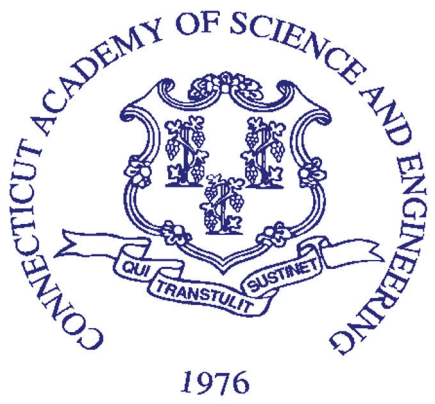
The Design-Build Contracting Methodology for Transportation Projects: A Review of Practice and Evaluation for Connecticut Applications

June 2010



A Report By

The Connecticut Academy of Science and Engineering

For

The Connecticut Department of Transportation

The Design-Build Contracting Methodology for Transportation Projects: A Review of Practice and Evaluation for Connecticut Applications

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Richard H. Strauss
Executive Director

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16. Abstract

Two primary contracting methods are used by most state transportation agencies to design and build infrastructure: design-bid-build and design-build. The objective of this study is to conduct a literature review to identify how ConnDOT's use of design-build contracting methodology may benefit the State of Connecticut. Advantages and disadvantages to design-build and design-bid-build are discussed in this report with respect to transportation projects in Connecticut. The report focuses on the challenges that must be overcome to make design-build viable in Connecticut. The primary conclusion of this study is that ConnDOT should be able to utilize the DB contracting methodology for design and construction of transportation-related projects. It is noted that DB is not entirely new to ConnDOT as the commissioner has the authority to modify or eliminate the bidding process for emergency declaration projects. The General Assembly should adopt legislation permitting use of DB contracting as an option for transportation projects. The legislation should require ConnDOT to periodically report on its experience in utilizing DB contracting to the Transportation Committee and other relevant committees of the Connecticut General Assembly for the purposes of determining the value and benefits of this method of contracting to the state and the public.

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EXECUTIVE SUMMARY

STUDY PURPOSE

The objective of this study is to conduct a literature review to identify how the Connecticut Department of Transportation's (ConnDOT) use of design-build (DB) contracting methodology may benefit the State of Connecticut. There are well documented advantages and disadvantages to both DB and design-bid-build (DBB) methods that are discussed in this report with respect to transportation projects in Connecticut. The report focuses on the challenges that must be overcome to make DB viable in Connecticut.

This study was conducted by the Connecticut Academy of Science and Engineering (CASE) at the request of the Connecticut Department of Transportation.

BRIEF STATEMENT OF PRIMARY CONCLUSION

ConnDOT should be able to utilize the DB contracting methodology for design and construction of transportation-related projects. It is noted that DB is not entirely new to ConnDOT, as the commissioner has the authority to modify or eliminate the bidding process for emergency declaration projects. The General Assembly should adopt legislation permitting use of DB contracting as an option for transportation projects. The legislation should require ConnDOT to periodically report on its experience in utilizing DB contracting to the Transportation Committee and other relevant committees of the General Assembly for the purposes of determining the value and benefits of this method of contracting to the state and the public.

SUMMARY OF BACKGROUND

Two primary contracting methods are used by most state transportation agencies to design and build infrastructure. The first, DBB, is a project delivery method where a project owner (for the purposes of this report, the "owner" will be considered a department of transportation [DOT]) executes multiple contracts for architectural/engineering services and construction. The second method, DB, is a project delivery method where the DOT issues a single contract for both architectural/engineering design services and construction services with a single entity.

Currently, DBB is the only project delivery method available to ConnDOT since it does not have legislative authority to use the DB method.

STUDY DESCRIPTION

The conclusions and recommendations developed by the study committee and research team were derived from

1. A literature review of existing design-build programs across the United States
2. DB project case studies
3. A survey of prominent state DOTs currently using DB
4. Guest presentations on a variety of aspects related to DB
5. Meetings conducted with various ConnDOT staff to gain an understanding of their perceived roles as related to the use of DB

CONTRACTING METHODOLOGY: ADVANTAGES AND DISADVANTAGES

The primary advantages identified for DB are a shortened project delivery timetable, greater price assurance, and the potential for innovative design. The primary disadvantages of DB include a subjective contract award selection process (if best value is used), high cost for proposer bid preparation, and significant permitting issues on environmentally sensitive projects. The reported advantages and disadvantages of DB and DBB are provided in the following table.

Advantages	Disadvantages
Design-Bid-Build	
• Owner-Loyal Design Team • Contract Award Objectivity (Lowest Price is the Only Consideration) • Design Is "Fully" Defined Before Contractor Bids • Reduced Project Monetary Cost through Competitive Lowest Bid Process • Quality and Quantity Control and Inspection • Opportunities for Small or New Contractors	• Low Bid Contract Award May Impact Project Quality • Agency is a Middleman Between Designer and Contractor • Contractor is Not Involved in the Design Process • Project Timetable Subject to Additional Contracts and Change Orders • Changes in Design and Constructability May Significantly Increase Final Price
Design-Build	
• Potentially Shorter Project Timeline • Reduced Number of Change Orders • Price Certainty, If Fixed Price is Used • Agency Not Involved in Contractor/ Designer Disputes • Contractor and Designer Work Together Early in the Project and Throughout the Project • Potential for Innovative Design • Reduced Legal Claims Against Owners	• Subjective Contract Award • High Cost for Contractors to Prepare a Bid • Environmental Permitting, Utility Relocation and ROW Acquisition Can be Significant Challenges • Agency limited in controlling quality unless performance specifications are used.

Another benefit to DB is potential cost savings. The use of DB was originally controlled by the Federal Highway Administration (FHWA) under "Special Experimental Project No. 14 - Innovative Contracting" (SEP-14). The objective of the SEP-14 project was to evaluate innovative contracting practices that have the potential to reduce project life-cycle cost, while maintaining quality. Under SEP-14, cost-plus-time bidding, lane rental, design-build contracting, and warranty clauses were evaluated and later determined suitable for use by state transportation agencies. A review of SEP-14 DB projects, reported in FHWA (2006), indicated a 3% cost savings over DBB projects. However, the cost savings varied based on project type, complexity and size, and were not seen on every project. Therefore, selection of DB or DBB as the contracting methodology for a project should take into consideration the various factors and goals of each project.

CASE DB SURVEY SUMMARY

A DB survey gathered information from a select group of states concerning their DB programs and experience. Appendix B contains a list of questions asked of each agency and their responses. The agencies surveyed were

- Colorado Department of Transportation (CDOT)
- Maryland State Highway Administration (MSHA)
- Massachