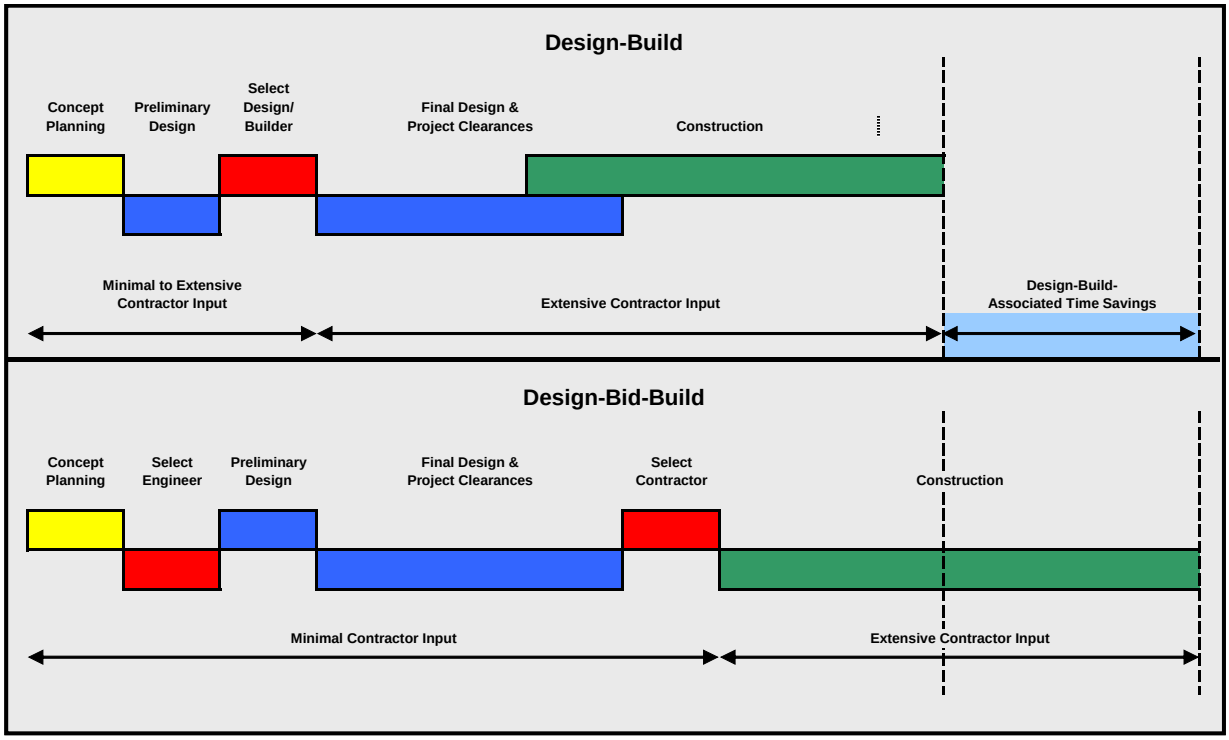
Exhibit 4 illustrates the general sequence of project development activities for both design-build and design-bid-build contracts. The two schedules demonstrate how the type of project delivery approach may influence the sequencing and duration of standard highway project development phases. The key feature that distinguishes these two project delivery approaches is the placement of design functions relative to the construction functions and the potential for overlap between the design and construction phases for the design-build approach.

Impacts on Project Cost

The project survey results revealed that design-build project delivery, in comparison to design-bid-build, had a mixed impact on project cost depending on the project type, complexity, and size. The surveyed design-build project managers indicated that project delivery approach (i.e., design-build versus design-bid-build) can be a contributing factor in controlling and potentially reducing project costs. However, project delivery approach was perceived to be less of a factor in affecting project cost than other characteristics of the project or its participants.

When project cost information was used from the project surveys, the design-build projects experienced no appreciable change in total cost due to off-setting cost increases and cost decreases among the project sample surveyed, which both vary widely. When cost information was used from a subset of similar design-build and design-bid-build projects, the design-bid-build projects demonstrated more favorable cost results.

Exhibit 4 Sequence of Project Delivery Activities by Contract Approach



Source: Dr. Keith Molenaar, University of Colorado at Boulder

Project costs experienced most growth from contract award to project completion. Respondents to the design-build project survey indicated that the leading cause of project cost changes was change orders: owner required additions or subtractions and design-builder or contractor suggested additions or subtractions. This was true for both project delivery approaches, with design-build projects being significantly more sensitive to delays, additions, or subtractions caused by third parties than design-bid-build projects.

Change orders represented 5 percent of the total costs for the surveyed projects. Claims represented less than one-tenth of one-percent of total project costs. The subset of design-build projects had fewer change orders than the comparable design-bid-build projects, but the average cost per change order was greater for the design-build projects. This can be attributed to the greater size of design-build projects. This was confirmed by the fact that change orders represented about the same share of total project costs for both design-build and design-bid-build projects. In contrast, the dollar value of claims per project was significantly lower for design-build projects than for comparable design-bid-build projects, with the subset of design-build projects having no reported cost of claims.

Impacts on Project Quality

Contracting agency satisfaction with the outcome and process of project delivery is one of the primary ways to measure the quality of different approaches. Project survey respondents expressed a high level of satisfaction with design-build projects, including compliance with

warranty provisions and conformance with standards and specifications. Based on a detailed statistical analysis of project survey responses, the research team discovered that overall contracting agency satisfaction was highly correlated with the following project characteristics:

- Procurement method;
- Type (complexity) of road project;
- Size of project; and
- Percent of preliminary design completed prior to contract award.

The results of this analysis are summarized in Exhibit 5.

Exhibit 5 Overall Contracting Agency Satisfaction by Project and Contract Type

Project/Contract Characteristic	Overall Sponsor Satisfaction	
	Lower	Higher
Procurement Method	Low Bid	Best Value
Project Type	Road-Resurface/Renewal	Road-New/Widen and Rehabilitate/Reconstruct
Project Size	Smaller	Larger
% of Design Completed at Award	Higher	Lower

Source: D-B project survey: Q2, Q4, Q10, and Q17; 69 responses

When a subset of 19 design-build projects was compared to similar design-bid-build projects, the survey results indicated that overall contracting agency satisfaction with design-build projects was on a par with design-bid-build projects. However, conformance with warranty provisions and standards and specifications were both rated higher for design-build projects than for similar design-bid-build projects.

OTHER DESIGN-BUILD CONTRACTING ISSUES

There are a number of additional issues relating to the use of design-build contracts that can impact the relative risk to the public and private sector participants in the contract and the opportunity to apply more cost-effective approaches to accomplishing the objectives of the project. These are discussed below.

Appropriate Level of Preliminary Design

Among the design-build projects surveyed for this study, design averaged 27 percent complete prior to design-build contract award. For 81 percent of the reported projects, the percentage of design completion by design-build contract award was 30 percent or less. For the subset of design-build projects surveyed, the average percent design completion prior to going to a design-

build contract was 37 percent, with 78 percent of the projects at 30 percent or less. An earlier survey of six STAs using design-build found a broad range for the level of preliminary design completed before issuing requests for bids of proposals for design-build projects.[2] The range was 15 percent to 50 percent, with the average among the six agencies being 31 percent.

These results are consistent with the finding in Exhibit 5 that the level of contracting agency satisfaction reported for design-build projects was higher for lower levels of preliminary design completed before design-build contract award. This can be attributed the design-builder's ability to influence the project design earlier in the process to promote its constructability and cost-effectiveness. While each project should be considered on an individual basis, the results suggest that no more than 30 percent of preliminary design be completed before design-build contract award, with lower percentages as the contracting agency gains more experience with design-build contracting and greater reliance is placed on performance-based specifications.

Impacts on Small Business

The advent of design-build project delivery has raised concerns by some that small firms[3] may be unable to participate on design-build teams, particularly as the design-build team lead or prime contractor, due to the increased functional scope and scale of many design-build contracts, more stringent qualification requirements, and/or higher bonding requirements. In some cases, contracting agencies have applied design-build to smaller projects to address these and other issues. In the context of this report, small business participation includes the involvement of smaller firms in design-build projects as a prime contractor, joint venture partner, or subcontractor.

Agency respondents to the design-build program survey indicate that the percentage of design-build project costs going to small businesses was about the same on average as for design-bid-build projects, with only a very small reduction indicated for design-build projects. These results suggest that small businesses were not disadvantaged when projects were developed through the design-build process, according to agency design-build program managers.

The survey results also indicated that design-build contracts spread more of the design work among subconsultants than comparable design-bid-build contracts, which should be a positive feature for small business enterprises.

Subjectivity in Contracting

The survey results suggested that while project urgency and innovation were the primary motivators for using design-build contracting, cost remained the primary factor for awarding

[2] Molenaar, Keith R. and Douglas D. Gransberg, *Design-Builder Selection for Small Highway Projects*, ASCE Journal of Management in Engineering, Vol. 17, No. 4, October 2001

[3] Small business is defined as any organization with less than 500 employees and $6 million in average annual receipts for service organizations ($28.5 million for general building and heavy construction contractors and $12 million for special trade construction contractors) For applicable small business size standards by industry category, see the U.S. Small Business Administration's Small Business Size Regulations, 13 CFR §121 or the Table of Small Business Size Standards.

design-build contracts, even when other factors such as duration, team reputation, and quality were included in the deliberations. In addition, low bid continued to play an important role in contract award decisions, with best-value approaches using multiple criteria including cost gaining momentum.

Since design-build includes a significant design element, it is important to include these other factors as is the case when purely design proposals are selected (which by law cannot be based solely on cost or low bid). Best value selection methods provide for the consideration of both cost and other, more subjective, factors such as project management, quality control, and team reputation. Best value is gaining popularity among contracting agencies of design-build projects due to its ability to consider all relevant factors that affect the desirability of a design-build bid.

AGENCY SUGGESTIONS FOR IMPROVING DESIGN-BUILD PROGRAMS

The project managers who completed design-build project surveys noted many lessons learned from these projects. Key lessons included

- Carefully choosing projects appropriate for design-build
- Adequately preparing to procure and manage a design-build project;
- Properly phasing the project by timing permitting, environmental clearance, and right-of-way acquisition prior to award of design-build contract;
- Leaving design guidelines "loose," with performance criteria designed to drive the creativity of the design-build team; and
- Maintaining communications between the contracting agency and design-build team.

They also identified various changes their agencies have undertaken or plan to make to improve the effectiveness of their design-build programs. Changes include amending quality assurance and quality control, better defining program guidelines, and working more closely with design and construction contractors to craft a better program. Several agencies also reported that their design-build programs were being reassessed on an on-going basis as projects moved through the process. Suggestions for further improving the design-build process included:

- More careful selection of projects appropriate for design-build;
- Better definition of the contracting agencies' and contractors' project scopes;
- Creation of more accurate bidding documents;
- Selection of design-build consortium on a best-value rather than low-bid basis;
- Modification of the quality control procedures; and
- Development of a procedure to review project design and manage construction issues.

CONCLUSIONS

Based upon the results of this study, the following conclusions are offered regarding the future disposition of design-build as an alternative method for delivering highway projects, relative to the areas of interest defined by Section 1307 (f) of TEA-21, which mandated this study:

Impacts on Project Timeliness

- The greatest motivation and realized benefit to a project contracting agency of using design-build instead of design-bid-build contracting is the ability to reduce the overall duration of the project development process by eliminating a second procurement process for the construction contract, reducing the potential for design errors and omissions, and allowing for more concurrent processing of design and constructing activities for different portions of the same project.

Impacts on Project Cost

- The impact of project delivery approach on project cost is more difficult to establish and the range of both cost increases and decreases was quite wide. Project costs are much more likely to be impacted by the following factors that are beyond the control of the design-builder:
  - Nature and complexity of the project;
  - Third-party requests for changes to the plans and the project; and
  - Quantity contingencies (typically +/- 10 percent) included in unit price-based design-bid-build contracts that apply to change orders and quantity overrun items but which are not present in lump sum-based design-build contracts.

  This last factor provides greater opportunity for a design-bid-build contractor to pass on added project costs before having to negotiate a new unit price contract.

- Greater cost efficiencies are most likely to occur for design-build projects as a result of enabling the design-builder to propose more cost-effective ways to realize the performance objectives of the project. This can be achieved by:
  - Encouraging the design-builder to use the latest innovative technologies and methodologies to more fully leverage available public resources;
  - Integrating the design and construction activities to reduce the potential for design errors and discontinuities between the design plans and construction efforts that can result in fewer change orders and extra work orders;
  - Shifting to greater use of performance-based specifications that promote design-builder creativity and decrease change orders; and
  - Greater opportunities to use value engineering in design-build than in design-bid-build.

- Significantly lower cost and number of claims for design-build projects reflect a fundamental shift in the adversarial nature of transportation construction contracting and bodes well for the future implementation of this procurement method, particularly for high visibility projects where cooperation between contracting agencies and their design and construction contractors is essential to project success.

Impacts on Project Quality

- Design-build does not appear to be a threat to the quality of highway projects. Indeed project contracting agencies expressed equal satisfaction with the results of design-build and design-bid-build projects, suggesting that the choice of project delivery approach is neither a determinant of nor a threat to project quality. Overall contracting agency satisfaction was highest when design-build was used for large projects, when lower levels of preliminary design were performed prior to the design-build contract, and when contract selection was based on best value.

Level of Design Completed Prior to Design-Build Contract

- The level of preliminary design that should be completed before a design-build contract is procured depends on the size and complexity of the project, the ability of the design-builder to develop a more cost-effective and constructible project design in a timely and competent manner, the degree to which performance specifications are used for the project, and the opportunity to gain valuable design capabilities, with earlier value engineering and constructability reviews as part of the process.

Impacts on Small Business

- Design-build projects provide opportunities for subcontractors to perform substantial portions of design-build projects. According to survey responses, small business contractors are playing comparable roles on completed design-build projects as for design-bid-build projects, with greater opportunities for subcontracting of the design work to smaller firms.

Subjectivity of Design-Build Contracting

- While low bid continues to be used as the basis for contract award decisions for many design-build projects, best-value approaches using multiple criteria including cost are gaining momentum. Best value selection provides for the consideration of both cost and other more subjective factors such project management, quality control, and team reputation and is gaining popularity among contracting agencies of design-build projects due to its ability to consider all relevant factors that affect the desirability of a design-build bid.

Other Considerations

- While the use of design-build is not a panacea for delivering highway projects, there are project features and circumstances that encourage its consideration if not use.
  - Medium to large projects that are more complex in nature and can benefit from the application of innovative concepts in project design and development earlier in the project conceptualization process are well suited to design-build project delivery.
  - New/widening, rehabilitation/reconstruction, and bridge/tunnel projects have the size and complexity to enable the private sector to apply more cost-effective ways to develop the project using design-build. These potential efficiencies permit design-builders to take on the higher project/contract risks associated with design-build contracting.
  - Projects that have a high sense of urgency (due to natural disasters or facility failures) or involve some kind of direct user fee-based financing are more likely to benefit from design-build contracting due to its ability to expedite project completion and/or facilitate the start of user fee-based revenue collection.
  - Projects with a dedicated revenue stream associated with completion (such as toll roads) provide added incentive for the public sector to complete a project on time and within budget.
  - Trained and capable contracting agency staff responsible for administering design-build projects must be designated for this method of project delivery, including procurement and contract administration processes.
  - The presence of a number of competent design and construction firms interested and willing to compete for work under the design-build contracting approach helps to ensure cost-competitive bids/proposals.
  - Public demands for accountability regarding project schedule and quality can be more readily met through the terms and conditions inherent in a design-build contract, where qualified design-builders take on more project risk associated with meeting the contract schedule and performance criteria because of their ability to apply innovative techniques that lower the costs of project delivery while achieving desired performance results.

- A large number of agencies have now undertaken one or more design-build projects under the auspices of SEP-14 and tested different ways to apply design-build to many different types and sizes of projects. The knowledge gained from setting up these programs and testing design-build provides a rich source of legislative, regulatory, procedural, and institutional documentation and insights to help institutionalize this process as an option for contracting agencies to consider as they develop their highway improvement programs and projects.

RECOMMENDATIONS

Based upon the results of this study, the following recommendations are offered to improve the use of design-build for delivering highway projects.

- The FHWA should continue to work with AASHTO and industry representatives to develop suggested guidelines and illustrative documents for use by contracting agencies interested in evaluating the design-build project delivery method. The FHWA recognizes this need and continues to support the activities of the AASHTO Design-Build Task Force and the design-build related research performed under the National Cooperative Highway Research Program (NCHRP). Two current research studies will be effective in accomplishing these goals: (NCHRP Project 25-25(12) - "Design-Build Environmental Compliance Process and Level of Detail Required" and NCHRP Project 20-07, Task 172, "Recommended AASHTO Design-Build Procurement Guide").

- To the extent practical, contracting agencies should provide for flexibility in the design criteria by using performance criteria to encourage creativity by the design-build proposing teams while providing a basis to hold the team accountable for project results.

- Preliminary designs that are incorporated in the RFP should be no more than 30 percent complete , dropping to lower levels as the size and complexity of the project increases and the contracting agency gains greater experience with this project delivery approach and the use of performance-based specifications.

- Raising the expertise and experience among transportation agency managers is a key challenge. Transportation agencies should invest in design-build training before attempting to execute their first design-build project. That training should include not only contracting agency personnel but also consulting engineers and construction contractors that will compete for these projects. On-going design-build training sessions could be used to institutionalize lessons learned for completed or active design-build projects.

- **CLOSING REMARKS**

The changing nature of the nation's highway development program and resources, at the federal, state, and local levels, is placing increasing burdens on the public sector's ability to meet the growing needs for renewed and expanded system capacity. Innovative techniques like design-build have been shown to offer the potential to help transportation agencies better serve these needs by doing things faster and more cost-effectively. While many of the conditions that spawned the promulgation of highly restrictive contracting laws and procedures early in the twentieth century are no longer in evidence, care must be taken to prevent a repeat of these conditions. This is why use of techniques like design-build contracting must be viewed and entered into with the understanding that the public and private participants in the process have a shared interest and liability for the process results, and are each held accountable for the results.

Design-build contracting represents a collaborative effort that integrates the various resources involved in the development of a highway project and provides incentives for a high level of technical performance and consistency with contractual budget and schedule terms. It has the potential to produce a more cost-effective project in less time than a process that contractually insulates the project participants while leaving the contracting agency with most of the project risk. The following quotes reflect the views of many of the respondents to the design-build surveys:

- *"We are sold on design-build. We feel that it offers the department an excellent option for procuring work faster and potentially more effectively that the traditional design-bid-build method." (a representative from the Construction Division ,Utah Department of Transportation)*

- *"The design-build technique for transportation [project] delivery has provided the department with another tool to meet the needs of our customers, the traveling public. This technique allows us to move from concept to concrete at an accelerated pace which has helped us to meet the needs of local municipalities quickly. We could not have met the President's and Governor's economic stimulus initiatives had we not had the design-build option. This program has been extremely beneficial." (a representative from the Florida DOT)*

- *"We utilized the design-build contracting method to [respond] to a significant increase in the bridge construction budget with little time to implement [the project]. Design-build effectively brought the program to construction." (a project manager from the Michigan DOT)*

"This project would not have been possible without design-build project delivery." (a representative from the Alameda Corridor Transportation Authority)

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APPENDICES

I. INTRODUCTION

This introductory chapter presents an overview of the study effort, including study background, legislative basis for the study request, purpose and objectives, scope and methodologies, work plan, and research team.

BACKGROUND

During the 1980s and 1990s, State transportation agencies (STAs) across the nation attempted to bridge the gap between highway program resources and needs by seeking new funding sources and experimenting with alternative processes to expedite critical highway capital projects needed to support statewide mobility and economic development. Since 1990, a number of transportation agencies (as owners, sponsors or contracting agencies of highway projects) have been experimenting with a wide variety of innovative project delivery strategies aimed at lowering the costs and time to produce highway construction and rehabilitation projects, while maintaining or improving project quality. Such strategies include the leveraging of private sector strengths in design and construction engineering functions, delegation of responsibilities for materials testing and project inspection functions to contractors, streamlining the project development process, and applying innovative project delivery, procurement, and contract administration functions[1,2]. Among these strategies, design-build (D-B) project delivery represents one of the most promising yet controversial methods for streamlining the project development function and potentially lowering project cost and duration while maintaining or improving product quality.

Design-build is a method of project delivery in which the design and construction phases of a project are combined into one contract, usually awarded on either a low bid or best-value basis[3,4]. This is in marked contrast to the more traditional design-bid-build (D-B-B) approach applied by transportation agencies that outsource project design work, in which two different contracting efforts must be undertaken in sequence to procure architecture/engineering services on a negotiated-price basis and construction services on a lowest-responsible-bid price basis. In design-build, the engineering firm and construction contractor have the incentive to become an integrated team that works concurrently on the design and construction phases of different segments of a project, with the potential to expedite delivery and better control product quality and costs. Instead of separate procurement efforts for design and construction phases, design-build combines these two phases into a single procurement effort that may incorporate value-based award criteria—versus the traditional qualifications-based designer selection criteria and low bid-based contractor selection criteria.

[1] FHWA (2002). *Briefing-FHWA Initiatives to Encourage Quality Through Innovative Contracting Practices*. Special Experimental Projects No. 14 (SEP-14).
[2] Transportation Research Board (1991). *Innovative Contracting Practices*, Transportation Research Circular 386, December.
[3] Beard, Jeffrey L.; Loulakis, Michael C. Sr.; Wundram, Edward C. (2001). *Design Build: Planning Through Development*, McGraw-Hill, New York.
[4] Friedlander, Mark C. (1998). "Design/Build Solutions," *Journal of Management in Engineering*, ASCE, Nov/Dec, 59-64.

Design-build contracting has become a popular form of project delivery for private firms and public agencies responsible for the development of buildings and other types of vertical infrastructure, spurred by the need to expedite project delivery in times of economic expansion and military build-up. By the end of the last decade, design-build contracting had grown to almost one-quarter of the total dollar volume of non-residential construction in the US, according to the Design-Build Institute of America. Much of this activity has been for vertical infrastructure (buildings), with the private sector most heavily committed to this form of facilities development contracting. In the future, further growth is expected in the following areas of public sector construction: transportation, corrections, education, and water/wastewater facilities.

While design-build project delivery is not new to the building construction industry, it is relatively new to the highway construction industry, whose roots are largely in the post World War II era when design-bid-build was already the established way to procure and deliver many types of infrastructure projects. Interest in the design-build approach by contracting agencies of highway projects has been spurred by reported successes achieved in applying this approach to project delivery by other infrastructure development sectors in this country (for buildings) and overseas (for buildings and highways)[5,6,7].

In 1990, Special Experimental Project Number 14 (SEP-14) – Innovative Contracting, was established by the Federal Highway Administration (FHWA) to enable state transportation agencies to test and evaluate a variety of alternative project contracting methods that provided the potential to expedite highway projects in a more cost-effective manner, without jeopardizing product quality or contractor profitability. Between 1995 and 2002, about 300 projects amounting to $14 billion in costs were proposed for design-build contracting under the SEP-14 program by transportation agencies in 32 states, the District of Columbia, and the Virgin Islands[8]. This compares to only a handful that were proposed between 1990 and 1994. Exhibit I.1 shows the total number of design-build projects proposed, active, or completed in each state.

The results of projects undertaken in the early years of SEP-14 enabled FHWA to mainstream a number of innovative contracting approaches such as cost-and-time (A+B) based awards and the use of warranties in contracts to ensure product quality. However, the results of design-build projects proved inconclusive and controversial, with proponents and critics offering widely differing conclusions about the cost-effectiveness and equity of this alternative project delivery approach. As a result, A+B and lane rental contracting approaches became mainstreamed in 1995 while design-build contracting did not. Position papers by the major highway associations led FHWA to believe that the industry was not ready for wholesale deployment of design-build.

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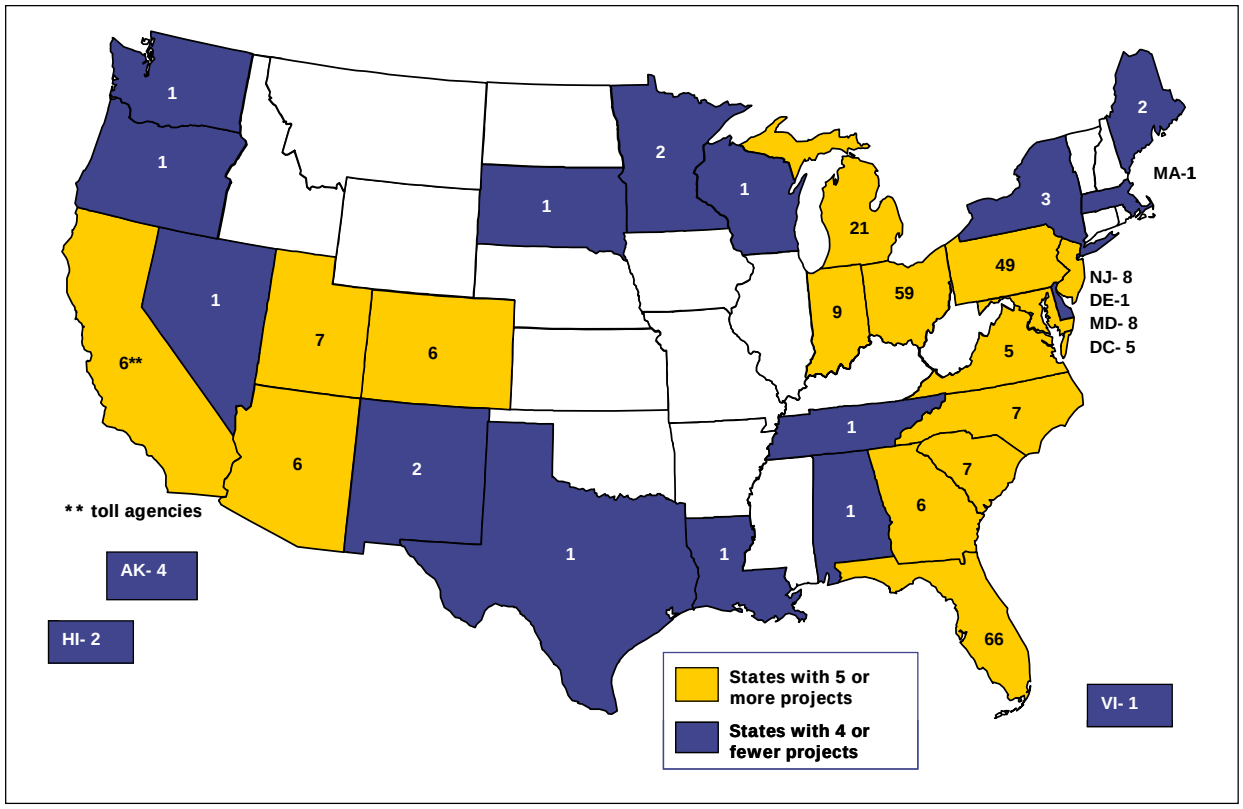
[5] Bennett, J.; Pothecary E.; Robinson, G. (1996). *The Industry Today: Designing and Building a World Class Industry*, Centre for Strategic Studies in Construction, United Kingdom.

[6] Pakkala, Pekka (2002). *Innovative Project Delivery Methods for Infrastructure: An International Perspective*, Finnish Road Enterprise.

[7] Sanvido, V.; Konchar, M. (1999). *Selecting Project Delivery Systems, Comparing Design-Build, Design-Bid-Build, and Construction Management at Risk*, The Project Delivery Institute, PA.

[8] FHWA (2002). *Design-Build Project Approvals under SEP-14 as of 12/31/2002*, http://www.fhwa.dot.gov/programadmin/contracts/sep14a.htm.

Exhibit I.1 SEP-14 Design-Build Projects by State
(proposed, active, or completed projects by STAs, toll agencies, or local public agencies)



Source: Design-Build Projects Approved Under SEP-14, Federal Highway Administration, July 2003

In 1998, the Transportation Equity Act for the 21st Century (TEA-21) became the new authorization legislation for the nation's surface transportation programs. Included in TEA-21 was Section 1307 (f), which required that a comprehensive national study be conducted to evaluate the effectiveness of design-build contracting, with the results subsequently reported to Congress. While individual transportation agencies have evaluated a number of design-build projects under SEP-14, there has not been a comprehensive national effort to evaluate these projects on a uniform basis. This study attempts to fill that void and respond to Section 1307 (f) by focusing the data collection and assessment on completed design-build projects authorized under SEP-14. SEP-14 projects provide the most comparable sample of completed design-build projects that are pertinent to the Federal-aid highway program.

PURPOSE AND OBJECTIVES

The purpose of this study is to report on the effectiveness of design-build contracting procedures in the Federal-aid highway program, as required by Section 1307 (f) of TEA-21. This section states:

> *(f) Report to Congress.--*
> *(1) In general.--Not later than 5 years after the date of enactment of this Act, the Secretary shall submit to Congress a report on the effectiveness of design-build contracting procedures.*

(2) Contents.--The report shall contain--

(A) an assessment of the effect of design-build contracting on project quality, project cost, and timeliness of project delivery;

(B) recommendations on the appropriate level of design for design-build procurements;

(C) an assessment of the impact of design-build contracting on small businesses;

(D) assessment of the subjectivity used in design- build contracting; and

(E) such recommendations concerning design-build contracting procedures as the Secretary determines to be appropriate.

SCOPE

To fulfill these study objectives, the analysis framework provides an objective basis for evaluating the impacts and implications of design-build contracting. The analysis framework defines the study scope and consists of the following attributes:

- The study focuses on capital projects in the Federal-aid highway program that were authorized under the SEP-14 Program and administered using design-build contracting by STAs, toll agencies, and local public agencies.
- Information was collected by web-based survey instruments regarding state design-build programs (as of the calendar year ending 2002), selected design-build projects performed under these programs, and comparable design-bid-build projects when provided by respondents.
- Only projects completed by the end of calendar year 2002 were considered for the fact-finding surveys to ensure that complete project performance histories could be obtained and to establish a consistent basis for assessing the performance of design-build contracting on Federal-aid projects.
- Design-bid-build, the more traditional form of project delivery used by state and local transportation agencies, served as the comparative basis for assessing the impacts of design-build project delivery.
- Additional information from prior or concurrent studies regarding the relative cost, schedule, and quality impacts of design-build versus design-bid-build project delivery was considered and included as comparative findings when applicable in terms of project types and delivery approaches considered.

Consistent with the study purpose and objectives, as defined by Congress, the following outcome criteria are used to evaluate the cost-effectiveness of design-build project delivery:

- Project cost
- Project timelines (duration)
- Project quality (contracting agency satisfaction)
- Level of preliminary design on which to base design-build contracts

- Subjectivity of award process for design-build contracts
- Small business impacts of design-build project delivery

These results were used to develop recommendations for improving the design-build procurement process and contract administration procedures.

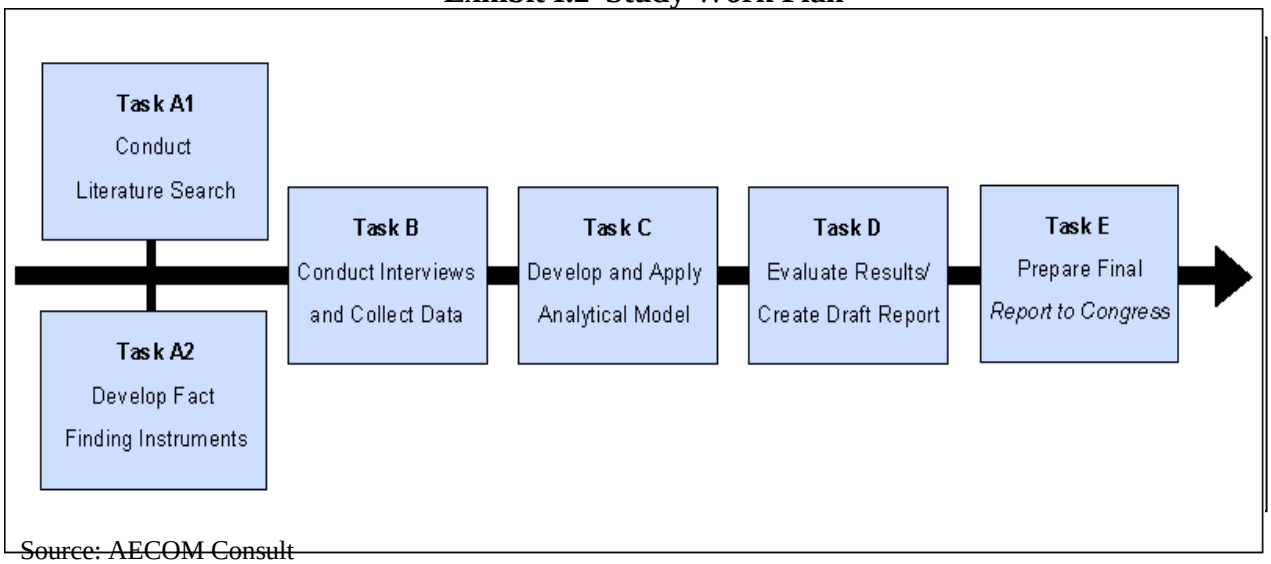
APPROACH

The findings and conclusions presented in this report are based on a variety of fact-finding and analysis approaches, including:

- Both domestic and international studies, papers, and articles by practitioners and researchers concerning alternative capital project delivery approaches and their implications and consequences, including design-build contracting (Appendix A contains a glossary of terms used in this report and Appendix G contains an extensive bibliography pertaining to design-build and other alternative contract delivery approaches);
- Prior surveys of highway capital programs and projects involving the application of design-build contracting and their impacts on project cost, duration, quality, and contracting agency satisfaction;
- Input provided by members of the study team, as well as the Intermodal Technical Advisory Panel and AASHTO's Design-Build Task Force;
- Lessons learned from the application of design-build contracting on other types of capital projects, including other modes, agencies, and industries;
- Summary information on highway capital projects in the SEP-14 Program, from its inception to October 2003 (Appendix C lists all completed, active, and proposed design-build projects in the SEP-14 Program at the time of the study fact-finding efforts);
- Baseline information on projects in the SEP-14 Program that were completed by the end of calendar year 2002 (Appendix F contains a summary and listing of completed SEP-14 projects for which evaluation reports were submitted by their contracting agencies);
- Comprehensive surveys of SEP-14 program managers at the state level (including STAs, toll agencies, and local public agencies), regarding the nature and effectiveness of their agency's design-build programs (Appendix B contains a detailed listing of the SEP-14 design-build program managers in each of the agencies contacted during the study and Appendix D describes the distribution of SEP-14 projects surveyed and reported);
- Comprehensive surveys of SEP-14 project managers regarding the nature and effects of design-build project delivery for a structured sample of completed projects as of the end of 2002, as well as comparable design-bid-build projects where available and submitted by the respondents (Appendix E contains the program, project, and comparable project survey instruments and instructions); and
- Comparative analysis of the responses to the program, project, and comparable project surveys to address the questions posed by Congress in Section 1307 (f) of TEA-21.

A five-task work plan, shown as Exhibit I.2, was followed to develop the data inputs, perform the analysis, and generate the findings and recommendations that are contained in this report.

Exhibit I.2 Study Work Plan



Source: AECOM Consult

A web-based interface was used to issue, receive, and process the surveys, with designated state participants accessing a secure website at the University of Colorado's School of Construction Engineering & Management to review, complete, and submit their survey responses. Having a secure study website enabled the research team to:

- Disseminate information about the study to a broad audience, while providing secure access only to those individuals designated to complete program and/or project surveys;
- Quickly disseminate the three surveys and cover letters to all designated state design-build program managers and to retrieve the results as soon as the surveys were completed by the respondents;
- Monitor the completion status of each state design-build program and project survey;
- Quickly process the large amount of data that the surveys generated and develop graphical representations of results relative to the study issues defined by Congress; and
- Provide study participants and others interested in the topic of innovative project delivery approaches access to an extensive literature database, including direct links to numerous documents on file and related web portals maintained by others.

DESIGN-BUILD PROGRAM AND PROJECT SURVEYS

This is the first comprehensive study of design-build contracting to involve both program and project managers of transportation agencies who are directly responsible for Federal-aid highway projects delivered under this approach. The key findings presented by this report are based primarily on responses to three types of surveys provided by design-build program and project

managers in agencies participating in the SEP-14 program. Data collection for the program/project analysis portion of the study spanned the six-month period from October 2003 through March 2004. This is the timeframe during which the survey instruments were issued to agencies expected to participate in the study, completed by designated design-build program and project managers, and returned for processing via the secure study website.

The following describes the three surveys and the numbers of each that were completed.

Design-Build Program Survey

The program-level survey determined how transportation agency managers participating in the SEP-14 Program view the use of design-build for their projects. For the purposes of this study, all agencies with active design-build programs were asked to complete program surveys, even if none of their projects were completed by the end of calendar year 2002 (the end date for project consideration). This included those transportation agencies, toll agencies, or local public agencies with design-build programs (toll agencies or local public agencies administered design-build projects in California, New York, and Tennessee)—for a total of 32 states plus the District of Columbia. Of this total, 27 states (including two local toll agencies) and the District of Columbia completed the design-build program survey, for an 85 percent response rate.

Design-Build Project Survey

The project-level survey was used to develop information on how design-build project delivery is used and its perceived consequences for a broad sample of SEP-14 projects completed before the end of calendar year 2002, as reported by agency managers responsible for these projects. A total of 282 projects made up the SEP-14 program for design-build projects by the end of 2002. Of this total, 140 projects had completion dates by the end of calendar year 2002. This group of completed design-build projects represented 24 out of the 32 states (plus the District of Columbia and the Virgin Islands) with design-build programs (71 percent of design-build states).

A sample of 86 projects out of 140 projects in the SEP-14 project database completed by the end of 2002 was selected for survey, representing 22 states and a broad cross-section of completed projects by type and size (a 61 percent sample). An upper limit of 12 projects per state was established to limit the amount of effort any one state would be expected to devote to this study's fact-finding process. Among the 22 states receiving design-build project surveys, 19 states submitted a total of 69 completed project surveys, representing an 80 percent response rate.

Given the modest number of design-build projects completed by the end of calendar year 2002, there is greater uncertainty in the results when the completed data sample is subdivided by state, project type, project size, or any number of disaggregating characteristic. Therefore, most of the survey results are presented in terms of the overall design-build program under SEP-14.

Comparable Design-Bid-Build Project Survey

In addition to completing surveys for designated design-build projects, respondents were asked to identify a comparable project using the design-bid-build project delivery approach for each design-build project surveyed, where a truly comparable project could be identified. The project-level survey was also used to develop information on these similar projects delivered by

the design-bid-build approach. This provided the opportunity to assess on a limited case-study basis differences in project performance between design-build and design-bid-build project delivery, including cost, duration, quality, and other factors related to competition and fairness.

This turned into a much more challenging effort than anticipated due to the difficulty in determining which projects could be considered comparable, identifying a knowledgeable person to complete the comparable project survey, and gaining the continued cooperation of respondents after completing the design-build program and project surveys. Consequently seven states submitted completed surveys for 17 design-bid-build projects. This represented 37 percent of the participating states and 25 percent of the design-build projects reported. Out of the 17 returned design-bid-build project surveys, 11 contained sufficient data to permit detailed analysis of project duration and cost by project phase. These results are reported in Chapter IV.

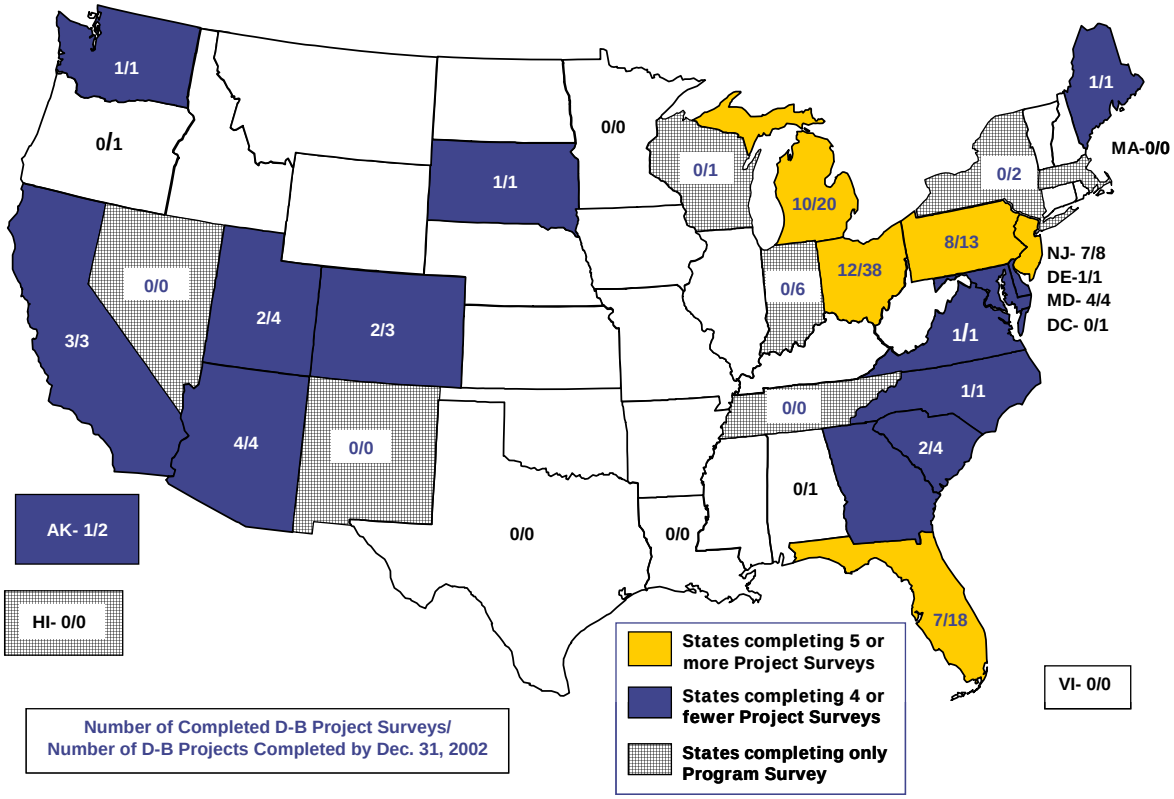
This is the first study to compare actual project results from similar pairs of projects, with one using design-build and the other using design-bid-build project delivery. Prior studies relied on comparisons based on actual results for design-build projects but only estimates of project cost and duration if delivered using the more traditional design-bid-build projects.

Survey Distribution and Response by States Participating in the SEP-14 Program

Exhibit I.3 shows the number of returned project surveys relative to the number of design-build projects completed by each state as of the end of calendar year 2002[9]. Appendix D provides a detailed discussion of the survey distribution and response rates relative to total number of state design-build programs and projects comprising the SEP-14 program at the time of the surveys.

[9] FHWA (2002). *Design-Build Project Approvals under SEP-14 as of 12/31/2002*, http://www.fhwa.dot.gov/programadmin/contracts/sep14a.htm.

Exhibit I.3 Design-Build Program and Project Survey Responses by State



Source: Design-Build Projects Approved Under SEP-14, Federal Highway Administration, July 2003

ANALYSIS METHODOLOGIES

A number of analytical methodologies are used to develop study findings that address the issues raised by Section 1307 (f) of TEA-21. These include the following:

- Identify performance measures and comparison of performance results for alternative project delivery approaches based on prior research and case studies of design-build and other project delivery approaches relative to the traditional design-bid-build approach.
- Develop findings from responses to the design-build program and project surveys distributed during the study using various comparative analysis techniques as appropriate, such as:
  - Univariate analysis comparing selected performance measures such as cost growth, delivery speed, schedule growth, and quality measures;
  - Comparisons of central tendency measures such as means, medians, and deviations;
  - Multivariate analysis techniques such as regression analysis; and
  - Statistical analysis of performance comparisons, where appropriate, to determine the relative significance of the results and level of confidence regarding their interpretation.

The application of multivariate analysis and modeling techniques to the survey results is limited in their application to this study because of the small number of comparable design-bid-build surveys that were completed and returned by state design-build project managers. This occurred despite repeated attempts to gain greater response rates over an extended timeframe that significantly stretched out the fact-finding efforts. The direct comparison of design-build and design-bid-build results reported in this study is therefore based on a combination of statistically significant findings and empirical data based on a limited set of comparable projects. The study results and findings are contained in Chapter IV.

RESEARCH TEAM

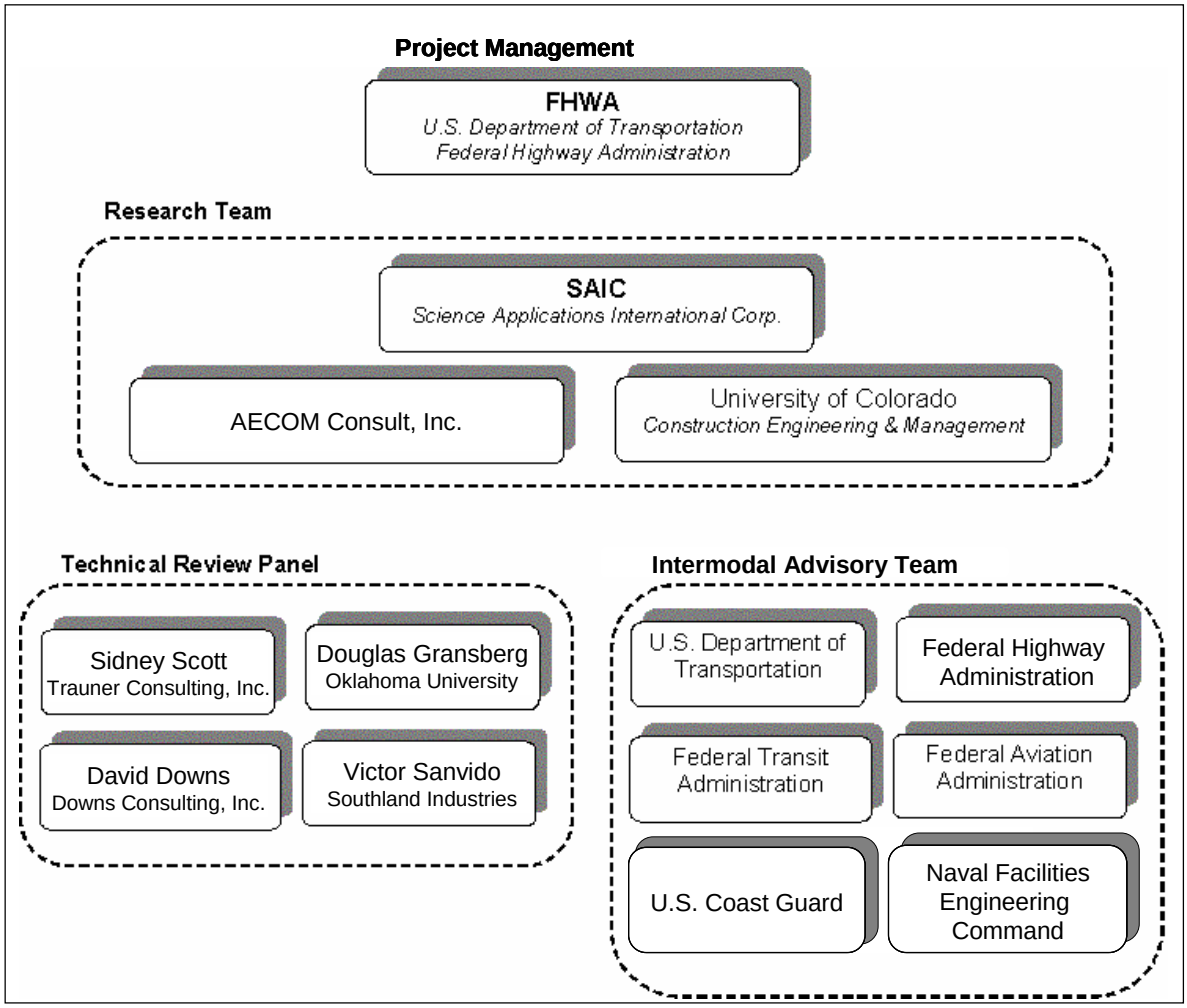
The research team for this study is shown in Exhibit I.8. Science Applications International Corporation (SAIC) served as the study contract manager. AECOM Consult, Inc. was the prime contractor, with Daniel Dornan serving as the Project Manager and Nathan Macek serving as the Principal Investigator. The University of Colorado's School of Construction Engineering & Management supported the team in the areas of literature search, survey development and processing, and survey results analysis. The University of Colorado team was led by Dr. Keith Molenaar, supported by graduate research assistants Jennifer Shane and Alfonso Bastias.

The team also included a Technical Review Panel composed of noted industry experts who provided review and comment on the survey design and analysis results, as noted in Exhibit I.8. These included the following:

- David Downs, P.E. – President, Downs Consulting, Inc.
- Dr. Douglas Gransberg, P.E. – Associate Professor, University of Oklahoma
- Dr. Victor Sanvido, P.E. – Vice President, Southland Industries, Inc.
- Sidney Scott III, P.E. – Vice President, Trauner Consulting Services, Inc.

An Intermodal Advisory Panel, representing both transportation modal administrations and defense agencies provided periodic review and comment on the interim deliverables of the study.

Exhibit I.4 Design-Build Study Research Team



REPORT OUTLINE

The remainder of this report consists of four chapters and seven appendices. The four chapters are briefly described below:

- **Chapter II – Design-Build Project Delivery**: discusses the background and characteristics of design-build project delivery relative to the more traditional design-bid-build approach. It also summarizes information developed in prior studies that have looked into the various consequences of alternative contracting approaches for developing infrastructure projects.
- **Chapter III – Special Experimental Program Number 14 – Design-Build Contracting**: discusses FHWA's experimental program, which has allowed the use of design-build for selected Federal-aid highway projects.
- **Chapter IV – Findings**: presents the findings of the various fact-finding efforts, particularly the design-build program and project surveys.

- **Chapter V - Conclusions and Recommendations**: provides a summary of the lessons learned as reported by the survey respondents and the changes already made and planned for the design-build programs of the surveyed agencies. The chapter also presents the conclusions and recommendations of the research team resulting from the overall study findings.

The seven appendices provide background documentation for the study, as listed below:

- **Appendix A – Glossary of Terms**
- **Appendix B – Participating SEP-14 Program States and Contact Information**
- **Appendix C – List of Total and Surveyed SEP-14 Projects**
- **Appendix D – Distribution of SEP-14 Projects Included in Study**
- **Appendix E – Survey Instruments and Related Documentation**
  - Email Cover Letter
  - Letter of Assistance
  - Survey Instructions
  - Survey Introduction
  - Program Survey
  - Project Survey
- **Appendix F – Summary of Completed SEP-14 Program Evaluation Reports**
- **Appendix G – Bibliography**

II. DESIGN-BUILD PROJECT DELIVERY

This chapter describes the nature of design-build as an alternative contracting approach to the traditional design-bid-build approach used by state transportation agencies to deliver projects funded through the Federal-aid highway program. It provides a historical context for considering design-build and other related project delivery approaches to the nation's highway construction program. It demonstrates the extensive use of design-build project delivery by other infrastructure development sectors, including buildings (vertical infrastructure) and public utilities (horizontal infrastructure). The section concludes by reviewing the results of prior studies of design-build and other innovative project delivery approaches and their performance relative to more traditional contracting approaches like design-bid-build.

DEFINITION OF DESIGN-BUILD PROJECT DELIVERY

There are a wide variety of ways in which infrastructure projects can be procured and delivered. Some segregate the roles and responsibilities of different phases of project development, as with design-bid-build in which the final design is completed by one party (in-house staff or under a negotiated contract) and subsequent construction is awarded to a separate low-bid contractor. Others integrate these activities under a single overall contract, as with design-build. Still others extend contract roles and responsibilities far beyond project development to include operations, maintenance, preservation, and even finance. Some are prescribed by federal and state statute and regulation (such as design-bid-build), while others are used extensively by private and certain public contracting agencies to expedite project delivery (such as design-build and its various manifestations)[1,2.]

This report focuses on the design-build approach and its relative advantages and disadvantages to the more stratified design-bid-build approach. This and other related project delivery methods are defined below.

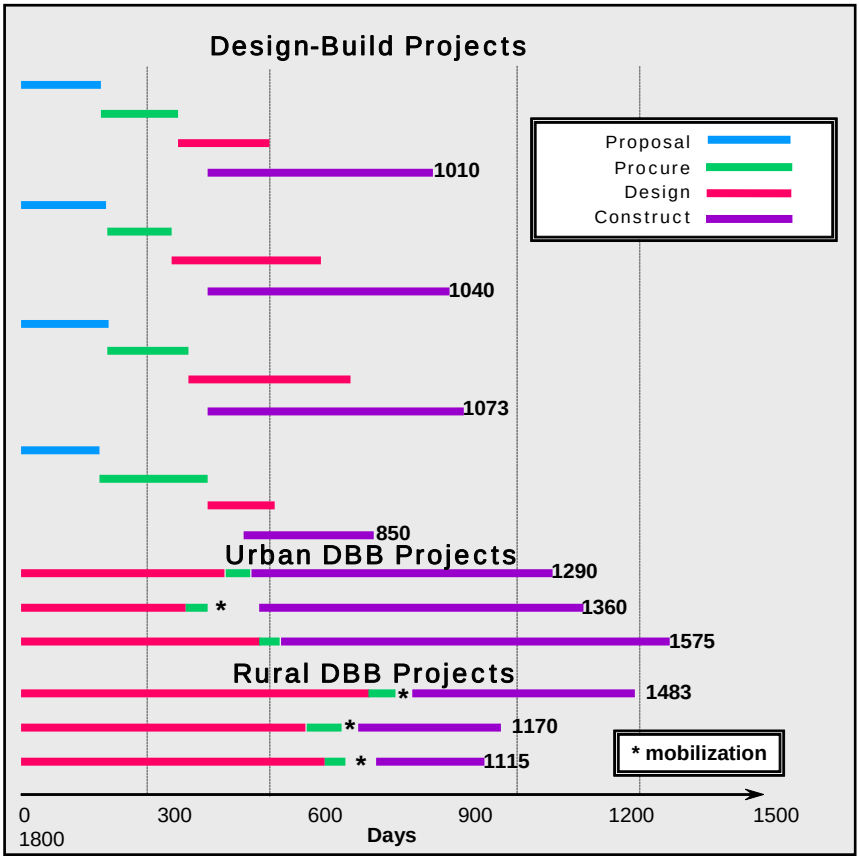
- **Design-Build (D-B)** - According to the Design-Build Institute of America (DBIA)[3], the design-build form of project delivery is a system of contracting whereby one entity performs both architectural/engineering and construction under one single contract. Under this arrangement, the design-builder warrants to the contracting agency that it will produce design documents that are complete and free from error (design-builder takes the risk). The selection process under design-build contracting can be in the form of a negotiated process involving one or more contracts, or a competitive process based on some combination of price, duration, and proposer qualifications. Portions of the overall design or construction work can be performed by the design-build entity or subcontracted out to other companies that may or may not be part of the design-build team.

[1] Beard, Jeffrey L.; Loulakis, Michael C. Sr.; Wundram, Edward C. (2001). *Design Build: Planning Through Development*, McGraw-Hill, New York.
[2] Transportation Research Board (1991). *Innovative Contracting Practices*, Transportation Research Circular 386, December.
[3] *An Introduction to Design-Build*. Design-Build Institute of America, Washington, D.C., 1994.

- **Design-Bid-Build (D-B-B)** - Design-bid-build is another form of project delivery whereby the contracting agency either performs the design work in-house or negotiates with an engineering design firm to prepare drawings and specifications under a design services contract, and then separately contracts for at-risk construction by engaging a contractor through competitive bidding. Under this arrangement, the contracting agency warrants to the contractor that the drawings and specifications are complete and free from error (contracting agency takes the risk). The selection process for design-bid-build is usually based on negotiated terms for the design contract and lowest responsible bid for the construction contract.

Exhibit II.1 shows the actual project timelines for a number of comparable design-build and design-bid-build projects documented by the Arizona Department of Transportation in 2004.[4] Although the data for the design-bid-build projects omit the time to develop and procure design contracts for these projects, the design-build projects still have shorter delivery times, especially for urban projects. This chart illustrates the effect of concurrent sequencing of project development phases for design-build projects versus consecutive sequencing of these phases for design-bid-build projects.

Exhibit II.1 Project Timelines for Comparable D-B and D-B-B Projects



[4] Ernzen, Jim, Williams, Ron, and Brisk, Debra: Arizona Department of Transportation. *Design-Build vs. Design-Bid-Build: Comparing Cost and Schedule*. Excerpted from a presentation made at the 2004 Annual Meeting of the Transportation Research Board, Washington, D.C., January 2004.

Source: Arizona Department of Transportation

As noted in Exhibit II.2, design-build is one of several innovative project delivery, procurement, and contracting techniques that have potential application in the highway construction industry.

Exhibit II.2 - Innovative Procurement and Contracting Approaches

Project Delivery Approaches	Procurement Approaches	Contract Payment Approaches
• Indefinite Quantity/Indefinite Delivery	• Alternative Bids/Designs	• Disincentive Provisions
• Construction Manager at Risk	• Request for Proposals	• Incentive Provisions
• Design-Build Contracts	• Cost Plus Time (A+B)	• Incentive/Disincentive Contracts
• Design-Build Warranty	• Multi-Parameter Bidding (A+B+Q)	• Lane Rental Contracts
• Design-Build-Operate-Maintain (DBOM)	• Best Value	• Active Management Payment Mechanism
• Design-Build-Operate-Maintain-Finance (DBOM-F)		• No Excuse Bonus Contracts
• Performance-Based Total Asset Management Contracts		• Lump Sum Contracts

Sources: Gransberg, Douglas D.; Senadheeka, Sanjaya P. (1999). "Design-Build Contract Award Methods for Transportation Projects," *Journal of Transportation Engineering*, ASCE, 125(6), 565-567

State of Florida (1996). *Innovative and Alternative Contracting Practices*, Florida Department of Transportation, August 30, 1996

Transportation Research Board (1991). "Innovative Contracting Practices," *Transportation Research Circular 386*, December 1991

Design-build is an established process for developing major capital projects used by the private sector and the armed services, which may be less constrained by state or local regulations that limit opportunities for achieving its potential benefits. Within the highway construction industry, the design-build procurement and delivery mechanism is a relatively new concept that has not yet achieved widespread acceptance and application. This is because the design-build approach is perceived as:

- Changing the roles and relationships between project designer and construction contractor, which may impact the independence of the designer with regard to construction inspection and testing functions;
- Broadening the selection criteria to include more than just initial cost in selecting and awarding major construction contractors;

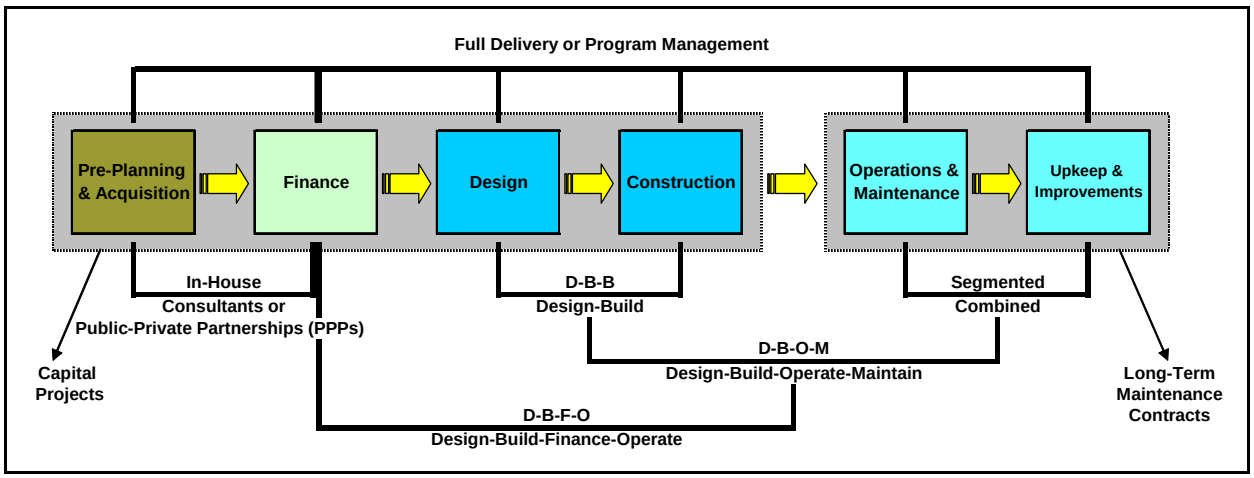
- Placing the emphasis on awarding the contract for both the design and construction phases of project development, thereby expediting the timeframe for committing available highway construction funds;
- Providing greater opportunity for larger construction and engineering firms to compete for projects, thereby potentially reducing project opportunities for smaller construction firms;
- Making it difficult to utilize unit price payments because a quantity survey cannot be completed before contract award; and
- Triggering legal or regulatory constraints of state and local governments that need to be relaxed or repealed before the approach can be more widely applied.

Other forms of design-build project delivery include the following variations and combinations:

- **Design-Build with a Warranty** (5, 10, 20 years) – the contractor provides an integrated design and construction process whose product is guaranteed to meet specified material and workmanship or performance standards over a prescribed timeframe. This usually applies to highway pavement. The inclusion of a warranty shifts more project risk to the design-build team and reduces the extent to which the contracting agency needs to conduct inspection and testing.
- **Design-Build-Operate-Maintain (DBOM)** – the contract team is responsible for design, construction, operation, and maintenance of the facility for a specified period of time, whereby payment beyond project completion is predicated on meeting certain prescribed performance standards relating to physical condition, capacity, congestion, and/or ride quality. This is an extension of design-build that provides an inherent incentive for the design-builder to provide a better quality plan and project by creating a lifecycle responsibility and accountability for the performance of the facility by the design-builder.
- **Design-Build-Finance-Operate (DBFO)** – this is an extension of the DBOM project delivery method in which the contract team is also responsible for the financing of the project and takes the risks of financing the project during the contract term.
- **Build-Operate-Transfer (BOT)** – this is a project delivery method similar to DBFO whereby the contract team acquires ownership of the facility until the end of the contract term at which time ownership of the facility is returned to the original public sectorcontracting agency.
- **Full Delivery or Program Management** – the construction entity provides a wide variety of services to the contracting agency beyond construction, starting at the planning stage and potentially continuing through facility operations and maintenance, thereby leveraging the resources of the contracting agency to a great extent.

Exhibit II.3 displays different types of project delivery approaches that combine various phases of the project life cycle.

Exhibit II.3 Alternative Contractual Arrangements for Delivering Highway Infrastructure



Source: Pekka Pakkala. *Innovative Project Delivery Methods for Infrastructure—An International Perspective.* Finnish Road Enterprise, Helsinki, 2002, p. 32.

Many of the project delivery approaches described above extend far beyond the scope of design-build contracting by placing increasing functional responsibilities for highway infrastructure under a single contract vehicle. The choice of which approach to use for a particular project depends on a number of factors, such as:

- Size and complexity of the project;
- Available budget for the project;
- Legal and regulatory ability to use various innovative project delivery techniques;
- Sources of funding for the project;
- Capability and creativity of the contracting agency; and
- Urgency of completing the project.

The effect of each contracting approach on project performance, as defined by several key performance measures, is discussed later in this section based on the results of several prior studies.

HISTORICAL PERSPECTIVE ON INFRASTRUCTURE PROJECT DELIVERY

According to Beard, et al.[5], the earliest form of infrastructure delivery involved a master builder serving as both project designer and builder. Throughout most of recorded history, this form of design-build project delivery has been used to develop infrastructure projects such as pyramids, temples, aqueducts, cathedrals, and major public buildings. The widespread use of design-build project delivery reflected the need to have the project designer intimately involved in the construction of the project to ensure the proper execution of the design plans and consideration

[5] Beard, J. L.; Loulakis, M.C.; Wundram, E. C. Design-Build: A Brief History. Design Build Planning Through Development. McGraw-Hill, 2001.

of construction challenges posed by the design before it is completed. In the absence of scientifically-based engineering principles, standards, and specifications, only the master builder had the experience and understanding of fundamental engineering and construction principles and techniques to know what could be built and how to build it. These master builders typically passed on their specialized skills and knowledge from one generation to the next, gradually enhancing the profession through the development and application of new techniques, often based on trial-and-error. By integrating these two sequential and highly interdependent phases of project development, the early design-builders could adjust the design to fit prevailing site conditions and to take advantage of new techniques or alternative sources of materials.

It was only in the period starting in Europe with the Renaissance that the knowledge and skills involved in project design and construction became increasingly complex, better documented, and more specialized. This enabled the design function to become more distinct from the construction function. Along with increased complexity and specialization came concerns over the accountability and responsibility of the various functions that comprise the project development process.

To respond to concerns over the objectivity and integrity of the project development process for large infrastructure projects in this country, particularly after such projects as the Transcontinental Railroad showed how favoritism and process manipulation could lead to fraud, waste, and abuse in the development of infrastructure, government agencies in the United States instituted contracting reforms late in the nineteenth century that culminated in the development of the two-step project delivery process known as design-bid-build.

Key legislative events in the United States that led to the formal separation of design and construction phases of infrastructure projects included the following:

- 1893 Congressional Act formally separating the design and construction phases of a capital project.
- 1926 Omnibus Public Buildings Act required all capital project plans and specifications be completed and approved before the construction phase can begin.
- 1947 Armed Services Procurement Act required that architectural and engineering (design) services be procured on a negotiated basis, while construction services continued to be procured through a formal advertisement and low bid selection process.
- 1949 federal procurement legislation extended the 1947 Armed Services Procurement Act requirements to all federal civilian agencies.
- 1972 Brooks Architect-Engineers Act required all design contracts for federal capital projects be awarded based on qualifications and not low bid.

Once it became institutionalized through laws and regulations, design-bid-build became the traditional form of procuring and delivering government infrastructure projects in the United States over the ensuing 50 years. This included Interstate highway facilities, whose genesis (starting with the National Defense Highway Act of 1956, which initiated the Interstate program of superhighway construction) postdated passage of most of the laws mandating design-bid-build for government projects.

Under the design-bid-build form of project delivery, the contracting agency first retains the services of an engineering design firm to prepare plans, specifications, and estimates (PS&E) for a project (unless the contracting agency uses in-house architects and engineers to do this). Once the PS&E is completed, the contracting agency then selects a contractor to construct the project. This two-step project delivery process separates the design and construction phases of project development, with the contracting agency assuming responsibility for the completeness and accuracy of the drawings and specifications produced by the design firm. As discussed further below, until 1996, federal law (the Brooks Act) precluded the award of engineering service contracts based on price, and required that they be awarded based on the qualifications of the winning team with the price determined through negotiation. Similar restrictions continue to be imposed on the award of engineering service contracts. Construction contracts are typically awarded on the basis of price, with the lowest responsible bid being awarded the contract (i.e., a realistic and responsive bid given the scope and complexity of the project).

RE-EMERGENCE OF DESIGN-BUILD PROJECT DELIVERY

As noted above, the development of the design-bid-build contracting process resulted from the increasing complexity and specialization of design and construction services, the perceived need to provide a check and balance between the development and execution of project plans, and a desire to produce projects at minimum cost. The primary benefits of design-bid-build were to reduce favoritism in the procurement process and spur competition among construction firms. However, as with most institutionalized processes, the benefits of design-bid-build began to be eroded by its inhibiting effects on the development and application of more efficient procedures and technology.

Despite the prevalence of the design-bid-build approach to project delivery among public works agencies, design-build project delivery has numerous advocates among private corporations not subject to federal procurement statutes and regulations, and certain public agencies responding to urgent requirements for project completion. Starting in the late 1960s, based in part on the successes achieved by the private sector in applying design-build to their capital projects and the need to expedite needed infrastructure projects and stretch scarce financial resources, a number of government agencies at the federal, state, and local levels began to experiment with and apply the design-build project delivery approach to reduce the time and cost to complete their projects. This included various branches of the Defense Department, public school districts, and public utilities, which became adept in its use for constructing buildings and other kinds of facilities (military base housing, schools, and water-wastewater treatment facilities). However it was not until the 1996 Federal Acquisitions Reform Act (Clinger-Cohen Act) that federal agencies received the legal authority to engage in design-build projects and use a new two-phase design-build process. Among the federal agencies using design-build project delivery are the Veterans Administration, General Services Administration, Postal Service, Federal Bureau of Prisons, Environmental Protection Agency, Department of Energy, and U.S. Army Corps of Engineers.

While design-build has become a significant project delivery approach for buildings, it is relatively new to the highway construction industry, whose roots are largely in the post World War II era in which design-bid-build was already the established way to procure and deliver all kinds of infrastructure projects. Interest in the design-build approach by sponsors of highway

projects has been spurred by the reported successes achieved in applying this approach to project delivery by other infrastructure development sectors in this country (for buildings) and overseas (for buildings and highways). As the nation's highway programs became increasingly challenged in the 1980s and 1990s, interest grew in alternative project development and delivery approaches that offered ways to improve the efficiency (time, cost, and quality) and cost-effectiveness of traditional contracting practices.

Responding to this renewed interest in alternative ways to deliver transportation infrastructure projects, the Transportation Research Board of the National Academy of Sciences established a broad-based task force of highway project delivery experts in January of 1988 to evaluate the potential for applying innovative contracting practices to Federal-aid projects, including design-build. This TRB task force (designated Task Force A2T51 – Innovative Contacting Practices) compiled information from a variety of domestic and foreign sources on contracting practices and their impacts on project cost, progress, and quality. The task force also considered impediments to the application of promising contracting approaches and made recommendations to improve contracting practices.

One of the outcomes of TRB Task Force on Innovative Contracting Practices was the establishment by the FHWA of an experimental project that would allow state transportation agencies to test and evaluate innovative contracting practices[6]. The development of Special Experimental Project Number 14 (SEP-14) – Innovative Contracting, provided the impetus for state transportation agencies, in cooperation with the FHWA, to try out these innovative approaches to project delivery; discover how they affect project costs, duration, and quality; and determine whether and under what conditions any of these contracting approaches might be used to improve the cost-effectiveness of Federal-aid highway projects. The SEP-14 Program and the lessons learned during the first ten years of testing innovative contracting approaches are discussed in the next chapter.

DESIGN-BUILD ISSUES

The rebirth of design-build as a project delivery method for government-sponsored infrastructure projects can be attributed to a number of complementary factors. First, design-build has its roots in the genesis of infrastructure development going back millennia when design and construction functions were integrated by the design-builder position. Second, in times of war or natural disaster the urgency to expedite projects has caused government agencies to suspend traditional procurement and contracting methods and permit alternative approaches such as design-build. Third, budget and personnel shortages or other constraints in the public sector and competitive pressures in the private sector have caused project sponsors to seek more cost-effective ways to deliver projects. Indeed, fiscal and national crises have often been the driving forces behind efforts to permit government to innovate and become more cost-effective. Design-build is viewed by many as one of the most promising "innovative" approaches to build highway infrastructure faster and cheaper without sacrificing product quality.

[6] Transportation Research Board (1991). "Innovative Contracting Practices," *Transportation Research Circular 386*, December.

Proclaimed Advantages of Design-Build Project Delivery

Proponents of design-build contracting proclaim a number of advantages over typical contracting arrangements such as design-bid-build[7,8,9], including:

- Time savings through:
  - Early contractor involvement that enables construction engineering considerations to be incorporated into the design phase and enhances the constructability of the engineered project plans;
  - Fast-tracking of the design and construct portions of the project, with overlapping (concurrency) of design and construction phases for different segments of the project; and
  - Elimination of a separate construction contractor bid phase following completion of the design phase.

- Cost savings from:
  - Communication efficiencies and integration between design, construction engineering, and construction team members throughout project schedule;
  - Reduced construction engineering and inspection (CEI) costs to the contracting agency when these quality control activities and risks are transferred to the design-builder;
  - Fewer change and extra work orders resulting from more complete field data and earlier identification and elimination of design errors or omissions that might otherwise show up during the construction phase;
  - Reduced potential for claims and litigation after project completion as issues are resolved by the members of the design-build team; and
  - Shortened project timeline that reduces the level of staff commitment by the design-build team and motorist inconvenience due to reduced lane closures.

- Improved quality through:
  - Greater focus on quality control and quality assurance through continuous involvement by design team throughout project development; and
  - Project innovations uniquely fashioned by project needs and contractor capabilities.

[7] Loulakis, M.C. (1999). *Construction Project Delivery Systems: Evaluating the Owners Alternatives*, AEC Training Technologies.
[8] Pakkala, Pekka (2002). *Innovative Project Delivery Methods for Infrastructure: An International Perspective*, Finnish Road Enterprise.
[9] Tenah, K.A. (2001). "Project Delivery Systems for Construction: An Overview," *Cost Engineering*, AACE International, Morgantown, WV, 43(1), 30-36.

In a design-build project development process, the procurement of the design-build contractor through a request for proposal (RFP) process might actually require substantially more time than the invitation for bid (IFB) process used to retain the construction contractor. However, overall time savings result from not having to go through two separate procurement processes, one for the design team and one for the construction team.

Proclaimed Disadvantages of Design-Build Project Delivery

Design-build contracting is also one of the most controversial of the innovative highway project delivery approaches, since it changes the fundamental way key stakeholders in the highway construction industry compete and cooperate with each other[10,11,12]. Critics claim that design-build:

- Reduces competition for construction services by excluding smaller firms unable to lead the larger projects most amenable to the design-build approach;
- Favors large national engineering and construction firms in competing for larger design-build contracts that are too big for smaller local or regional firms to pursue;
- Provides an opportunity for favoritism to enter into the contract award process by including non-price factors in the basis for selection;
- Undermines the inherent checks and balances between design and construction teams in the traditional delivery systems, with the design team no longer independent of the construction contractor;
- Strikes at the foundation of the traditional quality assurance/quality control roles through the combination of engineering and construction; and
- Increases project costs due to the elimination of the low bid contractor selection criteria.

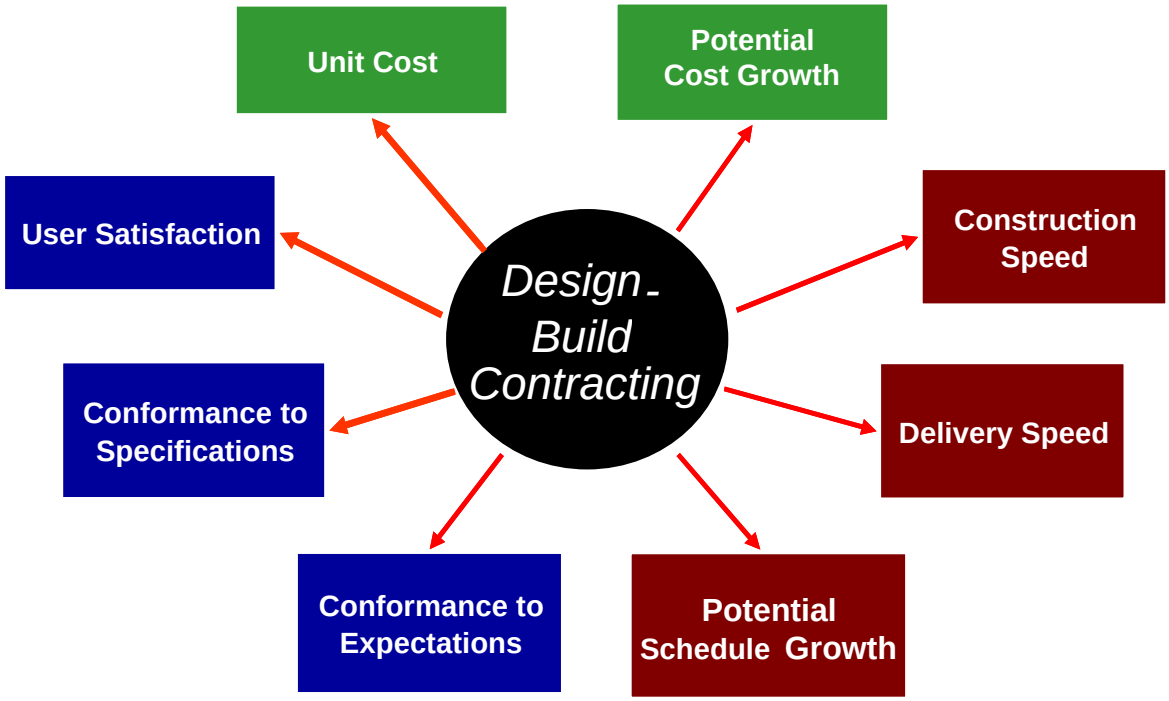
In considering alternative project delivery approaches, proponents of more traditional approaches question whether adequate checks and balances are provided to ensure product quality, integrity in the procurement function, and fairness to established businesses that compete for these contracts. Others ask whether any one method of project delivery is preferred for all types of projects and situations, or if a portfolio of alternative approaches should be available to suit different situations and project types.

[10] Loulakis, M.C. (1999). *Construction Project Delivery Systems: Evaluating the Owners Alternatives*, AEC Training Technologies.
[11] Pakkala, Pekka (2002). *Innovative Project Delivery Methods for Infrastructure: An International Perspective*, Finnish Road Enterprise.
[12] Tenah, K.A. (2001). "Project Delivery Systems for Construction: An Overview," *Cost Engineering*, AACE International, Morgantown, WV, 43(1), 30-36.

EVALUATION CRITERIA FOR ASSESSING DESIGN-BUILD PROJECT DELIVERY

Past research has considered a number of performance criteria when analyzing the implications of design-build contracting,[13,14,15] as shown in Exhibit II.4. This study characterizes the implications of design-build project delivery versus the traditional design-bid-build project delivery in terms of selected project characteristics and relevant/measurable performance criteria that directly relate to the issues posed by Congress in framing the requirements for this study.

Exhibit II.4 General Criteria for Evaluating Design-Build Project Delivery



Source: AECOM Consult

Pertinent literature on design-build project delivery reveals that proponents and critics use similar criteria for judging the applicability and effectiveness of design-build and related approaches to project delivery. These criteria relate to performance objectives that proponents seek to achieve and performance standards that critics fear will be jeopardized by using design-build.

[13]Bennett, J.; Pothecary E.; Robinson, G. (1996). *The Industry Today: Designing and Building a World Class Industry*, Centre for Strategic Studies in Construction, United Kingdom.
[14] Gransberg, Douglas D.; Villarreal-Buitrago, Monica E. (2002). "Construction Project Performance Metrics," *AACE International Transactions*, AACE International, Morgantown, WV, CSC.02.
[15] Sanvido, V.; Konchar, M. (1999). *Selecting Project Delivery Systems, Comparing Design-Build, Design-Bid-Build, and Construction Management at Risk*, The Project Delivery Institute, PA.

Expanding on the general criteria shown in Exhibit II.4, this study used the following criteria to assess the advantages and disadvantages of using design-build versus design-bid-build:

- Duration of project development, comprising the following two phases:
  - From concept to contract award
  - From contract award to completion
- Total cost of project development, including the following:
  - Project planning
  - Project administration
  - Design
  - Construction
  - Quality assurance and quality control
- Quality of the completed facility, which can be measured in both quantitative and qualitative terms, including:
  - Owner satisfaction—meet or exceed expectation
  - Meet or exceed standards
  - User satisfaction
- Equity of the procurement process for prospective bidders including:
  - Individual firms or teams providing planning, architecture, design, construction, and inspection services
  - Large, medium, small, and disadvantaged firms
  - Domestic or international firms or teams
- Competition among prospective bidders in the highway design and construction industry including:
  - Individual firms or teams providing planning, architecture, design, construction, and inspection services
  - Large, medium, small, and disadvantaged firms
  - Domestic or international firms or teams

Among these factors, proponents generally agree that project duration or speed of delivery is the most significant factor motivating project sponsors to try design-build, particularly when an emergency or other urgent condition exists. Cost control is the next most frequently cited reason for using design-build, particularly for contracting agencies who wish to minimize the extent and impact of change orders on project costs. Quality is the one feature of a project that both proponents and critics agree must be preserved regardless of the applied delivery approach. Where warranties are included as a part of the contract, the emphasis on project quality takes on even more significance due to the added cost exposure of the project delivery team.

Equity and competition are both important issues in the design-build versus design-bid-build debate, prompted largely by a concern that innovative project delivery is merely a way to get around current regulations that protect the interests of and promote continued competition among competent project design and construction firms in the United States. A prevailing complaint is that innovative contracting approaches will change the competitive landscape for companies involved in a particular state's highway development program by placing local firms at a distinct disadvantage to larger national firms that have significantly more experience in successfully responding to these kinds of procurements in states with laws, regulations, and institutional context more favorable to alternative approaches. Another concern is that increased use of design-build will lead to fewer business opportunities for small businesses, including disadvantaged business enterprises, minority-owned firms, and female-owned firms.

Other performance indicators for judging the success of design-build contracting include:

- Integration of various functions that constitute the project development process by establishing singular responsibility for project design and construction;
- Transfer of project risks to the design-build team;
- Reduction in administrative burden following contract award; and
- Application of innovative techniques and products.

Each of these features can be measured by the five primary performance criteria listed above. Indeed, these five criteria reflect the specific areas of focus established by Congress in TEA-21 for this study, based on the results of the literature search, SEP-14 program and project surveys, and project databases available to the research team.

RESULTS OF PRIOR STUDIES

This is not the first study of performance issues resulting from the application of design-build contracting to infrastructure projects. However, this is the first study to focus specifically on these issues with respect to highway projects funded under the Federal-aid highway program, using completed SEP-14 projects as the primary source of information. In the past ten years, a number of domestic and international studies have sought to determine how innovations in project delivery affect projects built by the private sector, defense agencies, and public infrastructure agencies. Several of these studies focus on infrastructure projects built in countries where the institutional context is quite different from this country. With federal funding legislation granting state transportation agencies significant latitude to experiment with and apply alternative project delivery approaches on Federal-aid projects, an increasing body of literature has grown that reveals the consequences of these efforts on highway projects built in the United States.

The information and insights provided by these earlier studies is broader in scope and application than the results of the SEP-14 program and project surveys conducted in this study. These prior studies varied in a number of ways that limit their applicability to comparison with the results of this study. These include differences in the following dimensions:

- Geographic Locations
  - Europe
  - United States
- Types of Project Sponsorship
  - Private sector firms
  - Public utilities
  - Public transportation agencies
- Types of Projects
  - Buildings
  - Rail lines
  - Highways and bridges and tunnels
  - Production facilities
- Evaluation Criteria
  - Award, contract, and project growth
  - Contract and project delivery speeds
  - Customer satisfaction and degree of expectations met
- Types of Documentation
  - Project data
  - Anecdotal results
  - Perceptions and insights
- Project Delivery Approaches
  - Design-Build
  - Design-Bid-Build
  - Construction Management at Risk

Exhibit II.5 summarizes key information from these prior studies. The following summarizes the key findings and conclusions from these prior studies:

- Prior research into the impacts of design-build relative to design-bid-build includes comprehensive studies of building projects, both domestic and in the United Kingdom, and more limited studies of horizontal (highway) projects.
- Both types of projects (buildings and highways) typically show a significant advantage for design-build in lowering the duration of the project, with a broad range of 4- to 60-percent reduction.

- Both types of projects typically show a cost advantage for design-build, except the SR500 Thurston Way Interchange project with a 23-percent increase in cost relative to design-bid-build. Otherwise, the range would be a zero percent to 18-percent reduction.
- There is little quantitative data on the quality of design-build versus design-bid-build, although what exists indicates the two approaches produce similar quality results.

Exhibit II.5 Performance Results from Studies of Alternative Project Delivery Approaches

Vertical Infrastructure - Buildings	Number of Projects or Agencies in Sample	% Reduction in Contract Cost Relative to D-B-B	% Reduction in Contract Duration Relative to D-B-B
J. Bennett, E. Pothecary & G. RFobinson, *Designing and Building a World-Class Industry* , University of Reading Design and Build Forum Report, Centre for Stratgegic Studies in Constrruction, Reading, United Kingdom, 1996.	330	13%	30%
Victor Sanvido & Mark Konchar, *Selecting Project Delivery Systems: Comparing Design-Bid-Build, Dseign-Build, and Construction Management at Risk* , The Project Delivery Institute, State College, PA., 1999.	351	6%	33%
Design-Build 101: Basics of Integrated Service Delivery , Design-Build Institute of America/American Institute of Architects Professional Design-Build Conference, Chicago, Illinois, October 14, 1998.	DOD	14%	18%
Design-Build 101: Basics of Integrated Service Delivery, DBIA	GSA	3%	N/A
Design-Build 101: Basics of Integrated Service Delivery, DBIA	NAVFAC 1	12%	15%
Design-Build 101: Basics of Integrated Service Delivery , DBIA	Vet Admin	0%	28%
Linda N. Allen, *Comparison of Design-Build to Design-Bid-Build as aq Project Delivery Method,* Master's thesis, Naval Postgraduate School, Monterey, CA., December 2001.	NAVFAC 2	18%	60%
Horizontal Infrastructure - Highways	**Number of Projects or Agencies in Sample**	**% Reduction in Contract Cost Relative to D-B-B**	**% Reduction in Contract Duration Relative to D-B-B**
Illinois DOT Study by SAIC, 2002	11 states	3 of 11 states reported lower cost	10 of 11 states reported shorter duration
New York State DOT Design-Build Practice Report, 2002	9 agencies	5 of 9 agencies reported lower cost	9 of 9 agencies reported shorter duration
Arizona DOT Study: Design-Build vs. Design-Bid-Build - Comparing Cost and Schedule. Jim Ernzen, Ron Williams, and Debra Brisk, TRB Paper 2004.	13	4%	22%
Ralph Ellis, Zahar Herbsman, & Ashish Kumar, *Evaluation of the Florida Department of Transportation's Pilot Design/Build Program,* University of Florida, College of Engineering, Gainesville, FL., August 1991.	11	11%	36%
Washington State DOT Study. Design-Build Pilot Project Evaluation: A Measurement of Performance for the Process, Cost, Time, and Quality - SR500 Thurston Way Interchange. Dr. Keith Molenaar, University of Colorado, Boulder, CO, January 2003.	1	-23%	16%
Jim Ernzen and Tom Feeney, *Contractor Led Quality Control and Quality Assurance Plus Design-Build: Who is Watching the Quality?* Transportation Research Board Paper, 2000 Annual Meeting, Washington, D.C., January 2000.	1	N/A	30%
Bulk of Ambitious $1.6 Billion Design-Build Job Complete, Engineering News Record, May 14, 2001, Page 13. (Utah I-15 Design-Build Project)	1	0%	9%
ODOT Experience on Six Design-Build Projects , Ohio Department of Transportation, Columbus, OH., 1999.	6	Lower administrative costs; little/no change orders or claims	Significant time savings

The use of design-build contracting goes beyond affecting project cost, delivery speed, and quality. Some states have used design-build to promote economic development. For example, in 2001 the Florida legislature passed a law that uses design-build project delivery as a key component of an economic stimulus package.

DESIGN-BUILD CONTRACTING FINAL RULE

In response to a requirement contained in Section 1307(c) of TEA-21, FHWA developed and issued a Final Rule laying out the regulations under which design-build contracting can be applied within the Federal-aid highway program. The Design-Build Contracting: Final Rule was published in the Federal Register on December 10, 2002 and became effective on January 9, 2003.[16]

The Design-Build Contracting Final Rule is based on the results of design-build projects developed and evaluated under SEP-14 since 1990 and significant comments provided by members of AASHTO and representatives of the various industries that make up the highway development community to a Notice of Proposed Rule Making (NPRM) published October 19, 2001.

The following lists the most salient parts of FHWA's Design-Build Contracting Final Rule for consideration by both representatives of transportation agencies and firms interested in proposing on prospective projects using the design-build contracting approach:

- Allows but does not require use of design-build contracting approaches;
- Permits the use of design-build contracting on both qualified and non-qualified projects, (where qualified projects are those over $50 million, or $5 million for Intelligent Transportation Systems (ITS) projects as defined by TEA-21, Section 1307(a));
- Requires completion of the NEPA environmental clearance process prior to the release of the final request for proposals document;
- Allows responsive unsuccessful proposers to receive stipends as partial compensation for their proposal development costs;
- Eliminates any minimum percentage participation by the prime contractor on the design-build team;
- Allocates various forms of risk based on ability to manage and control these risks;
- Encourages consideration of value engineering and life cycle costing;
- Permits multiple notices to proceed to enable work to proceed on specific project sections when environmental, utility, permit, and right-of-way clearances have been completed for those sections;
- Defines requirements for avoiding conflicts of interest in RFP development and proposal submission;

[16] Federal Register, December 10, 2002, Volume 67, No. 237, pages 75902 - 75935

- Allows public-private partnerships to submit design-build contract proposals under a competitive process, consistent with state and local laws; and
- Suggests a two-phase selection procedure, consisting of (1) shortlisting qualified teams based on responses (containing technical and qualifications-based information) to a request for qualifications (RFQ) and (2) evaluating technical and price proposals submitted in response to a request for proposal (RFP).

SECTION 1503 OF THE SAFE, ACCOUNTABLE, FLEXIBLE, EFFICIENT TRANSPORTATION EQUITY ACT: A LEGACY FOR USERS

Subsequent to the data collection efforts for this report, the President signed into law the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) on August 10, 2005. Section 1503 of this law includes several important provisions regarding design-build contracting. The following is a summary of the Section 1503 requirements:

- The definition of "qualified project" is broadened allowing a State transportation department or local transportation agency to award a design-build contract without the requirement to evaluate the project under the FHWA's experimental contracting program. This essentially removes the $50 million threshold for evaluating design-build projects under SEP-14.

- The Secretary is to issue revised design-build regulations that will provide for increased flexibility in initiating the design-build procurement process as it relates to the completion of the environmental review process. The regulations must not preclude a State transportation department or local transportation agency, prior to NEPA compliance, from:
    - issuing requests for proposals;
    - proceeding with awards of design-build contracts; or
    - issuing notices to proceed with preliminary design work under design-build contracts.

- The State or local transportation agency must receive concurrence from the Secretary before carrying out any of the preceding activities.

- The design-build contractor may not proceed with final design or construction prior to completion of the NEPA process.

* * * * * * *

Chapter III discusses how the FHWA has used the special experimental project (SEP) mechanism to enable transportation agencies to try alternative contracting approaches, including design-build, and to discover for themselves whether and under what conditions these innovative project delivery approaches produce sufficiently positive impacts on project cost-effectiveness to warrant more widespread use. The pilot projects approved under these testing and evaluation programs formed an important source of documentation for guiding development of the FHWA's Design-Build Contracting Final Rule, and for developing the results of this study contained in Chapter IV.

III. SPECIAL EXPERIMENTAL PROJECT NUMBER 14 – INNOVATIVE CONTRACTING

This chapter presents the program context for the assessment of design-build project delivery in the Federal-aid highway program. It describes the background and scope of Special Experimental Project Number 14 (SEP-14) – Innovative Contracting, under which state transportation agencies have been able to use design-build contracting approaches to deliver selected Federal-aid highway projects. It summarizes the composition of the SEP-14 program in terms of participating states; number, type, and size of design-build projects; and status of the program as of the end of calendar year 2002. This profile is representative of the SEP-14 program at the end of 2004 in that most of the projects currently in the program were proposed by the end of 2002.

SEP PROGRAM BACKGROUND

The nation's highway program is one of the largest infrastructure programs in the world. Based largely on revenues derived from federal and state taxes on motor fuels, the nation's highway program provides over $100 billion per year for construction, improvement, maintenance, and operation of interstate, state, and local roads. About three-quarters of this total come from federal and state user tax revenues. The remainder comes from local governments, tolls, general funds, and bond proceeds. Over half of the program funds are spent on capital improvement projects, 94 percent of which goes to Federal-aid highways. The remaining half goes to maintenance, operations, and administration of federal, state, and local roads, most of which (72 percent) is spent on state highways.[1] In the 2002 "Condition and Performance Report To Congress", the FHWA estimated additional highway program funding needs of $76 billion per year to maintain current conditions and $107 billion per year to bring the system up to appropriate standards[2].

In an effort to close the widening gap between highway program needs and resources, there have been a number of initiatives taken at the federal and state levels to increase program revenues and improve the cost-effectiveness of highway programs and projects. These initiatives include developing and applying alternative funding sources and financing methods, streamlining traditional project delivery processes and practices, and fostering broader partnerships among private and public stakeholders—all aimed at leveraging scarce public resources, including both funds and staff.

During the past fifteen years, with the costs of needed highway renewal, improvement, and expansion growing faster than available revenues and prospects pointing to further decline in the adequacy of traditional funding sources, a variety of federal acts have granted state and local transportation agencies increasing flexibility and freedom to apply new funding and financing approaches. These include:

[1] Highway Statistics, 2002 - Table SF-21, USDOT/FHWA, 2003.
[2] FHWA. (2002) *2002 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance Report to Congress.* http://www.fhwa.dot.gov/policy/2002cpr/index.htm.

- More flexible ways to provide matching funds for federal-aid projects - e.g., toll credits - counting capital expenditures on toll roads in a state towards the state/local match on Highway Trust Fund moneys (Intermodal Surface Transportation Efficiency Act of 1991 - ISTEA).
- Establishment of state infrastructure banks (SIBs) to provide a mechanism for administering the use of federal, state, and/or local transportation funds through credit assistance and revolving loans (National Highway System Designation Act of 1995 – NHS Act, Transportation Equity Act for the 21st Century – TEA-21).
- Provision of credit support and flexible terms for projects that involve third-party financing, and encouragement of public-private partnerships to leverage public funds for highway projects (Transportation Infrastructure Finance and Innovation Act of 1998 - TIFIA).
- Use of grant anticipation revenue vehicles (bonds or notes called GARVEEs) to expedite larger projects through the advanced accumulation of future federal funds (1995 NHS Act).
- Increased incentives for the use of public-private partnerships through improvements to innovative finance programs and the use private activity bonds for infrastructure improvements (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users - SAFETEA–LU).

SEP PROGRAM DESCRIPTIONS

Since 1990, the FHWA has used a "test and experiment" process to encourage contracting agencies to try innovative approaches to project development and delivery as a way to expedite delivery of needed projects. Two examples of this are:

- Special Experimental Project Number 14 (SEP-14) - which encourages the testing of innovative contracting approaches to assess their effects on project costs, duration, and quality.
- Special Experimental Project Number 15 (SEP-15) - which encourages innovation in a number of areas to foster public-private partnerships (PPPs), private investment, and more efficient project development processes and practices, in the areas of contracting, finance, planning, environmental clearance, and right-of-way acquisition.

Special Experimental Project programs permit the application of alternative approaches to develop and deliver selected projects on an experimental basis. The SEP process enables both federal and state transportation agencies to test and then evaluate new and promising techniques that would otherwise be prohibited under current statutes and regulations at the federal level. Project tests determine the advantages, disadvantages, applicability, and criteria for success for the alternative approaches being applied. Based on these documented results and the enthusiasm shown by contracting agencies and stakeholders, federal and state agencies can determine whether to mainstream certain alternative approaches that are found to be effective and appropriate, and the criteria for determining projects applicability.

FHWA first established SEP-14 in 1990 specifically for the purpose of for testing and evaluating on an experimental basis innovative contracting practices that offer the potential to reduce the life cycle costs of projects while preserving product quality and reasonable contractor profitability. Entitled the Innovative Contracting Practices, SEP-14 identified a number of innovative contracting approaches for trial, including cost-plus-time bidding, lane rental, design-build contracting, and warranty clauses. Other innovative contracting concepts tested under SEP-14 include indefinite delivery/indefinite quantity (IDIQ) contracts, alternative pavement type bidding, no excuse bonuses, lump sum bidding, price/qualifications bidding, quality incentives, warrantees and guarantees, system integrator contracts, and performance-based specifications.

After five years of trial and evaluation, FHWA mainstreamed the cost-plus-time bidding approach and allowed warranty clauses in contracts for items under the control of the contractor. However, due to continuing concerns over the cost-effectiveness and fairness of design-build contracting, design-build was retained under SEP-14 in 1995 to allow for additional testing and evaluation by interested state and local transportation agencies. To date, approximately two-thirds of the states and a few metropolitan areas have participated in SEP-14, with about half of the states completing at least one design-build project under SEP-14 by the end of 2002.

FHWA established SEP-15 in October 2004 to expand the number of functions for which alternative approaches can be tested to expedite projects and leverage scarce public resources through expanded opportunities for public-private partnerships. In addition to contracting, SEP-15 permits the testing of innovative approaches to finance, planning, environmental clearance, and right-of-way acquisition for designated projects. This new SEP-15 program expands on SEP-14 by enabling state and local highway agencies to test a combination of innovative approaches to different aspects of a project to optimize the effects on project cost, duration, and quality.

The common element in SEP-14 and SEP-15 is the ability to apply alternative contracting approaches to deliver highway projects. Design-build is unique among the methods evaluated under SEP-14 since it may encompass both SEP-14 and SEP-15 objectives, particularly if participant financing is part of the approach. Franchise and concession agreements are included in the term if the agreement provides for the franchisee or concessionaire to develop the project using the design-build approach.

SEP-14 DESIGN-BUILD PROGRAM OVERVIEW

Since the focus of this study is on evaluating design-build contracting as it relates to the Federal –aid highway program, the SEP-14 design-build program was selected as the primary basis for developing information on design-build programs and projects administered by transportation agencies. SEP-14 provides a common framework for addressing the issues and concerns raised by Congress in Section 1307 (f) of TEA-21. These include:

- Evaluating the cost-effectiveness and performance of design-build programs and projects;
- Determining the most appropriate types of projects for design-build project delivery;

- Developing conditions needed to protect the interests of both the contracting agency and contracting industry; and
- Developing strategies for improving the application of design-build and other related project delivery approaches to Federal-aid highway projects.

The following pages provide an overview of the SEP-14 design-build programs and projects that have been proposed or completed through the end of calendar year 2002[3]. This information reveals the extent to which transportation agencies have availed themselves of the opportunity to apply design-build contracting and indicates the types and size of projects that make up the program. It also indicates which states have been the most active in using SEP-14 to execute design-build projects and which types of projects various states have designated for design-build contracting.

Since its inception, STAs, toll agencies, and local public agencies in 32 states, the District of Columbia, and the U.S. Virgin Islands have established design-build programs under SEP-14. The latest summary of SEP-14 project information indicates there are 302 design-build projects in various stages of development, including proposed, active, and completed. Of these, there are 282 projects that have cost estimates or completion costs assigned to them.

Distribution of SEP-14 Projects by Type and Size

A wide variety of project types and sizes are included in SEP-14. For reporting purposes, SEP-14 results are grouped into the following project type and size categories:

- Project Types
  - Roads and Highways
    - New alignment and widening
    - Rehabilitation and reconstruction
    - Resurfacing
  - Bridges
  - Tunnels
  - Intelligent Transportation Systems (ITS)
  - Other (ferry boats, rest areas, sound walls, tower lighting, etc.)
- Project Sizes
  - Less than $2 million (micro)
  - $2 million to 10 million (small)
  - $10 million to $50 million (medium)
  - $50 million to $100 million (large)

[3] FHWA (2002b). *Design-Build Project Approvals under SEP-14 as of 12/31/2002*, http://www.fhwa.dot.gov/programadmin/contracts/sep14a.htm.

- Over $100 million (mega)

Given the limited number of tunnel projects in SEP-14 and their significance in terms of project size, bridges and tunnels are combined into the same category for reporting purposes in this report.

Exhibit III.1 provides summary statistics describing the breakdown of the SEP-14 design-build program projects by type and size.

Exhibit III.1 Distribution of SEP-14 Design-Build Projects (cost in millions)

Total SEP-14 Design-Build Projects - Proposed, Active, and Completed					
Project Type	**Number**	**%**	**Cost ($M)**	**%**	**$M/Project**
Road - New/Widen	78	28%	$9,390.5	67%	$120.4
Road - Rehabilitate/Reconstruct	35	12%	$2,447.8	18%	$69.9
Road - Resurface/Renewal	17	6%	$105.1	1%	$6.2
Bridge/Tunnel	105	37%	$1,432.4	10%	$13.6
ITS	12	4%	$74.0	1%	$6.2
Other	35	12%	$501.7	4%	$14.3
Total	**282**	**100%**	**$13,951.6**	**100%**	**$49.5**
Project Size	**Number**	**%**	**Cost ($M)**	**%**	**$M/Project**
<$2 Million	76	27%	$72.7	1%	$1.0
$2-10 Million	97	34%	$479.6	3%	$4.9
$10-50 Million	65	23%	$1,472.9	11%	$22.7
$50-100 Million	25	9%	$1,683.8	12%	$67.4
>$100 Million	19	7%	$10,242.6	73%	$539.1
N/A	0	0%	$0.0	0%	$0.0
Total	**282**	**100%**	**$13,951.6**	**100%**	**$49.5**

Source: Design-Build Projects Approved Under SEP-14, Federal Highway Administration, July 2003

The key characteristics of the SEP-14 program, as revealed by the figures in Exhibit III.1, are summarized below:

- The most prevalent SEP-14 design-build projects by type are Bridge/Tunnel and Road-New/Widen projects at 37 percent and 28 percent, respectively. Road-Rehabilitate/Reconstruct comes in third at 12 percent.

- Most of the funding for design-build projects is for Roads-New/Widen and Roads-Rehabilitate/ Reconstruct at 67 percent and 18 percent, respectively. Bridge/Tunnel comes in third at 10 percent. These three types of projects represent the vast majority of design-build projects in terms of numbers and costs.
- The numerical distribution of SEP-14 projects by size reveals the most prevalent projects are under $50 million, representing 84 percent of the total projects on the SEP-14 list.
- Most of the funding for design-build projects is for projects exceeding $100 million, representing 73 percent of total SEP-14 design-build projects. This reflects the influence of project size and the tendency of many contracting agencies to use design-build for very large projects that are more difficult and complex to administer. In contrast, the large percentage of projects under $2 million and the small percentage of money associated with these projects (1 percent) reveal the extensive use of design-build for small projects. This is particularly evident in those states that used SEP-14 to advance relatively small bridge replacement and rehabilitation projects in the program's early years.

Appendix D includes four additional tables that provide the same breakdown of information by project type and size for subsets of the data reflected in Exhibit III.1. This includes tables for each of the following sample sets of projects:

- The group of SEP-14 design-build projects completed by the end of calendar year 2002;
- Those SEP-14 design-build projects surveyed for this study;
- The surveyed SEP-14 design-build projects that produced a completed survey; and
- Comparable design-bid-build projects that had completed surveys.

Distribution of SEP-14 Projects by State and Timeframe

Exhibit III.2 shows the 32 states (plus the District of Columbia and the U. S. Virgin Islands) with design-build programs under SEP-14. Many of these states required special state legislation to use alternative procurement and contracting approaches for the delivery of highway projects. Also indicated is the number of design-build projects included in each state's program and how many of these were completed by the end of calendar year 2002.

As shown in Exhibit III.2, the states participating in SEP-14 are spread across the nation, with the most active states located in the east and southwest. Many of the Great Plains states have not yet participated in SEP-14.

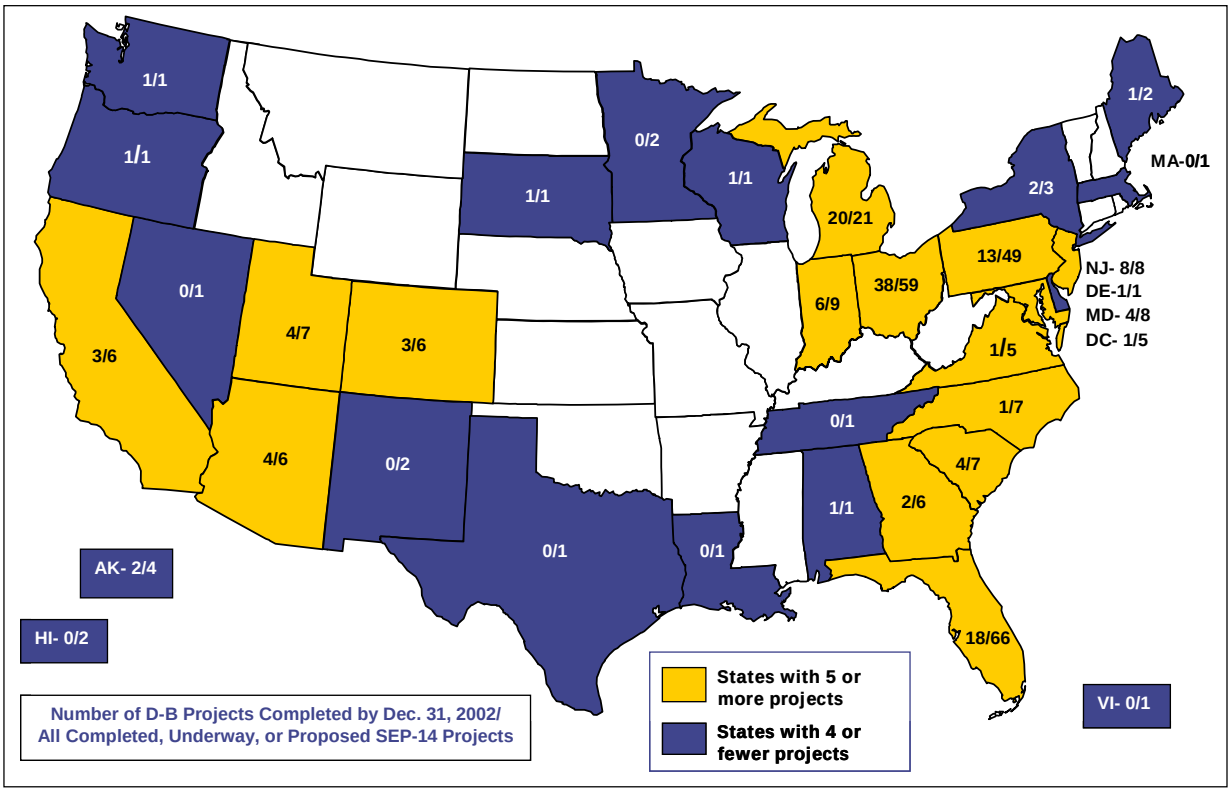
Major SEP-14 Design-Build Program States

Among the 32 participating STAs, toll agencies, or local transportation agencies, four stand out with the largest number and dollar volume of design-build projects authorized under the SEP-14 Program. These four states include the following (showing the proportion of each state's overall design-build program completed by 2002 to the program proposed by 2002):

- **Florida**: 66 projects – 18 completed by 2002 (10 percent of its proposed program value)

- **Michigan**: 21 projects – 20 completed by 2002 (98 percent of its proposed program value)
- **Ohio**: 59 projects – 38 completed by 2002 (61 percent of its proposed program value)
- **Pennsylvania**: 49 projects – 13 completed by 2002 (39 percent of its proposed program value)

Exhibit III.2 State SEP-14 Design-Build Programs and Projects
(total and those completed by December 31, 2002 by STAs, toll agencies, or local public agencies)



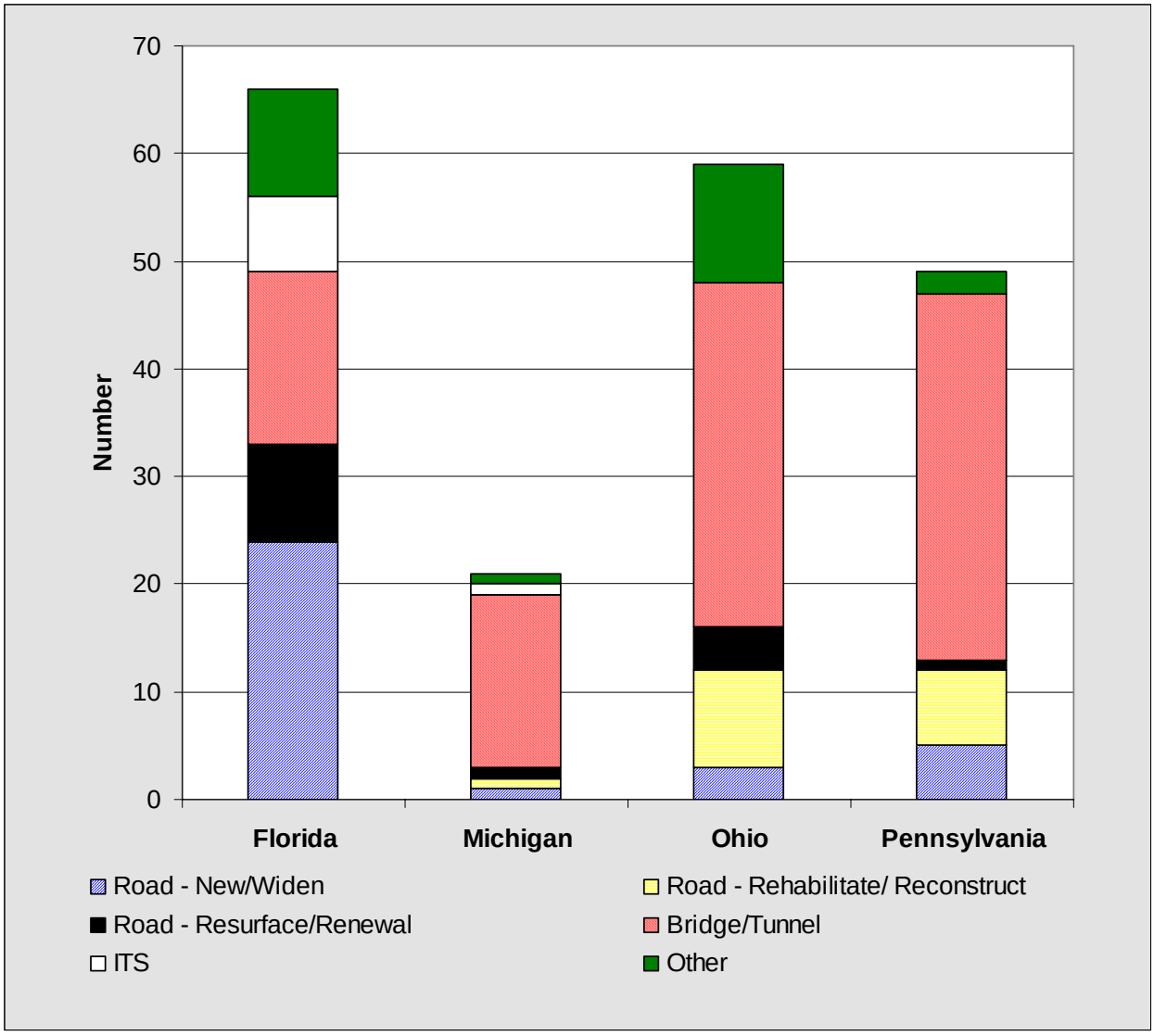
Source: Design-Build Projects Approved Under SEP-14, Federal Highway Administration, July 2003

These four states constitute 65 percent of the total number of design-build projects in the SEP-14 program and 12 percent of the total value of these projects. Among the SEP-14 design-build projects completed by the end of 2002, these four states comprise 64 percent of the projects and 9 percent of the total value. Both Michigan and Ohio represent early participants in the program since more than half of their projects were completed by the end of 2002. Michigan completed 95 percent of its proposed projects and Ohio completed 63 percent of its proposed projects by 2002. Both Florida and Pennsylvania show growing involvement in the SEP-14 Program, with most of their proposed projects coming after 2002 (73 percent for Florida and 71 percent for Pennsylvania).

Exhibit III.3 displays the relative number of design-build projects in each of the four major states. Florida has the largest number of projects and is the most balanced in terms of project type. The largest number of projects is in the Roads-New/Widen category, followed by

Bridge/Tunnel. The lack of Road-Rehabilitation/Reconstruct projects reflects Florida's decision to develop these types of projects using the more traditional approach. The other three states have a majority of their projects in the Bridge/Tunnel category. Both Pennsylvania and Ohio have more Road-Rehabilitation/Reconstruct projects than Road-New/Widen projects.

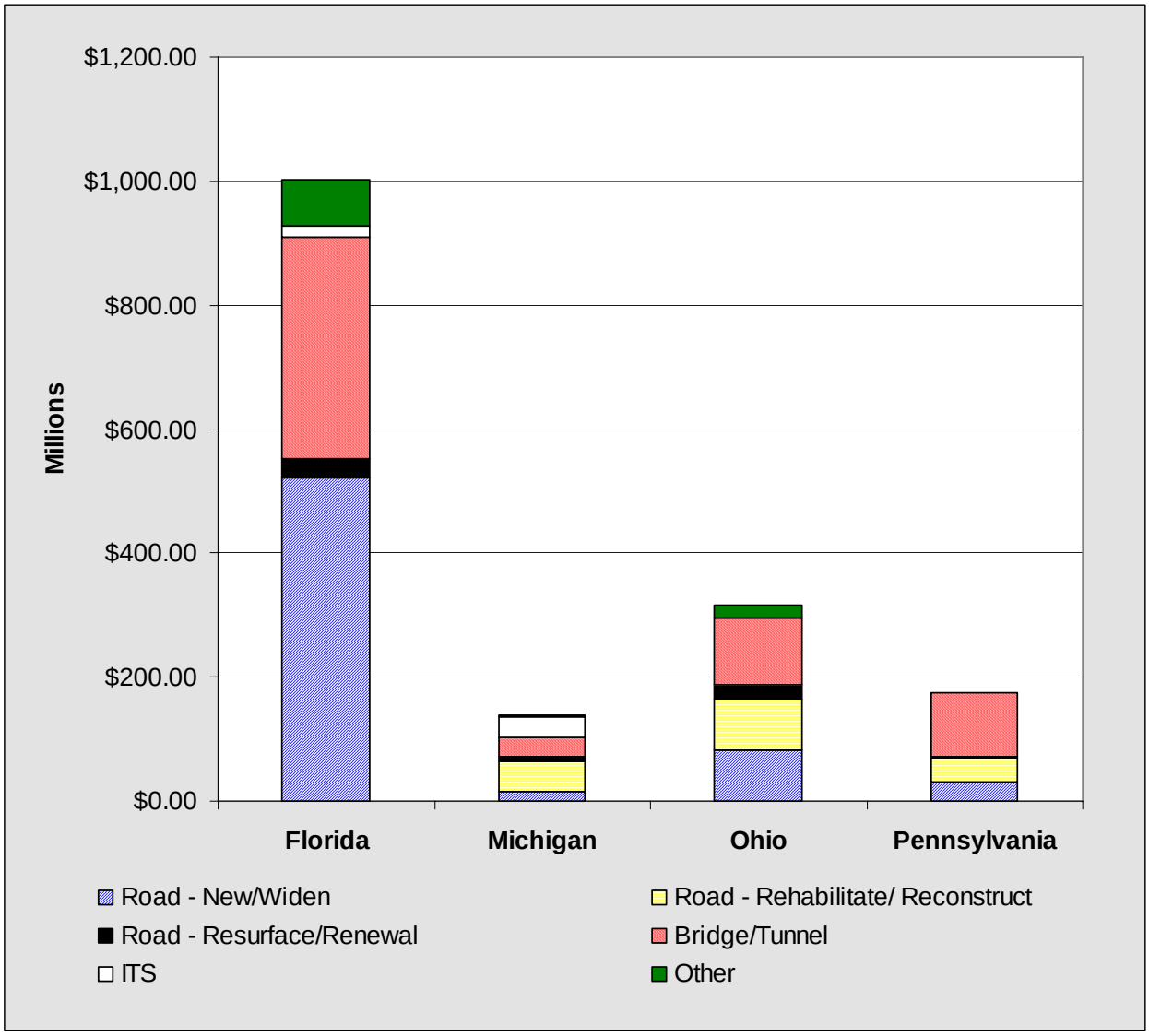
Exhibit III.3 Number of Design-Build Projects by Major State in SEP-14



Source: Design-Build Projects Approved Under SEP-14, Federal Highway Administration, July 2003

Exhibit III.4 shows the cost of design-build projects by type for the four major states. Florida has the largest overall design-build program in terms of cost, with Road-New/Widen and Bridge/Tunnel project types predominating. The other three states have significantly smaller design-build programs in terms of overall cost, with the largest program categories being Road-Rehabilitate/Reconstruct and Bridge/Tunnel. In Michigan, the ITS category stands out as an important type of project using design-build.

Exhibit III.4 Value of Design-Build Projects by Major State in SEP-14



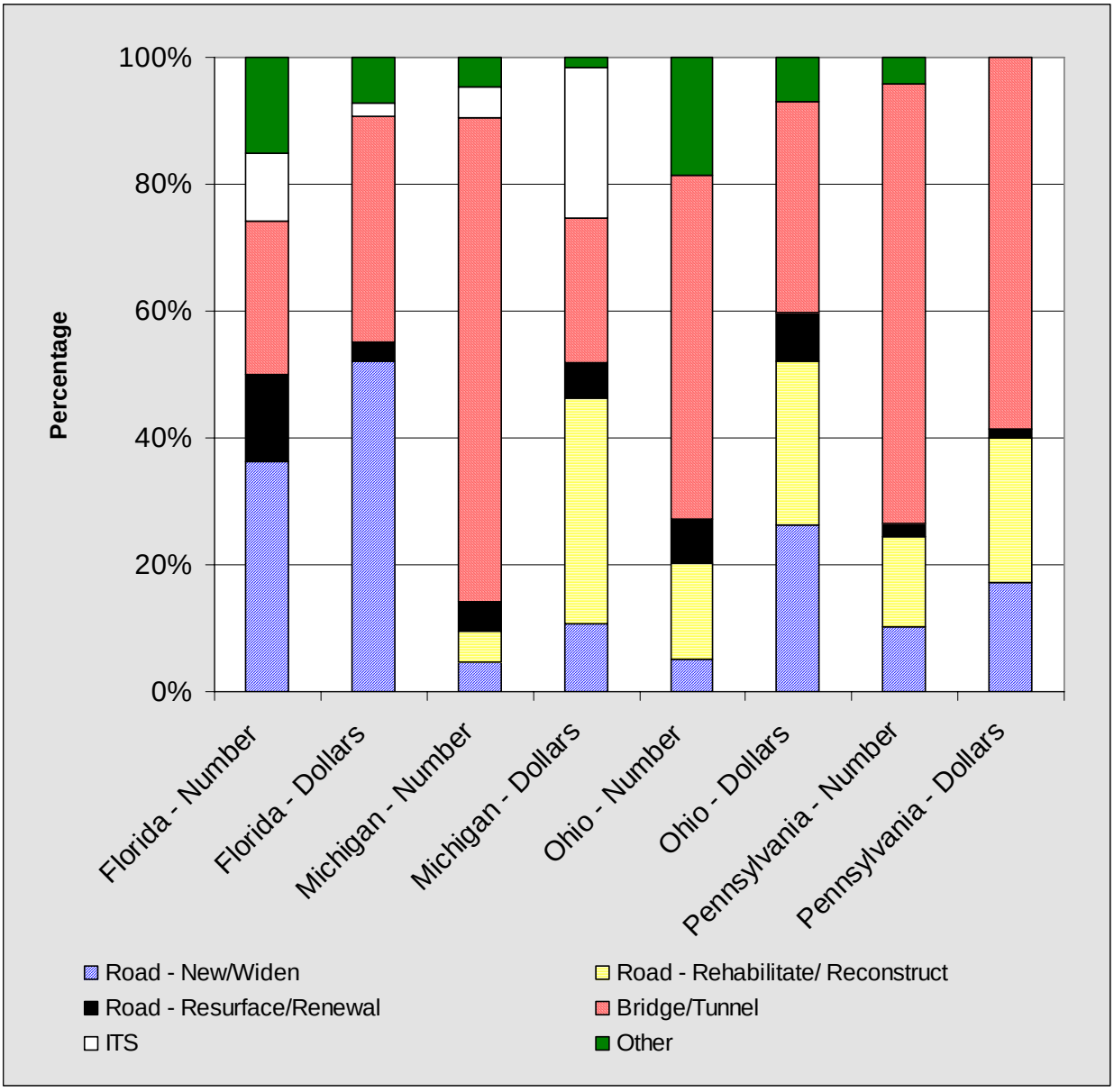
Source: Design-Build Projects Approved Under SEP-14, Federal Highway Administration, July 2003

Exhibit III.5 shows proportional breakdown of design-build projects by type for each of the four major SEP-14 states, in terms of both number of projects and program cost. This exhibit reveals the following characteristics of these programs:

- Florida's Road-New/Widen and Bridge/Tunnel projects are higher cost projects while its Road-Resurfacing and ITS projects are lower cost projects;
- Michigan's Road Rehabilitate/Reconstruct and ITS projects are higher cost projects while its Bridge/Tunnel projects are lower cost projects; and

- Ohio and Pennsylvania's Road-New/Widen and Road-Rehabilitate/Reconstruct projects are higher cost projects while their Bridge/Tunnel projects are lower cost projects. Neither state uses design-build for ITS projects to any noticeable extent.

Exhibit III.5 Percentage of Projects by Number and Dollars Expended by Type of Project by Major State in SEP-14



Source: Design-Build Projects Approved Under SEP-14, Federal Highway Administration, July 2003

The remaining states with active programs have far fewer design-build projects. Seventeen states have less than five proposed design-build projects. Twenty-six states completed less than

five design-build projects by the end of 2002. Some states have taken great advantage of the opportunity to apply design-build contracting, while many others are using the opportunity provided by SEP-14 on a much more selective, experimental basis.

This wide disparity in the use of design-build contracting between different regions of the country and different states could be due to a number of possible factors, including:

- Differences in the size of highway development programs;
- Varying state enabling legislation that in some cases limited the number of projects that could be piloted under the SEP-14 program;
- Newness of this project delivery approach and an agency's willingness to experiment with alternative methods of project delivery; or
- Different levels of tolerance for the uncertainty and perceived risks of this new project delivery approach.

While half the states have completed at least one design-build project under SEP-14, the use of design-build as a contract vehicle for highway capital projects varies greatly from state to state. Some states, such as Colorado DOT, Virginia DOT, and certain toll agencies in California have gone beyond design-build by sponsoring construction projects featuring design-build-operate-maintain contracting, in which a project developer bears responsibility not only for the design and construction of a highway (often a toll road) but also operations and maintenance responsibility for a fixed number of years. New Mexico and Virginia have coupled design-build with performance-based warranty programs, in which design-build teams are responsible for repairing certain deficiencies in highway performance for a given period of time.

Another variation is the scope of design-build work. Some states, including Georgia, Minnesota, Colorado, Utah, and Washington, have utilized or are considering design-build for certain mega-projects, including redevelopment of Interstate arteries through such cities as Rochester, Minn., Salt Lake City, and Seattle. Massachusetts is completing its first design-build project, the $385 million, 21-mile expansion of Route 3 North, while Oregon will use design-build under new legislation and regulations permitting public-private initiatives to expedite bridge and other road projects as part of a recent $400 million bond issue for highway construction.

Other states have proceeded more cautiously. Missouri has considered design-build contracting on a pilot basis but has yet to initiate their program. Ohio has let design-build projects with decreasing frequency in recent years, limiting design-build contracting to bridge re-decking and replacement projects and highway lighting in FY 2002 and FY 2003, as noted earlier. In Michigan, enabling legislation permits design-build contracting but there are claims that the technique does not allow the transportation agency to achieve its primary goal of minimizing impact to motorists. The legislature in New Hampshire, among other states, has failed to approve design-build contracting for highway projects. Despite a legislative prohibition against design-build contracting, the Texas Legislature in 2001 allowed up to four pilot projects to be developed under an arrangement similar to design-build, called a *comprehensive development agreement*.

* * * * * * *

This chapter demonstrates the diversity of programs and projects comprising the SEP-14 – Innovative Contracting program among the participating state and local transportation agencies. It also indicates the variety of approaches being taken by these agencies to apply design-build contracting, demonstrating the broad latitude individual state and local transportation agencies have to experiment, test, and apply design-build project delivery as part of their overall highway development programs.

Chapter IV presents the results of the design-build program and project surveys conducted during this study, as described in Chapter I. The findings derived from the survey responses provide the primary basis for addressing the issues and questions posed by Congress regarding the implications of design-build on the Federal-aid highway program, as expressed in Section 1307 (f) of TEA-21.

IV. FINDINGS

This chapter presents the results of the various fact-finding efforts performed during this study to address the issues and concerns posed by Congress in Section 1307(f) of TEA-21 regarding the application of design-build contracting to projects in the Federal-aid highway program. The study findings are organized into the following eight sections that include the areas of inquiry posed by Congress:

- Overview of SEP-14 design-build program
- Effects of design-build contracting on project duration
- Effects of design-build contracting on project cost
- Effects of design-build contracting on project quality
- Appropriate level of design for design-build procurements
- Impacts of design-build contracting on small businesses
- Degree of subjectivity used in design-build contracting
- Other design-build contract features

The impacts of delivery approach on project duration, cost, and quality, as reported by the respondents to the project surveys, are established by using several approaches whose combined results provide a profile of the prevalent effects of design-build versus design-bid-build project delivery. These approaches include the following:

- Project-specific impacts estimated by the responsible project manager relative to design-bid-build, based on the project surveys;
- Project-specific changes in actual project duration, cost, and quality during the development of the project based on actual project data provided by the responsible project manager, based on the project surveys; and
- Project-specific estimates and actual results for a comparable sample of similar design-build and design-bid-build projects provided by the respective project managers, based on the comparable project surveys.

The comparison of actual results for similar groupings of design-build and design-bid-build projects provides the most objective basis for determining the relative impacts of using each project delivery approach on project duration, cost, and quality. The small sample size for these direct comparisons limits the statistical representation of the results. However, by comparing the combined results for each group of projects, organized by project delivery approach, the results are more representative than would be provided by individual one-on-one comparisons. This is due to each project's inherent uniqueness and the potential for that uniqueness to skew the results in some way, thereby making the comparison less useful for the purpose of this study.

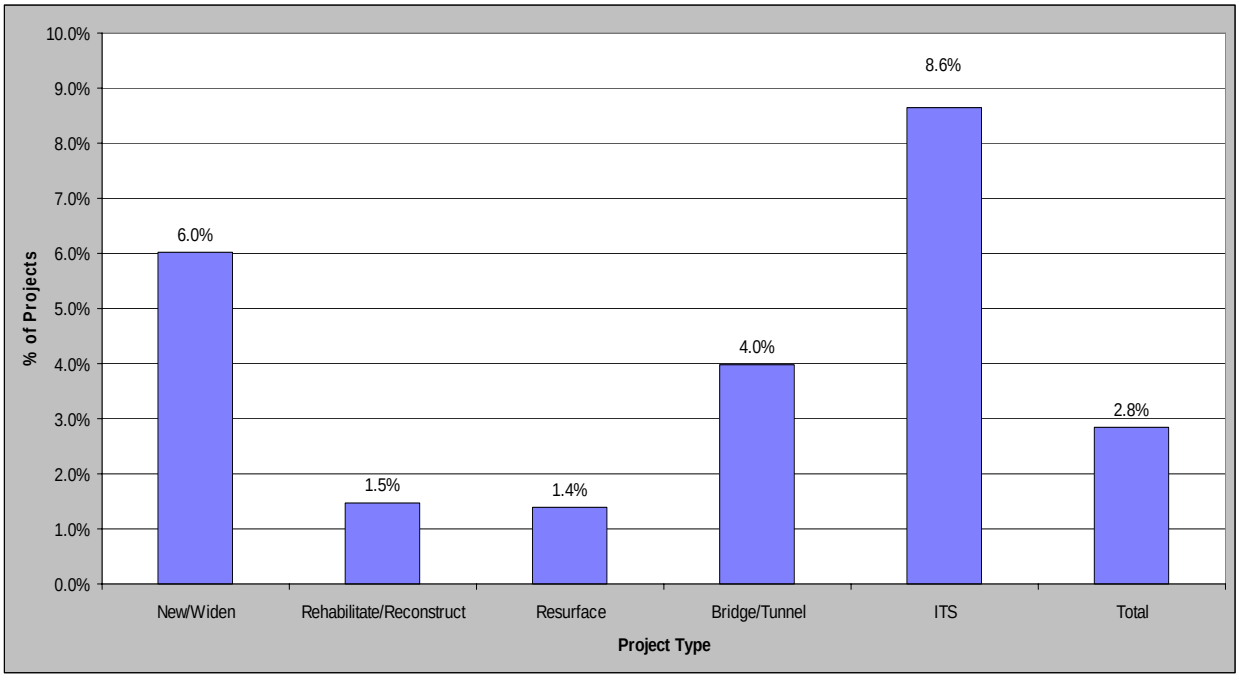
OVERVIEW OF SEP-14 DESIGN-BUILD PROGRAM

Out of the 29 STAs, toll agencies, and local public agencies (collectively referred to as agencies) that responded to the design-build program survey, 18 agencies provided information about the size of their overall design-build program compared to their total program, broken down by type of project. Given the difficulty of assigning costs for multi-year projects to a particular year, the survey requested information on the number and costs for design-build projects completed in 2002 (the last full year of design-build project activity prior to the conduct of the surveys for this study), and for all projects completed by the agency in that year. These responses enabled the research team to assess the relative size of agency design-build programs when compared to the total agency program, by type of project and overall. The results of these responses are described below.

Extent of Design-Build Program

The responding agencies with design-build programs completed 73 design-build projects in calendar year 2002, representing a reported $1.2 billion in costs. This compared to 3,034 total projects completed that same year, at a total cost of $7.4 billion. Hence, while design-build projects represented only 2.8 percent of the total projects completed in 2002 for these combined agencies, they comprised 25.5 percent of the total costs for these projects. This is illustrated in Exhibits IV.1 and IV.2 in the "Total" column for each exhibit respectively.

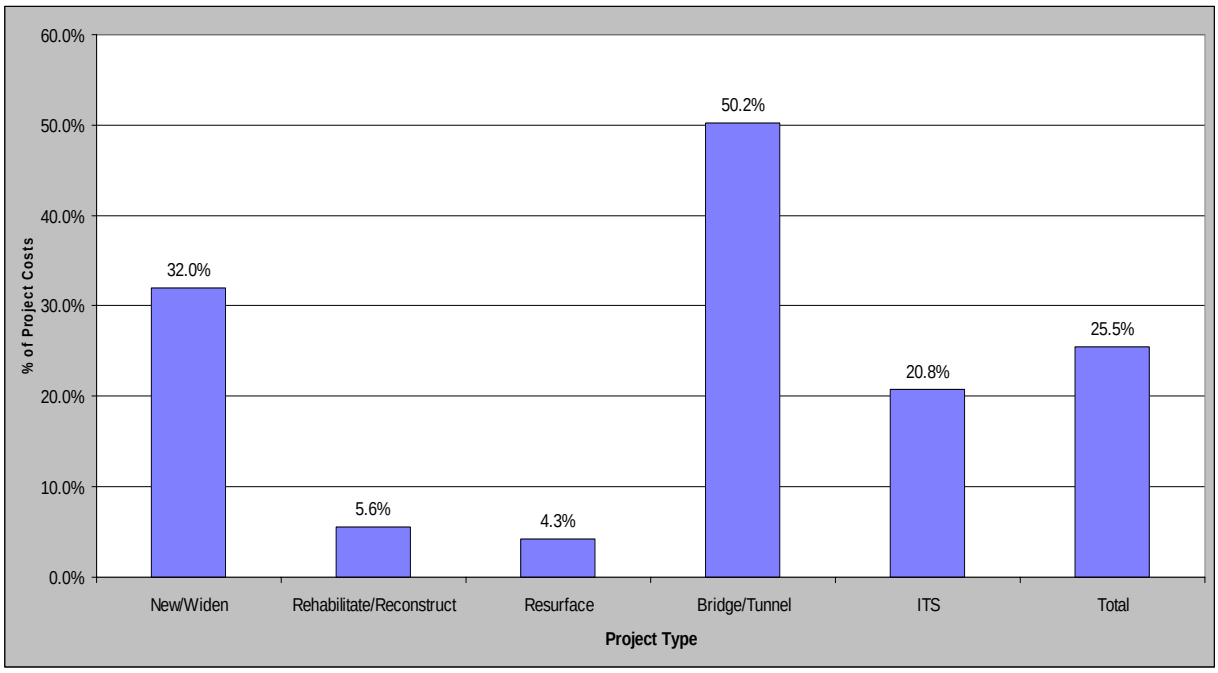
Exhibit IV.1 Design-Build Projects as a Proportion of Total Projects Completed in 2002 for Responding Agencies



Source: D-B program survey: Q18, 13 responses

Exhibit IV.1 shows the proportion of projects completed in 2002 by responding agencies that were delivered using the design-build approach. The largest proportion of projects using design-build were for ITS, Road-New/Widen, and Bridge/Tunnel, ranging from 4 percent to 9 percent. In terms of number of projects, design-build remains a small percentage of the total programs in responding agencies at 2.8 percent.

Exhibit IV.2 Design-Build Project Costs as a Proportion of Total Project Costs Completed in 2002 for Responding Agencies

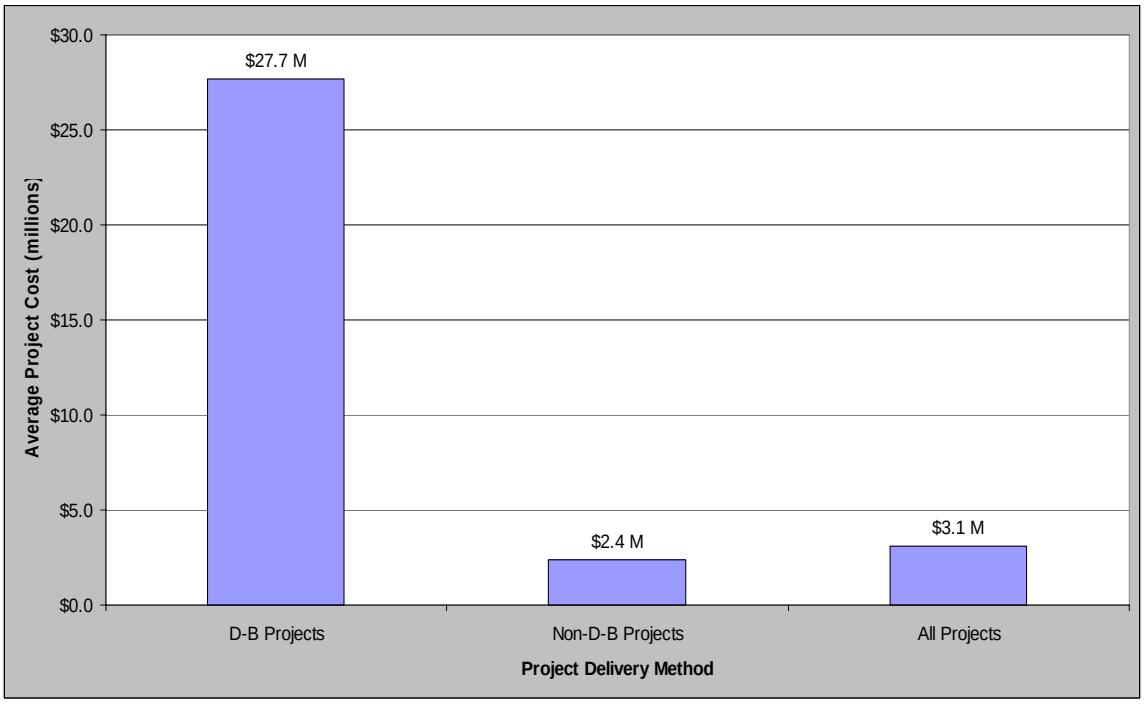


Source: D-B program survey: Q18, 13 responses

Exhibit IV.2 shows the proportion of overall design-build program costs for projects completed in 2002 by responding agencies. These percentages are much higher than in Exhibit IV.1 for all project types. While the proportion of project costs remains highest for the same project types as shown in Exhibit IV.1, the relative positions have shifted to favor more costly and perhaps risky project categories, such as Bridge/Tunnel and Road-New/Widen projects. These two project types show the highest increase in percentage when measuring the cost of projects versus the number of projects completed in 2002.

The higher percentage of total project costs using design-build indicates that in most cases, design-build projects tended to be significantly larger, more complicated projects. This is confirmed by Exhibit IV.3, which shows that the average cost of design-build projects completed in 2002 by agencies responding to the design-build program survey was $27.7 million, more than eleven times the average cost of all other projects completed that year (just under $2.4 million).

Exhibit IV.3 Average Project Costs by Delivery Method
Design-Build verses Non-Design-Build



Source: D-B program survey: Q18, 13 responses

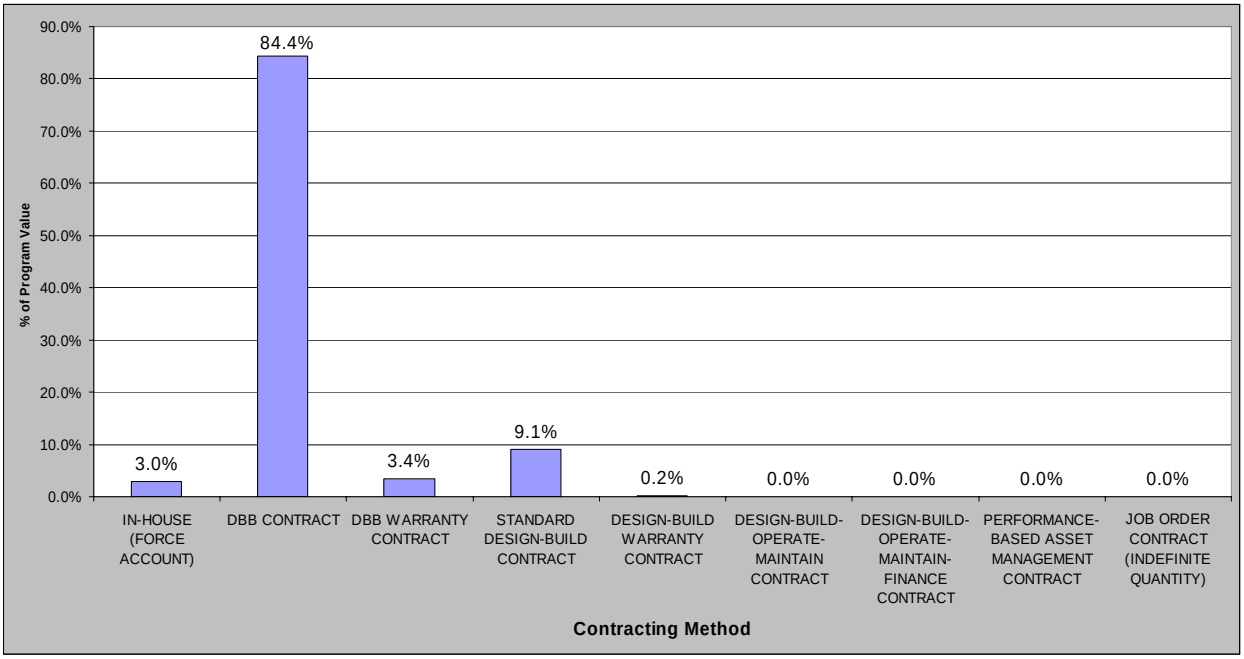
Contracting Methods Used by States with Design-Build Programs

The most frequently used contracting method reported by agencies in the design-build program survey is traditional design-bid-build, either by itself or combined with some kind of warranty (either material and workmanship or performance). As shown in Exhibit IV.4, 87 percent of the value of agency highway programs is reported to be delivered using some form of design-bid-build. Second in popularity is design-build, either alone or in combination with a warranty, which represents just over 9 percent of the program value. Besides in-house (force account) work, there is no other project delivery method with any significant use by the reporting agencies.

The predominant use of design-bid-build contracting applies across all types of projects, as shown in Exhibit IV.5. Design-build is most prevalent for Road-New/Widen, Rehabilitation/Reconstruct, and Bridge/Tunnel project types, ranging from 8 percent to 11 percent of the projects. The use of design-bid-build contracting ranges from 83- to 95-percent. This is a higher percentage than reported in Exhibit IV.1, which reflects only projects completed in 2002.

Design-build program managers responding to the program surveys estimated only about 2 percent of the design-build projects involved some other innovative contracting approach. In contrast, 21 percent of the design-build projects reported by design-build project managers involved another innovative contracting approach.

Exhibit IV.4 Contracting Methods Used for Agency Programs



Source: D-B program survey: Q19, 21 responses

Exhibit IV.5 Contracting Methods Used by Project Type

PROJECT TYPE	IN-HOUSE (FORCE ACCOUNT)	DESIGN-BID-BUILD CONTRACT	DESIGN-BID-BUILD WARRANTY CONTRACT	DESIGN-BUILD CONTRACT
New/Widen	2.6%	83.1%	3.2%	11.2%
Rehab/Reconstruct	2.9%	84.3%	3.9%	8.9%
Resurface	4.7%	84.6%	3.5%	7.2%
Bridge/Tunnel	2.5%	85.8%	3.2%	8.4%
ITS	0.0%	94.5%	0.0%	5.5%
All Project Types	**3.0%**	**84.4%**	**3.4%**	**9.3%**

Note: The Design-Build Contract column includes both Design-Build and Design-Build Warranty contracts.
Source: D-B program survey: Q19, 21 responses.

The distribution of innovative contracting approaches for the full sample of design-build projects surveyed was as follows:

- 20 percent were design-build-warranty;
- 1 percent were design-build-operate-maintain or DBOM; and
- 79 percent were straight design-build.

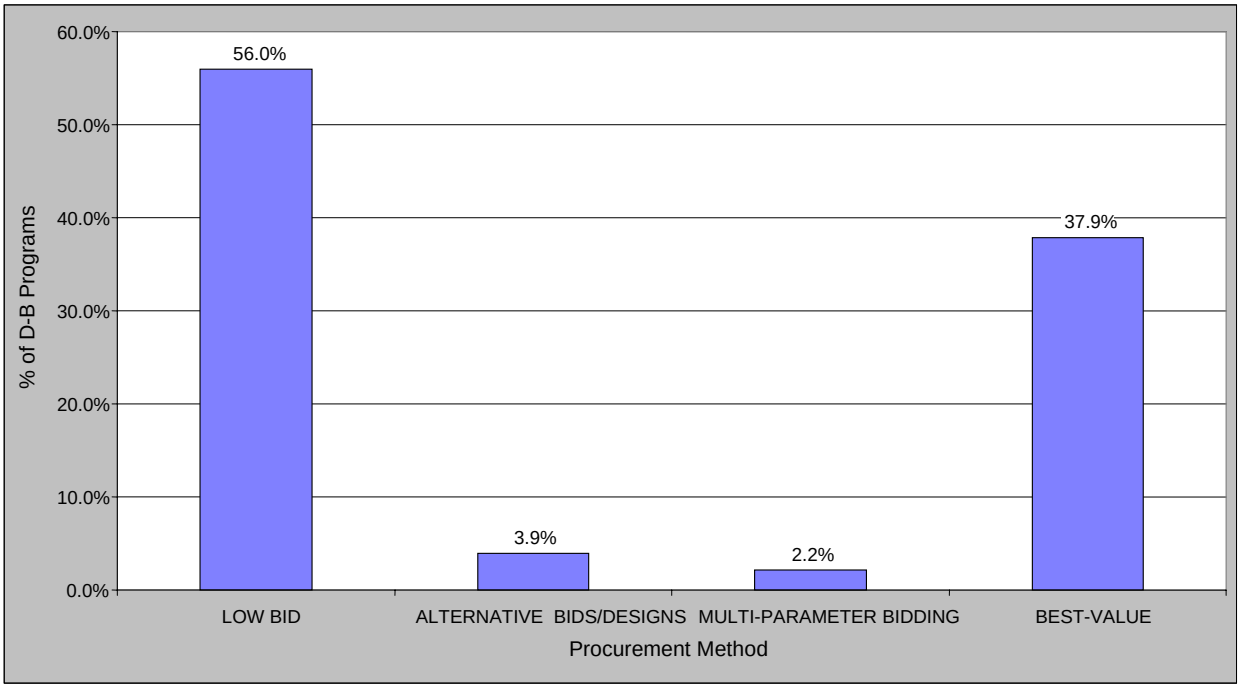
For the subset of design-build projects that were compared to similar design-bid-build projects, the distribution of innovative contracting approaches was as follows:

- 5 percent of the design-build projects were DBOM;
- 95 percent of the design-build projects were straight design-build;
- 5 percent of the design-bid-build projects were design-bid-build-warranty; and
- 95 percent of the design-bid-build projects were straight design-bid-build.

Procurement Methods Used for Design-Build Projects

For design-build projects completed in 2002, the predominant procurement method was Low Bid, as shown in Exhibit IV.6 at 56 percent. Best Value was used for 38 percent of the design-build projects. The only other procurement methods indicated were Alternative Bids/Designs and Multi-Parameter Bidding, each representing about 2 percent. This is in marked contrast to design-bid-build projects that were overwhelmingly low-bid based.

Exhibit IV.6 Procurement Methods Used for Design-Build Projects



Source: D-B program survey: Q20, 14 responses

As shown in Exhibit IV.7, this distribution is representative of most of the project types, including Road New/Widen, Rehabilitate/Reconstruct, and Resurface. ITS projects show an even split between Low Bid and Best-Value.

Exhibit IV.7 Procurement Methods Used for Design-Build Projects by Project Type

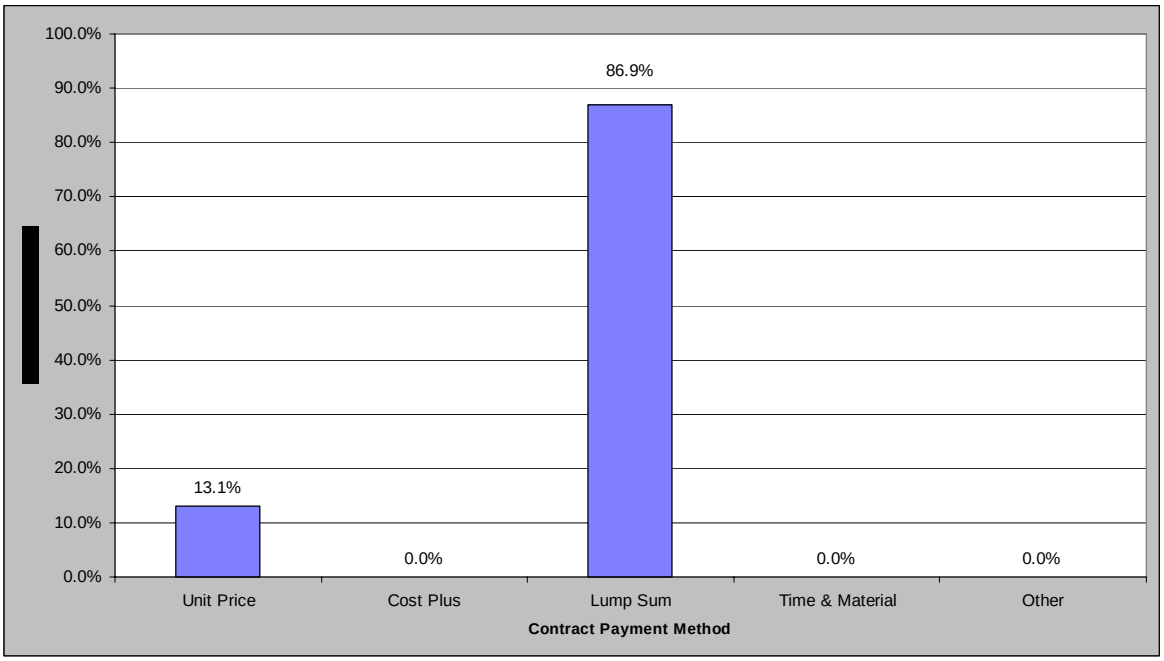
PROJECT TYPE	LOW BID	ALTERNATIVE BIDS/DESIGNS	MULTI-PARAMETER BIDDING	BEST-VALUE
New/Widen	54.2%	0.0%	2.9%	42.9%
Rehab/Reconstruct	64.9%	0.0%	1.7%	33.3%
Resurface	59.0%	0.0%	1.0%	40.0%
Bridge/Tunnel	56.6%	8.3%	1.7%	33.4%
ITS	48.6%	0.0%	1.3%	50.1%
All Project Types	**56.0%**	**3.9%**	**2.2%**	**37.9%**

Source: D-B program survey: Q20, 14 responses

Payment Methods Used by States with Design-Build Programs

The preferred payment method for design-build projects is lump sum, as shown in Exhibit IV.8. The only other payment method noted is Unit Price at 13 percent. This payment preference occurs for all project types, as shown in Exhibit IV.9, and reflects the transfer of project risk to the design-builder who is held responsible for satisfactory project completion and paid on that basis. The small portion of the design-build project costs falling under unit pricing is primarily due to the use of a combination approach to payment methods, whereby certain items are paid for on a unit price basis, while the majority of items are included in the lump sum (fixed price).

Exhibit IV.8 Payment Methods Used for Design-Build Projects



Source: D-B program survey: Q21, 16 responses

Exhibit IV.9 Payment Methods Used for Design-Build Projects by Project Type

PROJECT TYPE	UNIT PRICE	LUMP SUM
New/Widen	17%	83%
Rehab/Reconstruct	11%	89%
Resurface	13%	88%
Bridge/Tunnel	10%	90%
ITS	14%	86%
All Project Types	**13%**	**87%**

Source: D-B program survey: Q21, 16 responses

Suitability of Design-Build Project Delivery

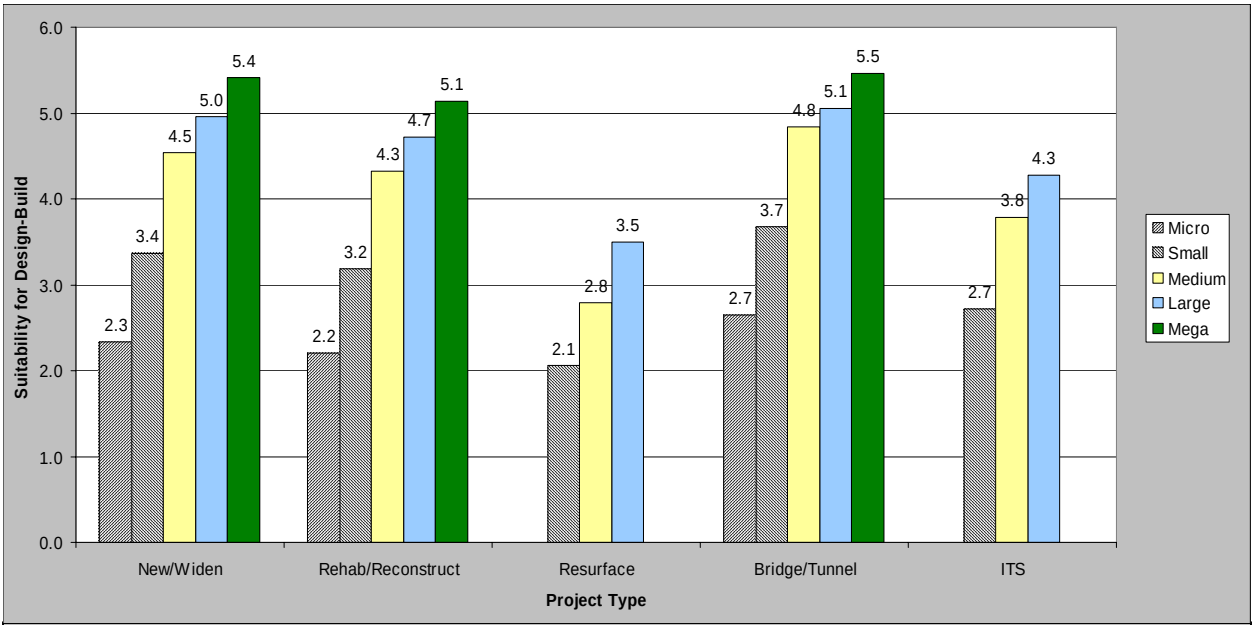
Projects of many sizes and complexities have used design-build project delivery over the years since the inception of the SEP-14 Innovative Contracting program, as shown in Exhibit III.3 in the last chapter. However, as Exhibit III.4 revealed, the overwhelming majority of SEP-14 program costs have been for projects over $100 million in cost. This reflects the perceptions of design-build program managers surveyed for this study. Based on the results of the program survey, design-build program managers rated the following project types as most suitable for design-build project delivery, as shown in Exhibit IV.10:

- Road-Rehabilitate/Reconstruct
- Bridge/Tunnel
- Road-New/Widen

Least suitable among the project types is Road-Resurface. The suitability rating for design-build contracting is highly correlated to the size of the project, wherein the suitability rating more than doubles when going from small projects to mega projects. When deciding which projects to apply design-build contracting, medium to large projects (over $10 million) are considered the most suited to this project delivery approach.

When asked to rate the degree to which design-build project delivery would likely be used in the future, managers of design-build programs indicated a modest level of use (average rating of 2.9 out of a possible 6.0) for all project types, as shown in Exhibit IV.11. The most likely project types to use design-build in the future were Road-New/Widen and Rehabilitate/Reconstruct. The least likely project type for design-build was perceived to be Road-Resurface. This is indeed reflective of the actual usage statistics for the SEP-14 Design-Build Program provided in Chapter III.

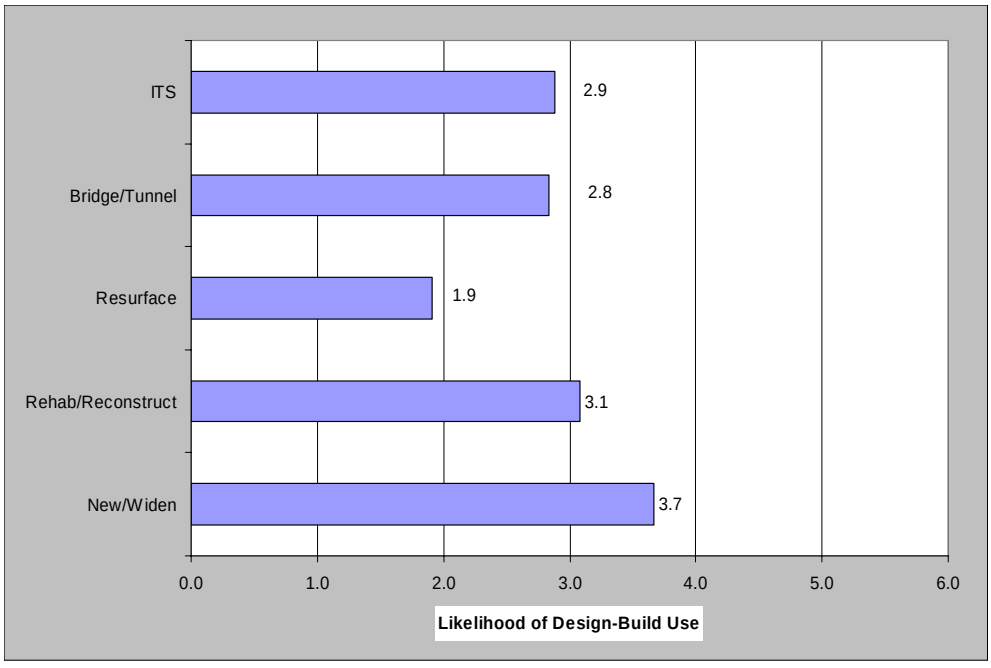
Exhibit IV.10 Perceived Suitability of Design-Build Project Delivery (Scale: 1 – Not Suitable; 6 – Highly Suitable)



Key: Micro - less than $2 million; Small - $2-10 million; Medium - $10-50 million; Large - $50-100 million; Mega - over $100 million

Source: D-B program survey: Q22, 26 responses

Exhibit IV.11 Likely Future Use of Design-Build Project Delivery (Scale: 1 – None; 6 – Significant)



Source: D-B program survey: Q23, 27 responses

Legislative and Policy Requirements

Seventy-two percent of the agencies responding to the design-build program survey needed special permission or legislation to use design-build contracting. Half of the agencies with design-build programs required special legislation. Other requirements or restrictions included:

- Adoption of another state agency's design-build authority and/or process
- Project-specific approval by head of agency
- Minimum project size

Fifty-nine percent of the agencies have developed written policies to guide their design-build programs. Seventy-one percent of these agencies had these policies in place before the first design-build project was initiated. The level of involvement by transportation agencies in formulating these policies ranged from none to very significant, with most having a modest to moderate level of involvement (averaging 3.6 on a 6-point scale). These results reveal the significant statutory and regulatory impediments that had to be overcome to enable agencies to apply SEP-14.

Adequacy of Design-Build Procurement and Contract Administration Procedures

Respondents to the design-build program survey generally characterized their agency's design-build procurement and contract administration procedures as adequate (averaging 4.7 on a 6-point scale for both). They also rated the resource levels available for procuring and administering design-build contracts as adequate (averaging 4.5 on a 6-point scale for both).

Among the contract administration procedures used for design-build projects, all of the respondents to the design-build program survey verified compliance with contract requirements as the project progressed to completion and/or upon project completion. Several of these agencies also had contract compliance verifications performed after project completion due to the inclusion of warranties. These verification procedures were specified in the design-build contract documents of the responding agencies.

EFFECTS OF DESIGN-BUILD CONTRACTING ON PROJECT DURATION, COST, AND QUALITY

Three of the key issues raised by Congress in requesting this study of design-build contracting in the Federal-aid highway program were the relative impacts of project delivery on project duration, cost, and quality. As part of this study, design-build project managers in STAs, toll agencies, and local transportation agencies involved in the SEP-14 program were surveyed to obtain available data and their perspectives concerning these three dimensions for specific design-build projects they were responsible for. As part of the project survey instrument, the respondents were asked to provide their best estimate of the percentage change in project duration, cost, and quality as a result of the design-build approach. The results of their responses are summarized in Exhibit IV.12 below. While this data reflects the recollections of design-build project managers and therefore may not be based on actual project records, it provides useful

insight into how design-build project managers view their experience with a specific design-build project delivery.

Exhibit IV.12 Summary of Estimated Impacts of Using Design-Build on Project Duration, Cost, and Quality

Duration Dimension	Value	Cost Dimension	Value	Quality Dimension	Value
Responses	62	Responses	48	Responses	61
Average	**-14.1%**	**Average**	**-2.6%**	**Average**	**0.0%**
Median	-10.0%	Median	0.0%	Median	0.0%
Mode	-0.1%	Mode	0.0%	Mode	0.0%
Maximum	50.0%	Maximum	65.0%	Maximum	10.0%
Minimum	-63.0%	Minimum	-61.8%	Minimum	-10.0%
Standard Deviation	**24.4%**	**Standard Deviation**	**20.5%**	**Standard Deviation**	**2.1%**

Source: D-B project survey: Q18, 48-62 responses

Exhibit IV.12 reveals that on average, the design-build projects had a distinctly greater potential for schedule reduction than cost reduction, as estimated by design-build project managers in their completed design-build project surveys. The average reduction in project duration was 14 percent, while the average reduction in project cost was almost 3 percent. There was no appreciable difference in project quality associated with project delivery approach, with most indicating no change. For both duration and cost impacts, there was a wide range of impacts, both positive and negative, that is reflected in the high standard deviations in these two data sets. This suggests that many other factors besides delivery approach impact the duration and cost of projects.

The following sections discuss in greater detail the impacts of design-build versus design-bid-build project delivery on the duration, cost, and quality of highway infrastructure projects developed under the SEP-14 program. The first section addresses the issue of project duration.

EFFECTS OF DESIGN-BUILD CONTRACTING ON PROJECT DURATION

The impacts of project delivery approach on project duration and the potential for project duration to change during the development process are presented in several ways in this section. This variety of information reflects the different ways in which survey participants responded to questions concerning the duration of design-build projects by project phase and relative to similar design-bid-build projects. Some of the information is based on estimates provided by survey respondents, while other information is based on actual data from sampled design-build projects and, when provided, from similar design-bid-build projects. When taken together, these various results provide a profile of schedule impacts that is indicative of the influence that the choice of project delivery approach can have on project length, both total and by phase.

The effect of project delivery on project duration can be determined in a number of ways. One way is to ask managers of actual design-build projects to estimate the impact of design-build project delivery on overall project duration. Another way is to compare the differences between planned and actual duration of project phases as the project moves from RFP development to completion. The effects of design-build project delivery on overall project and phase duration were developed in this study based on the combined results for the 69 completed project surveys, using respondent estimates and actual project schedule data.

A third method of measuring the impact of project delivery approach on project duration is to use cross-sectional data to compare the relative changes in project duration during the phases of project development between similar design-build and design-bid-build projects. This can be done by comparing either individual results for two very similar projects or the average results for a group of similar pairs of projects. Reported project-specific schedule changes by phase varied widely between different pairs of similar design-build and design-bid-build projects. To avoid the problem of the inherent differences between individual projects distorting the reported results, the analysis was based on comparing the average results by project delivery approach for the paired reported projects.

Out of the 17 pairs of projects reported, 11 pairs had sufficient data reported in the completed surveys to enable changes in project duration by phase to be developed. It should be noted that this is a relatively small sample that may not be statistically representative of the SEP-14 Program of projects or design-bid-build projects. Hence care needs to be taken in developing or applying any conclusions that are based on the results from this sample of paired design-build and design-bid-build projects.

Estimated Impacts of Design-Build on Project Duration

The project survey results revealed that design-build project delivery, in comparison to design-bid-build, had a mixed impact on project duration depending on the project type, complexity, and size. As Exhibit IV.13 shows, the estimated impacts of project delivery on project schedule resulted in a wide range of schedule variations, ranging from a 63-percent reduction to a 50-percent increase. This is reflected in the high standard deviation for this sample of estimates.

Exhibit IV.13 Estimated Change in Project Duration due to Design-Build Project Delivery

Duration Dimension	Value
Responses	62
Average	**-14.1%**
Median	-10.0%
Mode	-0.1%
Maximum	50.0%
Minimum	-63.0%
Standard Deviation	**24.4%**

Source: D-B project survey: Q18

When considered as a group, the surveyed design-build project managers estimated an average decrease of 14 percent in delivery time relative to design-bid-build. Out of 62 responses, 45 estimates were for schedule reductions and only 7 estimates indicated a schedule increase. Overall, 89 percent of the design-build project managers estimated no increase in project duration due to the application of design-build. These results suggest that from the perspectives of design-build project managers, project delivery approach (i.e., design-build versus design-bid-build) can be a significant factor in controlling and expediting project delivery schedules.

The range and average differences in procurement and contract administration time between design-build and design-bid-build project delivery approaches, as estimated by program survey respondents, is illustrated in Exhibit IV.14. Program survey respondents estimated that the time required for procurement of design-build contracts versus design-bid-build contracts ranged from 45-percent less to over 100-percent more time, with an average increased procurement time of 15 percent for design-build contracts. About two-thirds of the program survey respondents believed design-build projects had a longer procurement time than design-bid-build projects. In contrast, the actual time required for the administration of design-build contracts ranged from 75 percent less to 55 percent more time, with an average decrease in contract administration time of 3 percent for design-build contracts.

Exhibit IV.14 Range and Average Differences in Procurement and Contract Administration Time for Similar Design-Build and Design-Bid Build Projects

Activity	Average	Maximum	Minimum
Contract Administration	**-2.8%**	55.0%	-75.0%
Procurement	**15.0%**	105.0%	-45.0%

Source: D-B program survey: Q12, 27 responses

These results suggest that design-build projects are perceived to take more time to set up and procure, but once awarded, require slightly less time for the contracting agency to administer in comparison to similar design-bid-build projects. The wide variation in responses reflects the newness of design-build procurement and contract administration processes and the diversity of project types and sizes for which design-build project delivery is used by transportation agencies.

Planned versus Actual Project Duration

Another consideration is how the duration of design-build projects changed from what was planned to what actually occurred. To provide the same basis for comparing project duration between design-build and design-bid-build project, total project duration is defined in this section as the time from advertising the design-build project (following preparation of the RFP), to completing the project as signified by contracting agency acceptance. Construction phase duration is defined as the time from initiating construction activity to acceptance of the project by the contracting agency.

Relative to what was planned before the surveyed projects began, total project duration declined by 0.9 percent on average while construction duration increased by 1.0 percent. Exhibit IV.15 shows a wide range of differences between planned and actual delivery times for the surveyed design-build projects. The same number of projects experienced a decrease in duration (15) as experienced an increase in duration (15) for the total project and construction phase. Four of the reported design-build projects did not experience any change in total project or construction phase duration.

Exhibit IV.15 Range and Average Differences in Planned versus Actual Total Project and Construction Phase Duration for Design-Build Projects

Project Phase	Average	Maximum	Minimum	Standard Deviation
D-B Constuction Phase	**1.0%**	67.5%	-54.7%	28.5%
D-B Total Project	**-0.9%**	31.9%	-35.5%	15.4%

Source: D-B project survey: Q15, 51 responses for construction phase and 34 responses for total project

Design-Build versus Design-Bid-Build Project Duration

Another indication of the effect of design-build project delivery on project duration is obtained from the subset of 11 comparable design-build and design-bid-build project surveys completed for this study. For the purposes of this analysis, the time associated with preparation of procurement documents prior to advertising for bid is excluded from the definition of total project duration in Exhibit IV.16. This includes:

- Request for qualifications (RFQ) and request for proposal (RFP) for the single-phase, two-step design-build procurement process; and
- Prequalification and invitation for bids (IFB) for the two-phase design-bid-build procurement process

The pre-advertisement phase is subject to numerous influences beyond the control of contracting agency or respondents and not related to the choice of project delivery method.

Exhibit IV.16 Average Percent Change in Planned Versus Actual Total Project and Construction Phase Durations For Similar Design-Build and Design-Bid-Build Projects

Project Phase	Average	Maximum	Minimum	Standard Deviation
D-B Constuction Phase	**-1.2%**	30.6%	-54.7%	27.3%
D-B-B Construction Phase	**11.6%**	71.7%	-27.2%	28.7%
D-B Total Project	**-4.2%**	23.1%	-42.5%	20.8%
D-B-B Total Project	**4.8%**	30.6%	-20.9%	14.9%

Source: similar D-B and D-B-B project surveys: Q15, 11 responses per survey type

As shown in Exhibit IV.16, on average the design-build projects achieved shorter total project duration and construction duration than originally planned. In contrast, the similar design-bid-build projects incurred longer timeframes, on average, for both total project and construction phase durations than originally planned. The subset of design-build projects reduced the planned project duration by an average of 4 percent, while the comparable design-bid-build projects increased total project duration by an average of 5 percent. This represents a 9-percentage point differential in total project duration between similar sets of design-build and design-bid-build projects.

Meanwhile, the subset of design-build projects had a decreased construction duration averaging 1 percent, while the comparable design-bid-build projects increased construction duration by an averaging 12 percent. This represents a 13-percentage point difference between actual and planned project timeframes.

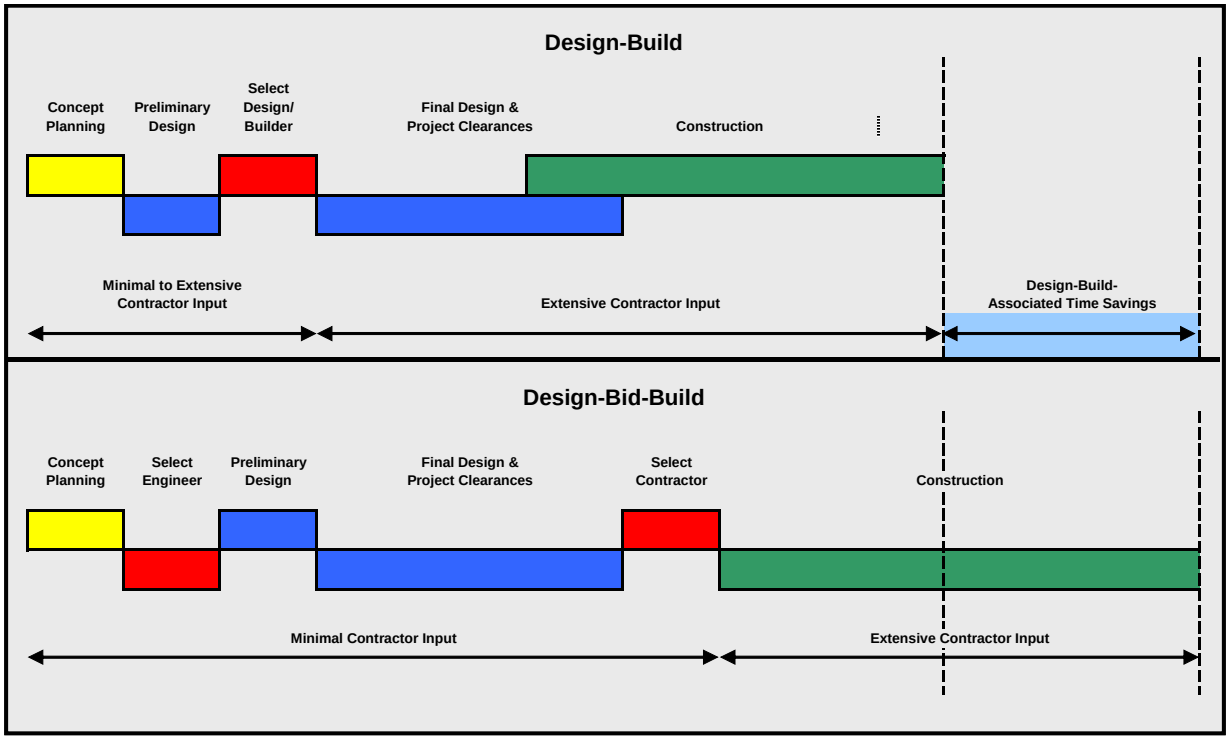
The results of the program and project surveys, including both project manager estimates and actual project documentation, supports the claim that the design-build approach can reduce the overall duration of a project, in certain cases significantly. Despite wide variations in changes to project duration among the surveyed design-build and design-bid-build projects, particularly for the construction phase, the results revealed that longer than planned contract development and evaluation timeframes and potentially longer construction timeframes could be more than offset by certain features of the design-build process. These features included:

- Eliminating the need for a second procurement cycle by combining contracting for design and construction contracts;
- Integrating these functions during the project development lifecycle, while design-bid-build keeps them contractually separate;
- Creating an incentive for improved designs that are more constructible and require fewer design "fixes" through change and extra work orders; and
- Allowing parallel processing of activities occurring on different portions of a project while design-bid-build keeps them sequential.

Exhibit IV.17 illustrates the general sequence of project development activities for both design-build and design-bid-build contracts. The two schedules demonstrate how the type of project delivery approach may influence the sequencing and duration of standard highway project development phases. The key feature that distinguishes these two project delivery approaches is the placement of design functions relative to the construction functions and the potential for overlap between the design and construction phases for the design-build approach.

These factors resulted in shorter total project durations than originally planned on average for the surveyed design-build projects, whereas these same timeframes increased for the surveyed design-bid-build projects. Interestingly, for the sampled design-build and design-bid-build pairs, the average planned project duration (excluding procurement document preparation) was longer for the design-build projects as a group, but actual project duration was shorter.

Exhibit IV.17 Sequence of Project Delivery Activities by Contract Approach



Source: Dr. Keith Molenaar, University of Colorado at Boulder

The ability for design-build contractors to have greater control to better integrate the design and construction functions and to use parallel processing of certain functions previously required by contract and regulation to be done sequentially provide significant opportunities for trimming the time it takes to deliver a design-build project in comparison to its design-bid-build counterpart. Numerous respondents to the project surveys noted the ability to expedite a needed project as the primary motivation for using the design-build approach to project delivery.

EFFECTS OF DESIGN-BUILD CONTRACTING ON PROJECT COSTS

As with the previous section on project duration, the impacts of project delivery approach on project cost and the potential for project cost to change during the development process are presented in several ways in this section. This variety of information reflects the different ways in which survey participants responded to questions concerning the costs of specific design-build projects by project phase and relative to similar design-bid-build projects. Some of the information is based on estimates provided by project survey respondents and some of the information is based on actual cost data provided for sampled design-build projects and, when provided, similar design-bid-build projects. When taken together, these various results provide a profile of cost impacts that is indicative of the various impacts that the choice of project delivery approach can have on project costs, both total and by phase.

The effect of project delivery on project costs can be measured in a number of ways. One method is to use time series data to compare the level of project cost as the project moves from budget to contract to completion. Three measures of project cost change are developed in this section based on the phase of the project development process:

- Pre-Contract Cost Change: the percent difference between contract and budget cost levels (i.e., [contract cost - budget cost]/budget cost), which measures what happens to project cost levels as the project moves from concept to contract.
- Contract Cost Change: the percent difference between final delivered cost and contract cost levels (i.e., [delivered cost - contract cost]/contract cost), which measures what happens to project cost levels during the design-build or construction contract.
- Total Project Cost Change: the percent difference between final delivered cost and budget cost levels (i.e., [delivered cost - budget cost]/budget cost), which measures what happens to project cost levels from concept to completion.

Average project cost changes by phase were developed in this study based on the combined results for the 69 completed project surveys, using actual project cost data. This provided the largest sample to determine these cost change impacts for design-build projects in the study.

As with project duration, another method of measuring the impact of project delivery approach on project cost is to compare the relative changes in project cost during the phases of project development between similar design-build and design-bid-build- projects. This can be done by comparing either individual results for two very similar projects or the average results for a group of similar pairs of projects. Project-specific cost changes by phase vary widely between different pairs of similar design-build and design-bid-build projects. To avoid the problem of the inherent differences between individual projects overly distorting the reported results, the analysis is based on comparing the average results by project delivery approach for the group of paired projects.

Out of the 17 pairs of projects reported, 11 pairs had sufficient data reported in the completed surveys to enable changes in project costs by phase to be developed. It should be noted that this is a relatively small sample that may not be statistically representative of the SEP-14 Program of projects or design-bid-build projects. Hence care needs to be taken in developing or applying any conclusions that are based on the results from this sample of paired design-build and design-bid-build projects.

Estimated Impacts of Design-Build on Project Cost

The project survey results revealed that design-build project delivery, in comparison to design-bid-build, had a mixed impact on project cost depending on the project type, complexity, and size. As Exhibit IV.18 shows, the estimated impacts of project delivery on project cost were wide-ranging, extending from a 62-percent reduction to a 65-percent increase. This is reflected in the high standard deviation for this sample of estimates.

Exhibit IV.18 Estimated Change in Project Cost due to Design-Build Project Delivery

Cost Dimension	Value
Responses	48
Average	**-2.6%**
Median	0.0%
Mode	0.0%
Maximum	65.0%
Minimum	-61.8%
Standard Deviation	**20.5%**

Source: D-B project survey: Q18

When considered as a group, the surveyed design-build project managers estimated an average decrease of 2.6 percent project cost relative to design-bid-build. Out of 48 responses, 20 estimates were for cost reductions, 17 for no change, and 11 for a cost increase. Overall, 77 percent of the design-build project managers estimated no increase in project cost due to design-build. These results suggest that from the perspectives of design-build project managers, project delivery approach (i.e., design-build versus design-bid-build) can be a contributing factor in controlling and potentially reducing project costs. However, project delivery approach is perceived to be less of a factor in affecting project cost than other characteristics of the project or its participants.

Reported Impacts of Design-Build on Project Cost

When actual project cost information is used from the project surveys, the design-build projects on average experienced no appreciable change in total cost (ranging from a decrease of 42 percent to an increase of 63 percent). As shown in Exhibit IV-19, this resulted from an average cost decrease of 2.3 percent between concept budget and contract, and an average cost increase of 3.2 percent during the contract phase.

When considering individual project results, the zero percent average total project cost change was the result of off-setting cost increases and cost decreases that both varied widely. Slightly more of the surveyed design-build projects experienced a decline in total project cost from budget to completion than experienced an increase, although the cost increases tended to be a somewhat higher percentage than the cost decreases per project. One-half of the design-build projects experienced a change in total cost within plus or minus 10 percent. One-quarter of the design-build projects experienced a decline in total cost of 10 percent or more and one-quarter experienced an increase of 10 percent or more.

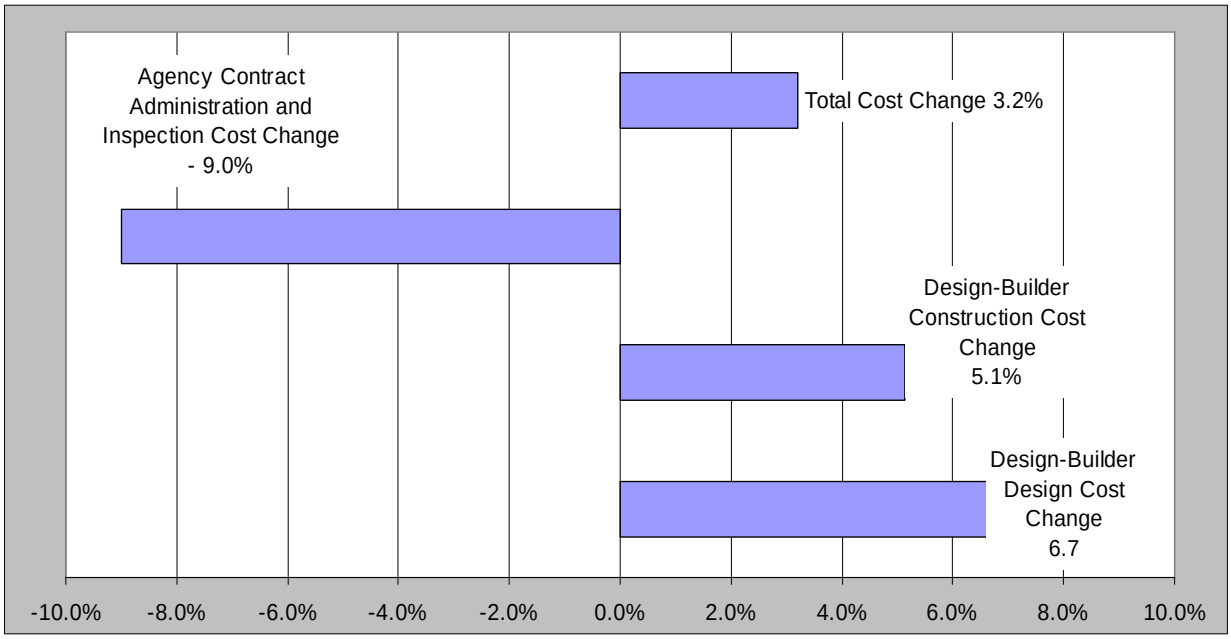
Exhibit IV.19 Reported Change in Project Costs for Surveyed Design-Build Projects

Dimension	Award Growth ((Award-Budget)/ Budget)	Contract Growth ((Final-Award)/ Award)	Total Growth ((Final-Budget)/ Budget)
Responses	36	36	36
Average	**-2.3%**	**3.2%**	**0.0%**
Median	-0.1%	0.5%	-0.9%
Mode	0.0%	0.0%	N/A
Maximum	63%	37%	63%
Minimum	-45%	-42%	-42%
Standard Deviation	**21%**	**12%**	**22%**

Source: D-B project survey: Q16

In considering the average 3.2 percent increase in cost during the contract phase, most of the increase was due to design-builder increases of 5 to 7 percent, as shown in Exhibit IV-20.

Exhibit IV.20 Reported Changes in Design-Build Project Costs after Contract Execution



Source: D-B project survey: Q16, 36 responses

The major compensating factors were decreases in the administrative costs to the contracting agency for preliminary engineering, contract preparation, contract administration, and quality control inspections, all of which represent significantly smaller portions of the project costs.

Comparison of Reported Project Cost Change Between Design-Build and Design-Bid-Build Project Delivery

The design-bid-build projects demonstrated somewhat more favorable cost results than their design-build project counterparts, as shown in Exhibit IV.21. As indicated by the results, there is a wide range of project costs for each project phase that is reflected by the large standard deviations shown for both design-build and similar design-bid-build survey samples. This suggests that many other factors besides project delivery approach are influencing the results.

Exhibit IV.21 Supporting Data for Reported Changes in Project Costs for Similar Design-Build and Design-Bid-Build Projects

Design-Build Projects

Dimension	Award Growth ((Award-Budget)/ Budget)	Contract Growth ((Final-Award)/ Award)	Total Growth ((Final-Budget)/Budget)
Responses	11	11	11
Average	**1.9%**	**6.0%**	**7.4%**
Median	2.4%	1.6%	2.4%
Mode	N/A	N/A	N/A
Maximum	23%	21%	40%
Minimum	-41%	-4%	-28%
Standard Deviation	**17%**	**9%**	**17%**

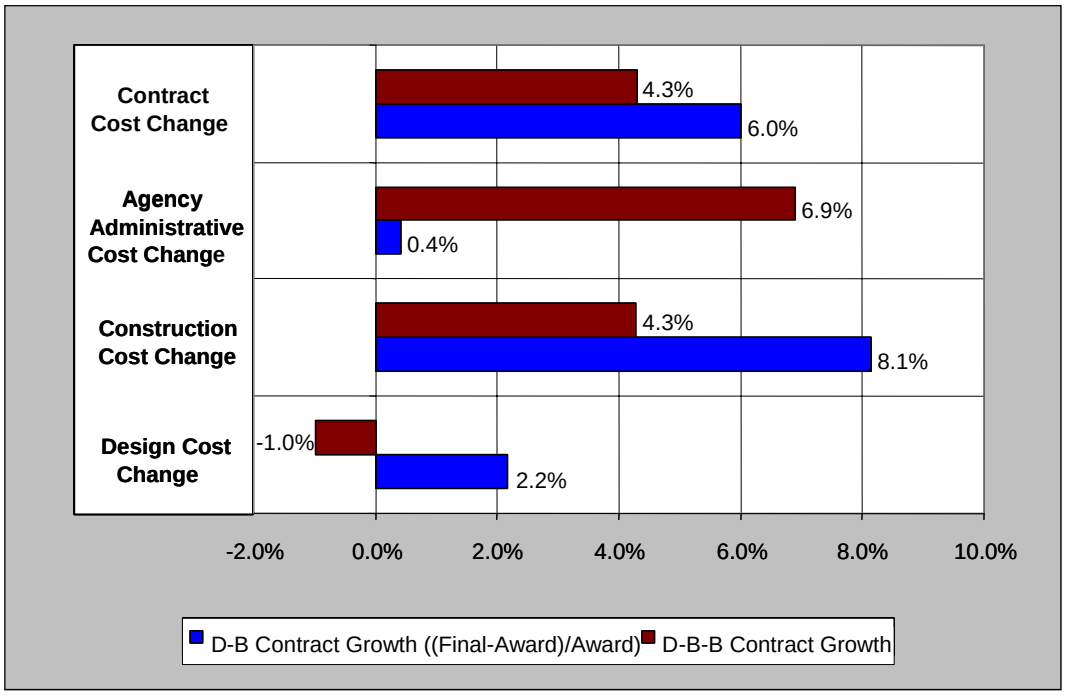
Design-Bid-Build Projects

Dimension	Award Growth ((Award-Budget)/ Budget)	Contract Growth ((Final-Award)/ Award)	Total Growth ((Final-Budget)/Budget)
Responses	9	9	9
Average	**-1.4%**	**4.3%**	**3.6%**
Median	-0.9%	0.4%	-3.9%
Mode	N/A	N/A	N/A
Maximum	27%	29%	64%
Minimum	-18%	-3%	-13%
Standard Deviation	**15%**	**10%**	**24%**

Source: similar D-B and D-B-B project surveys: Q16

In considering the increases in cost during the contract phase of both the subset of design-build projects and similar design-bid-build projects, most of the increases occurred during the construction phase of the projects, as shown in Exhibit IV.22. For this small sample of similar projects, there was less cost growth indicated for the design-bid-build projects.

Exhibit IV.22 Comparison of Actual Reported Changes in Project Costs after Contract Execution for Similar Design-Build and Design-Bid-Build Projects



Source: similar D-B and D-B-B project surveys: Q16, 9-11 responses per survey type

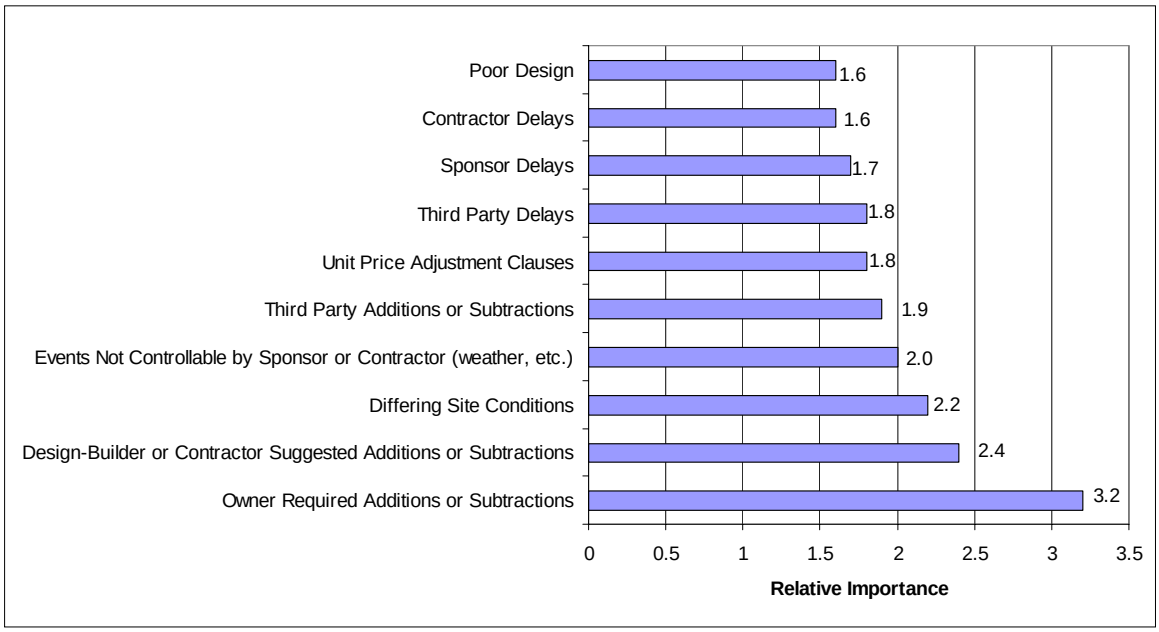
Causes of Project Cost Changes

As noted earlier, project costs tend to experience most cost growth from contract award to project completion. Respondents to the design-build project survey were asked to rate the reasons for major changes in project costs (using a six-point scale ranging from "No Impact" (0) to "Major Impact" (6). This resulted in a series of ratings for the various factors listed in Exhibit IV.26, many of which are outside the control of the design-builder.

According to Exhibit IV.23, the leading cause of project cost changes was change orders: Owner required additions or subtractions had an average rating of 3.2, followed by design-builder or contractor suggested additions or subtractions at 2.4. The relative impacts of other factors on the cost of design-build projects are also shown below, with most between 1.6 and 2.0.

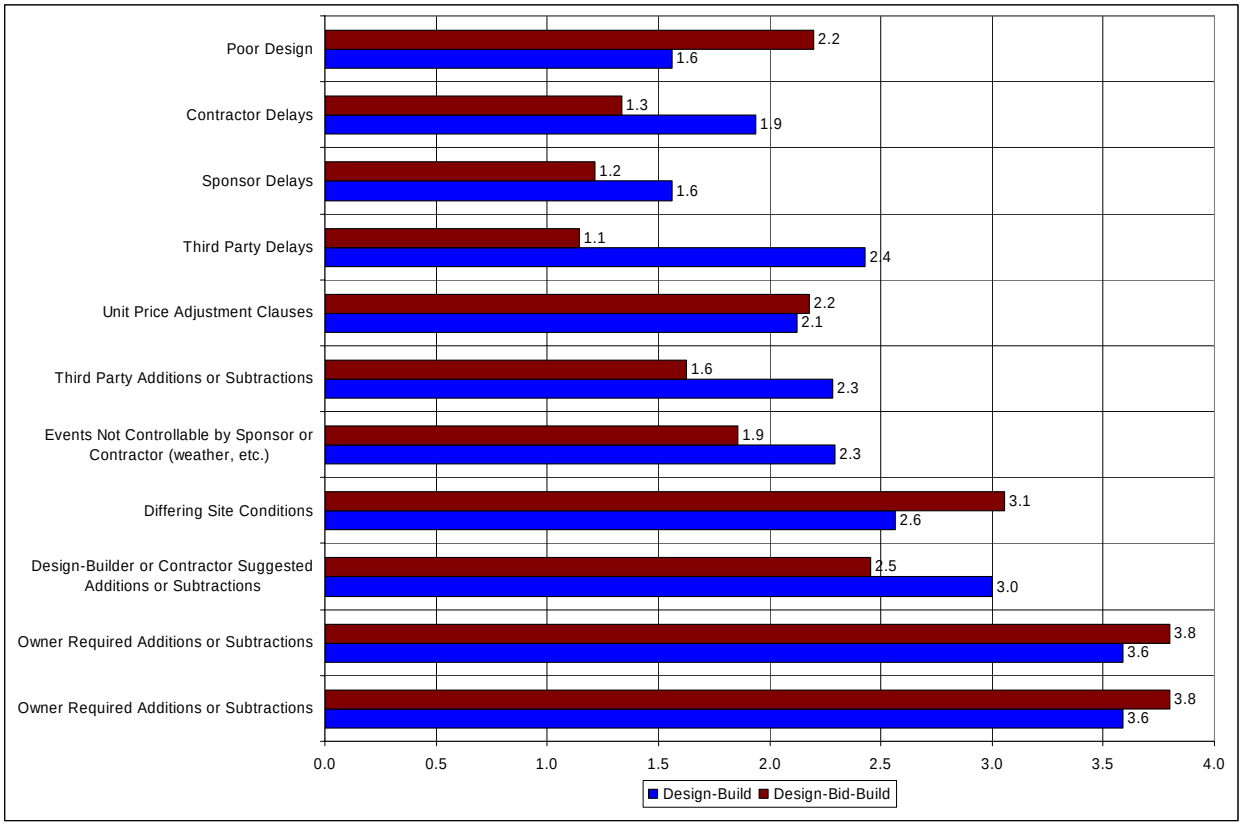
When the subset of design-build projects is compared to similar design-bid-build projects, as shown in Exhibit IV.24, the results reveal similar ratings of the causes of project cost changes for the two project delivery approaches. This suggests that both project delivery approaches are sensitive to similar factors, with design-build projects being significantly more sensitive to delays, additions, or subtractions caused by third parties than design-bid-build.

Exhibit IV.23 Causes of Cost Changes for Design-Build Projects



Source: D-B project surveys: Q16, 64 responses

Exhibit IV.24 Causes of Cost Changes for Similar Design-Build and Design-Bid-Build Projects



Source: similar D-B and D-B-B project surveys: Q16, 17 responses per survey type

Change Orders and Claims

As noted above, a significant factor affecting project cost, as well as project duration and quality, is change orders. Exhibit IV.25 lists the number and effect of change orders, as well as claims, on the costs of design-build projects surveyed during the study.

Exhibit IV.25 Reported Change Order and Claim Activity for Design-Build Projects

Change Order Dimension	Change Orders Per Project	Change Order Costs Per Project ($000)	Cost Per Change Order ($000)	Claims Per Project	Claims Cost Per Project ($000)
Responses	61	61	61	62	62
Average	**18**	**$3,722**	**$122**	**0.3**	**$80**
Median	8	$400	$29	0	$0
Mode	0	$0	$0	0	$0
Maximum	187	$73,000	$1,169	5	$3,000
Minimum	0	$0	$0	0	$0
Standard Deviation	**30**	**$12,813**	**$237**	**1**	**$429**

Source: D-B project survey: Q16

Change orders represented 4.7 percent of the total costs for the surveyed projects. The average total value of change orders per project was $3.7 million. On average, reported design-build projects experienced 18 change orders per project. Out of 61 design-build projects reported, seven had more than 40 change orders. Only 12 projects had change orders with a total value of greater than $2 million. The average design-build change order equaled $122,000. The large standard deviation shown in Exhibit IV.26 reflects the wide range of change order experience among the surveyed projects.

Claims represented less than one-tenth of one percent of total project costs, with an average value per surveyed design-build project of $80,000 for claims. While there were few reported claims per design-build project, the average reported design-build project claim was $225,000. Claims affected less than 10 percent of the design-build projects reported.

Exhibit IV.26 lists the number and effect of change orders and claims on the costs of the subset of comparable design-build and design-bid-build projects surveyed during the study.

Exhibit IV.26 Change Order and Claim Activity for Similar Design-Build and Design-Bid-Build Projects

Design-Build Projects

Change Order Dimension	Change Orders Per Project	Change Order Costs Per Project ($000)	Cost Per Change Order ($000)	Claims Per Project	Claims Cost Per Project ($000)
Responses	16	16	16	18	17
Average	**16**	**$837**	**$85**	**0**	**$0**
Median	14	$467	$35	0	$0
Mode	17	$400	N/A	0	$0
Maximum	49	$3,355	$472	6	$0
Minimum	4	$14	$1	0	$0
Standard Deviation	**13**	**$890**	**$119**	**1**	**$0**

Design-Bid-Build Projects

Change Order Dimension	Change Orders Per Project	Change Order Costs Per Project ($000)	Cost Per Change Order ($000)	Claims Per Project	Claims Cost Per Project ($000)
Responses	14	14	13	18	18
Average	**22**	**$588**	**$47**	**0.6**	**$337**
Median	8	$275	$47	0	$0
Mode	5	N/A	$50	0	$0
Maximum	80	$4,000	$180	4	$6,000
Minimum	0	$0	$3	0	$0
Standard Deviation	**27**	**$1,013**	**$49**	**1**	**$1,413**

Source: similar D-B and D-B-B project surveys, Q16

As shown in Exhibit IV.26, the subset of design-build projects had fewer change orders than the comparable design-bid-build projects, but the average cost per change order was greater for the design-build projects. This could be attributed to the greater size of design-build projects. This can be confirmed by the fact that change orders represented about the same share of total project costs for both design-build and design-bid-build projects. In contrast, the dollar value of claims per project was significantly lower for design-build projects than for comparable design-bid-build projects, with the subset of design-build projects having no reported cost of claims.

The various levels of cost change (growth and decline) indicated in this section for design-build projects from the program and project surveys reflects the difficulty in isolating the cause of cost changes and the influence of project delivery approach on cost control. The effect of project delivery approach on project costs is difficult to determine due to the many other factors beyond the control of the contract team than can influence the final project cost. Since both design-build and design-bid-build projects experienced a wide range of cost changes during development, project costs appeared to be more influenced by factors independent of project delivery approach. Design-build project delivery appeared to reduce agency costs of contract administration and inspection relative to design-bid-build project delivery. Of particular note was the reduced level of claims and their related impacts on cost growth for the full survey sample of design-build projects reported, and especially for the subset of design-build projects when compared to similar design-bid-build projects.

EFFECT OF DESIGN-BUILD CONTRACTING ON PROJECT QUALITY

Contracting agencies are interested in obtaining a quality project, as well as one that is completed in a timely and cost-effective manner. Quality can be defined in a number of ways, depending on the point of view of the evaluator and the aspect of the project being considered. For many, project quality is defined as meeting all project specifications and their prescribed standards. As engineered projects, conformance with project specifications is determined by testing project materials and inspecting the end product relative to these standards. Project acceptance is based on the results of these tests and inspections.

Project quality can also be measured by determining if the contracting agency is satisfied with the product. Contracting agency satisfaction can have many dimensions, ranging from knowing the project meets all specifications (input-based measure of quality) to being pleased with the performance of product (outcome-based measure of quality). Performance-based specifications focus on the results or outcomes of the project and can be measured by various criteria, such as ride quality, durability, and visual aesthetics. These can be either quantitative or qualitative criteria and are subject to the expectations of thecontracting agency.

Prescribed (standards-based) specifications are the traditional way of determining project acceptance. However, with more responsibility being given to contractors for delivery of highway projects, the use of performance (outcome-based) specifications is increasing as a way to account for project quality dimensions not captured by standards and specifications and to promote greater innovation by contractors to achieve more cost-effective projects of equal of better quality.

In this section, project quality is discussed in terms of the following three criteria:

- Conformance with standards & specifications;
- Compliance with provisions of contract warranties; and
- Overall contracting agency satisfaction.

Estimated Impacts of Design-Build on Project Quality

The design-build project survey responses indicated that application of design-build project delivery had no differential impact on project quality in the opinion of the survey respondent. According to Exhibit IV.27, most (93 percent) of the design-build projects performed at the same level of quality as those delivered by the design-bid-build approach. Three percent of the surveyed projects note an increase in project quality while the same small percentage noted a decrease in project quality. Of the projects that experienced an increase in project quality, the average improvement was 8.5 percent, while the average decrease in project quality for projects that experienced a decline was 7.5 percent. These results are based on estimates provided by project survey respondents regarding changes in project quality by applying the design-build project delivery approach.

Exhibit IV.27 Estimated Change in Project Quality due to Design-Build Project Delivery

Quality Dimension	Value
Responses	61
Average	**0.0%**
Median	0.0%
Mode	0.0%
Maximum	10.0%
Minimum	-10.0%
Standard Deviation	**2.1%**

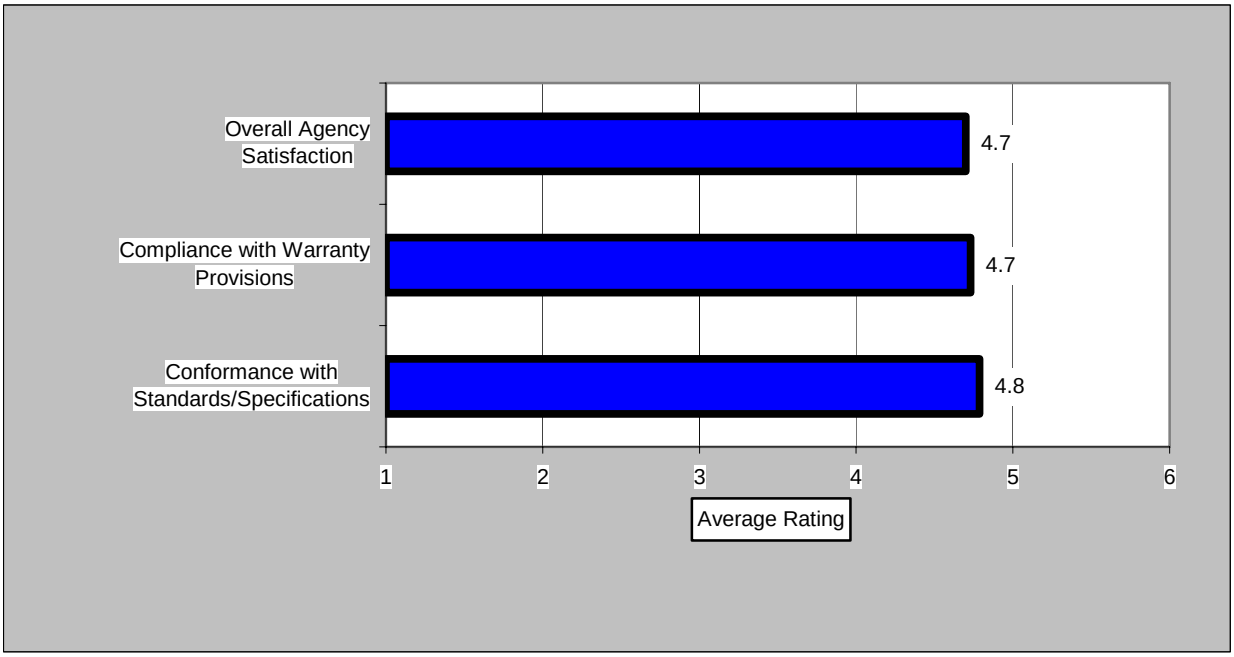
Source: D-B project survey: Q. 18

Contracting Agency Satisfaction

Contracting agency satisfaction with the outcome and process of project delivery is one of the primary ways to measure the quality of different approaches. According to project survey respondents, 97 percent of the design-build projects have fulfilled their intended purpose. Half of the respondents indicate that the method of project delivery has had a significant impact on the outcome of the project.

As shown in Exhibit IV.28, project survey respondents express a high level of satisfaction with design-build projects, averaging 4.7 on a six-point scale (in which 1 is poor and 6 is superior). The same high level of contracting agency satisfaction is noted in the compliance with warranties and standards & specifications.

Exhibit IV.28 Contracting Agency Satisfaction Ratings of Design-Build Projects (Scale: 1 – Poor; 6 – Superior)



Source: D-B project survey: Q17, 69 responses. Out of the 69 surveyed projects, 26 had warranty provisions.

Based on a detailed statistical analysis of project survey responses, the research team discovered that overall contracting agency satisfaction is highly correlated with the following project characteristics:

- Procurement method
- Type (complexity) of road project
- Size of project
- Percent of preliminary design completed prior to contract award

The results of this analysis are summarized in Exhibit IV.29. These results are statistically significant at the 95 percent confidence level.

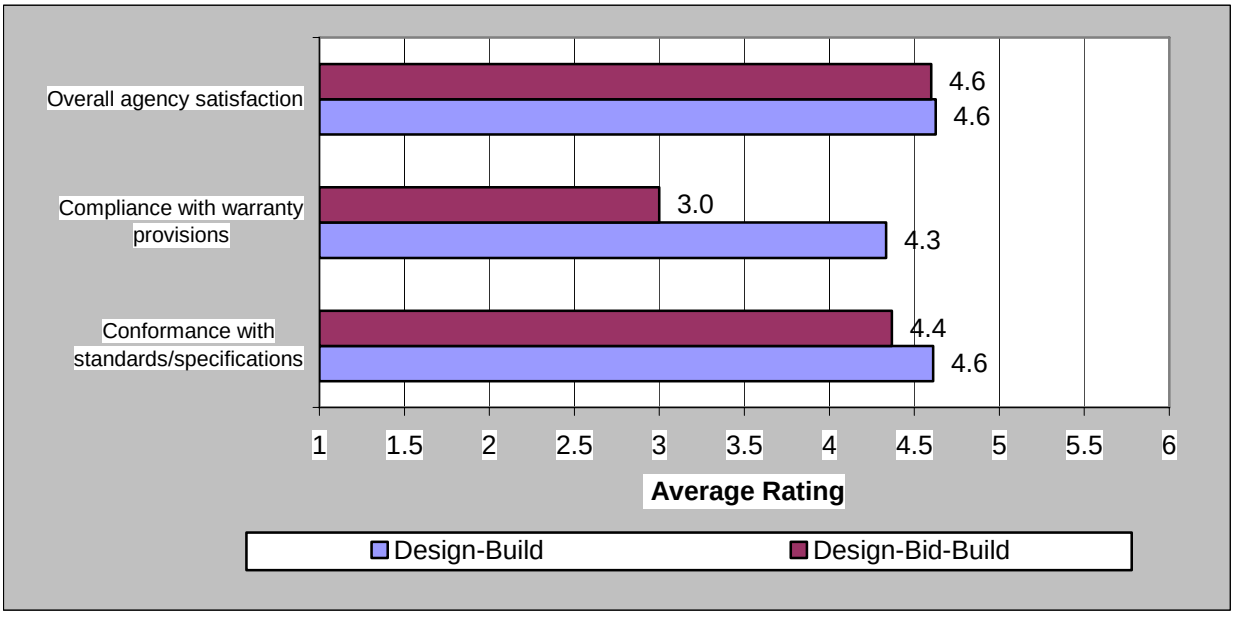
Exhibit IV.29 Overall Contracting Agency Satisfaction by Project and Contract Type

Project/Contract Characteristic	Overall Agency Satisfaction	
	Lower	Higher
Procurement Method	Low Bid	Best Value
Project Type	Road-Resurface/Renewal	Road-New/Widen and Rehabilitate/Reconstruct
Project Size	Smaller	Larger
% of Design Completed at Award	Higher	Lower

Source: D-B project survey: Q2, 4, 10, and 17, 69 responses

When a subset of 19 design-build projects is compared to similar design-bid-build projects, the survey results indicate that overall contracting agency satisfaction with design-build projects is on a par with design-bid-build projects, as shown in Exhibit IV.30. However, conformance with warranty provisions and standards and specifications are both rated higher for design-build projects than for similar design-bid-build projects.

Exhibit IV.30 Comparison of Contracting Agency Satisfaction Ratings between Similar Design-Build Projects and Design-Bid-Build Projects (Scale: 1 – Poor; 6 – Superior)



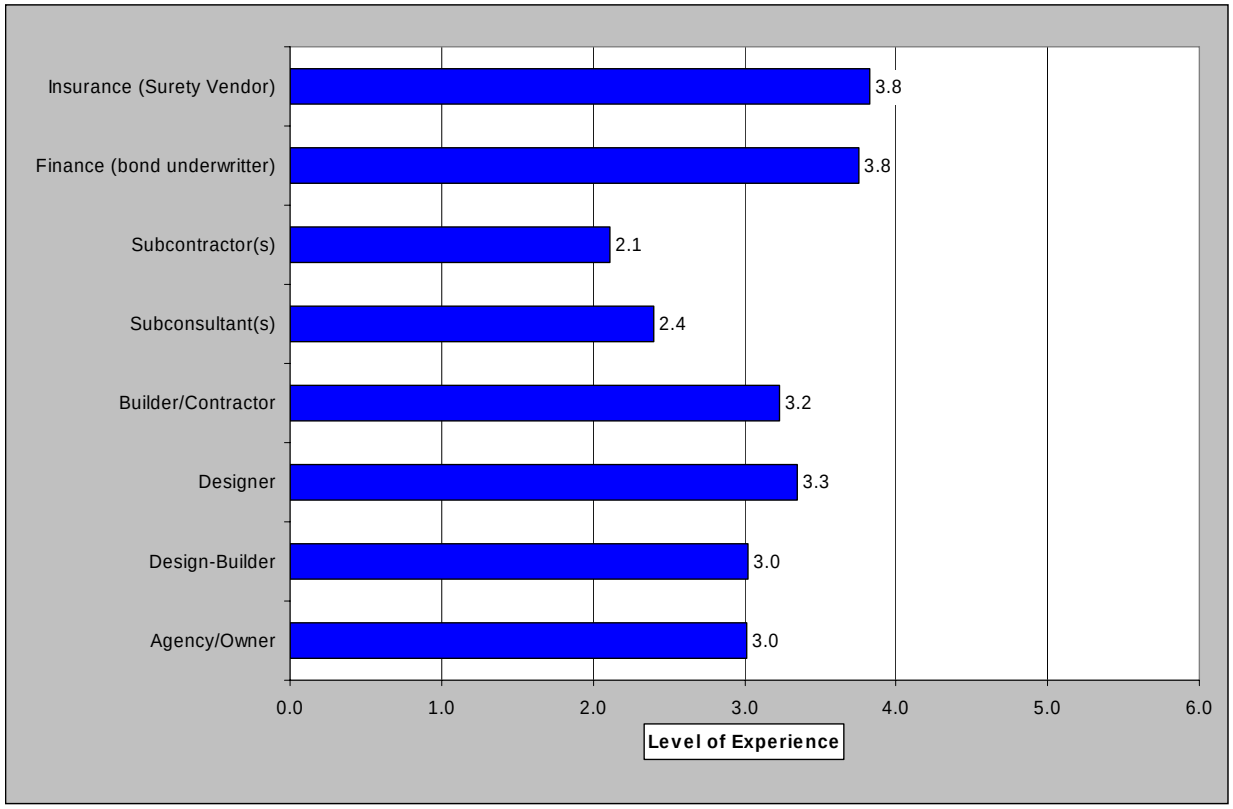
Source: similar D-B and D-B-B project surveys: Q17, 17 responses per survey type

Experience of the Project Delivery Team

Another measure of the quality of project delivery is the relative experience of members of the project team for the various functions comprising the project. Those teams with highly qualified and experienced members are likely to perform the best in delivering a quality project consistent with the terms of the contract. When asked to characterize the prior experience and expertise of key design-build project stakeholders, respondents to the design-build project surveys provided the responses listed in Exhibit IV.31.

As shown in Exhibit IV.31, design-build project survey respondents perceived that insurance and finance officials were the most experienced parties, with a 3.8 rating on a six-point scale (in which 1 equals no experience and 6 equals significant experience). Designers, builders/contractors, design-builders, and agency-sponsors were next most experienced, with ratings ranging from 3.0 to 3.3. Subcontractors and subconsultants were rated the least experienced, with ratings of 2.1 and 2.4 respectively. These modest ratings reflected the relative newness of the design-build project delivery approach to the domestic highway industry.

Exhibit IV.31 Perceived Experience among Stakeholder Groups for Design-Build Projects (Scale: 1 – None; 6 – Significant Experience)

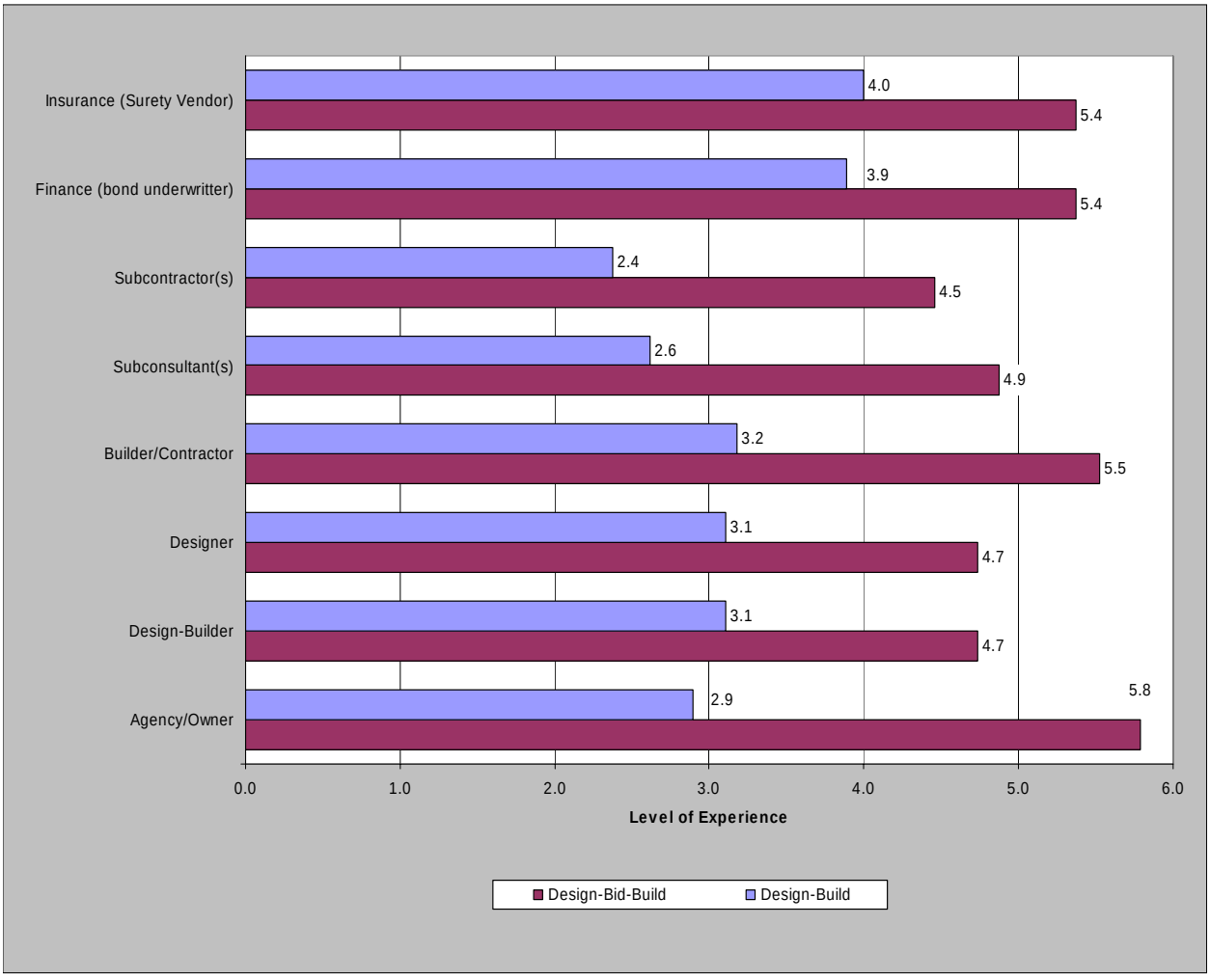


Source: D-B project surveys: Q17, 69 responses

When responses to the subset of design-build project surveys were compared to those for similar design-bid-build projects, respondents perceived stakeholders in the design-bid-build process had a much greater level of expertise and familiarity. These results, shown in Exhibit IV.32, are consistent with the prevalence of design-bid-build contracting by transportation agencies and the relative newness of design-build contracts.

It is interesting to note the high average experience rating given to the Agency/Owner category for design-bid-build projects (5.8) and the much lower experience rating given to this same category for design-build projects by the survey respondents (who themselves are part of this stakeholder group). This further highlights one of the challenges facing those interested in pursuing design-build project delivery—raising the expertise and experience in this approach among contracting agencies and thereby increasing their comfort in applying design-build at a more significant level.

Exhibit IV.32 Perceived Experience among Stakeholder Groups for Similar Design-Build and Design-Bid-Build Projects



Source: similar D-B and D-B-B project surveys: Q17, 17 responses per survey type

Other Project Delivery Success Criteria

Survey respondents report a number of factors they use to measure project delivery success. Chief among them is meeting the objective quality standards of the contracting agency, plus project completion on time and under budget. These and other project delivery success criteria are outlined in Exhibit IV.33. Each of these factors relates in some way to the issues of concern posed by Congress in requesting this study.

Exhibit IV.33 Project Delivery Success Criteria Used by Project Survey Respondents

Quality
• Project quality relative to comparable design-bid-build projects • Number of claims or change orders • Achievement of project scope and objectives, including project quality standards, traffic impacts, and environmental goals
Cost
• Total project cost relative to budget • Amount of cost overrun • Cost of claims or change orders
Timeliness
• Project opening relative to scheduled completion date • Length of project extension • Project advancement or velocity relative to schedule
Other
• Dollar amount of incentive payment to contractor relative to maximum possible incentive payment • Ability to control cost and schedule to issue toll road revenue bonds at minimum risk • Success of implementing new technology or construction techniques • Experience of contractor with design-build projects or other projects similar in scope to the design-build project • Project likelihood without use of design-build or other approaches to advance project • Implementation of extended warranty or other risk mitigation approaches

Source: D-B project survey: Q17, 48 responses

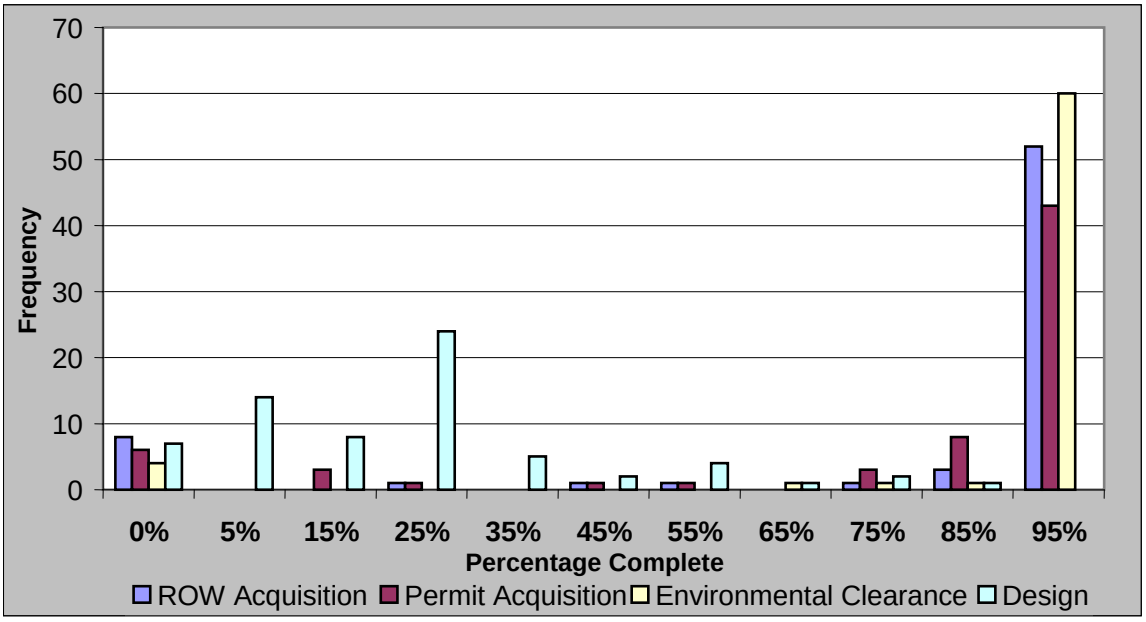
APPROPRIATE LEVEL OF PRELIMINARY DESIGN FOR DESIGN-BUILD PROCUREMENTS

Having chosen design-build contracting to deliver a particular project, contracting agencies must decide at which point in the project development life cycle to initiate the design-build contract. This decision is influenced by the nature and complexity of the project, the needs of prospective design-build teams to understand the full requirements and potential risks of the proposed project before developing and offering a design-build contract proposal, the comfort level that contracting agencies have in letting design-builders develop the scope of the project based on the project's defined performance objectives, and what has become accepted practice based on other, earlier design-build projects.

An earlier survey of six STAs using design-build found a broad range for the level of preliminary design completed before issuing requests for bids of proposals for design-build projects.[1] The range was 15 percent to 50 percent, with the average among the six agencies being 31 percent (Colorado and Washington, respectively). The higher the percentage preliminary design completed before design-build procurement the more likely the selection process was based on low bid (New Jersey and Indiana). The lower the percentage preliminary design completed the more likely the selection process was based on a composite score or best-value (South Carolina and Arizona).

Based on the completed design-build project surveys, Exhibit IV.34 shows the distribution of the percentage completion of preliminary design relative to other pre-construction activities such as right-of-way acquisition, permit acquisition, and environmental review.

Exhibit IV.34 Percent Completion of Selected Functions at Design-Build Project Award



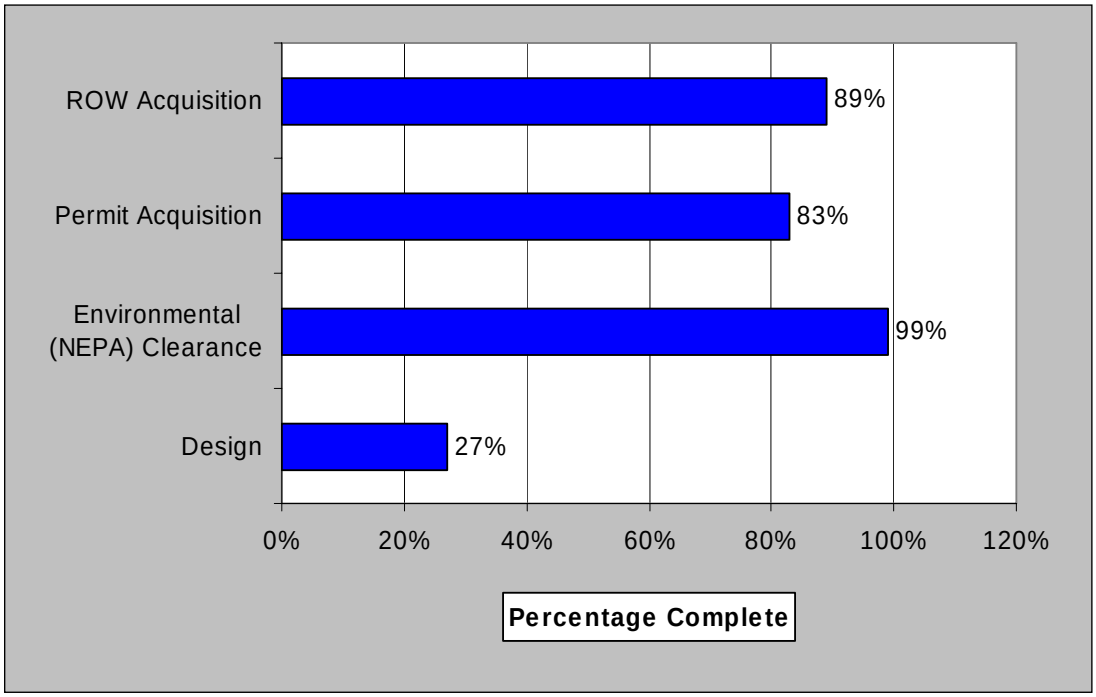
Source: D-B project surveys: Q10, 69 responses

[1] Molenaar, Keith R. and Douglas D. Gransberg, *Design-Builder Selection for Small Highway Projects*, ASCE Journal of Management in Engineering, Vol. 17, No. 4, October 2001

A high proportion of right-of-way acquisition, permit acquisition, and environmental review functions are completed by design-build contract award, while most preliminary designs are below 30 percent complete by design-build award. Notice that several projects had the design-builder responsible for all of these functions (the projects with functions at 0 percent completion by design-build award, to the far left of the chart).

On average, as shown in Exhibit IV.35, right-of-way acquisition was 89 percent complete for surveyed design-build projects, permit acquisition was 83 percent complete, and environmental clearance[2] was 99 percent complete.

Exhibit IV.35 Average Percent Completion of Selected Functions at Design-Build Project Award



Source: D-B project surveys: Q10, 69 responses

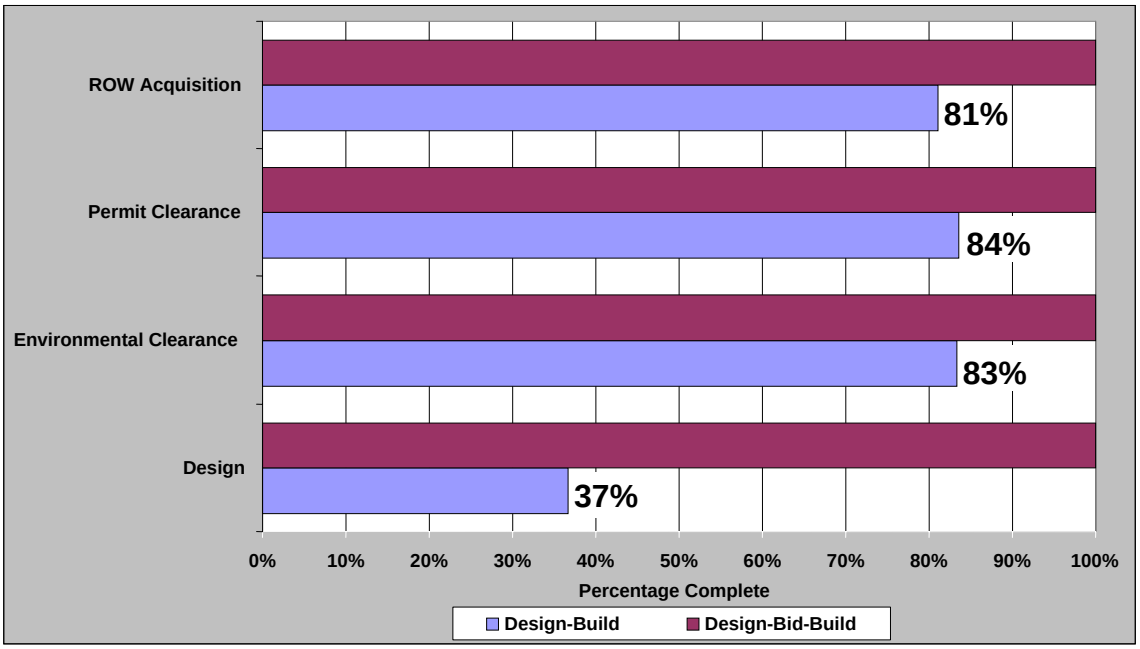
Permit acquisition may include Section 404, navigable waterways, water quality, air quality, noise levels, and other local permits. NEPA clearance may include an environmental assessment or preparation of a full environmental impact statement. Most of the surveyed design-build projects had completed 100 percent of right-of-way acquisition and permit and environmental clearance prior to project award. On average, design was 27 percent complete prior to design-build contract award. For 81 percent of the reported projects, the percentage of design completion by design-build contract award was 30 percent or less.

When a subset of design-build projects is compared to similar design-bid-build projects, survey results reveal that design-build projects had somewhat less right-of-way acquisition and permit and environmental clearance complete by contract award, as shown in Exhibit IV.36. All

[2] Under the National Environmental Policy Act (NEPA) or similar state legislation

comparable design-bid-build projects had completed 100 percent of preliminary project activities. For the subset of design-build projects surveyed, the average percent design completion prior to going to a design-build contract was 37 percent, with 78 percent of the projects at 30 percent or less.

Exhibit IV.36 Average Percent Completion of Selected Functions at Project Award for Similar Design-Build and Design-Bid-Build Projects



Source: similar D-B and D-B-B project surveys: Q10, 17 responses per survey type

These results are consistent with the finding in Exhibit IV.29 that the level of contracting agency satisfaction reported for design-build projects was higher for lower levels of preliminary design completed before design-build contract award. This could be attributed to a design-builder's ability to influence the project design earlier in the process to promote its constructability and cost-effectiveness. While each project should be considered on an individual basis, the results suggest that no more than 30 percent of preliminary design be completed before design-build contract award, with lower percentages as the contracting agency gains more experience with design-build contracting and greater reliance is placed on performance-based specifications.

IMPACT OF DESIGN-BUILD CONTRACTING ON SMALL BUSINESSES

The advent of design-build project delivery has raised concerns by some that small firms[3] may be unable to participate on design-build teams, particularly as the design-build team lead or

[3] Small business is defined as any organization with less than 500 employees and $6 million in average annual receipts for service organizations ($28.5 million for general building and heavy construction contractors and $12 million for special trade construction contractors) For applicable small business size standards by industry category, see the U.S. Small Business Administration's Small Business Size Regulations, 13 CFR §121 or the Table of Small Business Size Standards.

prime contractor, due to the increased functional scope and scale of many design-build contracts, more stringent qualification requirements, and/or higher bonding requirements. In some cases, contracting agencies have applied design-build to smaller projects to address this and other issues. In the context of this report, small business participation includes the involvement of smaller firms in design-build projects as a prime contractor, joint venture partner, or subcontractor.

Agency respondents to the design-build program survey indicated that the percentage of design-build project costs going to small businesses was about the same on average as design-bid-build projects, with only a very small reduction indicated for design-build projects. This is shown in Exhibit IV.37, in which small business involvement with design-build projects is estimated to be within 2 percent of the level of involvement with design-bid-build projects overall, and within 1 percent of that for design-bid-build projects when the design-build team is based locally. These results suggest that small businesses are not disadvantaged when projects are developed through the design-build process, according to agency design-build program managers.

Exhibit IV.37 Small Business Involvement on Similar Design-Build and Design-Bid-Build Projects

Competitive Dimension	Design-Build			Design-Bid-Build		
	Average	Maximum	Miniumum	Average	Maximum	Miniumum
Percent of Project Costs Provided by Small Firms	**31.3%**	55.0%	5.0%	**33.0%**	55.0%	15.0%
Percent of Project Costs Provided by Small Firms on Local Competing Teams	**32.3%**	75.0%	5.0%	**32.9%**	75.0%	15.0%

Source: D-B program survey: Q15, 15 to 22 responses

Size of Prime Contractors and Subcontractors for Design-Build Versus Design-Bid-Build Projects

Two-thirds of agency design-build program respondents indicated that on average, the prime contractors and subcontractors for design-build projects are similar in size to their counterparts on design-bid-build projects. The remaining one-third indicated that prime contractors for design-build projects were significantly larger than their counterparts for design-bid-build projects (5.4 on a 6-point scale with 1 being smaller and 6 being larger), while subcontractors for design-build projects were only marginally larger in size than their counterparts for design-bid-build projects (3.4 on the same 6-point scale).

While the size of prime contractor firms may have been somewhat larger for design-build projects than for design-bid-build projects (though not always so), the size of subcontractor firms was essentially the same. To the extent small businesses are currently involved in the design and construction of design-bid-build projects, similar opportunity appears to exist for design-build

projects, particularly in the role of subcontractor. These results suggest small businesses are playing a comparable role for design-build projects as for design-bid-build projects, and that the design-build project delivery process is not preventing small businesses from participating in design-build projects to a comparable degree.

Limits on the Extent of Design-Build Contract Value Held by the Prime Contractor

The opportunity for small businesses to participate in design-build projects is also affected by the amount of the contract retained by the prime contractor. Where maximum limits are defined, the contracting agency determines the extent to which firms other than the prime contractor must be involved in the project. Where minimum limits are defined, the contracting agency determines the limits to which firms other than the prime contractor can be involved in the project. The larger the contract value and the higher the percentage of contract value required to be retained by the prime contractor both suggest fewer opportunities for involvement by small businesses that are less likely to have the resources or background to warrant serving as the prime contractor.

On a program-wide basis, 81 percent of the respondents indicate there are maximum limits and/or minimum limits on prime contractor involvement specified in design-build contract language. Where maximum limits existed, the maximum percentage ranged from 70 percent to 100 percent. Where minimum limits existed, the minimum percentage ranged from 30 percent to 51 percent. FHWA eliminated the 30 percent self-performance requirements for traditional contracts when it developed the Design-Build Contracting Regulations[4].

Use of Direct Hire Versus Subcontractor Resources for Design-Build Contracts

The project survey results indicate that for design-build projects, an average of 60 percent of design work was subcontracted, with the remaining 40 percent handled as direct hire (self-performance by the design-builder or its core team members). As shown in Exhibit IV.38, an average of 75 percent of construction work was directly hired and 25 percent was subcontracted.

Exhibit IV.38 Proportion of Direct Hire and Subcontracted Work by Function for Design-Build Projects

Analysis Dimension	Direct Hire Design	Subcontracted Design	Direct Hire Construction	Subcontracted Construction
Responses	48	48	48	48
Average	**40%**	**60%**	**75%**	**25%**
Median	4%	96%	85%	16%
Mode	0%	100%	100%	0%
Maximum	100%	100%	100%	100%
Minimum	0%	0%	0%	0%
Standard Deviation	**45%**	**45%**	**32%**	**32%**

Source: D-B project survey: Q13

[4] 23 CFR §635.116(d)(1)

Based on the smaller sample of similar design-build and design-bid-build projects shown below in Exhibit IV.39, the project survey indicates that design-bid projects had a much higher percentage of subcontracted design work than similar design-bid-build projects, averaging 52 percent for design-build projects versus only 11 percent for design-bid-build projects. In contrast, the proportion of subcontracted construction work was about the same for design-build as for design-bid-build projects, at 21 percent to 24 percent, respectively. This may be due to the predominant role of construction contractors on many design-build teams, who may be more willing to subcontract design work than construction work. This may also be due to the larger size and complexity of many design-build projects, which require more sophisticated designs.

Exhibit IV.39 Proportion of Direct Hire and Subcontracted Work by Function for Similar Design-Build and Design-Bid-Build Projects

Design-Build Projects

Analysis Dimension	Direct Hire Design	Subcontracted Design	Direct Hire Construction	Subcontracted Construction
Responses	11	11	11	11
Average	**48%**	**52%**	**79%**	**21%**
Median	70%	30%	80%	20%
Mode	0%	100%	100%	0%
Maximum	100%	100%	100%	45%
Minimum	0%	0%	55%	0%
Standard Deviation	**47%**	**47%**	**17%**	**17%**

Design-Bid-Build Projects

Analysis Dimension	Direct Hire Design	Subcontracted Design	Direct Hire Construction	Subcontracted Construction
Responses	5	5	11	11
Average	**89%**	**11%**	**76%**	**24%**
Median	89%	11%	70%	30%
Mode	89%	11%	100%	0%
Maximum	100%	20%	100%	42%
Minimum	80%	0%	58%	0%
Standard Deviation	**7%**	**7%**	**16%**	**16%**

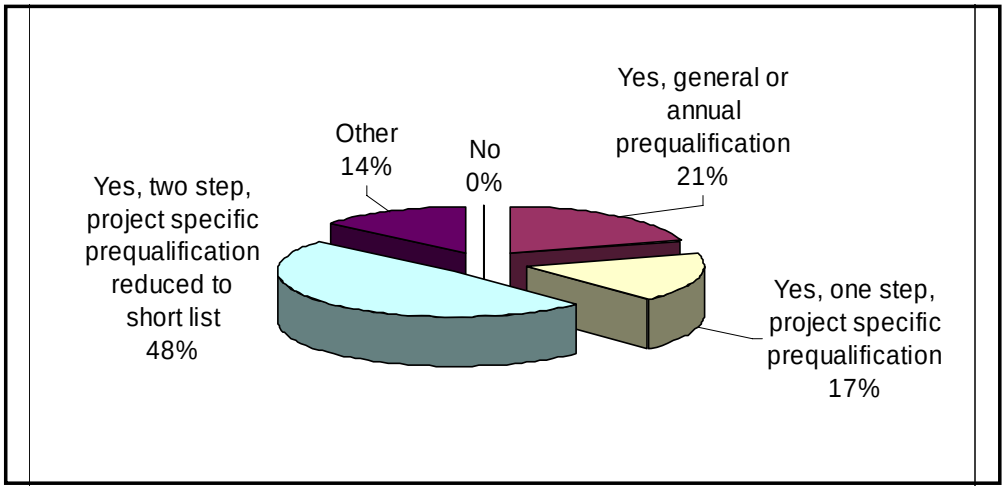
Source: similar D-B and D-B-B project surveys: Q13. A smaller number of D-B-B project surveys reported a breakdown in design work between direct hire and subcontract resources.

These results suggest that design-build contracts may spread more of the design work among subconsultants than comparable design-bid-build contracts, which should be a positive feature for small business enterprises.

Prequalification Requirements

Another factor impacting the extent of competition for design-build projects is the extent to which proposers must be prequalified, which means having satisfied certain performance or capability criteria to be able to bid on design-build project contracts. All respondents to the design-build program survey indicated they require some form of prequalification, as noted in Exhibit IV.40. About half the respondents used a two-step project-specific process, whereby the initial step used prequalification information to select a short list of prospective proposers for design-build projects. The rest used either a one-step project-specific prequalification or a more general or annual prequalification to define eligible prospective proposers.

Exhibit IV.40 Prequalification Requirements for Design-Build Projects



Source: D-B program survey: Q3, 29 responses

Extent of Competition for Design-Build Projects Versus Design-Bid-Build Projects

As reported in the design-build program surveys, the extent of competition for design-build projects is perceived to be significantly lower than that reported for design-bid-build projects. As shown in Exhibit IV.41, almost 40-percent fewer teams responded to requests for qualifications (RFQs) for design-build projects than to requests for pre-qualifications for design-bid-build projects; however, it is recognized that many states use an RFQ process for the design phase and an annual program-wide prequalification process for the construction phase of a design-bid-build project. One-third fewer teams responded to requests for proposals (RFPs) for design-build projects than to invitations for bids (IFB) for design-bid-build projects. Similarly, there were 40-percent fewer local design-build teams than local design-bid-build teams that responded per project opportunity. The design-build program survey also revealed that the

proportion of design-build teams led by local firms was estimated by respondents to be 81 percent, versus 91 percent for design-bid-build teams.

The ability to offer stipends to unsuccessful proposers of design-build projects recognizes the relatively high cost of preparing a design-build proposal when compared to a design proposal or construction bid. By offering a stipend to pre-qualified proposers, contracting agencies also seek to increase the number of capable proposers and thereby enhance competition for these types of procurements. The program survey indicated that just over half of the design-build program respondents paid stipends to unsuccessful teams proposing on a design-build project, with the average approximately $50,000 per team.

Exhibit IV.41 Level and Type of Competition for Similar Design-Build And Design-Bid-Build Projects

Competitive Dimension	Design-Build			Competitive Dimension	Design-Bid-Build		
	Ave	Max	Min		Ave	Max	Min
Average Number of Teams Responding to Request for Qualifications (RFQ) per Project	**6**	15	3	Average Number of Teams Responding to Prequalification per Project	**10**	40	0
Average Number of Teams Responding to Request for Proposals (RFP) per Project	**4**	6	2	Average Number of Teams Responding to Invitation for Bid (IFB) per Project	**6**	12	0
Average Number of Local Teams (Led by Local Firms) per Project	**3**	5	1	Average Number of Local Teams (Led by Local Firms) per Project	**5**	10	2
Average Amount of Stipends Paid per Team per Project ($000s)	**$48.8**	$250.0	$0.0	Average Amount of Stipends Paid per Team per Project ($000s)	**$0.0**	$0.0	$0.0

Source: D-B program survey: Q15, 24 responses

These results indicate that the number of firms or teams responding to a design-build project was estimated to be smaller than that for design-bid-build projects, particularly at the local level. This may reflect the newness and perceived risks (including the higher costs of proposal preparation) associated with this particular project delivery approach to the Federal-aid highway program and the traditional design and construction firms that have served this program over the years. It may also result from the two-step selection process frequently used for design-build projects whereby only qualified firms are short-listed by the agency. This "short-listing" process limits the level of competition for these projects to avoid having too many firms commit the large level of resources typically needed to generate a design-build proposal. It also limits the financial exposure of the contracting agency if a stipend is offered to all unsuccessful proposers. This is not considered a detriment to the design-build procurement process since competition among qualified firms is retained.

The larger scale and scope of a typical design-build project, the more extensive use of short-listing to procure design-build services, and the newness of this project delivery method makes it impossible to compare the number of proposing teams for a design-build project and a similar

design-bid-build project. Of note is the relatively high proportion of local teams reported to be proposing on design-build projects by agency program managers, which would tend to refute claims that design-build project delivery heavily favors national firms over local firms.

ASSESSMENT OF SUBJECTIVITY USED IN DESIGN-BUILD CONTRACTING

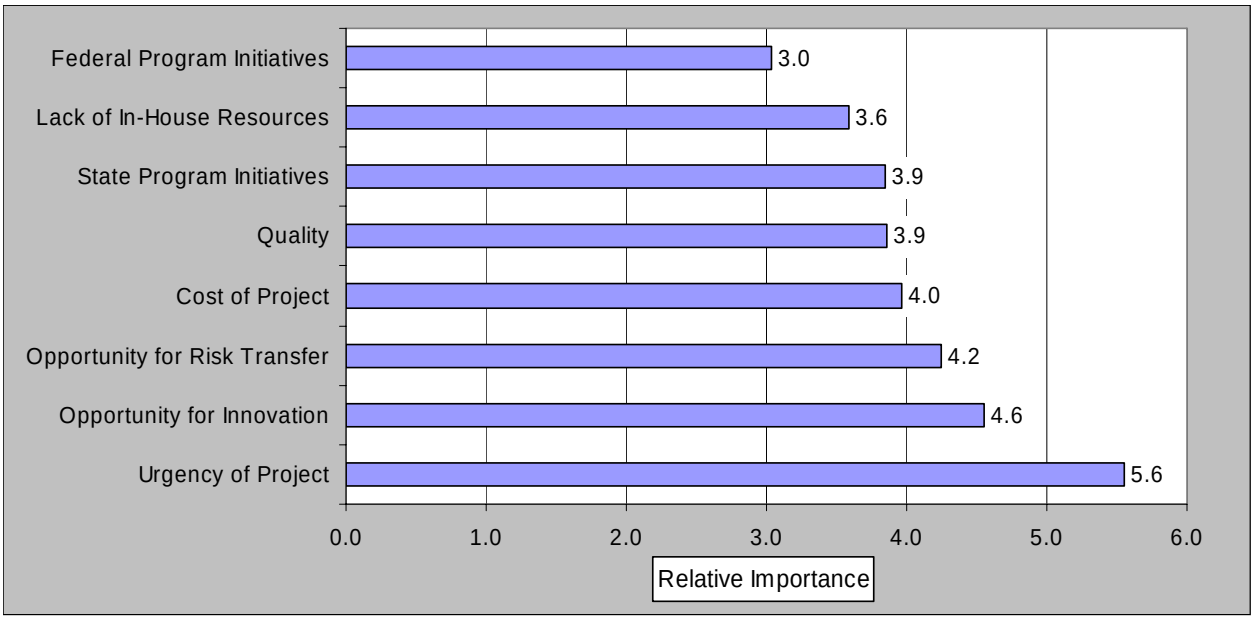
The advent of design-build project delivery has also raised questions regarding the extent of subjectivity used in selecting a design-build contractor team and the effect this can have on project cost-effectiveness and the equity of the procurement process. The primary issues involve the use of non-cost factors in determining the successful bidder for a design-build project and the perceived objectivity of the selection criteria and process used. This is of particular concern when design-build contracts are assigned on the basis of expected best-value to the contracting agency, versus the more traditional low-bid selection process.

To properly address this issue, it is important to understand what factors prompt contracting agencies to use design-build in the first place and to what extent cost is an important factor in their considerations. These and other factors that affect the extent of competition for design-build contracts are explored in this section from both program-level and project-level perspectives.

Design-Build Project Designation Criteria

On a program-wide basis, there are a number of factors that affect the decision of whether or not to use design-build. Exhibit IV.42 shows the relative rankings in descending order of eight factors (using a 6-point scale where 0 is unimportant and 6 is extremely important). According to the design-build program survey responses, the most important factor was viewed as the urgency of the project.

Exhibit IV.42 Relative Importance of Factors Considered in Deciding Whether to Use Design-Build (Scale: 1 – Unimportant; 6 – Extremely Important)



Source: D-B program survey: Q1, 29 responses

Among the design-build program survey respondents, 97 percent considered project urgency of great importance to making this decision. The next most important factor was opportunity for innovation, followed by opportunity for risk transfer. The other five factors, headed by project cost and quality, were not viewed as important as project urgency in deciding whether to use the design-build approach.

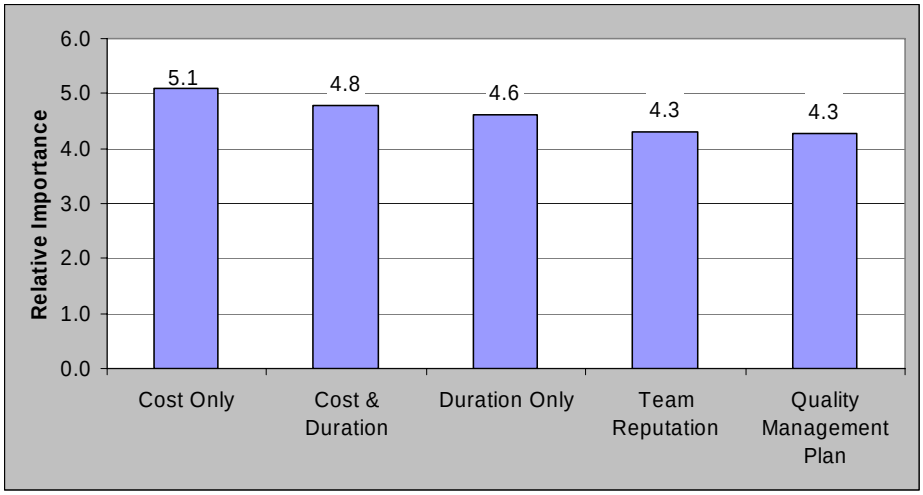
Respondents rated federal initiatives that encourage agencies to consider design-build project delivery, even on an experimental basis such as SEP-14, as having the least influence on their decisions regarding the application of this project delivery approach to particular projects among the factors noted above. Other factors considered important by individual respondents but not included in the average ratings shown above included project size, project type, and funding availability.

These results suggest that for early users of design-build in the Federal-aid highway program, the potential for faster project delivery and the application of innovative approaches served as the primary motivators for their decision to use design-build project delivery for projects. The importance of project delivery speed reinforces the earlier findings in this chapter that show that design-build offered the greatest potential for reducing project duration than for improving any other key project performance criteria.

Design-Build Contract Award Criteria

For those projects designated for design-build delivery, respondents to the design-build program survey perceived cost as the most important factor in awarding project contracts even though project duration was the most important factor in deciding whether to use the design-build approach. As shown in Exhibit IV.43, cost and cost combined with duration were perceived to be the most important factors in awarding design-build project contracts by the design-build program managers from responding agencies.

Exhibit IV.43 Key Factors Considered in Awarding Design-Build Project Contracts (Scale: 1 – Unimportant; 6 – Extremely Important)

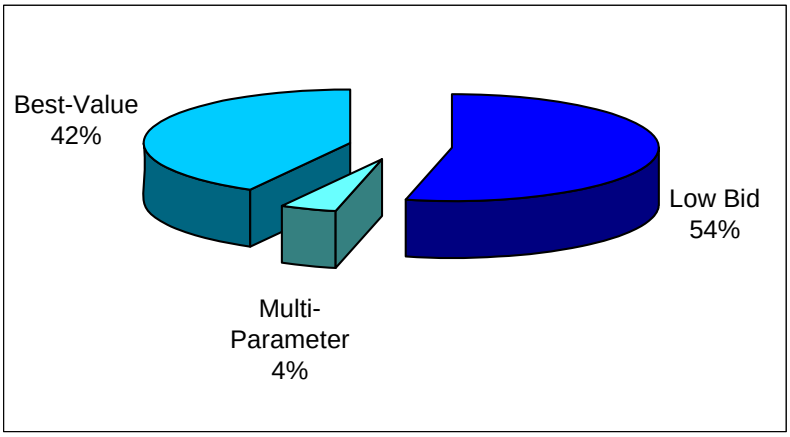


Source: D-B program survey: Q2, 29 responses.

Overall, cost represented just over half of the weighting (55 percent) when factors other than cost were included in the proposal evaluation. In several cases, respondents noted that their traditional project award process and criteria had not changed for design-build projects—namely low bid-based project award (cost only—100 percent weighting). Other approaches used included adjusted scoring based on the weighting of factors unique to the project and technical merit.

These results are reflective of the design-build project survey responses, where just over half of the design-build projects were procured on the basis on low-bid, versus 42 percent using best-value and 4 percent using multi-parameter approaches. This is illustrated in Exhibit IV.44.

Exhibit IV.44 Procurement Approach of Design-Build Projects

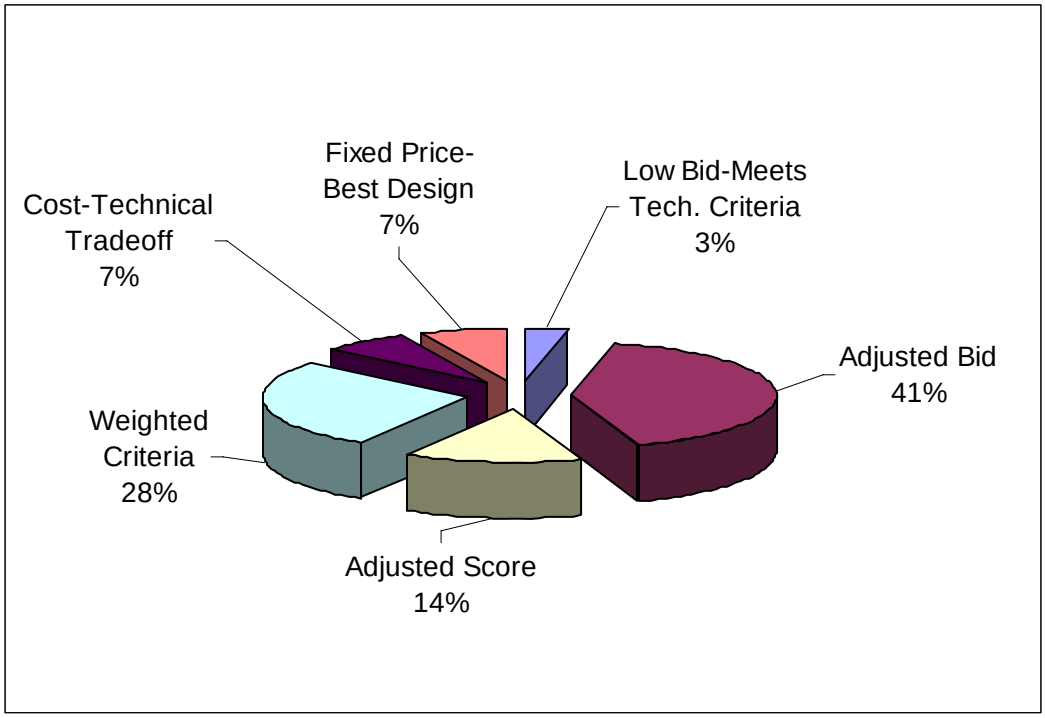


Source: D-B project survey: Q4, 29 responses

Among the design-build projects procured based on best-value, a diversity of evaluation approaches was used, as illustrated in Exhibit IV.45 (see Appendix A - Glossary of Terms for definitions of each best value method). Forty-one percent of the reported projects were awarded based on an adjusted bid and 14 percent were awarded based on an adjusted score for a combined total of 55 percent. These two best value evaluation methods are quite similar (they are the mathematical reciprocal of each other) and both weigh price at 50 percent. Weighted criteria represent 28 percent of the best-value procurements. Cost-technical tradeoff, fixed price/best design, and low bid meeting technical criteria round out the remaining approaches.

These results suggest that while project urgency and innovation were the primary motivators for using design-build contracting, cost remains the primary factor for awarding design-build contracts, even when other factors such as duration, team reputation, and quality were included in the deliberations. In addition, low bid continued to play an important role in contract award decisions, with best-value approaches using multiple criteria including cost gaining momentum.

Exhibit IV.45 Best Value Procurement Evaluation Methods for Design-Build Projects



Source: D-B program survey: Q4, 29 responses

Since design-build includes a significant design element, it is important to include these other factors as is the case for the procurement of engineering service contracts (which must use qualifications-based selection procedures). Best value selection provides for the consideration of both cost and other more subjective factors such project management, quality control, and team reputation.

Given the results of this review of contracting approaches and features of design-build versus design-bid-build projects, it is apparent there remain significant controls in place to limit the extent of subjectivity in awarding design-build contracts and to preserve reasonable access for prospective contractors of all types and sizes to projects using this contracting approach.

OTHER DESIGN-BUILD CONTRACT FEATURES

There are a number of additional features of design-build contracts that can impact the relative risk to the public and private sector participants in the contract and the opportunity to apply more cost-effective approaches to accomplishing the objectives of the project. These include:

- Methods of pricing the major elements of the contract;
- Use of prescriptive versus performance-based specifications;
- Provision of monetary and other incentives for superior performance or early completion and disincentives for inadequate performance or late completion; and

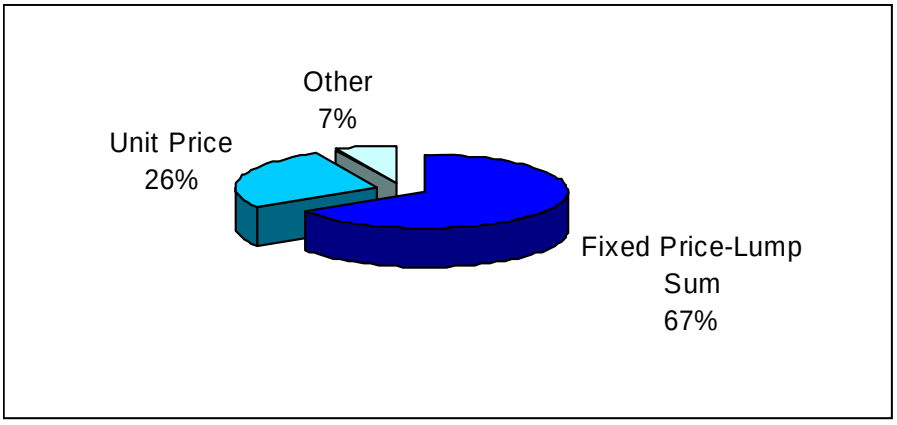
- Inclusion of warranties linked to facility condition over a specified period of time or cumulative volume of traffic.

Each of these features is discussed below as they relate to the SEP-14 design-build projects surveyed in this study.

Design-Build Contract Pricing Approaches

The majority of the value of reported design-build projects used fixed price-lump sum pricing, as shown in Exhibit IV.46. This is in contrast to design-bid-build contracts that typically use unit pricing. One-quarter of the value of the reported design-build projects involved the use of unit pricing. As noted earlier, the smaller portion of design-build project costs falling under unit pricing or other approaches was primarily due to the use of a combination of payment methods, whereby certain breakout items were quoted on a unit price basis, while the majority of items were included in the fixed price-lump sum.

Exhibit IV.46 Contract Pricing Methods for Design-Build Projects



Source: D-B project survey: Q6, 69 responses

The use of fixed price-lump sum pricing by design-build contracts is a distinguishing feature that reflects greater project risks transferred to a design-build contract team. This form of contract pricing allows for progress billing and payment instead of detailed quantity measurement and verification. This simplifies and reduces the field administrative effort associated with contract billing and payment for the contracting agency and design-builder. Lump sum contract pricing can also be linked to performance standards, which can be used to trigger payments for work/service delivered. Lump sum pricing focuses attention on the project schedule and encourages the design-builder to stay within project scope, avoid change or extra work orders that are a major cause of project cost creep, and complete the project within the allotted timeframe.

Design-Build Contract Specifications

One of the purported advantages of design-build project delivery is the opportunity to use more performance-based specifications to encourage greater innovation by the design-build team and

focus on project performance results versus conformance with product specifications that may be outdated given the latest technology and research. Some are concerned that the substitution of performance-based specifications may confer unfair advantage to those contract teams with access to proprietary technology that may satisfy performance standards more cost-effectively than their competitors.

Based on the results of the design-build project survey, the specifications used for over half of the reported design-build projects were reported to be entirely prescriptive. The remaining projects were reported to involve some combination of prescriptive and performance-based specifications. Only 3 percent of the responses were reported to use only performance-based specifications in their contract. About 10 percent of the projects had a 50/50 mix of performance and prescriptive specifications. When combined, the sample of design-build projects reflected a 73 percent use of prescriptive-based specifications and only a 20 percent use of performance-based specifications, as shown in Exhibit IV.47.

Exhibit IV.47 Average Relative Use of Prescriptive and Performance Specifications for Design-Build and Design-Bid-Build Projects

Survey Source	Sample Size	Prescriptive Specifications	Performance Specifications
D-B Survey Sample	69	73%	20%
D-B Project Subset	17	58%	34%
D-B-B Similar Projects	17	59%	33%

Source: D-B project survey and similar D-B and D-B-B project surveys: Q11

In comparing a more limited sample of design-build projects to similar design-bid-build projects, the average relative use of prescriptive and performance specifications was similar for both project delivery methods. As shown in Exhibit IV.47, prescriptive specifications were used for nearly 60 percent of design-build and design-bid-build projects, while performance specifications were used for approximately 33 percent of design-build and design-bid-build projects in the sample. These results demonstrate the growing use of performance-based specifications for highway project contracts for both project delivery approaches.

Design-Build Contract Incentives and Disincentives

The use of incentives and disincentives in project contracts is intended to promote certain desirable project delivery results (such as early completion) and minimize undesirable consequences (such as unexcused completion delay or failure to meet specifications). Project incentives are becoming more popular for reconstruction and rehabilitation of existing roads to promote early project completion and thereby reduce inconvenience to motorists using the facility. Liquidated damage and disincentive provisions are frequently included in construction contracts to recover the contracting agency's construction engineering costs and road user costs resulting from contractor delays.

When questioned about the use of incentives and disincentives on completed design-build projects, 20 percent of the respondents to the project survey indicated the use of specific incentive clauses while 46 percent indicated the use of specific disincentive clauses. The various kinds of incentives noted in the design-build project survey responses are listed in Exhibit IV.48.

Exhibit IV.48 Design-Build Contract Incentive Types

Early Completion Incentive • Flat incentive for early completion • Daily incentive for early completion • Completion of specified elements such as roadway lighting and bridges	**Project Quality** • Pavement smoothness or ride quality • Materials quality • Workmanship quality
Traffic Management • Auxiliary lane availability • Travel time	**Other Incentives** • Award fee for management, quality, and schedule • Project safety • Public relations program
Revenue Sharing • 70 percent of net toll revenue from early traffic	

Source: D-B project survey: Q7, 69 responses

Most frequently mentioned incentives were for early completion of the project or a specified element of a project, or for project quality including pavement smoothness. Other incentives were offered for traffic management, public information, project safety, and toll revenue sharing for early opening.

The various kinds of disincentives noted in the design-build project survey responses are listed in Exhibit IV.49. Disincentives included late completion penalties and stipulated damages as well as lane rental fees for the closure of traffic lanes and shoulders. The same relative usage and types of incentives and disincentives were found among the seven pairs of comparable design-build and design-bid-build projects. This suggests that the issue of incentive and disincentive use is more a function of evolving industry practice rather than project delivery approach.

Exhibit IV.49 Design-Build Contract Disincentive Types

Late Completion Penalties • Project schedule overruns • Escalated damages for extended delay • Failure to meet given materials and roadway smoothness standards	**Stipulated Damages** • Delay in substantial completion • Delay in final acceptance
Other Disincentives • Limited eligibility for time extensions • Lane rental fees for closing existing traffic lane and/or shoulder	

Source: D-B project survey: Q7, 69 responses

Extended Warranties in Design-Build Contracts

Thirty percent of the surveyed design-build projects included extended warranties[5]. Of those design-build projects with warranties, two-thirds were material and workmanship warranties and one-third were performance or condition warranties. The duration of design-build project warranties ranged from six months to ten years. One ITS project included a two-year warranty for computer software. Most warranties were one, five, or seven years in duration, with the average duration of just over four years

Most reported design-build project warranties included clauses that defined conditions that complete or void the warranty. These were typically defined in terms of time limits. Several projects had other "escape" clause criteria, including the impact of a natural disaster on the project or other factors beyond the contractor's control. Pavement warranties usually have an axle loading limit on the warranty to account for the impacts of vehicle use on pavement deterioration. However, none of the survey respondents indicated the use of an axle loading exclusion clause in their pavement warranty clauses.

In general, the inclusion of an extended warranty is not considered a competitive factor in the selection of design-build projects by the respondents. In addition, extended warranties are reported to have little or no impact on the quality, timeliness, and cost of design-build projects. Like incentives and disincentives, the use of extended warranties appears to be more a function of project type than project delivery approach. As a form of risk transfer to the project contracting team, they have been used for projects involving all kinds of project delivery approaches, not just design-build. This may reflect the fact that design-build contracts are used more for project expediency and innovation than to ensure the longevity of project performance.

Certainly extended warranties can be a distinguishing feature in promoting competitive products to consumers, as the automobile manufacturers have discovered. However, in the case of highway projects, the traditional separation of project development and preservation phases (operations and maintenance), both temporally and organizationally within agencies, likely diminishes the perceived value of extended warranties for those units responsible only for project development.

* * * * * *

Chapter V presents the conclusions and recommendations of the study, based on the findings presented in this chapter.

[5] Based on D-B project survey: Q8, 69 responses

V. CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the lessons learned by survey respondents and changes planned for their agencies' design-build programs. The chapter also presents the conclusions of the research team regarding the prospective use of design-build project delivery and the team's recommendations for improving the use of design-build contracting in the nation's highway development program.

AGENCY SUGGESTIONS FOR IMPROVING DESIGN-BUILD PROGRAMS

In responding to the study surveys, the design-build project managers shared their thoughts regarding lessons learned during the SEP-14 program. The research team also received numerous comments and suggestions regarding changes the surveyed agencies have made in their design-build programs and suggestions to further improve these programs, based in part on these lessons learned. This section summarizes the comments and suggestions for improvement.

Design-Build Program Lessons Learned Based on Project Surveys

The project managers who completed design-build project surveys noted many lessons learned from these projects. Key lessons included:

- Carefully choosing projects appropriate for design-build
- Adequately preparing to procure and manage a design-build project;
- Properly phasing the project by timing permitting, environmental clearance, and right-of-way acquisition prior to award of design-build contract;
- Leaving design guidelines "loose," with performance criteria designed to drive the creativity of the design-build team; and
- Maintaining communications between the contracting agency and design-build team.

The full digest of "lessons learned" comments is provided in Exhibit V.1.

Design-Build Program Improvements Based on Program Surveys

Design-build project managers responding to the surveys reported having undertaken or proposed several major changes to improve the effectiveness of their agencies' design-build programs. Changes included amending quality assurance and quality control, better defining program guidelines, and working more closely with design and construction contractors to craft a better program. Several agencies reported that their design-build program was reassessed on an ongoing basis as projects moved through the process. Florida DOT's response was typical:

> "Design-build is a continually evolving concept in which we incorporate changes and make improvements with the completion of every job."

Actual changes that have already been undertaken as reported in the program surveys are summarized in Exhibit V.2, and those that are proposed are summarized in Exhibit V.3.

Exhibit V.1 Summary of Lessons Learned from Design-Build Projects

Guidelines	Cooperation with Industry
• Performance criteria in lieu of prescribed specifications is key to efficiency of the design-build process • Project criteria should state project goals	• Process works best with experienced contractors and designers • Contracting community requires education on conceptual estimating practices, especially the subcontracting community
Project Selection	**Project Phasing**
• It is relatively simple to use design-build to replace existing similar construction • May not be well-suited for small projects such as small bridges • May be better suited for roadway construction rather than ITS projects • Ideal method for road widening under traffic	• Right-of-way acquisition required prior to letting design-build contract • Permitting and geotechnical borings prior to letting place contractors at ease and facilitate process
Project Management	**Preliminary Engineering**
• Co-locating project team for the entire duration of project facilitates coordination • Establish and maintain open communications channels, including regular progress meetings • Establish expectations of all parties prior to beginning work • Facilitate cooperative working relationship between contracting agency and design-build team • Recognize criticality of schedule • Provide efficient management structure • Establish meaningful incentives and penalties	• Development of original documents may have stifled contractor creativity and innovation • Carefully consider the appropriate level of design to complete prior to letting contract • Over-prescribing design details or construction techniques may stifle potential innovation • Focus technical scoring of proposals on areas that the agency values
Third-Parties	**Owner Participation**
• Effort and time to tie down third party (railroads, utilities, local agencies) commitments prior to project award is essential	• There is major effort required of the project contracting agency, so design-build should be used only when it provides the most effective delivery means • Successful management of design-build may require a new approach to project administration by the contracting agency
Contract Language and Definitions	**Change Orders**
• To ensure the contracting agency receives the expected product within budget, clear and concise performance specifications are essential to the success of a design-build contract	• Establish funding responsibility for any unforeseen changes required in project design and construction
Risk Allocation	**Procurement**

• Allocate risks where they are best managed	• Design-build is not well suited to low-bid selection method

Source: D-B project survey: Q18, 49 responses

Exhibit V.2 Summary of Actual Design-Build Program Changes

Quality Assurance/Quality Control	Cooperation with Industry
• Better define quality control and who provides it. Third-party contracting of quality assurance • Change in QA/QC responsibility, with contracting agency responsible for quality assurance and contractor responsible for quality control, in lieu of previous arrangement in which contractor had responsibility for QA and QC and contracting agency had discretionary sampling and testing privileges	• Agency periodically conducts design-build workshops with industry partners, contractors and designers to refine delivery processes. Recent successes include continuity of agency selection team, debriefing process, agreement to include alternate technical concept, and one-on-one communication process during RFP stage.
Project Selection	**Procurement Regulations**
• Streamlining selection process	• Changed state statutes to permit best-value approach • Achieved regulatory authority to implement design-build
Preliminary Engineering	**Stipends**
• Reduce level of preliminary engineering and transfer this work to design-build contractors	• Use of stipends to offset cost of preliminary design for unsuccessful proposers
Environmental Monitoring	**Utilities**
• Placement of environmental monitors (agents of the state) on environmentally sensitive projects to ensure compliance with permit requirements of the contractor	• Incorporation of utilities design and construction into contract documents, making it a requirement of the design-build team
Contract Language and Definitions	**Baseline Information**
• Standardized contract language for design-build procurement, including general and project-specific requirements • Refinements of project scope definitions and standard specifications	• Providing upfront information such as soils, geotechnical, permit, and right-of-way information • Standardization of plan package content based on 30 percent plan details, including line, grade, and typical section for roadway and/or type, size, and location for structures
Risk Allocation	
• DOT works closely with AGC and ACEC to develop more focused risk allocation, used by agency to develop	

initial plans as well as proposal	

Source: D-B program survey: Q24, 27 responses

Exhibit V.3 Summary of Proposed Design-Build Program Changes

Quality Assurance/Quality Control	Cooperation with Industry
• Continued refinement of QA/QC plan	• Re-establishing partnership efforts with DOT, FHWA, contractors, and consulting engineers
Project Selection	**Procurement Regulations**
• Improved guidance for when to utilize innovative contracting methods • Incorporate more structures into program, and evaluate use of design-build on mega-projects, smaller projects, and bridge and ITS projects	• Considering deleting the Federal statutory definition of a "qualified project" so that SEP-14 will no longer be necessary for design-build projects that comply with FHWA's regulation.
Project Management	**Stipends**
• Bring construction engineering management in-house	• Development of a formal process for stipend determination
Contract Language and Definitions	**Risk Allocation**
• Clarifying third-party and quality assurance requirements • Refinement of contract language based on feedback from the contracting industry, consultants, FHWA, and DOT personnel • Revise program documents to make easier to use • Continued refinement of contract template	• Move all responsibility for project decisions, quality control, engineering, and inspection to the contractor, who would hold a comprehensive warranty to cover workmanship repairs and defects. Contractor would be held accountable for the entire project (i.e. no shared responsibilities). Difficult to accomplish within the culture of the transportation and insurance industries

Source: D-B program survey: Q25, 25 responses

Among project survey respondents, 33 percent reported that their projects could have been more successful with what they know now about the design-build process. Suggestions for further improving the design-build process included:

- More careful selection of projects appropriate for design-build
- Better definition of the contracting agencies' and contractors' project scopes
- Creation of more accurate bidding documents

- Selection of design-build consortium on a best-value rather than low-bid basis
- Modification of the quality control procedures
- Development of a procedure to review project design and manage construction issues

CONCLUSIONS

Based upon the results of this study, the following conclusions are offered regarding the future disposition of design-build as an alternative method for delivering highway projects, relative to the areas of interest defined by Section 1307 (f) of TEA-21, which mandated this study:

Impacts on Project Timeliness

- The greatest motivation and realized benefit to a contracting agency of using design-build instead of design-bid-build contracting is the ability to reduce the overall duration of the project development process by eliminating a second procurement process for the construction contract, reducing the potential for design errors and omissions, and allowing for more concurrent processing of design and constructing activities for different portions of the same project. Procurement efforts increase with design-build due to the extra effort put into crafting more clearly-defined contract documents, terms, and oversight requirements and responsibilities. In contrast, contracting agency contract administration and field inspection requirements decrease when the design-builder assumes more responsibility for quality control and there was greater reliance on performance-based progress billing.

Impacts on Project Cost

- The impact of project delivery approach on project cost is more difficult to establish and the range of both cost increases and decreases was quite wide. Project costs are much more likely to be impacted by the following factors that are beyond the control of the design-builder:
  - Nature and complexity of the project;
  - Third-party requests for changes to the plans and the project; and
  - Quantity contingencies (typically +/- 10-percent) included in unit price-based design-bid-build contracts that apply to change orders and quantity overrun items but which are not present in lump sum-based design-build contracts.

  This last factor provides greater opportunity for a design-bid-build contractor to pass on added project costs before having to negotiate a new unit price contract.

- Greater cost efficiencies are most likely to occur for design-build projects as a result of enabling the design-builder to propose more cost-effective ways to realize the performance objectives of the project. This can be achieved by:
  - Encouraging the design-builder to use the latest innovative technologies and methodologies to more fully leverage available public resources;
  - Integrating the design and construction activities to reduce the potential for design errors and discontinuities between the design plans and construction efforts that can result in fewer change orders and extra work orders; and
  - Shifting to greater use of performance-based specifications that promote design-builder creativity and decrease change orders.

Reducing the potential for cost growth through design-build contracting enables contracting agencies to budget more of their capital program funds for projects instead of reserves to cover cost increase contingencies. This provides for more efficient use of available funds, putting more of taxpayer money to work and delivering more projects.

- Significantly lower cost and number of claims for design-build projects reflect a fundamental shift in the adversarial nature of transportation construction contracting and bodes well for the future implementation of this procurement method, particularly for high visibility projects where cooperation between contracting agencies and their design and construction contractors is essential to project success.

Impacts on Project Quality

- Design-build does not appear to be a threat to the quality of highway projects. Indeed contracting agencies expressed equal satisfaction with the results of design-build and design-bid-build projects, suggesting that the choice of project delivery approach is neither a determinant of nor a threat to project quality. Overall contracting agency satisfaction was highest when design-build was used for large projects, when lower levels of preliminary design were performed prior to the design-build contract, and when contract selection was based on best value.

Level of Design Completed Prior to Design-Build Contract

- The use of design-build contracting provides an effective way for contracting agencies to gain access to specialized staff resources able to perform highly technical design work, with earlier value engineering and constructability reviews as part of the process. The level of preliminary design that should be completed before a design-build contract is procured depends on the size and complexity of the project, the ability of the design-builder to develop a more cost-effective and constructible project design in a timely and competent manner, and the degree to which performance specifications are used for the project. The survey results indicate higher contracting agency satisfaction with design-build projects that have lower levels of preliminary design performed before the involvement of the design-build team.

Impacts on Small Business

- The level of competition for design-build projects is somewhat smaller than for design-bid-build projects, most likely due to the newness and perceived risk associated with this particular project delivery approach to the Federal-aid highway program and the traditional design and construction firms that have served this program. This should increase as more design and construction firms participate on design-build project teams.

- Stipends or payments to unsuccessful proposers for design-build projects are frequently used to increase the number of capable proposers and thereby enhance competition for these types of procurements. Half of the projects surveyed offered stipends averaging $50,000.

- Design-build projects provide opportunities for smaller subcontractors to perform substantial portions of design-build projects. According to survey responses, small business contractors are playing comparable roles on completed design-build projects as for design-bid-build projects, with greater opportunities for subcontracting of the design work to smaller firms.

Subjectivity of Design-Build Contracting

- Cost remains the primary factor for awarding design-build contracts, even when other factors such as duration, team reputation, and quality are included in the deliberations. While low bid continues to be used as the basis for contract award decisions for many design-build projects, best-value approaches using multiple criteria including cost are gaining momentum. Best value selection provides for the consideration of both cost and other more subjective factors such project management, quality control, and team reputation and is gaining popularity among contracting agencies of design-build projects due to its ability to consider all relevant factors that affect the desirability of a design-build proposal.

Other Considerations

- While the use of design-build is not a panacea for delivering highway projects, there are clearly project features and circumstances that encourage its consideration if not use.
  - Medium to large projects that are more complex in nature and can benefit from the application of innovative concepts in project design and development earlier in the project conceptualization process are well suited to design-build project delivery.
  - New/widening, rehabilitation/reconstruction, and bridge/tunnel projects have the size and complexity to enable the private sector to apply more cost-effective ways to develop the project using design-build. These potential efficiencies permit design-builders to take on the higher project/contract risks associated with design-build contracting.
  - Projects that have a high sense of urgency (due to natural disasters or facility failures) or involve some kind of direct user fee-based financing are more likely to benefit from design-build contracting due to its ability to expedite project completion and/or facilitate the start of user fee-based revenue collection.
  - Projects with a dedicated revenue stream associated with completion (such as toll roads) provide added incentive for the public sector to complete a project on time and within budget.
  - Trained and capable contracting agency staff responsible for administering design-build projects must be designated for this method of project delivery, including procurement and contract administration processes.
  - The presence of a number of competent design and construction firms interested and willing to compete for work under the design-build contracting approach helps to ensure cost-competitive bids/proposals.
  - Public demands for accountability regarding project schedule and quality can be more readily met through the terms and conditions inherent in a design-build contract, where qualified design-builders take on more project risk associated with meeting the contract

schedule and performance criteria because of their ability to apply innovative techniques that lower the costs of project delivery while achieving desired performance results.

- A large number of agencies have now undertaken one or more design-build projects under the auspices of SEP-14 and tested different ways to apply design-build to many different types and sizes of projects. The knowledge gained from developing these programs and testing design-build provides a rich source of legislative, regulatory, procedural, and institutional documentation and insights to help institutionalize this process as an option for contracting agencies to consider as they develop their highway improvement programs and projects.

- While some states have cut back their design-build programs (such as Michigan, Ohio, and New Jersey), having completed the urgent projects that first prompted their interest in design-build, other states (such as Florida and Pennsylvania) are building on their growing knowledge base and success to propose increasing numbers of projects for design-build. This is becoming a self-fulfilling process as local design and construction firms participate in these projects and gain familiarity and confidence in their ability to delivery projects using design-build contracts and to make a reasonable rate of return for their efforts and risks.

- Nationally there is an extensive array of reports, books, periodicals, research studies, practice guides, and project evaluation reports to inform prospective and current practitioners in the use of design-build contracting for highway projects. There is also ample experience gained by various states in the use of design-build for a whole variety of projects to enable any first-time user to obtain useful insights and documentation on rules, regulations, policies, and procedures to set up and apply design-build with greater confidence that those early experimenters who first applied design-build during the early years of SEP-14. Among the states with well established design-build programs and significant documentation on their programs and projects are Florida, Pennsylvania, Michigan, and Ohio. Emerging major users of design-build include the states of Maryland, New Jersey, North Carolina, Indiana, Utah, Texas, and Virginia who have continuing and expanding design-build programs.

- The Design-Build Contracting Regulations[1] provide wide latitude to transportation agencies in the use of design-build contracting if they choose to apply this project development approach provided there are reasonable controls in place to:

  - Protect the public interest in obtaining a cost-effective project that meets or exceeds stated performance standards over time;
  - Minimize the opportunity for waste, fraud, and abuse due to favoritism in the selection process; and
  - Promote competition, particularly among competent local and national firms of all sizes and capabilities that can participate on design-build project teams.

[1] 23 CFR part 636

Minimum levels of participation by the prime contractor of a design-build team are no longer required under these regulations. This will encourage even greater use of local and small subcontractors to support the design-build teams, thereby ensuring their open and competitive access to design-build highway projects.

RECOMMENDATIONS

Based upon the results of this study, the following recommendations are offered to improve the use of design-build for delivering highway projects.

- The FHWA should continue to work with AASHTO and industry representatives to develop suggested guidelines and illustrative documents for use by contracting agencies interested in evaluating the design-build project delivery method. The FHWA recognizes this need and continues to support the activities of the AASHTO Design-Build Task Force and the design-build related research performed under the National Cooperative Highway Research Program (NCHRP). Two current research studies will be effective in accomplishing these goals: (NCHRP Project 25-25(12) - "Design-Build Environmental Compliance Process and Level of Detail Required" and NCHRP Project 20-07, Task 172, "Recommended AASHTO Design-Build Procurement Guide").

- To the extent practical, contracting agencies should provide for flexibility in the design criteria by using performance criteria to encourage creativity by the design-build proposing teams while providing a basis to hold the team accountable for project results.

- Preliminary designs that are incorporated in the RFP should be no more than 30 percent complete, dropping to lower levels as the size and complexity of the project increases and the contracting agency gains greater experience with this project delivery approach and the use of performance-based specifications.

- Raising the expertise and experience among transportation agency managers is a key challenge. Transportation agencies should invest in design-build training before attempting to execute their first design-build project. That training should include not only contracting agency personnel but also consulting engineers and construction contractors that will compete for these projects. On-going design-build training sessions could be used to institutionalize lessons learned for completed or active design-build projects.

CLOSING REMARKS

The changing nature of the nation's highway infrastructure development program and resources, at the federal, state, and local levels, is placing increasing burdens on the public sector's ability to meet the growing needs for renewed and expanded system capacity. Innovative techniques like design-build have been shown to offer significant potential to help transportation agencies better serve these needs by doing things faster and more cost-effectively. While many of the conditions that spawned the promulgation of highly restrictive contracting laws and procedures early in the twentieth century are no longer in evidence, care must be taken to prevent a repeat of these conditions. This is why the use of techniques like design-build contracting must be viewed and entered into with the understanding that the public and private participants in the process have a shared interest and liability for the results of the process, and are each held accountable for the results.

Design-build contracting represents a collaborative effort that integrates the various resources involved in the development of a highway project and provides incentives for a high level of technical performance and consistency with contractual budget and schedule terms. It has the potential to produce a more cost-effective project in less time than a process that contractually insulates the project participants while leaving the contracting agency with most of the project risk. The following quotes reflect the views of many of the respondents to the design-build surveys:

- *"We are sold on design-build. We feel that it offers the department an excellent option for procuring work faster and potentially more effectively that the traditional design-bid-build method." (a representative from the Construction Division ,Utah Department of Transportation)*

- *"The design-build technique for transportation [project] delivery has provided the department with another tool to meet the needs of our customers, the traveling public. This technique allows us to move from concept to concrete at an accelerated pace which has helped us to meet the needs of local municipalities quickly. We could not have met the President's and Governor's economic stimulus initiatives had we not had the design-build option. This program has been extremely beneficial." (a representative from the Florida DOT)*

- *"We utilized the design-build contracting method to [respond] to a significant increase in the bridge construction budget with little time to implement [the project]. Design-build effectively brought the program to construction." (a project manager from the Michigan DOT)*

- *"This project would not have been possible without design-build project delivery." (a representative from the Alameda Corridor Transportation Authority)*

APPENDIX A

GLOSSARY OF TERMS

A + B: The contractor bids both the standard pay items plus the time required to complete the project. This total bid is then used to determine the lowest bidder for award purposes.

A + B Bidding: An adjustment to the price proposal to reflect the worth of time ("B").The contractor bids both the standard pay items plus the time required to complete the project. This total bid is then used to determine the lowest bidder for award purposes.

Adjusted Bid: price proposals are opened after the technical proposals are scored. When the price proposal is opened, the project price is adjusted in some manner by the technical score, typically through the division of price by a technical score between 0 -1. The adjusted bid is used only for project award. The offered will be paid according to the price stated in the price proposal. The offeror with the lowest adjusted bid will be awarded the project.

Adjusted Score: price proposals are opened after the technical proposals are scored. The adjusted score is calculated by multiplying the technical score by the total estimated project price and then divided by the price proposal. The award made is to the offeror with the highest adjusted score

Allowable Contract Time: (adjusted contract time) Original contract time plus any contract time granted for weather, extra work, and unforeseen conditions.

Alternative or Innovative Contracting: Various methods of contracting authorized by state statute that departs to some degree from the traditional design-bid-build low-bid process. These methods include but are not limited to Time-Plus-Money (A + B), Design/Build, Warranty, and Incentive/Disincentive.

Bid Averaging Method (BAM): The contractor with a bid closest to the average of all the bids is awarded the contract.

Best Value: The overall maximum value of the proposal to a sponsor after considering all of the evaluation factors described in the specifications for the project including but not limited to the time needed for performance of the contract, innovative design approaches, the scope and quality of the work, work management, aesthetics, project control, and total project cost of the formulas or other criteria for establishing the parameters for the Best Value are generally clearly defined with the goal of being objective.

Bid Proposal: A technical proposal and a separately sealed price proposal submitted by each Design-Build Firm.

Bonus: A monetary incentive placed on a specific milestone within a contract for the expressed purpose of completing that element within the prescribed time.

Building Project: A project that provides rest areas, weigh-in-motion facilities, maintenance depots, toll highway service plazas, welcome centers, and other buildings incidental to the highway system.

Change Order: a written order to the contractor detailing changes to the specified work quantities or modifications in the scope of the original contract.

Claim: a continued demand for payment by the contractor that has been previously denied under the contracting agency's change approval procedures.

Cost-Technical Tradeoff: this approach involves calculating the technical score and the price score increment and then examining the difference between the incremental advantages of each. The increment in the technical score is calculated by dividing the highest technical score by the next highest technical score less one multiplied by 100%. The increment in price score is calculated by dividing the highest price score by the next highest price score less one multiplied by 100%. The award is to the offeror with the lowest price, unless the higher priced offers can be justified through a higher technical value. This justification is made by determining if the added increment of price is offset by an added increment in technical score.

An alternative qualitative version of this approach is used by many federal agencies under the Federal Acquisitions Regulation. This version relies on the judgment of the selection official and not on the evaluation ratings and scores. The final decision consists of an evaluation, comparative analysis, and tradeoff process that often require subjectivity and judgment on the part of the selecting official.

Design-Bid-Build: The traditional method for building highways and making highway improvements where the state transportation department (STA) or a consulting engineer working for the STA designs the project, solicits bids, and awards the construction contract to the lowest responsive bidder (construction contractor) to build the project.

Design-Build: the process of entering into a single contract with a contractor in which the contractor agrees to design and build a highway, structure or facility, or any other items required in an RFP.

Design-Build Contractor (or Design-Build Firm): An individual, company, firm, partnership, corporation, association, joint venture or other legal entity that is permitted by law to provide the necessary design and construction services, including engineering, architecture, construction contracting, and contract administration. The entity may include a construction contractor as the primary party with a design professional as the secondary party or vice versa. The contractor or design professional cannot team with other partners to submit more than one bid per project. Likewise, the secondary part of the design-build team, either designer or contractor, cannot change after award. Design-Build Contractor means the same as Design-Builder.

Design-Build Package (also Design and Construction Criteria Package): Document published by the STA that contains the Public Advertisement (Notice to Bidders), the Request

for Proposals, General Requirements, Design Scope of Work, Technical Specifications, Price Proposal Documents including the Bid Schedule, and any forms, drawings and other supporting documents necessary to guide the proposers in preparation and submittal of a proposal for a design-build project.

Disincentive: Monies subtracted from the contractor for completing the project later than time allowed for in the contract, or other performance-related penalty.

Fixed Price – Best Design: this approach uses a maximum price or a fixed price for the project. Offerors must submit a price proposal that is equal or less than the specified bid price. The award is based only on the technical proposal evaluation. The offeror selected will be the one whose technical score is the highest.

Incentive: Monies paid to the contractor for early completion of a project as provided for in the contract. Incentives may be paid for on A + B, Bonus, Incentive/Disincentive, Liquidated Savings, and Escalating Incentive/Disincentive contracts.

Incentive/Disincentive: Various methods of contracting authorized by state statutes which apply an incentive for early completion or a disincentive for late completion by the contractor. These methods include but are not limited to Incentive/Disincentive and Escalating Incentive/Disincentive arrangements.

Lane Rental: Method to reduce the impact to the traveling public by charging the contractor for blocking a lane during construction.

Letters of Interest (LOI): Refers to the process that establishes criteria for evaluating interested design-build contractors for the short-listing process. Criteria required for letters of interest is stated in the advertisement. In some states, firms desiring to submit bid proposals on design-build projects must submit a letter of interest setting forth the qualifications of the members of the firm and providing any other information required by the project announcement.

Liquidated Savings: The contractor is able to receive an incentive payment for early completion of a project. This incentive is tied to the amount of savings to the STA for this early completion.

Low Bid - Meets Technical Criteria: final award decision is based on price. Technical proposals are scored before any cost proposals are reviewed. The price proposal is opened only if technical proposal is above the minimum technical score. If it is below the technical score, the proposal is deemed non-responsive and the price proposal is not considered. Award will be determined by the lowest prices, fully qualified offeror.

Lump Sum: The contractor is required to perform a take off on the contract plans in order to develop project quantities. The contractor then submits lump sum bid for the entire contract.

Non-Responsive: Refers to any letter of interest that does not meet the criteria identified in the short-listing process or any proposal that does not comply with the criteria defined in the Request for Proposal.

Price Proposal: Contains the proposer's price for performing the work contained in the technical proposal and specified in the design-build package. In general, the price proposal is sealed and completed only on forms included in the design-build package. The proposer for an A + B type of price proposal also quotes a specified project time.

Project: The project to be designed and constructed as described in the public announcement.

Project Manager: The STA's designee responsible for administering the design-build project.

Proposer: A design-build firm or joint venture submitting a technical proposal for a design-build project.

Request for Proposal (RFP): The package to be provided to the firms qualified to bid on a project. It may contain, but is not limited to a detailed scope of work, including design concepts, technical requirements and specifications, time allowed for design and construction, STA's estimated cost of the project, deadline for submitting a proposal, selection criteria and a copy of the contracts. FHWA approval of the RFP is required on FHWA oversight projects prior to authorization and the release of the RFP to short-listed Firms. The RFP must clearly define all functions and responsibilities required by the firm. This RFP should consist of the following:

- **Dates:** Technical proposal due date; STA's selection schedule; delivery of services/products date; STA's submittal reviews (if required) time period; and payout schedule.

- **Design and Construction Criteria:** The design and construction requirements clearly define the specifications essential to ensure that the project is designed and constructed to meet the needs determined by the STA.

- **Guidelines** for preparation/presentation of technical proposals and the following:
  - Proposal evaluation criteria
  - Price proposal requirements
  - Identification of the design-build firm's project manager
  - Insurance requirements
  - Subcontract services
  - Minority/disadvantaged business participation requirements
  - Bonding requirements

Request for Qualifications (RFQ): A frequent part of the design-build selection process that contains the desired minimum qualifications of the firm, a scope of work statement, project requirements, amount of stipend or reimbursement (if any) that the STA has determined will be paid to prospective firms who qualify for the short list, but are not awarded a contract, selection criteria that STA will use in compiling the short list of prospective Firms to consider, and a copy of the contract.

Responsive: A proposal that substantially complies with the criteria identified in the short-listing process or a proposal that contains all the information and level of detail requested in the RFP and complies with the design and construction criteria defined in the RFP or design-build package.

Road User Cost: Cost/value established by the STA related to the estimated delay costs/impacts caused by construction.

Scope of Work: Information provided or furnishes in the design-build package and RFP that describes the project work and provides the firm with the essential requirements.

Standard Bid: The traditional cost associated with the materials and labor to construct the project.

STA: State transportation agency.

Statement of Qualifications (SOQ): Refers to the process that establishes criteria for evaluating interested Firms. Criteria required for the SOQ is stated in the advertisement. Often, firms desiring to submit bid proposals on design-build projects must submit an SOQ setting forth the qualifications of members of the firm and providing any other information required by the announcement of the project.

Stipend: The fee paid to unsuccessful firms for development of a responsive proposal.

Technical Proposal: The design-builder's response to the Request for Proposals. This document contains detailed descriptions and methodology of the design-builder's approach to designing, constructing, and managing the project in accordance with the design-build package. The design-builder's conceptual design is included as well as a proposed construction sequence and schedule. Technical proposals are expected to be in-depth, and could contain tables, charts, drawings, plots, and sketches.

Time Bid ('B' Portion): This is the cost directly related to the time bid by the contractor and dollars per day established by the STA.

Time-Plus-Money: Various methods of contracting including but not limited to Lane Rental, A + B Bidding, and Liquidated Savings. These methods consider both the construction costs and time of project. Reduction of contract time is a critical consideration for these methods.

Total Bid: The standard bid cost and the time bid cost added together for determining the low bidder.

Warranties: An insurance policy to warranty a specific element or elements within the contract from premature failure.

Weighted Criteria: the technical proposal and the price proposal are evaluated individually. A weight is assigned to the price and each of the technical evaluation factors. The sum of these values becomes the total score. The offeror with the highest total score is selected.

APPENDIX B

PARTICIPATING SEP-14 PROGRAM AGENCIES AND CONTACT INFORMATION

State	Agency D-B Program Contacts	Program Survey Completed	Project Surveys Completed
AK	Mr. Gordon Keith Director of Construction & Operations Division Department of Transportation & Public Facilities 4111 Aviation Avenues Anchorage, Alaska 99519 (p) 907-269-0780 (f) 907-248-1573 E-mail: gordon_keith@dot.state.ak.us	Yes	1
AZ	Mr. John Louis Assistant State Engineer Roadway Engineering Group Arizona Department of Transportation 205 South 17th Avenue Mail Drop 611E Phoenix, Arizona 85007 (p) 602-712-7707 (f) 602-712-3475 E-mail - jlouis@dot.state.az.us Secondary Contact: Mr. Julio Alvarado - Assist. State Engineer Construction Group - ADOT 206 South 17th Avenue - Mail Drop 172A Phoenix, Arizona 85007 (p) 602-712-7323 (f) 602-254-5128	Yes	4
CA	TCA - Mr. James Brown, P.E. Chief Engineer Transportation Corridor Agencies 125 Pacifica, Suite 100 Irvine, California 92618 (p) 949-754-3428 (f) 949-754-3491 E-mail - brown@sjhtca.com (*for the TCA program and projects*)	Yes	2
CA	Mr. Manny Hernandez (310) 816-0460, Ext. 146 Alameda Corridor Transportation Authority One Civic Plaza - Suite 600 Carson, California 90745 (p) 310-816-0460, Ext. 197 or 146 (f) 310-233-7483 (c) 310-505-8203 E-mail: mhernandez@trenchteam.com (for the Alameda Corridor program/project)	Yes	1

State	Agency D-B Program Contacts	Program Survey Completed	Project Surveys Completed
CO	Mr. Dean Van DeWege Project Development Branch Manager Colorado Department of Transportation 4201 East Arkansas Avenue Denver, Colorado 80222 (p) 303-757-9040 (f) 303-757-9868 E-mail: dean.vandewege@dot.state.co.us (Secondary contact:James Zufall Assistant Project Development Manager (cell) 303-916-3204)	Yes	2
DC	Mr. John Deatrick Deputy Director and Chief Engineer IPMA - D.C. Department of Transportation Peoples Building 64 New York Avenue, N.E. Washington, D.C. 20002-3326 (p) 202-671-2800 (f) 202-671-4710 E-mail - john.deatrick@dc.go (program questionnaire only)	Yes	N/A
DE	Mr. Barry Benton Supervising Bridge Engineer Bridge Design Division Delaware Department of Transportation P.O. Box 778 800 Bay Road Dover, Delaware 19903 (p) 302-760-2311 (f) 302-739-2217 E-mail: bbenton@maildot.state.de.us	Yes	1
FL	Mr. Ken Leuderalbert Quality Initiative Manager Florida Department of Transportation 605 Suwannee Street - Room 210 Tallahassee, Florida 32399-0450 (p) 850-414-4792 (f) 850-414-4796 E-mail - ken.leuderalbert@dot.state.fl.us Secondary contact - Mr. Brian Blanchard State Roadway Design Engineer (p) 850-414-4377 (f) 850-414-9293 E-mail - brian.blanchard@dot.state.fl.us	Yes	7
GA	Mr. Michael Haithcock Assistant State Consultant Design Engineer Pre-Construction Division Georgia Department of Transportation Number 2 Capitol Square - S.W. Atlanta, Georgia 30334 (p) 404-657-9758 (f) 404-463-6136 E-mail - michael.haithcock@dot.state.ga.us	Yes	1

State	Agency D-B Program Contacts	Program Survey Completed	Project Surveys Completed
HI	Mr. Kevin Ito Technical Design Section Highway Division Hawaii Department of Transportation 869 Punchbowl Street Honolulu, Hawaii 96813 (p) 808-692-7548 (f) 808-334-8789 E-mail - kevin.ito@hawaii.gov (program questionnaire only)	Yes	N/A
IN	Mr. Walter Land Manager of Special Projects Contracts & Construction Division Indiana Department of Transportation 100 North Senate Avenue - Room 601 Indianapolis, Indiana 46204 (p) 317-233-3699 (f) 317-233-4929 E-mail: wland@indot.state.in.us	Yes	0
LA	Mr. Buddy Porta Road Design Engineer/Administrator Road Design Section Louisiana Department of Transportation 1201 Capitol Access Road Baton Rouge, Louisiana 70804-9245 (p) 225-379-1388 (f) 225-379-1351 E-mail - buddyporta@dotd.state.la.us (program questionnaire only)	No	N/A
MA	Mr. Thomas Broderick III Chief Engineer Massachusetts Highway Department 10 Park Plaza Boston, Massachusetts 02116 (p) 617-973-7830 (f) 617-973-8032 E-mail - thomas.broderick@mhd.state.ma.us (Secondary contact - Mr. Frank Suszynski, cell - (978) 589-1754)	Yes	N/A
MD	Ms. Lisa Choplin Assistant Division Chief Highway Design Division State Highway Administration Maryland Department of Transportation 707 North Calvert Street - C102 Baltimore, Maryland 21202 (p) 410-545-8824 (f) 410-209-5001 E-mail: lchoplin@sha.state.md.us	Yes	4

State	Agency D-B Program Contacts	Program Survey Completed	Project Surveys Completed
ME	Mr. Bradford Foley Assistant Program Manager Urban & Arterial Highways Division Maine Department of Transportation 16 State House Station Augusta, Maine 04333 (p) 207-624-3359 (f) 207-624-3481 E-mail: brad.foley@maine.gov	Yes	1
MI	Mr. Mark Van Port Fleet Engineer of Design Design Support Area Michigan Department of Transportation P.O. Box 30050 Lansing, Michigan 48909 (p) 517-373-0030 (f) 517-241-4619 E-mail - vanportfleetm@michigan.gov	Yes	10
MN	Mr. Paul Huston, P.E. Design-Build Program Manager Minnesota Department of Transportation 395 John Ireland Boulevard, MS 670 St. Paul, Minnesota 55155 (p) 651-284-3605 (f) 651-296-1805 E-mail - paul.huston@dot.state.mn.us (program questionnaire only)	No	N/A
NC	Mr. Steve Dewitt State Construction Engineer North Carolina Department of Transportation 1 South Wilmington Street - 2nd Floor Raleigh, North Carolina 27601 (p) 919-733-2210 (f) 919-733-8441 E-mail - sdewitt@dot.state.nc.us Secondary Contact:Tim Boland (704)982-0101	Yes	1
NJ	Mr. Richard Gramlich Director - Division of Project Management New Jersey Department of Transportation 1035 Parkway Avenue Trenton, New Jersey 08625-0600 (p) 609-530-2191 (f) 609-530-2532 E-mail - richard.gramlich@dot.state.nj.us (Secondary contact - Joe Bertoni - Project Manager)	Yes	7

State	Agency D-B Program Contacts	Program Survey Completed	Project Surveys Completed
NM	Mr. Tony Abbo Design-Build Project Engineer New Mexico State Highway & Transportation Department P.O. Box 1149 Santa Fe, New Mexico 87504-1149 (p) 505-827-9852 (f) 505-827-5642 E-mail - tony.abbo@nmshtd.state.nm.us (program questionnaire only)	Yes	N/A
NV	Ms. Susan Matinovich Deputy Director Nevada Department of Transportation 1263 South Stewart Street Carson City, Nevada 89712 (p) 775-888-7440 (f) 775-888-7115 E-mail - info@dot.state.nv.us (program questionnaire only)	Yes	N/A
NY	Mr. Daniel D'Angelo Director Design Quality Assurance Bureau New York State Department of Transportation 1220 Washington Avenue, 5-410 Albany, New York 12232-0751 (p) 518-457-6467 (f) 518-457-6477 E-mail - ddangelo@gw.dot.state.ny.us (Secondary contact - Mr. Richard Lee,	Yes	N/A
OH	Mr. Cash Misel, P.E. Assistant Director Office of Planning & Production Management Ohio Department of Transportation 1980 West Broad Street Columbus, Ohio 43223 (p) 614-466-2448 (f) 614-466-0587 E-mail - cash.misel@dot.state.oh.us (Secondary contact -	Yes	12
OR	Mr. Robert (Bob) Burns Highway Division Oregon Department of Transportation 1144 Center Street Salem, Oregon 97301 (p) 503-986-3801 (f) 503-986-4469 E-mail - robert.g.burns@state.or.us	No	0

State	Agency D-B Program Contacts	Program Survey Completed	Project Surveys Completed
PA	Mr. Tucker Ferguson Chief of Contract Management Division of Construction and Materials Pennsylvania Department of Transportation Transportation & Safety Building - 7th Floor Harrisburg, PA. 17120 (p) 717-787-7894 (f) 717-787-7969 E-mail - ferguhl@dot.state.pa.us (Secondary contact - Mr. David Azzato Chief Contract Development Design & Award Section, Bureau of Design (p) 717-787-5914 (f) 717-783-6412 E-mail - dazzato@state.pa.us)	Yes	8
SC	Mr. Rocque Kneece Program Development Engineer Program Management Division - East South Carolina Department of Transportation 955 Park Street - Suite 427 Columbia, South Carolina 29202 (p) 803-737-1127 (f) 803-737-3590 E-mail - KneeceRL@scdot.org	Yes	2
SD	Mr. Monte Schneider Development project Engineer Division of Planning & Engineering South Dakota Department of Transportation 700 East Broadway Avenue Pierre, South Dakota 57501 (p) 605-773-3268 (f) 605-773-6608 E-mail - monte.schneider@state.sd.us	Yes	1
TN	Mr. Jeffery Jones Design Director Tennessee Department of Transportation 505 Deaderick Street - Suite 1300 Nashville, Tennessee 32343-0349 (p) 615-741-2221 (f) 615-532-2799 E-mail - jeff.c.jones@state.tn.us (program questionnaire only)	Yes	N/A

State	Agency D-B Program Contacts	Program Survey Completed	Project Surveys Completed
TX	TTA - Mr. Phillip Russell - Director Texas Turnpike Authority 125 East 11th Street Austin, Texas 78701 (p) 512-225-1311 (f) 512-936-0970 E-mail - prussel@dot.state.tx.us (program questionnaire only) TexDOT - Mr. Thomas Bohuslav Director, Construction Texas Department of Transportation 125 East 11th Street Austin, Texas 78701-2483 (p) 512-416-2559 (f) 512-416-2539 E-mail - tbohusl@dot.state.tx.us	No	N/A
UT	Mr. Robert (Bob) Dyer Innovative Contracting Engineer Construction Division Utah Department of Transportation 4501 South - 2700 West Fourth Floor Salt Lake City, Utah 84114-8415 (p) 801-965-4384 (f) 801-965-4564 E-mail: rdyer@utah.gov	Yes	2
VA	Ms. Cyndi Ward Director of Special Projects Asset Management Division Virginia Department of Transportation 1401 East Broad Street Richmond, Virginia 23219 (p) 804-692-0390 (f) 804-786-8755 E-mail - cyndiward@virginiadot.org	Yes	1
WA	Mr. Jeffery Carpenter Innovative Contracting Engineer Washington State Department of Transportation P.O. Box 47300 Olympia, Washington 98504-7300 (p) 360-705-7804 (f) 360-705-6809 E-mail - carpenj@wa.gov	Yes	1
WI	Mr. Gary Whited Bureau of Highway Development Division of Transportation Infrastructure Development Wisconsin Department of Transportation Hillfarm State Office Building - Room 451 4802 Sheboygan Avenue Madison, Wisconsin 53707 (p) 608-267-7774 (f) 608-264-6667 E-mail - gary.whited@dot.state.wi.us	Yes	0

APPENDIX C

C-1 LIST OF TOTAL AND SURVEYED SEP-14 PROJECTS

State	Project	Date Completed	Final Cost (Millions)	Complete by Dec. 31, 2002	Included in Project Survey Sample	Project Survey Received	Compare to Design-Bid-Build
AL	Ferry boat	12/1/2002	$0.70	X			
AK	Ocean Class Ferry boat (Kennicott)	6/28/1998	$80.40	X			
AK	Whittier tunnel	5/30/2000	$57.00	X	X	X	X
AK	Very Fast Vehicle Ferry (option to buy up to 5 ferries)	N/A	$35.20				
AK	Glenn-Parks Interchange Project	N/A	$42.00				
AZ	Emergency Relief bridge Replacement	N/A	$3.50	X	X	X	
AZ	I-10/Cortaro Rd Interchange	N/A	$2.80	X	X	X	
AZ	I-17 Thomas Road to Dunlap Avenue, Phoeniz	7/1/2000	$75.00	X	X	X	
AZ	AZ State Route 68 near Kingman AZ, 13.5 miles reconstruction	N/A	$46.50	X	X	X	
AZ	US Route 60	N/A	$263.00				
AZ	AZ State route 51 inPhoenix between I-10 and Shea Blvd	N/A	$68.00				
CA	Alameda Corridor	4/1/2002	$740.00	X	X	X	
CA	Emergency Relief - LaCienega / Venice Undercrossing	N/A	$3.30				
CA	SR-125	6/26/1905	$105.00				
CA	TCA Foothills Eastern	6/1/1998	$504.00	X	X	X	
CA	TCA - San Joaquin Hills	6/1/1998	$795.00	X	X	X	
CA	TCA - Glenwood-Pacific Park Drive	6/1/1998	$7.20				
CO	Woodland Park urban street	N/A	$0.00				
CO	I-70 reconstruction, MP 336.8 for 11.4 miles	6/1/1999	$20.66	X	X	X	X
CO	I-76 Reconstruction, MP 418 - 427, Hudson to Keensburg	3/1/2001	$1.20	X	X	X	X
CO	Colorado Transportation Management System - System Integrator	N/A	$0.00				
CO	I-25 near Wellington, CO, 27 km roadway reconstruction	6/6/2001	$26.33	X	X		X
CO	TREX, formerly Southeast Corridor Denver I-25	N/A	$1,186.00				
DC	Emissions Inspection station	4/30/1999	$7.00	X			
DC	Local Street Upgrading (by EFLHD) Wards 3 and 4	N/A	$34.00				
DC	DC DOW Anacostia Riverwalk and Trail Project	N/A	$0.40				
DC	Taylor Street N.E. bridge Replacement Project	N/A	$10.60				
DC	Southern Avenue S.E.bridge Replacement Project	N/A	$8.00				
DE	Choptank Road over Back Creek	12/19/2001	$1.20	X	X	X	
FL	Peace River Drainage Canal	Complete	$3.87	X	X		
FL	Ringling Causeway	Active	$56.30				
FL	Peace River bridge/widen	Active	$52.98				
FL	Bee Ridge Rd. Repair/rehab	Complete	$1.49	X	X		
FL	US-17 add lanes & Reconst	Active	$17.97				
FL	US-41 add lanes & Reconst	Active	$4.47				
FL	SR-80 add lanes & Reconst	Active	$14.99				
FL	I-4 add lanes & Reconst	Active	$72.76				
FL	US 441 add lanes & Reconst	Active	$12.70				
FL	I-4 add lanes & rehab Pavt	Active	$59.60				
FL	I-4 Interchange(major)	Active	$62.15				
FL	SR 70 Slope rehab	Proposal	$3.38				
FL	Lake Okee Scenic Trail	Proposal	$2.27				
FL	Lake Okee Scenic Trail	Proposal	$5.62				
FL	I-75 Full Panel Replac wide bridge	Proposal	$7.69				
FL	I-75 Alligator Alley Fence	Proposal	$6.11				
FL	Add Lanes & Rehab Pavement	Active	$24.50				
FL	Add Lanes & Rehab Pavement	N/A	$16.20				
FL	Add Lanes & Rehab Pavement	Active	$25.60				
FL	ITS Surveillance System	N/A	$5.47				
FL	Add Lanes & Rehab Pavement	N/A	$4.71				
FL	Add Lanes & Rehab Pavement	N/A	$23.49				
FL	Weigh station	Active	$2.91				
FL	St. George bridge Replacement	Active	$71.68				
FL	Resurfacing	Complete	$1.48	X			
FL	Welcome station	Active	$5.87				
FL	Blackwater River bridge	Complete	$30.44	X	X		

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State	Project	Date Completed	Final Cost (Millions)	Complete by Dec. 31, 2002	Included in Project Survey Sample	Project Survey Received	Compare to Design-Bid-Build
FL	Hathway bridge	Active	$81.52				
FL	Ochlockonee River bridge	Complete	$12.21	X	X		
FL	I-10 rest areas	Active	$29.45				
FL	US-27, 3r, Milling, resurf.	Active	$4.87				
FL	SR-80, 3r	Active	$9.14				
FL	Misc. Constr.	Complete	$2.18	X			
FL	Replace Movable span	Active	$10.59				
FL	Interchange	Complete	$2.05	X	X	X	X
FL	Drainage Improvements	Active	$10.98				
FL	I-95 widening	Active	$67.30				
FL	I-95 3r, widening	Active	$5.12				
FL	Resurfacing	Complete	$0.64	X	X	X	
FL	Pedestrain overpass	Complete	$2.13	X	X	X	
FL	Traffic control system	Active	$0.67				
FL	Pedestrain overpass	Complete	$1.12	X	X	X	
FL	ITS Surveillance System	Active	$3.50				
FL	Pedestrain overpass	Complete	$0.97	X			
FL	I-95 rest area	Active	$9.29				
FL	Pedestrain overpass	Complete	$2.63	X			
FL	Add Thru Lanes	Active	$51.10				
FL	Resurfacing	Active	$6.60				
FL	St. John River bridge	Active	$2.63	X	X		
FL	Add Lanes & Rehab Pavement	Complete	$3.68	X	X	X	
FL	Widen bridge	Complete	$19.28	X	X	X	
FL	ITS Surveillance System	Complete	$1.58	X	X		
FL	Add Lanes & Rehab Pavement	Active	$2.36				
FL	Resurfacing	Active	$1.59				
FL	Safety Project	Active	$2.16				
FL	I-4 Aux Lane	Active	$13.96				
FL	Add Lanes	Active	$16.90				
FL	Sound Walls	Complete	$9.39	X	X	X	X
FL	ITS Surveillance System	Active	$6.00				
FL	ITS Surveillance System	Complete	$0.70	X			
FL	Pedestrain overpass	Active	$1.22				
FL	Resurfacing/Repave	Active	$0.36				
FL	ITS Surveillance System	Active	$1.35				
FL	Widening/Resurfacing	Active	$2.13				
FL	Access Improvement	Active	$4.93				
FL	Safety Project	Active	$0.42				
GA	I-95 Bryan County, N/O Jerico River to S/O US 17 (7.4 miles)	2/26/2003	$19.70				
GA	I-75 Turner-Crisp Cos., SR 159 to SR 300 (14.5 miles)	N/A	$51.90				
GA	I-75 Tift Co., N/O US-41 to the Turner Co. Line (8 miles)	N/A	$33.20				
GA	I-95 Glynn Co., Horse Stamp Church Road to US-17 (7 miles)	N/A	$27.50	X	X	X	
GA	Rest area reconstruction, Gwinnett and Franklin Counties	11/22/2002	$0.50	X	X		
GA	I-75 Lowndes Co., SR-133 to Cook Co. Line (13.7 miles)	N/A	$67.00				
HI	Kuihelani Highway on Maui	N/A	$15.00				
HI	Kamehameha Hwy, Kahuku Hospital drainage improvements	N/A	$0.00				
IN	#1 I-65, reconstruction--N. of SR 43 to S. OF US 24, Tippecanoe / White Co's	7/31/1999	$30.60	X			
IN	#2 I-65, reconstruction & Add Ln.-Cold Spring Rd. to I-465- Indianapolis, Marion Co.	10/1/2001	$76.50	X	X		
IN	#3 I-65, reconstruction& Add Ln.- 61 St. To I-80/94- Lake County	12/15/2000	$31.80	X	X		

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IN	#4 I-65, reconstruction & Add Ln.-61 St. Interchange to S. of US 30- Lake Co.	12/15/2001	$31.30	X	X		
IN	#5 I-65, reconstruct I-65 / US-30 Interchange-Merrillville-Lake Co.	6/1/2003	$29.90				
IN	#6 I-80/94, Reconstruct of Harrison and Clark Steet bridges over I-80/94- Lake Co..	11/1/2002	$5.50	X			
IN	#7 I-465 / I-70, Recostruction of Interchange in Indianapolis, Marion County	11/20/2002	$67.10	X	X		
IN	#8 I-80/94 reconstruction of Georgia and Chase bridges over I-80/94, Lake Co.	N/A	$6.00				
IN	#9 Midwest Steel Hwy Grade Separation, Porter Co	N/A	$6.40				
LA	Replace Tensas River bridge and Approaches, LA 4, Tensas Parish	N/A	$0.00				
MA	Route 3 North, from Route 128 to the NH border	N/A	$385.00				
MD	US113 from US50 to MD589, four-lane highway on new align, Worcester Co	10/10/2000	$10.34	X	X	X	X
MD	MD32 at Samford Rd, interchg constr, Anne Arundel Co	9/29/2001	$6.50	X	X	X	
MD	MD695 from I-97 to MD10, widening, Anne Arundel Co	5/20/2002	$9.40	X	X	X	
MD	MD32 at Airfield Rd, interchg constr, Anne Arundel Co	7/1/2003	$10.00				X
MD	US50 from US301to MD410, widening for HOV, Prince George's Co	12/19/2002	$19.00	X	X	X	
MD	US113 from Jarvis Rd to Delaware state line, dualization, Wicomico Co	TBD	$10.70				X
MD	US29 from Blackburn to Dustin Rd, widen/interchg improvements, Montgomery Co	TBD	$28.30				
MD	MD216 from US29 to I-95, new alignment, Howard Co	TBD	$20.40				
ME	Bath-Woolwich bridge Replacement	8/1/2000	$46.60	X	X	X	X
ME	I-295 Commercial Street Connector Project	N/A	$17.50				
MI	Detroit Freeway Management System, atms / ATIS	4/1/1997	$32.80	X	X	X	
MI	I-94 / Vining Rd Interchange	11/7/1997	$14.90	X	X	X	
MI	US 23 pavement rehab project	10/11/1997	$7.60	X	X	X	
MI	I-94 Frazho& Martin bridge Deck Replacement	8/1/1997	$1.73	X			
MI	I-96 Wixom bridge Deck Replacement	10/1/1997	$1.05	X			
MI	I-75 Gardenia bridge Superstructure replacement	10/1/1997	$0.85	X			
MI	I-69 Wadham bridge Superstructure replacement	10/1/1997	$0.64	X			
MI	I-94 Burns bridge Deck Replacement	9/1/1997	$1.14	X			
MI	US-24 Rouge R. bridge Deck Replacement	10/1/1997	$1.73	X			
MI	M-10 Lafayette & Us12 bridge Deck Replacement	7/1/1998	$3.54	X	X	X	
MI	M-10- Warren bridge Deck Replacement	7/1/1998	$2.04	X	X	X	
MI	M-10 Greenfield bridge Deck Replacement	6/1/1998	$2.06	X			
MI	I-75 Second bridge Deck Replacement	10/1/1997	$1.46	X			
MI	I-96 BL GTW RRbridge Deck Replacement	7/1/1998	$3.75	X			
MI	I-696 M-10 bridge Superstructure replacement	10/1/1998	$0.99	X	X	X	
MI	M-28 Ontonagon River bridge Deck Replacement	10/1/1998	$0.73	X			
MI	I-94 Rouge River B& GTW RRridge Superstructure replacement	10/1/1998	$4.90	X	X	X	
MI	US 131 - 84th Street Overpass - bridge replacement	10/1/1999	$3.30	X	X	X	
MI	I-94 Harper bridge Deck Replacement	10/1/1998	$1.55	X	X	X	
MI	Beaver Island Ferry boat	N/A	$2.40				
MI	I-275 reconstruction, 8.3 km, 5 Mile Road to I-696, Wayne and Oakland Co.	11/7/2001	$49.30	X	X	X	
MN	I-35 pavement rehabilitation	N/A	$7.70				
MN	US Highway 52 (ROC 52)	N/A	$232.00				
NJ	Route I-280 Access Ramps	6/24/1998	$4.60	X	X	X	X
NJ	Local bridge Projects 11th Ave & 14th St	10/1/1998	$1.83	X	X	X	X
NJ	Local bridge Projects Bordentown - Georgetown Rd	1/30/1998	$1.51	X	X	X	
NJ	Local bridge Projects Oakview Ave, Roosevelt and Westervelt Ave.	10/2/1998	$2.77	X	X	X	

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NJ	Route 29 Improvements - Tunnel	3/2/2002	$70.93	X	X	X	
NJ	Routes 50 & 322 Interchange reconstruction	9/29/2000	$8.42	X	X	X	X
NJ	Route 9, 25K	6/30/2002	$57.94	X	X	X	
NJ	Enhanced I&M stations	8/1/2000	$63.16	X			
NM	US 70 in Hondo Valley, Ruidoso Downs to Riverside, 37.9 miles	N/A	$129.50				
NM	NM 528 Bernalillo and Sandoval Counties	N/A	$19.10				
NV	Reno Transportation Rail Access Corridor Project	N/A	$170.70				
NY	New York City DOT, pedestrian safety project	5/1/2000	$1.00	X			
NY	New York City DOT, Belt Parkway / Ocean Parkway bridge	N/A	$1.00				
NY	Port Authority of NY and NJ - Traffic Surveillance on George Washington bridge	8/20/1999	$17.54	X			
NC	CARAT ITS project	12/31/2002	$13.75	X	X	X	
NC	Statewide wetland mitigation	12/7/2008	$31.10				
NC	Reconstruction of I-77 and programmatic use of D-B	10/11/2004	$70.90				
NC	I-26 reconstruction from NC 225 to NC 280	8/1/2005	$83.70				
NC	rehabilitation & widening of I-85 from US-29 to NC73 in Mecklenburg County	10/1/2005	$87.73				
NC	US 64 - Knightdale Bypass	8/1/2005	$131.02				
NC	SR-1128 Ruin Creek Road from Graham Ave (SR-1218) to Dabney Dr (SR-1304)	11/1/2004	$9.10				
OH	OTT/ERI-2-44.103/0.000 roadway mill and resurface, deck overlays	11/30/1998	$2.60	X			
OH	WYA-231-27.868; bridge replacement	6/30/1998	$0.50	X			
OH	LOR-252-8.738; bridge replacement	9/30/1999	$2.00	X			
OH	LAK 2-12.231 bridge replacement	1/1/1900	$2.00	X	X	X	
OH	TUS -800-36.967; bridge replacement	6/30/1999	$0.20	X			
OH	CHP / CLA-68-0.0024.441 ; 1.2 km of new 4-lane highway 3 structures	8/31/2000	$13.90	X	X	X	
OH	Toledo Lucas County marine passenger terminal	N/A	$0.00				
OH	VAN-US127-12.39, replace 3 bridge decks	8/31/2000	$1.01	X			
OH	ALL-IR075-29.548, replace Swaney Rd. bridge deck	6/30/2000	$0.67	X			
OH	LOR-IR090-10.76, 4 lane resurfacing & deck overlays	8/31/2002	$13.80	X			
OH	MED-IR271-0.00, complete pavement replacement	10/31/2001	$17.31	X	X	X	
OH	ATB-SR045-19.92, SR45 over IR90 bridge widening	8/1/2001	$2.96	X			
OH	STA-IR077-11.85, add 3rd lane & replace existing pavement	5/30/2003	$24.00	X	X	X	
OH	GUE-SR660-4.98, replace 2 bridges	8/31/2000	$0.47				
OH	MIA-IR075-7.948, add 3rd lane & replace existing pavement	5/20/2003	$45.48				
OH	PRE-IR070-0.00, pavement rehab & bridge work	10/15/2001	$20.53	X			
OH	GRE-US35J-0.00, pavement planning & overlay	10/15/2001	$10.50	X			
OH	HAM-IR071-11.08, pavement planning & overlay	8/15/2002	$10.80	X			
OH	HAM-IR275-32.27, pavement rehab & bridge work	7/31/2003	$29.50				
OH	HAM-IR471-00.26, pavement rehabilitation	6/15/2002	$15.40	X			
OH	ROS-SR159-0.00, pavement repair & overlay	11/15/2000	$2.29	X			
OH	NOB-IR077-6.22, joint replacement & concrete overlay	8/30/2001	$10.65	X			
OH	CUY-IR480-19.93, noisewall retrofit panels	9/30/2000	$2.52	X	X	X	
OH	MAH-11-16.04, bridge Deck replacements	10/30/2002	$4.14	X	X	X	
OH	ATH-33-10.41, bridge Deck rehabilitation	5/2/2002	$1.80	X	X	X	
OH	TRU-80-9.08, Pavement & bridge rehabilitation	6/30/2002	$4.93	X			
OH	TUS-77-3.94, Pavement & bridge rehabilitation	8/15/2002	$9.19	X	X	X	
OH	BEL-70-16.60, Sign Upgrading	6/30/2002	$0.83	X	X	X	
OH	ATB-11-23.33, bridge deck replacement	5/11/2002	$0.72	X			
OH	SAN-6-14.76, rehabilitate 3 bridges	8/31/2002	$1.80	X			
OH	SAN-20-14.86, bridge rehabilitation	10/31/2001	$0.80	X			
OH	POR-224-0.00, resurfacing and safety Upgrading	6/30/2002	$3.70	X	X	X	

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OH	PRE-40-1.33, bridge replacement	7/1/2002	$0.24	X			
OH	HAR-81-16.54, bridge deck replacement	6/30/2002	$0.33	X			
OH	MOT-4-4.83, bridge replacement	5/31/2002	$0.28	X			
OH	HEN-108-15.61, bridge rehabilitation	10/31/2002	$0.94	X			
OH	PAU-613-22.02, bridge replacement	10/31/2000	$0.57	X			
OH	FRA-71-14.39, Pavement rehabilitation, replacement, and safety upgrading	9/30/2001	$3.68	X	X	X	
OH	ALL-30-18.18, bridge Deck replacements	10/31/2001	$2.17	X			
OH	SUM-77-22.32, tower Lighting	10/30/2001	$1.67	X	X	X	
OH	HAN-103-16.57, bridge rehabilitation	7/5/2001	$0.46	X			
OH	ATB-11-25.16, bridge deck replacement	N/A	$9.26				
OH	SUM-77-15.47, bridge deck replacement and Painting	N/A	$1.41				
OH	DAR-705-11.02, culvert replacement	5/22/2003	$0.22				
OH	STA-77-0.00, resurfacing	N/A	$4.76				
OH	SUM-21-1.79, bridge widening	N/A	$1.00				
OH	GUE-77-7.68, bridge deck replacement and Painting	N/A	$2.00				
OH	PIC-22-17.03, bridge superstructure replacement	N/A	$2.73				
OH	TRU-11-9.08, Interchange Lighting	N/A	$2.07				
OH	TUS-77-7.55, 4 Lane Major rehab	N/A	$8.45				
OH	COS-16-7.18, culvert Replacement	N/A	$0.50				
OH	FRA-270-1.52, noise Wall replacement	N/A	$0.50				
OH	SEN-67-9.87, 2 Lane resurfacing	N/A	$1.43				
OH	Dist11-Wide-Sign, Replace Overhead Signs, Supports	N/A	$1.23				
OH	Dist11-Wide-Sign, Upgrade E1isting Signs	N/A	$1.32				
OH	MOT-48-5.16	N/A	$0.30				
OH	Dist2-Wide-Sign, District Wide Sign Upgrade	N/A	$0.30				
OH	HAN-37-10.81, bridge Repair, Deck Replacement	N/A	$0.40				
OH	FRA-270-17.47, noise Wall Replacement	N/A	$11.00				
OR	I-5 Surface Preservation	12/30/1999	$7.80	X	X		
PA	Wetland bank on US 220 project	N/A	$0.00				
PA	District 1 Warren Co, Expressway reconstruction	10/16/2001	$15.60	X	X	X	
PA	District 1 Veango Co., Bethel Sunville Rd., bridge Replacement	N/A	$0.00				
PA	District 1-0 Erie Land Lighthouse Restoration	N/A	$0.20				
PA	District 1-0 Warren County SR6-B04 bridge rehab and Replacement	N/A	$0.00				
PA	District 1-0 Erie County SR97-10M Betterment Project	N/A	$1.00				
PA	District 1-0 Mercer County SR62-10M Betterment Project	N/A	$1.80				
PA	District 2-0 Clearfield 53-A04 022C035 bridge Replacement	N/A	$0.00				
PA	Distict 2 Mifflin County 1005(A01), bridge over Kishacoquilas Creek	N/A	$5.50				
PA	District 2 McKean 6(A02&A03) bridges over Allegheny River and Railroad	N/A	$6.60				
PA	District 3-0 Tioga 0015-F13 037C1386 New 2 Lane bridge on SBL	7/27/2001	$8.60	X	X	X	
PA	District 3 Lycoming Deck Replacment on the Susquehana River bridge at Muncy	N/A	$9.00				
PA	District 4-0 Susquehanna 0706-570 045C034 Wyalusing Creek bridge	9/24/1998	$2.40	X	X	X	
PA	District 4-0 Wyoming 0029-770 047C026 Bowman's Creek bridge	N/A	$0.00				
PA	District 4 Luzerne, bridge Replacement Carey Ave	N/A	$27.50				
PA	District 4-0 Susquehanna 1037-570 bridge Replacement Dubois Creek	11/11/2001	$5.80	X			
PA	District 4-0 Susquehanna 0011-573 bridge Replacement Hallstead/Great Bend	N/A	$6.50				

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PA	District 4-0 Wayne 9911-BRG New bridge Church Street Honesdale	N/A	$0.00				
PA	District 4-0 Luzerne 9900-BRG Pedestian bridge Wilkes-Barre	12/20/2002	$0.50	X			
PA	District 4-0 Pike 0434-470 bridge Replacement Sholola bridge	N/A	$0.00				
PA	District 4-0 Pike 1011-470 bridge Replacement Pond Eddy bridge	N/A	$0.00				
PA	District 4-0 Luzerne 2010-371 bridge Replacement	N/A	$0.00				
PA	District 4-0 Lackawanna 2003-250 bridge Replacement Cortez Road	N/A	$0.00				
PA	District 4-0 Susquehanna 547-571 bridge Replacement	N/A	$0.00				
PA	District 5-0 Lehigh 0078-07M Emergency Superstructure Replacement	11/20/2000	$3.10	X	X	X	
PA	District 5-0 Schuylkill 0081-02B bridge Replacement	N/A	$3.70				
PA	District 6-0 Chester 0029-50S 062C050 bridge Replacement	N/A	$1.00				
PA	District 6-0 Bucks 2006-02S 061C102 Deck Replacement	N/A	$2.10				
PA	District 8-0 Cumberland 0081 Section 27	11/16/2001	$9.00	X	X	X	X
PA	District 8-0 York 30 Expressway PM	10/25/2001	$2.60	X	X	X	X
PA	District 9-0 Bedford 30-13B Everett Bypass bridge Replacement	11/2/2000	$0.50	X	X	X	X
PA	District 9-0 Somerset 56-12B Replacement of 69 foot Pipe culvert	9/7/2000	$0.20	X			
PA	District 9-0 Cambria 22-CP3 Trace and RR bridge rehabilitation	8/29/2001	$1.30	X			
PA	District 9-0 Cambria Improve roads and parking facilities St. Francis College	10/28/1999	$0.70	X			
PA	District 9-0 Somerset 0219-022 4-lane pavement rehab w/ structures	N/A	$0.00				
PA	District 9-0 Somerset 0219-023 4-lane pavement rehab w/ structures	1/18/2002	$10.70	X	X	X	X
PA	District 9-0 Blair County SR9900 Prefab structure on ped/bike trail	N/A	$0.00				
PA	District 9-0 Huntingdon County SR 6900 Prefab structure on ped/bike trail	N/A	$0.00				
PA	District 9-0 Somerset 0219-024 4-lane pavement rehab w/ structures	N/A	$9.90				
PA	District 10-0 Jefferson 0830-0590 Access Brige overpass of I-80	N/A	$3.00				
PA	District 10-0 Indiana 0954 104C033 Two Lick bridge	N/A	$0.00				
PA	District 11-0 Allegheny 4003-A03 Nelson Run bridge	N/A	$0.00				
PA	District 11-0 Lawrence 3009-L04 Hickory Run bridge	N/A	$0.00				
PA	District 11-0 Beaver County 1022-B02 13th Street Blockhouse Run bridge	N/A	$1.10				
PA	District 11-0 Frazier Heights Interchange with developer	N/A	$0.00				
PA	District 11-0 Allegheny/Beaver Counties SR0060-A32&B20 2-bridge Deck Repl.	N/A	$10.70				
PA	District 11-0 Allegheny County Convention Center Infrastructure Phase III	N/A	$8.90				
PA	District 12-0 Fayette 201-06R TR 201 Rest Connellsville	N/A	$1.70				
PA	District 12-0 westmoreland 0066-R10 Appolo bridge	N/A	$6.30				
SC	Bridge Replacements- Reedy Creek, Enoree River	7/2/1997	$2.84	X	X		
SC	Bridge Replacement - Wateree River	8/1/1998	$7.86	X	X	X	
SC	Bridge Replacement - Stono Creek	N/A	$0.00				
SC	Conway Bypass	Dec. 2001	$386.30	X	X		
SC	Carolina Bays Parkway	6/1/2002	$225.40	X	X	X	

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SC	SC 170 widening	3/1/2003	$65.70				
SC	Cooper River bridge Repl.	7/2/2005	$531.30				
SD	Reconstruction of I-229 from Western Ave. to Benson Rd. in Siou1 Falls	7/15/2002	$32.40	X	X	X	
TX	Texas Turnpike Authority - US183A and SH130	N/A	$986.30				
TN	MPW Nashville and Davidson County, ITS Parking and Traffic Guidance System	N/A	$2.10				
UT	ITS Traffic Operations Center project	10/31/1998	$4.57	X	X	X	
UT	ITS Interim traffic control System	12/31/1997	$1.50	X	X		
UT	I-15 reconstruction Project	7/15/2001	$1,325.00	X	X	X	
UT	Legacy West Davis Highway , Farmington to Salt Lake City, 19.3 km	TBD	$312.50				
UT	SR-176 lake Powell vehicle / passenger ferry system	12/1/2000	$2.65	X			
UT	12300 South Interchange	TBD	$65.50				
UT	11400 South Interchange	TBD	$25.80				
VA	Safety rest area / Welcome Center - NB I-85 (Mecklenburg County)	3/27/2002	$2.65	X	X	X	
VA	Safety rest area / Welcome Center - EB I-64 (New Kent County)	N/A	$7.90				
VA	Coalfields Expesseway	N/A	$1,600.00				
VA	Route 288 (I-64/288 interchange and I-64 to rt.250 connection)	10/30/2003	$236.00				
VA	Highway Advisory Radio, I-81 Pulaski, Montgomery, Roanoke & Botetourt counties	N/A	$1.00				
VI	Marine Cargo Terminal at Enighed Pond	N/A	$0.00				
WA	SR 500 and Thurston Way - new interchange	10/7/2002	$22.73	X	X	X	
WI	CIty of Milwaukee, Menominee Valley Viaduct	9/9/2002	$49.75	X	X		
	SUM		$13,934	140	86	69	17

Note: Highlighting indicates projects for which project surveys were received.

C-2 List of Design-Bid-Build Comparable Projects

State	Design-Bid-Build Project	Final Cost (Millions)	Design-Build Comparable	Final Cost (Millions)
AK	Parks Highway, MP 37-30	$15.50	Whittier tunnel	$57.00
CO	I-70, Pretoria East	$10.70	I-70 reconstruction, MP 336.8 for 11.4 miles	$20.66
CO	I-70, Cedar Point East	$16.50	I-76 Reconstruction, MP 418 - 427, Hudson to Keensburg	$1.20
CO	I-70, Strasburg East	$17.10	I-25 near Wellington, CO, 27 km roadway reconstruction	$26.33
FL	Turnpike Partial Interchange at Atlantic Boulevard	$3.40	Interchange	$2.05
FL	I-95 HOV Reconstruction (niose wall portion)	$1.30	Sound Walls	$9.39
MD	US 113 from MD 589 to Jarvis Road	$18.60	US50 from US301to MD410, widening for HOV, Prince George's Co	$19.00
MD	US 29, from I-70 to MD 100	$11.00	MD32 at Airfield Rd, interchg constr, Anne Arundel Co	$10.00
MD	US 29 Interchange at Hopkins/Gorman Road	$18.90	US113 from Jarvis Rd to Delaware state line, dualization, Wicomico Co	$10.70
ME	Casco Bay Bridge	$143.90	Bath-Woolwich bridge Replacement	$46.60
NJ	Route I-280, Section 7W	$12.00	Route I-280 Access Ramps	$4.60
NJ	Lumberton Vincentown Road Bridge Replacement	$1.30	Local bridge Projects 11th Ave & 14th St	$1.83
NJ			Local bridge Projects Bordentown - Georgetown Rd	$1.51
NJ			Local bridge Projects Oakview Ave, Roosevelt and Westervelt Ave.	$2.77
NJ	Route 73, Section 5C/Route 30, Sections 1E, 12B	$12.50	Routes 50 & 322 Interchange reconstruction	$8.42
PA	District 8-0 Franflin & Cumberland 0081 Section 025	$7.20	District 8-0 Cumberland 0081 Section 27	$9.00
PA	District 8-0 York 0030 Section 32/34	$2.10	District 8-0 York 30 Expressway PM	$2.60
PA	Tyrone Viaduct Rehabilitation/Maloy Street Rehabilitation	$5.30	District 9-0 Bedford 30-13B Everett Bypass bridge Replacement	$0.50
PA	S.R. 0219-018 Boswell Resurfacing, Somerset County	$18.00	District 9-0 Somerset 0219-023 4-lane pavement rehab w/ structures	$10.70
	SUM - Design-Bid-Build Projects	$315.30	SUM - Design-Build Comparables	$244.85

Note: Highlighting indicates projects representing the most similar projects to design-build comparables and the most complete data.

APPENDIX D

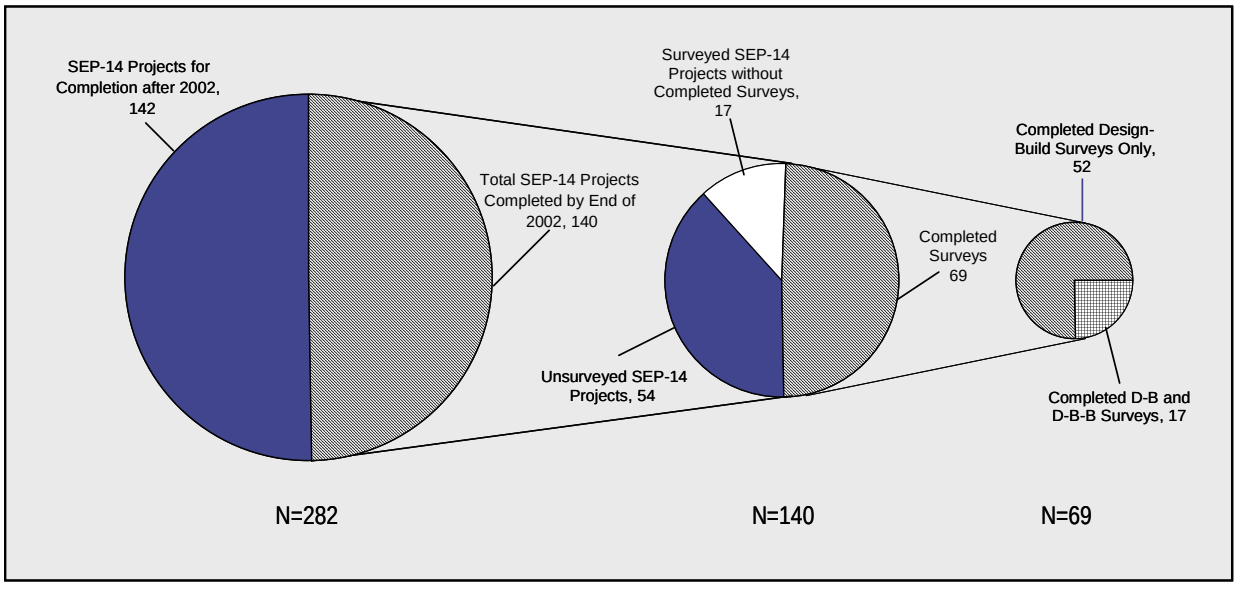
SURVEY DISTRIBUTION AND RESPONSE RATES

Program and project surveys were conducted on the fall of 2003 and the summer of 2004. The program surveys focused on the individual state design-build programs while the project surveys focused on selected design-build projects and comparable design-bid-build surveys completed by responding states participating in the SEP-14 program. This appendix describes the distribution and response rates for the design-build program and project surveys conducted for this study relative to universe of SEP-14 design-build programs and projects completed by the end of 2002.

By end of 2002, there were 282 design-build projects in the SEP-14 program, including projects already completed and those planned for completion after 2002. These 282 projects represented a capital program of $14 billion. Out of these 282 design-build projects, 140 projects (50-percent) were completed by the end of 2002. Of these 140 projects, 86 projects (61-percent) were selected for survey and 69 of these surveyed projects (80-percent) produced completed project surveys and 17 comparable design-bid-build project surveys (20-percent), based on project type, size, sponsoring organization. Out of the 17 returned D-B-B project surveys, 11 contained sufficient data to permit detailed analysis of project duration and cost by project phase.

Exhibit D.1 shows the breakdown of project surveys distributed and completed relative to the number of SEP-14 design-build projects completed by the end of calendar year 2002.

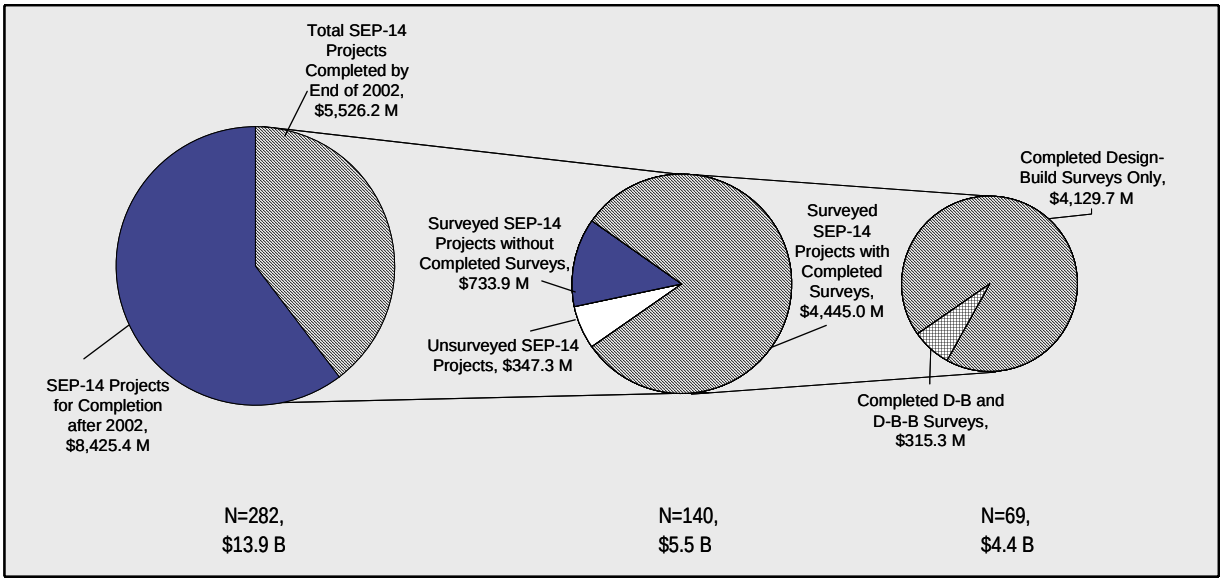
Exhibit D.1 Distribution of the Number of SEP-14 Design-Build Projects Surveyed and Completed Design-Build and Design-Bid-Build Surveys



* Design-Build Projects Approved Under SEP-14, Federal Highway Administration, July 2003

Out of $13.9 billion in total potential SEP-14 projects, $5.5 billion (40-percent) were completed by the end of calendar year 2002. Of this amount, $5.2 billion (94-percent) in completed projects were selected for survey. Completed design-build project surveys were returned representing $4.1 billion in project costs or 75-percent of completed project costs. $315 million worth of design-bid-build projects were also completed and retuned, which is 8-percent of the value of completed design-build surveys. Exhibit D.2 shows the cost breakdown of project surveys distributed and completed relative to the cost of SEP-14 design-build projects completed by the end of calendar year 2002.

Exhibit D.2 Distribution of the Cost of SEP-14 Design-Build Projects Surveyed and Completed design-build and Design-Bid-Build Surveys



* Design-Build Projects Approved Under SEP-14, Federal Highway Administration, July 2003

Exhibit D.3 shows the composition of surveys distributed and completed relative to the number of SEP-14 design-build projects by project type. As shown in Exhibit D.3, the sampling of design-build projects completed by the end of calendar year 2002 shows a fairly consistent numerical distribution by type of project in going from total completed projects to surveyed projects to completed surveys. In each group, Bridge/Tunnel and Road-New/Widen project types predominate. Only for the limited sample of design-bid-build projects does the distribution significantly change, with the Road-Rehabilitate/Reconstruct project type becoming more predominant. In terms of the cost categories of projects surveyed, there is also consistency in going from total completed projects to surveyed projects to completed surveys, with the $2-10 million category predominating, followed by the under $2 million and $10-50 million categories. In the case of the completed design-bid-build surveys, the $10-50 million category predominates. The Road-Rehabilitation/Reconstruction project category makes up most of this project sample.

Exhibit D.4 shows the composition of surveys distributed and completed relative to the cost of SEP-14 design-build projects by project type. As shown in Exhibit D.4, the sampling of design-build projects completed by the end of calendar year 2002 shows a fairly consistent cost distribution by type of project in going from total completed projects to surveyed projects to

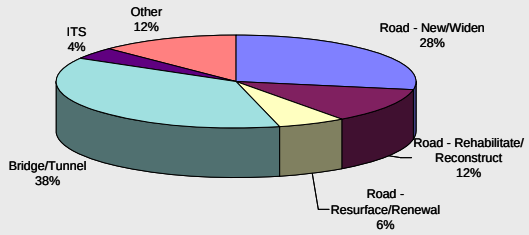
completed surveys. In each group, Road-New/Widen and Road-Rehabilitate/ Reconstruct project types predominate. Only for the limited sample of design-bid-build projects does the distribution significantly change, with the Bridge/Tunnel project type becoming more predominant. In terms of the cost categories of projects surveyed, there is also consistency in going from total completed projects to surveyed projects to completed surveys, with the over $100 million category predominating. This reflects the frequent use of design-build to delivery very large projects that are more difficult to produce under traditional project delivery approaches. In the case of the completed design-bid-build surveys, the $10-50 million category becomes more significant, reflecting the smaller typical size of design-bid-build projects.

The distribution and response rates for the program and project surveys were fairly high for the length and complexity of the survey instruments used. Only the comparable design-bid-build survey response rate was relatively low. Exhibits D.3 and D.4 show that the survey sample and completed projects are highly representative of the major types and sizes of design-build projects completed by the end of 2002 under the Sep-14 program. This suggests that the findings produced by the study surveys are fairly typical of design-build projects in the Federal-aid highway program.

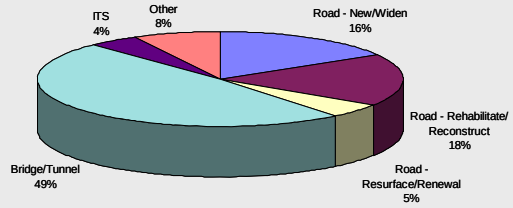
Exhibit D.5 consists of a series of tables containing the number and percent distribution of projects surveys relative to the SEP-14 program, survey sample, and completed surveys, broken down by type and size of project.

Exhibit D.3 Composition of Surveys Distributed and Completed by Project Type and Size (relative to the number of projects)

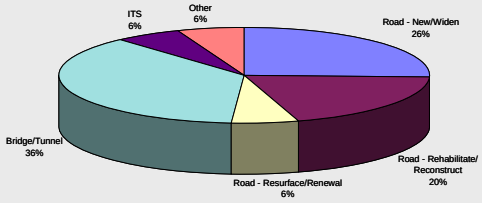
All SEP-14 Projects by Type (Percentage of Number of Projects) N=282



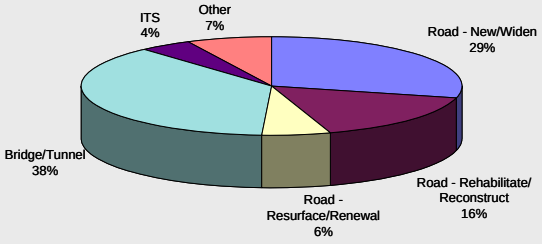
SEP-14 Projects Completed by End of 2002 by Type (Percentage of Number of Projects) N=140



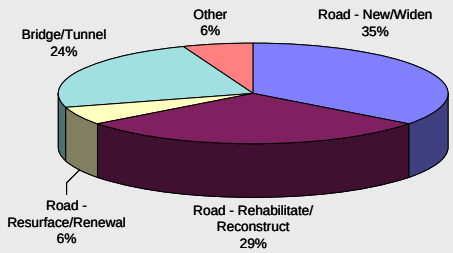
SEP-14 Projects Included in Survey Sample by Type (Percentage of Number of Projects) N=86



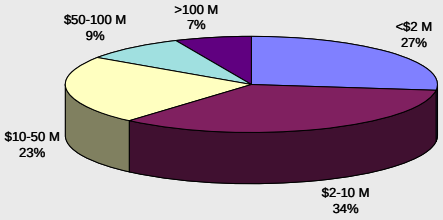
SEP-14 Projects with Completed Design-Build Surveys by Type (Percentage of Number of Projects) N=69



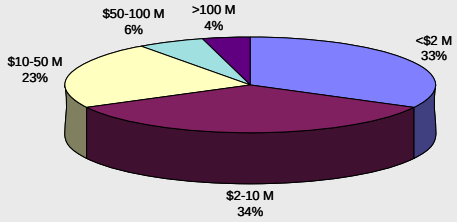
SEP-14 Projects with Completed Design-Bid-Build Surveys by Type (Percentage of Number of Projects) N=17



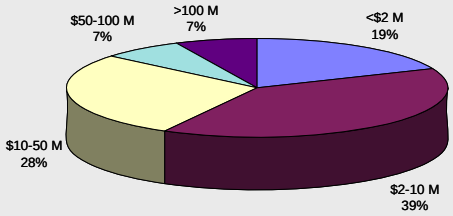
All SEP-14 Projects by Size (Percentage of Number of Projects) N=282



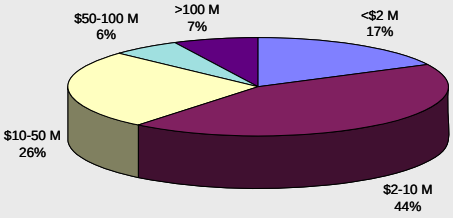
SEP-14 Projects Completed by End of 2002 by Size (Percentage of Number of Projects) N=140



SEP-14 Projects Included in Survey Sample by Size (Percentage of Number of Projects) N=86



SEP-14 Projects with Completed Design-Build Surveys by Size (Percentage of Number of Projects) N=69



SEP-14 Projects with Completed Design-Bid-Build Surveys by Size (Percentage of Number of Projects) N=17

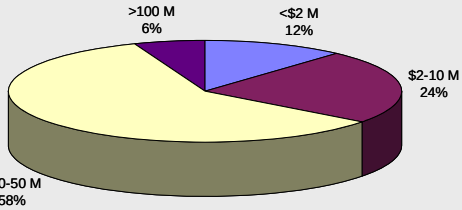
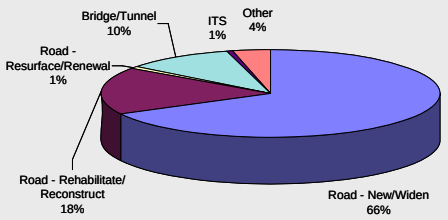
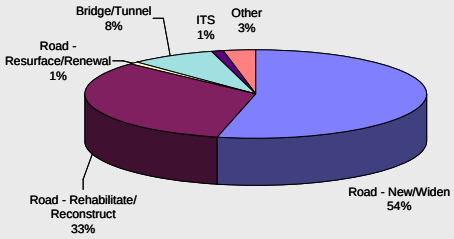


Exhibit D.4 Composition of Surveys Distributed and Completed by Project Type and Size (relative to project costs)

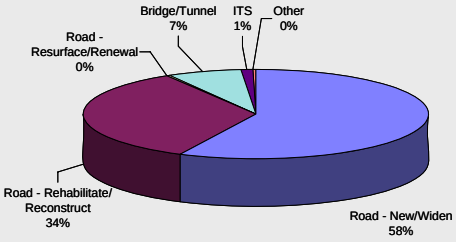
All SEP-14 Projects by Type (Percentage of Dollars Expended) N=282/$14.0 Billion



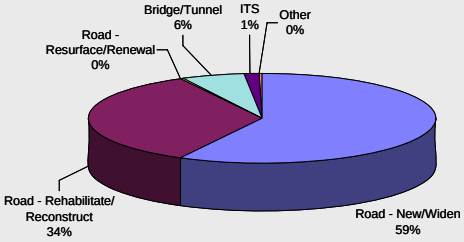
SEP-14 Projects Completed by End of 2002 by Type (Percentage of Dollars Expended) N=140/$5.5 Billion



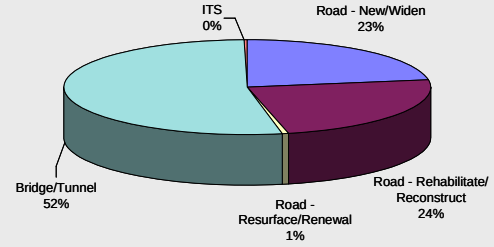
SEP-14 Projects Included in Survey Sample by Type (Percentage of Dollars Expended) N=86/$5.2 Billion



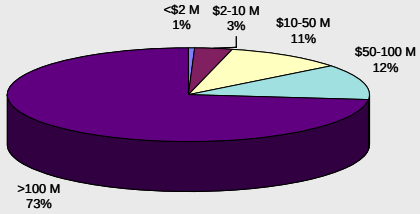
SEP-14 Projects with Completed Design-Build Surveys by Type (Percentage of Dollars Expended) N=69/$4.5 Billion



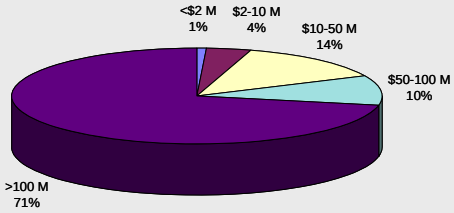
SEP-14 Projects with Completed Design-Bid-Build Surveys by Type (Percentage of Dollars Expended) N=17/$0.3 Billion



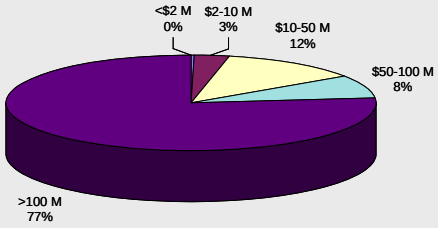
All SEP-14 Projects by Size (Percentage of Dollars Expended) N=282/$14.0 Billion



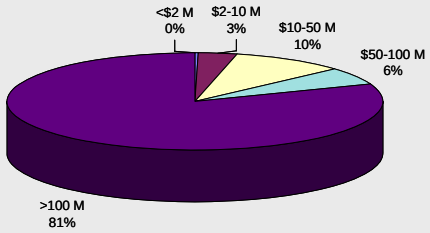
SEP-14 Projects Completed by End of 2002 by Size (Percentage of Dollars Expended) N=140/$5.5 Billion



SEP-14 Projects Included in Survey Sample by Size (Percentage of Dollars Expended) N=86/$5.2 Billion



SEP-14 Projects with Completed Design-Build Surveys by Size (Percentage of Dollars Expended) N=69/$4.5 Billion



SEP-14 Projects with Completed Design-Bid-Build Surveys by Size (Percentage of Dollars Expended) N=17/$0.3 Billion

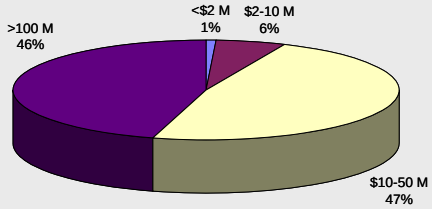


Exhibit D.5 Distribution of SEP-14 Projects Included In Study Surveys

Total SEP-14 Design-Build Projects - Proposed, Active, and Completed					
Project Type	**Number**	**%**	**Cost ($000)**	**%**	**$/Project**
Road - New/Widen	78	28%	$9,390.5	67%	$120.4
Road - Rehabilitate/Reconstruct	35	12%	$2,447.8	18%	$69.9
Road - Resurface/Renewal	17	6%	$105.1	1%	$6.2
Bridge/Tunnel	105	37%	$1,432.4	10%	$13.6
ITS	12	4%	$74.0	1%	$6.2
Other	35	12%	$501.7	4%	$14.3
Total	282	100%	$13,951.6	100%	$49.5
Project Size	**Number**	**%**	**Cost ($000)**	**%**	**$/Project**
<$2 Million	76	27%	$72.7	1%	$1.0
$2-10 Million	97	34%	$479.6	3%	$4.9
$10-50 Million	65	23%	$1,472.9	11%	$22.7
$50-100 Million	25	9%	$1,683.8	12%	$67.4
>$100 Million	19	7%	$10,242.6	73%	$539.1
N/A	0	0%	$0.0	0%	$0.0
Total	282	100%	$13,951.6	100%	$49.5

SEP-14 Design-Build Projects - Completed by 2002					
Project Type	**Number**	**%**	**Cost ($000)**	**%**	**$/Project**
Road - New/Widen	23	16%	$2,964.0	54%	$128.9
Road - Rehabilitate/Reconstruct	25	18%	$1,847.8	33%	$73.9
Road - Resurface/Renewal	7	5%	$31.3	1%	$4.5
Bridge/Tunnel	68	49%	$456.2	8%	$6.7
ITS	6	4%	$54.9	1%	$9.2
Other	11	8%	$172.0	3%	$15.6
Total	140	100%	$5,526.2	100%	$39.5
Project Size	**Number**	**%**	**Cost ($000)**	**%**	**$/Project**
<$2 Million	46	33%	$45.3	1%	$1.0
$2-10 Million	48	34%	$209.8	4%	$4.4
$10-50 Million	32	23%	$748.9	14%	$23.4
$50-100 Million	8	6%	$548.0	10%	$68.5
>$100 Million	6	4%	$3,974.2	72%	$662.4
N/A	0	0%	$0.0	0%	$0.0
Total	140	100%	$5,526.2	100%	$39.5

Exhibit D.5 Distribution of SEP-14 Projects Included in Study Surveys (continued)

Surveyed Completed Design-Build Projects					
Project Type	**Number**	**%**	**Cost ($000)**	**%**	**$/Project**
Road - New/Widen	22	26%	$2,961.8	57%	$134.6
Road - Rehabilitate/Reconstruct	17	20%	$1,764.3	34%	$103.8
Road - Resurface/Renewal	5	6%	$16.0	0%	$3.2
Bridge/Tunnel	32	37%	$365.5	7%	$11.4
ITS	5	6%	$54.2	1%	$10.8
Other	5	6%	$17.1	0%	$3.4
Total	86	100%	$5,178.9	100%	$60.2
Project Size	**Number**	**%**	**Cost ($000)**	**%**	**$/Project**
<$2 Million	16	19%	$19.9	0%	$1.2
$2-10 Million	34	40%	$159.7	3%	$4.7
$10-50 Million	24	28%	$619.1	12%	$25.8
$50-100 Million	6	7%	$404.5	8%	$67.4
>$100 Million	6	7%	$3,975.7	77%	$662.6
N/A	0	0%	$0.0	0%	$0.0
Total	86	100%	$5,178.9	100%	$60.2

Completed Design-Build Surveys					
Project Type	**Number**	**%**	**Cost ($000)**	**%**	**$/Project**
Road - New/Widen	20	29%	$2,567.7	58%	$128.4
Road - Rehabilitate/Reconstruct	11	16%	$1,530.8	34%	$139.2
Road - Resurface/Renewal	4	6%	$14.5	0%	$3.6
Bridge/Tunnel	26	38%	$263.8	6%	$10.1
ITS	3	4%	$51.1	1%	$17.0
Other	5	7%	$17.1	0%	$3.4
Total	69	100%	$4,445.0	100%	$64.4
Project Size	**Number**	**%**	**Cost ($000)**	**%**	**$/Project**
<$2 Million	12	17%	$14.8	0%	$1.2
$2-10 Million	30	43%	$142.6	3%	$4.8
$10-50 Million	18	26%	$437.3	10%	$24.3
$50-100 Million	4	6%	$260.9	6%	$65.2
>$100 Million	5	7%	$3,589.4	81%	$717.9
N/A	0	0%	$0.0	0%	$0.0
Total	69	100%	$4,445.0	100%	$64.4

Exhibit D.5 Distribution of SEP-14 Projects Included in Study Surveys (continued)

Completed Design-Bid-Build Surveys					
Project Type	**Number**	**%**	**Cost ($000)**	**%**	**$/Project**
Road - New/Widen	6	35%	$71.1	23%	$11.9
Road - Rehabilitate/Reconstruct	5	29%	$74.8	24%	$15.0
Road - Resurface/Renewal	1	6%	$2.1	1%	$2.1
Bridge/Tunnel	4	24%	$166.0	53%	$41.5
ITS	0	0%	$0.0	0%	$0.0
Other	1	6%	$1.3	0%	$1.3
Total	17	100%	$315.3	100%	$18.5
Project Size	**Number**	**%**	**Cost ($000)**	**%**	**$/Project**
<$2 Million	2	12%	$2.6	1%	$1.3
$2-10 Million	4	24%	$18.0	6%	$4.5
$10-50 Million	10	59%	$150.8	48%	$15.1
$50-100 Million	0	0%	$0.0	0%	$0.0
>$100 Million	1	6%	$143.9	46%	$143.9
N/A	0	0%	$0.0	0%	$0.0
Total	17	100%	$315.3	100%	$18.5

APPENDIX E

SURVEY INSTRUMENTS AND RELATED DOCUMENTATION

E.1 Email Cover Letter

From: Design-Build Study Team
Sent: Monday, October 20, 2003
To: State Transportation Agency Design-Build Program Managers
Subject: Request for Assistance Regarding FHWA Design-Build Study for Congress

This correspondence announces the long-awaited Program and Project surveys and instructions for the Design-Build Study for Congress being sponsored by the Federal Highway Administration, described below. The survey process is intended to be paperless. Therefore all communication is being done by e-mail, while the survey process is being handled through a website at the University of Colorado at Boulder.

Information on the study and each of the survey forms can be found on the study website, http://construction.colorado.edu/design-build/. To access the survey files, you will need to use the following user name and password:

User name: flastname
Password: xxdot

This has been done to limit access to the survey forms to only those individuals designated to complete the surveys for each participating state and project.

Attached to this e-mail message are several pdf files. One file contains an official Request for Assistance letter which can be used to inform agency leadership that may have to approve staff commitments to this effort, as well as project staff that will be asked to complete the Project Surveys. Another file contains Survey Instructions. These files are attached to enable you and your designated staff to get prepared to complete the surveys and understand which projects are to be reported on, before actually beginning the on-line survey effort. If you need software to download the pdf files, please use the following link to obtain the necessary software from the Adobe Company: http://www.adobe.com

Please note that only states involved in the SEP-14 Program are being asked to complete the Program Survey. Also, only those states with design-build projects completed by the end of calendar year 2002 are being asked to complete Project Surveys for a selected number of these projects - as well as a comparable design-bid-build project (selected at your discretion) for each design-build project included in the study sample. The states and sampled projects are listed in the project website by clicking on the word: Survey, on the Design-Build Program and Project Survey section of the Home page, and then clicking on the Proceed to Program Survey and Proceed to Project Survey boxes, respectively.

Please have all requested surveys completed and submitted to the study

website on or before Friday, November 21, 2003. A member of the project Research Team, Dan Dornan, Keith Molenaar, Nate Macek, or Jennifer Shane will call to confirm the receipt of this email and answer any questions.

Thank you for your assistance in helping the FHWA-sponsored Research Team obtain the design-build program and project information essential to this important study effort. If you have any questions, please contact the Research Team at: Design-Build@construction.colorado.edu.

Sincerely,
Gerald Yakowenko, P.E.
FHWA Contract Administration Group
Office of Program Administration, HIPA-30

Daniel Dornan, P.E.
Research Team Project Manager
AECOM Consult, Inc.

Keith Molenaar, Ph.D.
Research Team Analyst
University of Colorado

(See attached file: Letter of Assistance.pdf)
(See attached file: Survey Instructions.pdf)

E.2 Letter of Assistance

TO: State Transportation Agency Design-Build Program Coordinators

FROM: The FHWA / SAIC Design-Build Study Research Team

DATE: October 2003

RE: Request for Assistance Regarding FHWA Design-Build Study for Congress

This letter requests your assistance helping the Federal Highway Administration (FHWA) respond to one of the requirements of the Transportation Equity Act for the 21st Century (TEA-21). This study has significant potential to help both FHWA and state transportation agencies (STAs) across the nation address one of the burning questions regarding the delivery of highway capital projects: what are the measurable differences between projects delivered using a design-build, as opposed to design-bid-build, delivery method. We hope you will appreciate the need for your assistance and the value of this effort for both your agency and other STAs. Before you decide on the merits of this request, please consider the following background information.

Background

While awaiting Congressional reauthorization of the federal highway trust fund, we are reminded that highway funding has not kept up with the needs. Consequently Congress and the Federal Highway Administration have encouraged the development and application of innovative techniques to leverage available transportation program funds and streamline the highway project development process. These include the use of innovative contracting approaches. Among these is the ***design-build*** project delivery approach.

In recent years there has been a lot of discussion about the advantages and disadvantages of the ***design-build*** project delivery approach. Proponents proclaim its advantages in terms of cost, timeliness, or quality. Opponents point out potential disadvantages in terms of contract development and administration, project control, and industry impacts.

Both sides have good reasons for their positions and are sincere in their views. Unfortunately there is more conjecture than fact behind these strongly-held views. Much of this is driven by agency and industry reluctance to change from a proven technique that has worked all these years - the more traditional ***design-bid-build*** approach.

Have you ever considered:

• *Whether one of these project development approaches is truly better than the other, in terms of cost, schedule, and quality?*

• *Whether certain types and characteristics of projects make them more suitable for design-build versus design-bid-build?*

• *What is the impact on the local design and construction firms when the design build approach is used, particularly smaller firms?*

• *Under what terms and conditions might one approach be preferred to the other?*

Members of AASHTO and the design and construction industries have also considered these same questions. The problem is that no definitive study has been conducted to address these issues. The subject is complex and requires in-depth information regarding state design-build programs and completed design-build projects. In addition, this information should be collected in an objective and unbiased manner based on actual program and project results from agencies such as yours.

We ask for your agency's involvement through its participation in one element of the study's fact-finding effort – namely completing several web-based surveys that are available on the study website (noted below).

There is no financial cost to your agency—FHWA is fully funding the study effort and therefore the study results will be available to all participants for no charge. The study report is due in the spring of 2004—before reauthorization—and will be made available to participating agencies upon completion.

The ultimate sponsor of the study is the U.S. Congress, with the Federal Highway Administration serving as administrator. The intended audience for the study report is the U.S. Congress and all stakeholders in the funding and development of highway capital projects, particularly those projects using federal funds.

With the Congressional mandate and the strong backing of the FHWA, we hope to have gained your commitment to participate in this important study effort. We assure you that this is not just another troublesome survey request but a valuable and objective fact-finding effort to produce usable results for all involved in developing our nation's highway system. The nature of the assistance being requested is described below. We have endeavored to streamline the fact-finding process as much as possible, while remaining true to the requirements of TEA-21 and Congress for this study.

Nature of Assistance Requested

In 1997, TEA-21 ushered in a new funding program for the nation's surface transportation systems. Section 1307 (f) of the act requires a comprehensive national study to evaluate the effectiveness of design-build contracting in the Federal-Aid highway program, with the results subsequently reported to Congress. The report to Congress will comprise the results of an extensive literature search, interviews with key stakeholders in the Federal-Aid highway program and the SEP-14 program, and surveys of state transportation agency representatives with design-build program or project experience.

Each STA with design-build experience under the SEP-14 program is requested to complete a design-build Program Survey. In addition, those states that have completed at least one design-build project (as of the end of calendar year 2002) are asked to complete a Project Survey for a select sample of these projects. For comparative purposes, respondents are also asked to identify a similar design-bid-build project for each design-build project reported on, where available. Completion of a separate survey is requested for each of these comparable projects.

Survey Completion Process

The survey process is intended to be paperless to facilitate ease of completion, submittal, and tabulation of results. To this end, the Research Team[1] developed a website specifically for this study. The study website can be reach at the following address: **http://construction.colorado.edu/design-build/**.

This website provides public access to the following information:

• A description of this study;

• A virtual library of resource materials relating to design-build, including some that are accessible from the site in pdf format; and

• A listing of useful web sites on design-build, including state DOT websites.

Several activities on this website require a user name and password. This includes access to the following listings, which include the survey forms to be used by study participants:

• Design-build program contacts for each state participating in the SEP-14 Program (whether or not they have a design-build project completed prior to 2003).

• Sample of design-build projects for each state for which completed surveys are requested.

• Design-build program survey form.

• Project-specific survey form for design-build projects and design-bid-build projects.

The password limits access to the survey forms to those individuals designated to complete the surveys for each participating state.

Survey Instructions – Next Steps

The person identified as the primary point of contact for each agency's design-build program is being requested to complete the Program Survey on the website, following the instructions provided in an attached memo. We are also requested the state agency's Design-Build Program coordinator to assign individual staff to complete each of the project surveys, with one survey for each of the sample design-build projects listed and a comparable design-bid-build project that can be identified. Staff respondents should be those persons most familiar with these projects. Information and directions for designated survey respondents are also being sent to each participating state agency.

Both the Program Survey and the Project Survey can be completed by more than one person, if necessary, so long as all respondents are given user names and passwords. Additional user names and passwords can be established for your agency per your request by emailing **Design-Build@construction.colorado.edu**. These additional respondents will have the ability to view the Program Survey and edit the Project

[1] The research team for this effort consists of AECOM Consult, Inc. and the University of Colorado at Boulder's Construction Engineering & Management Program, working under a competitive open contract between SAIC, Inc. and FHWA.

Survey(s). The surveys are also designed to allow respondents to complete portions of the survey at different times, and then submit the completed survey when done. The website will let respondents know when the survey form is completed and ready for submission. ***All surveys should be completed and submitted on the designated website – we are requesting that respondents do not attempt to print out the survey forms, fill them out by hand, or mail them in.***

Please have all requested surveys completed and submitted to the study website on or before **Friday, November 21, 2003**. Thank you for your support in helping the Research Team assess the effectiveness of the design-build project delivery process in the Federal-Aid highway program. Thank you for encouraging agency staff to complete the program and project surveys on the study website. If you have any questions regarding the study or this request for assistance, please call either Dan Dornan (Study Project Manager) or me at the numbers listed below.

Sincerely,

Gerald Yakowenko, P.E.
FHWA Contract Administration Group
Office of Program Administration, HIPA-30

Daniel Dornan, P.E.
Research Team Project Manager
AECOM Consult, Inc.

E.3 Survey Instructions

To: State Transportation Agency Design-Build Program Coordinator

From: FHWA-Sponsored Design-Build Study Research Team

Date: October 2003

Re: **Instructions for Completing Survey(s) Relating to Design-Build Study for Congress**

Background Information

Two web-based surveys have been developed to streamline the data collection effort for this study: 1) Program Survey, and 2) Project Survey. To participate in the survey, users will need to register on the website. The Design-Build Study website (located at the University of Colorado at Boulder) is: **http://construction.colorado.edu/design-build/.** Use this website to login to the system and complete the appropriate survey(s), as well as to view details regarding the Design-Build Study for Congress and to access a vast array of design-build information. To login to the section of the website that contains the study surveys, use the unique ***user name*** and ***password*** provided to you in the e-mail message that conveyed this file.

User Profile Information

There are 2 types of respondents for this set of surveys.

1. **Adm** - The person who is the lead respondent for the agency, the Program Contact. This person can edit both the Program Survey and Project Survey(s) and is responsible for providing the Design-Build Study Team with names and email addresses for other persons within the agency who will complete the Project Survey(s).
2. **Usr** - A person designated by the Adm to complete one or more Project Surveys for his or her agency. This person can view both the Program Survey and Project Survey(s) for the agency as well as edit the agency's Project Survey(s) as designated by Adm. There may be multiple Usr respondents for each agency/project.

There are 2 features available to each respondent. The first feature allows for the respondent to edit their profile, including changing his or her password. This can be achieved once signed in to the system simply by clicking on the respondent's name on the right side of the screen between the banner and the main body of the web page. The second feature allows respondents who forget their password to receive an email with their password. Simply click on "Forget Password?" on the sign in screen, fill out the information requested, and the password will be sent to the respondent's email address.

Instructions for both the Program Survey and Project Survey are provided on the next page.

Please note: All surveys should be completed and submitted on the designated website - do not attempt to print out the survey forms, fill them out by hand, or mail them in. Please have all requested surveys completed and submitted to the study website on or before **Friday, November 21, 2003**.

Program Survey Instructions

1. Click on website address (noted above) to access system and files
2. Sign in to system using unique user name and password
3. Go to survey link
4. Select 'Proceed with Program Survey'
5. A program list will appear, find and click on your Agency
6. Fill out the survey. A 'save' function is available for use if you would like to complete the survey in more than one sitting; this is located at the bottom of the survey form.
7. Once you have completed the survey please select the 'Save' button.
8. A report indicating the percentage of the survey completed will appear. To view a detailed report select the 'Show Report' function. If the survey is 100 percent complete please select the 'Submit' button. Once the survey is submitted changes cannot be made without contacting the Research Team. If all of the information that is available is input into the survey and the survey is still not 100 percent complete, and therefore not able to be submitted, please contact the Research Team at: **Design-Build@construction.colorado.edu**.

Project Survey Instructions

1. Click on website address (noted above) to access system and files
2. Sign in to system using unique user name and password
3. Go to survey link
4. Select 'Proceed to Project Survey'
5. The projects are listed by the state in which they are located. Each respondent will only be allowed to view the projects under their agency.
6. Each project survey can be viewed or edited.
   a. To view the survey click on the project name.
   b. To edit the survey you must check out the survey by clicking on the lock icon next to the project name. If you check a survey out please remember to return the survey when you are done editing. The survey can only be edited by one person at a time.
7. Fill out the survey. A 'save' function is available for use if you would like to complete the survey in more than one sitting; this is located at the bottom of the survey form.
8. Once you have completed the survey please select the 'Save' button.
9. A report indicating the percentage of the survey completed will appear. To view a detailed report select the 'Show Report' function. If the survey is 100 percent complete please select the 'Submit' button. Once the survey is submitted changes cannot be made without contacting the Research Team. If all of the information that is available is input into the survey and the survey is still not 100 percent complete, and therefore not able to be submitted, please contact the Research Team at: **Design-Build@construction.colorado.edu**.

All surveys should be completed and submitted on the designated website – please do not attempt to print out the survey forms, fill them out by hand, or mail them in.

We look forward to reviewing the information you and your colleagues provide and incorporating the results in the overall study effort and report to Congress, which will be distributed to respondents once authorized by FHWA. Thank you for your time and effort in support of this important study.

E.4 Survey Introduction

This **Design-Build Program Survey** requests information on the general nature and results of your agency's design-build program involving Federal-aid highway projects. The agency's designated design-build contact person should complete the Design-Build Program Survey.

The **Design-Build Project Survey** requests information on a sample of design-build projects completed by the end of 2002. A separate survey should be used for each of the projects that have been pre-selected by the SAIC/AECOM study team. For each design-build project reported on, we request that respondents also complete Part 2 of the survey form, which requires similar data for a comparable design-bid-build project (if there is one). By comparable we mean a project of similar type, size, and purpose. The individual(s) most familiar with the sampled design-build projects and comparable design-bid-build projects should complete a Design-Build Project Survey for each project reported on.

Please complete the surveys at the study web site. If required, a paper copy of the survey is available, but it will likely take more time to complete than the web survey. Please have the program or project cost data available before you begin the survey. The survey may be saved to complete a later time. If you have any questions regarding the study, please contact Study Team member Nathan Macek at nathan.macek@aecomconsult.com. Questions about the Web survey can be directed to Keith Molenaar at keith.molenaar@colorado.edu.

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E.5 Program Survey

PROGRAM SURVEY

State: **Liberty**
Agency: **Liberty Department of Transportation**

Respondent Information

First Name	
Last Name	
Email	
Job Title	
Organization	
Phone 1	
Phone 2	
Fax	
Address	
Address (Cont.)	
City	
State	
Zip Code	* Enter a valid US zip code

Definition of Key Terms Used in the Survey

- **Design-Bid-Build (D-B-B)**: The traditional project delivery method in which design and construction are distinct, sequential steps in the project development process, subject to separate procurement approaches and processes.
- **Design-Build (D-B)**: A project delivery method in which the design and construction phases are contractually-integrated activities of the project development process. As used in this study, design-build includes the design and construction development stages. The term can also be used to encompass services in addition to design and construction, such as maintenance, operations, and finance (i.e., design-build-maintain, design-build-operate-maintain, and design-build-finance). Franchise and concession agreements are included in the term if they provide for the franchisee or concessionaire to develop the project that is the subject of the agreement.
- **Design-Builder**: The entity contractually responsible for delivering the project design and construction that holds the design-build contract with the owner.
- **Designer**: The lead professional design firm for the project.
- **Builder**: The lead general construction contractor for the project.
- **Subconsultant**: A designer that has a design subcontract with the lead design firm.
- **Subcontractor**: A construction firm that has a subcontract with the lead general contractor.
- **Contracting Agency**: Public agency awarding and administering a design-build contract. The contracting agency may be the State Transportation Agency or another state or local public agency.
- **ITS**: Intelligent Transportation Systems.

Agency Procurement Practices

1. How important are the following factors when making the decision whether or not to use the design-build project delivery approach:

Selection Criteria	Importance Unimportant: 1 Extremely: 6	
Cost of Project	1 2 3 4 5 6	N/A
Urgency of Project	1 2 3 4 5 6	N/A
Opportunity for Innovation	1 2 3 4 5 6	N/A
Opportunity for Appropriate Risk Transfer	1 2 3 4 5 6	N/A
Federal Program Initiative (SEP-14)	1 2 3 4 5 6	N/A
State Program Initiatives	1 2 3 4 5 6	N/A
Lack of In-House Resources	1 2 3 4 5 6	N/A
Quality	1 2 3 4 5 6	N/A
Other - Specify:	1 2 3 4 5 6	N/A

2a. Rate the following cost and non-cost factors relative to their importance in awarding design-build contracts:

Selection Criteria	Importance Least: 1 Most: 6	
Cost	1 2 3 4 5 6	N/A
Duration	1 2 3 4 5 6	N/A
Cost & Duration (A+B Contracts)	1 2 3 4 5 6	N/A
Quality Management Plan	1 2 3 4 5 6	N/A
Team Reputation (Past Performance)	1 2 3 4 5 6	N/A
Other:	1 2 3 4 5 6	N/A

2b. If factors other than cost are used for awarding of design-build projects, what is the average weighting of the cost factor? (%) *

3. Is project prequalification generally required for design-build projects?

- No
- Yes, general or annual prequalification
- Yes, one step, project specific prequalification
- Yes, two step, project specific prequalification reduced to short list
- Other?

4. Is there a minimum and/or a maximum percentage participation of total contract value typically required for the prime contractor on a design-build team?

No Yes

If yes, indicate percentages below:

(%) Maximum Percent *

(%) Minimum Percent *

Agency Design-Build Policies and Procedures

5. Did your agency require special permission or legislation to use design-build contracting?

No Yes

If yes, check which of the following changes were needed (check more than one category if applicable):

Special Legislation

Change in agency regulation

Other - specify:

6. Does your agency have written design-build contracting policies?

No Yes

If yes, did the development of design-build contracting policies and procedures precede the first design-build project?

No Yes

7. To what extent was the highway design/construction industry involved in developing the agency's design-build program?

None: 1 **Significant:6**	
1 2 3 4 5 6	N/A

8. Was any assistance provided to the highway design/construction industry to help them respond to design-build project opportunities?

No Yes N/A

If yes, check whichever applies:

Training workshops

Design-Build guidebook or manual

Stipends

Other - specify:

9. How adequate/appropriate are your agency's procedures and resources used for handling the procurement and contract administration of design-build projects:

Administrative Procedures/Resources	Rating Inadequate: 1 Adequate: 6
Procurement Procedures	1 2 3 4 5 6
Procurement Resources	1 2 3 4 5 6
Contract Administration Procedures	1 2 3 4 5 6
Contract Administration Resources	1 2 3 4 5 6

10. At what point in the design-build project delivery process does your agency typically verify compliance with the contract requirements and accept/reject the work? (check one):

As work progresses

At project's end

At warranty's end

Other - explain:

11. Is the agency's role in performing these quality assurance activities specified in the design-build contract?

○ No ○ Yes

General Experience with Design-Build versus Design-Bid-Build Projects

12. Relative to design-bid-build contracting, how much agency administrative time (pre-award and post award) is typically required for design-build project? (indicate a positive or negative percentage change in agency administrative time relative to design-bid-build contracting):

Agency Project Administration	D-B Projects Relative to D-B-B Projects (%)
Procurement time	% *
Contract administration time	% *

13. Which group(s) are typically responsible for the following functions, for design-build projects and for design-bid-build projects, respectively? (check all that apply):

Risk/Responsibility Category	Design-Build	Project		Design-Bid-Build	Project
	Owner	Design-Builder	Owner	Designer	Builder
Final Alignment Geometry	☐	☐	☐	☐	☐
Geotechnical Data	☐	☐	☐	☐	☐
Environmental Permits	☐	☐	☐	☐	☐
Design Criteria	☐	☐	☐	☐	☐
Design Defects	☐	☐	☐	☐	☐
Constructability of Design	☐	☐	☐	☐	☐
Obtaining ROW	☐	☐	☐	☐	☐
Coordinating with Utilities/Railroads	☐	☐	☐	☐	☐
Quality Assurance	☐	☐	☐	☐	☐

14. Which project stakeholder(s) are typically responsible for providing the following type of insurance for design-build projects, and for design-bid-build projects (check all that apply):

Type of Insurance	Design-Build		Design-Bid-Build	
	Project		Project	
	Agency	Contractor	Agency	Contractor
Commercial General Liability	☐	☐	☐	☐
Excess Liability	☐	☐	☐	☐
Environmental Liability	☐	☐	☐	☐
Workers' Comp./Employer's Liability	☐	☐	☐	☐
Professional Liability	☐	☐	☐	☐

Small Business Implications

15. In assessing the level and type of competition for design-build projects, provide your best estimate of the average number of teams/firms competing per project by project delivery approach below: (use N/A for Not Applicable or Not Available)

Dimension (average per project)	D-B Projects	D-B-B Projects
Average number of teams responding to RFQ per project	*	*
Average number of teams responding to RFP per project	*	*
Average percentage of project costs to be provided by small firms (%)	*	*
Average number of local competing teams (led by local firms) per project	*	*
Average percentage of project costs to be provided by small local firms on local competing teams (%)	*	*
Average amount of stipends paid per team per project ($000s)	*	*

* **Note:** Small business is defined as any organization with less than 500 employees and $6 million in average annual receipts for service organizations ($28.5 million for general building and heavy construction contractors and $12 million for special trade construction contractors) For applicable small business size standards by industry category, see the U.S. Small Business Administration's Small Business Size Regulations, 13 CFR §121 or the Table of Small Business Size Standards.

16. Have small businesses (engineering firms and construction contractors) been more or less involved in design-build projects versus design-bid-build projects? (check one for each category below):

Type of Insurance	Rating Less: 1 More: 6	
Involvement by small design firms:	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6	○ N/A
Involvement by small contractors:	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6	○ N/A

17. On average, are design-build companies and their subcontractors similar in size to those of similar design-bid-build projects?

○ No ○ Yes

If no, how do they differ from design-bid-build teams? (check one for each category)

Design-Build Teams	Rating Smaller: 1 Larger: 6
Design-Build Contractor Size	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6
Design-Build Subcontractor Size	○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6

The following questions seek information to characterize the nature and extent of your agency's Design-Build program

18. Please list the volume of design-build projects completed in the past fiscal year versus all capital projects for each project type:

Design-Build Project Volume	Highway			Bridge	Tunnel	ITS	Total
	[redacted]	[redacted]	[redacted]				[redacted]
	New/ Realignment/ Widening	Rehabilitation/ Reconstruction	Resurfacing				
Number of D-B projects finished in the past fiscal year (#)	*	*	*	*	*	*	*
Total costs of D-B projects finished in the past fiscal year ($000s)	*	*	*	*	*	*	*
Number of all projects finished in past fiscal year (#)	*	*	*	*	*	*	*
Total costs of all projects finished in past fiscal year ($000s)	*	*	*	*	*	*	*

19. For each project type estimate the proportion (%) of all capital program costs that used each of the following project delivery approaches for projects completed during the past fiscal year: (each column should sum 100% or 0%)

Project Delivery Approach	Highway			Bridge	Tunnel	ITS
	New/ Realignment/ Widening	Rehabilitation/ Reconstruction	Resurfacing			
In-House (force account)	*	*	*	*	*	*
Design-Bid-Build Contract	*	*	*	*	*	*
Design-Bid-Build Warranty Contract	*	*	*	*	*	*
Standard Design-Build Contract	*	*	*	*	*	*
Design-Build Warranty Contract	*	*	*	*	*	*
Design-Build-Operate-Maintain Contract	*	*	*	*	*	*
D-B-Operate-Maintain-Finance Contract	*	*	*	*	*	*
Performance-Based Asset Mgt. Contract	*	*	*	*	*	*
Job Order Contracting (indefinite quantity)	*	*	*	*	*	*
Other :	*	*	*	*	*	*
Total All Projects (%) Calc	0%	0%	0%	0%	0%	0%

20. For each project type, estimate the proportion (%) of design-build program costs that used each of the following procurement approaches for projects completed during the past fiscal year: (each column should sum 100% or 0%)

Procurement Approach	Highway			Bridge	Tunnel	ITS
	New/ Realignment/ Widening	Rehabilitation/ Reconstruction	Resurfacing			
Low Bid	*	*	*	*	*	*
Bid Averaging Method (BAM)	*	*	*	*	*	*
Alternative Bids/Designs	*	*	*	*	*	*
Request for Proposals	*	*	*	*	*	*
Multi-Parameter Bidding, such as: Schedule, Cost-plus-time or Lane Rental, Traffic Control, Warranty, Warranty Credit, Quality Parameter	*	*	*	*	*	*
Best-Value, such as: Adjusted Bid, Adjusted Score, Weighted Criteria, Cost-technical Tradeoff, Fixed Price-Best Design	*	*	*	*	*	*
Total All Design-Build Projects Calc	0%	0%	0%	0%	0%	0%

21. For each project type estimate the proportion (%) of design-build program costs that used each of the following contract payment approaches for projects completed during the past fiscal year: (each column should sum 100% or 0%)

Contract Payment Approach	Highway			Bridge	Tunnel	ITS
	New/ Realignment/ Widening	Rehabilitation/ Reconstruction	Resurfacing			
Unit Price	*	*	*	*	*	*
Cost Plus	*	*	*	*	*	*
Lump Sum	*	*	*	*	*	*
Time & Material	*	*	*	*	*	*
Other – please specify:	*	*	*	*	*	*
Total All Approaches Calc	0%	0%	0%	0%	0%	0%

22. Based on your agency's experience to date, indicate in general, how suitable certain types of highway projects are to design-build project delivery, versus design-bid-build project delivery?

Highway Widening/New Alignment	Suitability None: 1 Highly: 6							
Mega (>$100 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Large ($50-$100 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Medium ($10-$50 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Small ($2-$10 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Micro (<$2 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	

Highway Rehabilitation/ Reconstruction	Suitability None: 1 Highly: 6							
Mega (>$100 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Large ($50-$100 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Medium ($10-$50 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Small ($2-$10 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Micro (<$2 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	

Bridges/Tunnels	Suitability None: 1 Highly: 6							
Mega (>$100 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Large ($50-$100 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Medium ($10-$50 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Small ($2-$10 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	
Micro (<$2 million)	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ N/A	

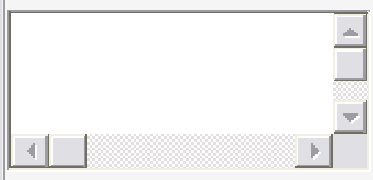
Highway Resurfacing	Suitability None: 1 Highly: 6	
Large (>$5 million)	1 2 3 4 5 6	N/A
Medium ($1-$5 million)	1 2 3 4 5 6	N/A
Small (<$1 million)	1 2 3 4 5 6	N/A

ITS	Suitability None: 1 Highly: 6	
Large (>$2 million)	1 2 3 4 5 6	N/A
Medium ($1-$2 million)	1 2 3 4 5 6	N/A
Small (<$1 million)	1 2 3 4 5 6	N/A

23. Indicate the degree to which your agency plans to use design-build project delivery in the future, by project type:

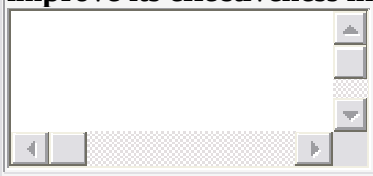
Project Type	Rating None: 1 Significantly : 6	
Highway new or widening	1 2 3 4 5 6	N/A
Highway rehabilitation	1 2 3 4 5 6	N/A
Pavement resurface	1 2 3 4 5 6	N/A
Bridge	1 2 3 4 5 6	N/A
Tunnel	1 2 3 4 5 6	N/A
ITS	1 2 3 4 5 6	N/A

24. What major changes have been made in the agency's design-build program to improve its effectiveness since its inception?

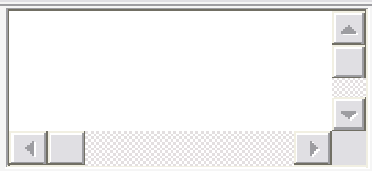


Have they accomplished their intended purpose? No Yes Partially N/A

25. What major changes are planned in the agency's design-build program to improve its effectiveness in future years?



26. Other comments (Optional)



Save Cancel

E.6 Project Survey

PROJECT SURVEY (Design-Build)

State:	Liberty
Agency:	Liberty Department of Transportation
Project	I-50 Liberty City Bridge Repair

Contact and Respondent Information

Primary Team Contact

First Name	
Last Name	
Email	
Job Title	
Organization	
Phone 1	
Phone 2	
Fax	
Address	
Address (Cont.)	
City	
State	
Zip Code	* Enter a valid US zip code

Respondent Information (Edit your personal information**)**

First Name	John

Last Name	Smith
Email	john.smith@dot.state.li.us
Job Title	
Organization	
Phone 1	
Phone 2	
Fax	
Address	
City	
State	
Zip Code	

Definition of Key Terms Used in the Survey

- **Design-Bid-Build (D-B-B)**: The traditional project delivery method in which design and construction are distinct, sequential steps in the project development process, subject to separate procurement approaches and processes.
- **Design-Build (D-B)**: A project delivery method in which the design and construction phases are contractually-integrated activities of the project development process. As used in this study, design-build includes the design and construction development stages. The term can also be used to encompass services in addition to design and construction, such as maintenance, operations, and finance (i.e., design-build-maintain, design-build-operate-maintain, and design-build-finance). Franchise and concession agreements are included in the term if they provide for the franchisee or concessionaire to develop the project that is the subject of the agreement.
- **Design-Builder**: The entity contractually responsible for delivering the project design and construction that holds the design-build contract with the owner.
- **Designer**: The lead professional design firm for the project.
- **Builder**: The lead general construction contractor for the project.
- **Subconsultant**: A designer that has a design subcontract with the lead design firm.
- **Subcontractor**: A construction firm that has a subcontract with the lead general contractor.
- **Contracting Agency**: Public agency awarding and administering a design-build contract. The contracting agency may be the State Transportation Agency or another state or local public agency.
- **ITS**: Intelligent Transportation Systems.

Project Specific Information

1. Project Specific Information

Project Name *	I-50 Liberty City Bridge Repair
Project Location	
Project Team or Contractor	
Respondent Role in this project	Role of *John Smith*

2. Project Description

a. Facility Type (Estimate percentage of total project cost that falls into each category)	(%) Road	
	(%)Bridge(s)	
	(%)Tunnel(s)	
	(%)HOV Lanes	
	(%)ITS	
	(%)Other:	
b. Project Type (Estimate percentage of total project cost that falls into each category)	New Construction/Expansion	% *
	Rehabilitation/Reconstruction	% *
	Resurfacing/Renewal	% *
	Other:	% *
c. Highway Type (Estimate percentage of project cost that falls into each category)	Rural Interstate	% *
	Urban Interstate	% *

		Rural Primary	% *
		Urban Primary	% *
		Rural Secondary	% *
		Urban Secondary	% *
d. Project Size (Indicate dimensions)		Total Cost	($000s)
		Road Length	Lane-Miles *
		Square Feet of Bridge Deck	Square Feet *
		Maximum Bridge Height	Feet *
		Number of Bridge Columns	(#) *
		Other (ITS, etc.):	*unit

3. Project Delivery Approach (Indicate approach used for this project)

- ○ Design-Bid-Build
- ○ Design-Bid-Build w/Warranty
- ○ Design-Build
- ○ Design-Build w/Warranty
- ○ Design-Build-Operate-Maintain (DBOM)
- ○ Design-Build-Operate-Maintain-Finance (DBOM-F)
- ○ Performance-Based Total Asset Management
- ○ Job Order Contract (Indefinite Delivery/ Indefine Quantity)
- ○ In-House Agency Staff (i.e. force account)

Additional Commensts:

4. Procurement Approach (Indicate approach used for this project)

- ○ Low Bid - no technical evaluation
- ○ Bid Averaging Method (BAM)
- ○ Request for Proposals w/Design Alternatives
- ○ Multi-Parameter Bidding
  - ☐ Schedule
  - ☐ Lane Rental
  - ☐ Cost Plus Time (A+B)
  - ☐ Traffic Control
  - ☐ Warranty
  - ☐ Warranty Credit
  - ☐ Quality Parameter Measures within Percent Limits
  - ☐ Quality Parameter Measures within Performance Indicators

Best-Value, please review this link for definitions of the following terms

- ○ Low Bid - Meets Technical Criteria
- ○ Adjusted Bid
- ○ Adjusted Score
- ○ Weighted Criteria
- ○ Cost-Technical Tradeoff
- ○ Fixed Price - Best Design

5. Award Basis

- ☐ Competitive bid
- ☐ Negotiated award

6. Contract Type

- Fixed Price - Lump Sum
- Unit Price
- Cost Plus Fixed Fee
- Cost Plus Fixed Fee with Guarantee Maximum Price
- Other:

7. Use of Incentives or Disincentives

7a. Were incentive clauses used for this project?

No Yes

If "yes", indicate the kind of incentives used:

7b. Were disincentive or penalty clauses used for this project?

No Yes

If "yes", indicate the kind of disincentives or penalty clauses were used:

8. Extended Warranty Beyond Specified Minimum

a. Was any kind of warranty associated with the contract for this project?

No Yes

If "No", skip to question 9.

b. Type of warranty included in the project contract:

Material & workmanship

Performance or Condition

Other (indicate below):

c. Duration of warranty - after project completion, in years:

d. Escape clause criteria (specify which type(s) used in the contract):

Time limit

Cumulative axle loading

Other (indicate below):

e. Was the extended warranty a competitive factor in the selection process?

No Yes

f. Did the extended warranty increase or decress any of the following project attributes?

Project Duration	No Yes; if "Yes", by what % (+ or -)	
Project Quality	No Yes; if "Yes", by what % (+ or -)	
Project Cost	No Yes; if "Yes", by what % (+ or -)	

Additional Comments:

9. Project Team Organization

- Builder as prime
- Designer as prime
- Joint Venture
- Multi Prime/Multiple Prime Contracts
- Integrated design-builder
- Other:

10. Project Characteristics:

a. Primary project purpose:

b. Characterize the project according to the following criteria

Project Characteristics	Rating Low: 1 High: 6	
Degree of technical/engineering complexity	1 2 3 4 5 6	N/A
Degree of schedule urgency	1 2 3 4 5 6	N/A
Flexibility of project scope	1 2 3 4 5 6	N/A

c. What percentage of the following activities were complete when the design-build contract or the construction contract was issued for this project?

Activity	% Completed

Design:	% *
NEPA Clearance:	% *
Permit Clearance:	% *
Right-of-way Acquisition:	% *

d. Describe any unique feature about this project that significantly influenced any of the following project attributes:

Duration:

Cost:

Quality:

e. Was lifecycle costing taken into account during project conceptualization?

No Yes

If so, was it a factor in your agency's bid evaluation process? No Yes

Comments:

11. Specification Type

Specification Type	% of Total Specifications
Prescriptive	% *
Performance	% *

12. Prevailing Labor Environment (Complete all applicable portions - percentage refers to portion of total project costs):

Union State: No Yes

Percent union involvement (%): *

13. Contract Work Split (Complete as appropriate - percentage refers to portion of total project costs):

Direct hire:	Design (%): *	Construction (%): *	or, Combined (%): *
Subcontracted:	Design (%): *	Construction (%): *	or, Combined (%): *

14. Competition (Complete as appropriate):

Number of responsive proposers/bidders:

Design	
Construction	
Design/Build	

Additional Comments:

15. Duration Performance Metrics. Indicate the dates or characteristics for the following project delivery activities:

Activity	Dates	Units
Start RFP development		(mm/dd/yyyy)
Date project advertised		(mm/dd/yyyy)
Date RFPs submitted		(mm/dd/yyyy)
Date of Project Award		(mm/dd/yyyy)
Design initiation date		(mm/dd/yyyy)
Construction initiation date		(mm/dd/yyyy)
Planned project acceptance date		(mm/dd/yyyy)

Actual project acceptance date		(mm/dd/yyyy)
Number of liquidated damages days		days
Project Velocity - average per month:		
Lane-miles completed		Lane mile/month
Square feet of bridge deck completed		sq ft deck/month
Project cost spent		$000s/month

16. Cost Performance Metrics. Indicate the planned and actual costs (in thousands of dollars) for the following project delivery activities:

Project Development Stage	Agency PE Cost/ RFP Cost	Design-Builder Design Costs	Design-Builder Construction Costs	Agency Contract Administration and Inspections Costs	Total Project Costs
At Budget (Engineer's estimate)	*	*	*	*	*
At Contract Award	*	*	*	*	*
At Final Cost	*	*	*	*	*

b. Indicate the reasons for major changes in project costs:

	Rating None: 1 Major: 6	
Owner required additions or subtractions	1 2 3 4 5 6	N/A
Design-Builder or Contractor suggested additions or subtractions	1 2 3 4 5 6	N/A
Events not controllable by sponsor or contractor (weather, etc.)	1 2 3 4 5 6	N/A
Poor design	1 2 3 4 5 6	N/A
Differing site conditions	1 2 3 4 5 6	N/A
Unit price adjustment clauses	1 2 3 4 5 6	N/A
Sponsor delays (environmental clearance, land acquisition)	1 2 3 4 5 6	N/A
Contractor delays (design, environmental clearance, land acquisition, construction, inspection approval)	1 2 3 4 5 6	N/A

Third party additions or subtractions	1 2 3 4 5 6	N/A
Third party delays	1 2 3 4 5 6	N/A
Other:	1 2 3 4 5 6	N/A

c. Indicate the number and total cumulative value of all **change orders/extra work orders** for this project:

Number of approved change/extra work orders	*	Number
Cumulative net value of approved change/extra work orders	*	($000s)

d. Indicate the number and total cumulative value of all **claims** for this projects:

Number of approved claims	*	Number
Cumulative net value of approved claims	*	($000s)

e. Indicate the amount (value) of **any re-work** required after the project was accepted by the owner (re-work means additional work required to correct deficiencies that appear after the project is put into service as a result of design or construction errors):

Within 1 year	*	($000s)
Beyond 1 year	*	($000s)

17. Quality Performance Metrics

a. List the success criteria used for this project by the agency and the relative performance acheived:

b. Indicate the overall quality results for this project:

Quality Criteria	Rating Poor: 1 Superior: 6	
Conformance with standards/specifications	1 2 3 4 5 6	N/A
Compliance with warranty provisions	1 2 3 4 5 6	N/A
Overall sponsor satisfaction	1 2 3 4 5 6	N/A

c. Characterize the prior experience/expertise of the key stakeholders of this project with the project development approach used (check whichever boxes apply, with one box checked per row):

Stakeholder Group	Prior Experience None: 1 Excellent: 6	
Agency/Owner	1 2 3 4 5 6	N/A
Design-Builder	1 2 3 4 5 6	N/A
Designer	1 2 3 4 5 6	N/A
Builder/Constructor	1 2 3 4 5 6	N/A
Subconsultant(s)	1 2 3 4 5 6	N/A
Subcontractor(s)	1 2 3 4 5 6	N/A
Finance (bond underwriter)	1 2 3 4 5 6	N/A
Insurance (surety vendor)	1 2 3 4 5 6	N/A

18. Lessons Learned from this project:

a. Did the project fulfill its intended purpose?

No Yes

If "No", in what way(s)

b. Did the project delivery approach significantly impact the outcome of the project in fulfilling its intended purpose?

No Yes

If "Yes", in what way(s)

c. For design-build projects only, how did the following performance criteria change because of using the design-build delivery approach? (Indicate positive (+) percentage for increase, negative (-) percentage for decrease, zero (0) percent for no change)

Project Performance Criteria	Value (+% or -%)
Duration	%
Cost	%
Quality	%

d. Lessons learned from the project regarding the delivery approach used?

e. Could this project have been delivered more successfully, based on what you now know about the delivery approach used?

No Yes Unclear

If "Yes", explain how:

Additional Comments:

Save Cancel

APPENDIX F

REVIEW OF COMPLETED SEP-14 PROJECT EVALUATION REPORTS

The review of completed SEP-14 project evaluation reports process was used to structure design-build study survey questions and confirm the applicability of data requested. The review used available information from SEP-14 reports, the SEP-14 project database, and design-build project evaluation reports. The sample size was limited by the availability of comparable information—only 33 projects in 15 states were documented.

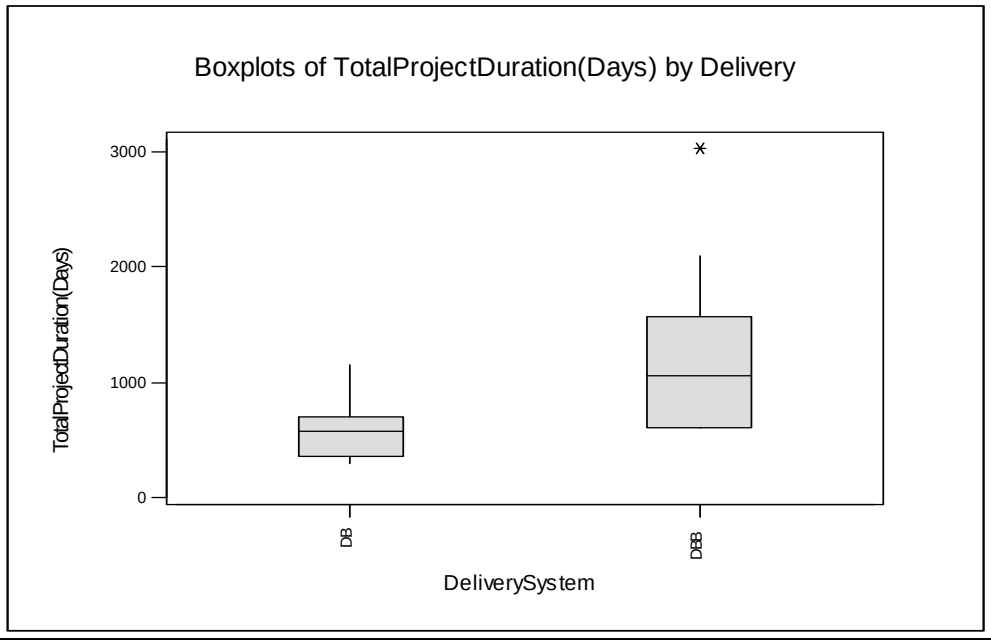
SEP-14 project evaluation reports provide a glimpse into the kinds of information state DOT sponsors are most likely to have and share, hence the need to be cognizant of this information when formulating study surveys. The reports suggest a variety in how SEP-14 projects are executed and documented, and demonstrate a need for a consistent reporting basis for analysis & determination of results.

Completed project evaluation reports do not provide an adequate basis for assessing design-build impacts on projects or industry, so a larger sample of completed projects uniformly reported on is required, as well as a program-level assessment. This study addresses these concerns and provides a wealth of useful information to developers and implementers of design-build projects, with the full cooperation and assistance of STD design-build program managers and project leaders.

Preliminary Results

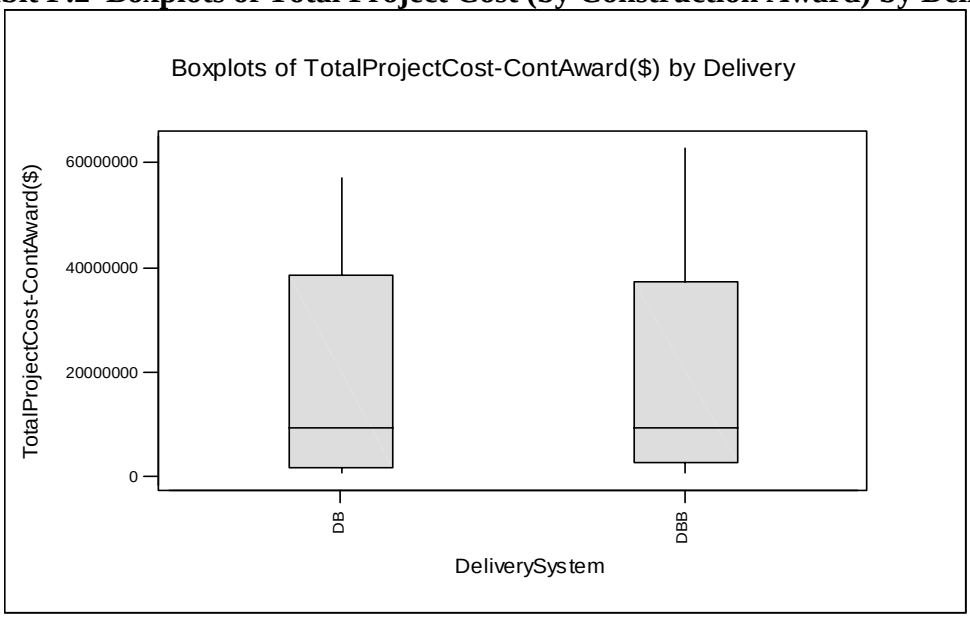
With 14 available observations, the review found that there was significant difference in the mean project duration between design-build and design-bid-build projects. The average duration is 583 days for design-build, compared to 1,215 days for design-bid-build. This is illustrated in Exhibit F.1.

Exhibit F.1 Boxplots of Total Project Duration (in Days) by Delivery



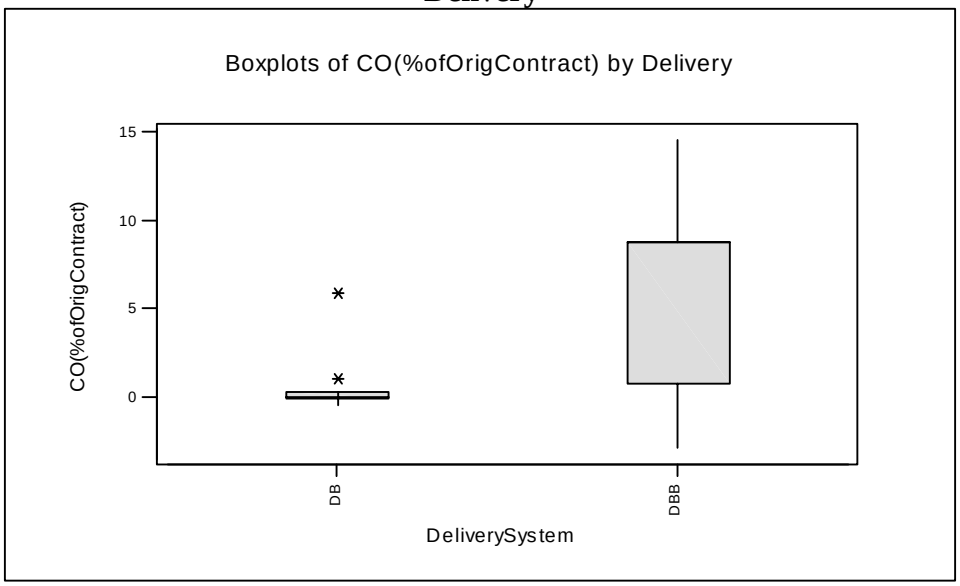
With six available observations, the review found no significant difference in mean cost between design-build and design-bid-build projects. The average project cost was $18.4 million for design-build projects, and $18.9 million for design-bid-build. This is shown in Exhibit F.2.

Exhibit F.2 Boxplots of Total Project Cost (by Construction Award) by Delivery



With 10 available observations, the review found significant differences in the additional project cost per change order. The difference was 0.6% of project costs for design-build projects compared to 6.0 percent for design-bid-build projects. This is illustrated in Exhibit F.3.

Exhibit F.3 Boxplots of Change Orders (As Percentage of Original Contract Costs) by Delivery



Conclusions

Only about 10% of the design-build project evaluation reports required by FHWA were submitted. Completed reports were prepared by persons familiar with projects, and most of the reports submitted were of high quality. However, the reports lack consistency in structure, contents, format, and terminology, and the sample size is not statistically significant for the population of design-build projects. These issues demonstrate the need to conduct the full design-build study program and project surveys.

List of SEP-14 Project Evaluation Reports

State

Number of projects approved/if evaluations found and number

1. Evaluations that are in possession of team at University of Colorado-Boulder

- Comments from Researcher Jennifer Shane, University of Colorado-Boulder
    A. Evaluations that are indicated on FHWA Design-Build Project Approvals under SEP-14 as of 12/31/2002 (http://www.fhwa.dot.gov//programadmin/contracts/sep14a.htm)

Alabama

1 Project Approved/No Evaluations Found

Alaska

4 Projects Approved/No Evaluations Found

A. Dated 13-Apr-99 for Ocean Class Ferry Boat
B. Dated 01-Mar-99 for Whittier Tunnel

Arizona

6 Projects Approved/Several Evaluations Found

1. Evaluation of the Design-Build Delivery Process for A State Department of Transportation Pilot Project. James Ernzen, Craig Albelda, Kraig Knutson. Construction Congress VI, Reston Virginia, 2000.
2. Arizona's new Design-Build Law and Experience to Date. Arizona Department of Transportation, 1998.
3. 3 Masters Thesis-In Transit

A. Dated 29-Mar-02 for I17 Thomas Road to Dunlap Avenue, Phoenix

Arkansas

No Projects Approved

California

4 Projects Approved/No Evaluations Found

A. Dated 25-May-94, 01-Oct-94 for Emergency Relief-LaCienega/Venice Undercrossing

Colorado
6 Projects Approved/3 Evaluations Found

1. Evaluation of Design-Build Practice in Colorado Project IR IM(CX) 025-3(113). Pete Graham, March 2001.
2. Evaluation of Design Build Practice in Colorado IR(CX)70-4(143). Ahmad Ardain, Paul Jesaitisl July 1999.
3. Evaluation of Design Build Practice in Colorado IR(CX)70-4(143). Ahmad Ardain, Bernnie Guevara, William Sccheuerman, November 1997.
4. Interstate 25 and 225 Transportation Expansion Project (T-REX): Special Experimental Project 14 Initial Report. January 15, 2002.
    - *Numbers 2 and 3 are on the same project, one addresses pre-construction activities and the other summarizes all activities.*
        A. Dated 15-Jan-02 for Southeast Corridor Denver I-25

Connecticut
No Projects Approved

Delaware
1 Project Approved/No Evaluations Found
A. Dated 28-Aug-02 for Choptank Road over Back Creek

Florida
67 Projects Approved/3 Evaluations Found

1. State of the Practice Review in Design-Build. Florida DOT, 2002.
    - *Included in this review is an overview of design-build practices in South Carolina and Arizona but there is very little information regarding Florida's use of design-build.*
2. Final Evaluation of the Florida Department of Transportation's Pilot Design/Build Program. Ralph D. Ellis, Jr, Ashis Kumar. Transportation Research Record 1351, 1992.
    - Many cost and schedule numbers appear to be available.
3. Evaluation of the FDOT Design/Build Program. Ralph Ellis, Zohar Herbsman, Ashish Kumar. University of Florida, August 1991.
    - This may contain much of the same information as the item listed in Florida 2.

Georgia
8 Projects Approved/No Evaluations Found

Hawaii
1 Project Approved/No Evaluations Found

Idaho
No Projects Approved

Illinois
No Projects Approved

1. 2002 Survey by SAIC for Illinois DOT on the Current Use of Design-Build.
    - *This survey was completed by several states but does not include many hard data.*

Indiana
8 Projects Approved/1 Evaluation Found

1. An Initial Evaluation of Design-Build Highway Projects Performed by Indiana Department of Transportation. Nicholas Tymvois, Bobby G. McCullouch, Kumares C. Sinha. Purdue University, September 2002.

Iowa
No Projects Approved

Kansas
No Projects Approved

Kentucky
No Projects Approved

Louisiana
1 Project Approved/No Evaluations Found

Maine
2 Projects Approved/3 Evaluations Found

1. Design-Build-Warranty in Maine: The Bath-Woolwich Bridge Project Mid Year 1998 Report. Bruce A. Van Note.
2. Practical Considerations for Design-Build: The Bath-Woolwich , Maine Design-Build-Warranty Bridge Project. Bruce A. Van Note, 1998.
3. Maine Develops Unique Design-Build Selection Process for Bath-Woolwich Bridge Project. Alan R. Phips, 1999.
    - *These may contain relatively the same information.*
        A. Dated 11-Dec-01 for Bath-Woolwich Bridge Replacement

Maryland
9 Projects Approved/No Evaluations Found

Massachusetts
1 Project Approved/No Evaluations Found

A. Dated 15-Oct-00 for Route 3 North from Route 128 to the NH border

Michigan
21 Projects Approved/No Evaluations Found

A. Dated 26-Nov-96 (To FHWA on 20-Mar-97) for Detroit Freeway Management System ATMS/ATIS

Minnesota
2 Projects Approved/No Evaluations Found

Mississippi
No Projects Approved

Missouri
No Projects Approved

Montana
No Projects Approved

Nebraska
No Projects Approved

Nevada
1 Project Approved/No Evaluations Found

New Hampshire
No Projects Approved

New Jersey
12 Projects Approved/3 Evaluations Found

1. New Jersey's Modified Design/Build Program Progress Report 6. August 11, 1999.
2. New Jersey's Modified Design-Build Program-Part I Progress Report 4. 1998.
3. New Jersey's Modified Design-Build Program Initial Progress Report. 1996.
    - *I have contacted the Library for the New Jersey DOT about other reports but I have not received anything from them.*
        A. There should be more but am unable to obtain them (Progress Reports 2, 3, 5, >6)

New Mexico
2 Projects Approved/No Evaluations Found

A. Dated 28-Feb-03 for US 70 in Hondo Valley, Ruidoso Downs to Riverside and NM 528 Bernalillo and Sandoval Counties

New York
3 Projects Approved/No Evaluations Found

1. Design-Build Practice Report. Parsons Brinkcerhoff Quade & Douglas, Inc. August 2002.
    - *This is essentially a survey of the current practices in many states, not including NY.*

North Carolina
7 Projects Approved/1 Evaluation Found

1. CARAT-An Operational Test of Design-Build-Warrant Procurement for ITS Deployment, Evaluation Report of Phase 1 Procurement, Chapter 1. The HNTB Companies, 1997.
2. CARAT-An Operational Test of Design-Build-Warrant Procurement for ITS Deployment, Evaluation Report of Phase 1 Procurement, Chapter 2. The HNTB Companies, 1997.
3. CARAT-An Operational Test of Design-Build-Warrant Procurement for ITS Deployment, Evaluation Report of Phase 1 Procurement, Chapter 4. The HNTB Companies, 1997.

A. Dated 01-Apr-97 for Carat ITS Project
B. 01-Sep-00 Statewide Wetland Mitigations

North Dakota
No Projects Approved

Ohio
52 Projects Approved/2 Evaluations Found

1. Final Report: Six-State Survey of Construction Administration Practices and Procedures. Ohio Department of Transportation and Trauner Consulting Services, Inc.
   - *This report appears to compare the DB experiences of ADOT, FDOT, MDOT, WSDOT, and WisDOT but may not offer much in the way of useful information.*
2. ODOT Experience on Six Pilot Design-Build Projects: Interim Report. Ohio DOT. January 29, 1999.
   - *Initial (letting) cost are given, however, there is little to no final cost information readily available.*
   - Walid E. Gemayel, P.E., Deputy Director, Division of Construction Management, has been contacted to see if there is any other information available.
     A. *Dated 31-Oct-00 for Van-US 127, ALL-IRO75, LOR-IRO90, MED-IR271, ATB-SR045, STA-IR077, GUE-SR660, MIA-IR075, PRE-IR070, GRE-US35J, HAM-IR071, HAM-IR275, HAM-IR471, ROS-SR159, NOB-IR077, CUY-IR480*

Oklahoma
No Projects Approved

Oregon
2 Projects Approved/5 Evaluations Found

1. Design Build Contracting in the Oregon Department of Transportation. Masters Thesis by Francico O. Simas. November 1998, Oregon State University.
   - *I don't know that this contains any useful information about the actual work on the project of if it is just an over view of the RFQ/RFP process and some lessons learned to date.*
2. *ODOT Design-Build Pilot Projects Evaluation for Evans Creek-Rock Point Design-Build Pilot Project. David F. Rogge, Rodolfo Pinto, Darrell Gobble. 2001, Oregon State University.*
3. *ODOT Design-Build Pilot Projects Evaluation Volume I. David F. Rogge, 2001.*
4. *ODOT Design-Build Pilot Projects Evaluation Volume II. David F. Rogge, 2001.*
5. *ODOT Design-Build Pilot Projects Evaluation Volume III. David F. Rogge, 2001.*
   - *Reports 2-5 may contain the same information.*

Pennsylvania
52 Projects Approved/2 Evaluations Found

1. Initial/Interim Report on Design/Build. 2000.
2. Initial/Interim/Final Report Modified Turnkey (Design/Build) Suquehana County. 1999.
   A. *Dated 27-Mar-01 for District 1 Warren Co. Expressway Reconstruction*
   B. *Dated 11-Jan-02 for District 4-0 Susquehanna 0011-573 Bridge Replacement Hallstead/Great Bend*
   C. *Dated 07-Jun-01 District 11 Beaver Count 1022-B02 13th Street Blockhouse Run Bridge*

Rhode Island
No Projects Approved

South Carolina
8 Projects Approved/1 Evaluations Found

1. Initial Report for SEP 14 Design-Build Contract for the Replacement of US 601 South Bound Bridge over the Wateree River. 1997.
    A. Dated 03-Sep-96 for Bridge Replacements-Reedy Creek, Enoree River

South Dakota
1 Project Approved/3 Evaluations Found

1. Design/Build-Lessons Learned to Date. Lawrence L. Weiss. October 7, 2000.
2. Design/Build-Interim Report and Additional Lessons Learned. Lawrence L. Weiss. February 28, 2001.
3. Design/Build-Additional Lessons Learned to Date. Lawrence L. Weiss. February 25, 2003.
    - *These appear to be all on the same project and may contain basically the same information.*

Tennessee
1 Project Approved/No Evaluations Found

Texas
1 Project Approved/1 Report Found

1. Design-Build Contracting for Highway Construction Projects in Texas. Douglas D. Gransberg, Jason Valerius, Sanjaya Senadheera, Mustaque Rumi. Texas Tech University, September 1997.
    A. Dated 04-Feb-02 for Texas Turnpike Authority US183A and SH130

Utah
8 Projects Approved/5 Evaluations Found

1. I-15 Corridor Reconstruction Project Design/Build Evaluation 2000 Annual Report.
2. I-15 Corridor Reconstruction Project Design/Build Evaluation 1999 Annual Report.
3. I-15 Corridor Reconstruction Project 1998 Annual Report.
4. I-15 Corridor Reconstruction Project Initial Report. 1997.
5. Utah Department of Transportation I-15 Case Study. Masters Report by Donna Kimball. July 11, 1999.
    A. Dated 01-Dec-97 and 30-Sep-99 for ITS Traffic Operations Center Project
    B. Dated 01-Jun-97 and 30-Mar-99 for ITS Interim Traffic Control System
    C. Dated 01-Nov-99 for SR-176 Lake Powell vehicle/passenger ferry system

Vermont
1 Project Approved/No Evaluations Found

Virginia

7 Projects Approved/No Evaluation Found

A. *Dated 01-Nov-01 for Route 288 (I-64/288 Interchange and I-64 to Rt. 250 Connection)*

Washington

3 Projects Approved/2 Evaluations Found

1. Washington State Department of Transportation Design-Build Pilot Project Evaluation. Keith Molenaar, Justin Sencer, Jamal Parker, Travis Stewart, Brian Saller, Steve Coggins, Colleen Butler. University of Colorado and WSDOT, 2003.
2. Washington State Department of Transportation Design-Build Pilot Project Evaluation: Interim Report-POQ/BAFP. Keith Molenaar.
    - These may contain the same information.

West Virginia

No Projects Approved

Wisconsin

1 Project Approved/No Evaluations Found

A. *Dated 20-Aug-02 for City of Milwaukee, Menominee Valley Viaduct*

Wyoming

No Projects Approved

APPENDIX G

BIBLIOGRAPHY

This appendix presents a summary of the literature search undertaken as part of this study. The contents of this interim document are derived from the website developed by the AECOM Consult Team and posted at **http://construction.colorado.edu/Design-Build**. The Design-Build website contains five major sections briefly described below:

- **Home Page** – presents the background, goal, objectives, and scope of the study, including a brief overview of the study effort.
- **Project Page** – describes the methodology, work plan, and project team structure for the study.
- **Literature Page** – presents a bibliography of all reference documents obtained during the literature search, alphabetically organized by type of document.
- **Library Page** – provides a searchable listing of all reference documents contained in the literature database, complete with direct links to web-posted documents and pdf files where available.
- **Useful Links Page** - contains links to various design-build web sites as well as links to each state transportation agency's web site.

Members of the design-build community and the general public are welcome to visit the Design-Build website at **http://construction.colorado.edu/Design-Build**. To enable full access to the site, visitors must register using the "register" link from the Home Page. Upon registration, users will receive email notification of their User ID and Password in order to successfully login to the website. As registered members of the site, users will have full access to all links and all documents that are not copyright protected. In addition, registered members may contribute additional documents to the site and provide commentary on any documents contained in the library.

New documents may be posted to this website by registered members by clicking on the "Upload Documents" text on the left-hand side of the Library Page. General information regarding a piece of literature as well as an abstract may be typed into the Upload box and automatically uploaded to the website. The Library Page also supports posting PDF and Microsoft Word versions of documents to the site.

Following completion of this research study, this website will continue to be hosted by the University of Colorado at Boulder as a continuing resource for members of the design-build community.

The up-to-date contents of the Literature page represent the bibliography that follows. For a more complete indication of the contents of this database, including reference documents accessible from the Library page, please use the referenced website address to visit the site directly at **http://construction.colorado.edu/Design-Build** and access the resident documents.

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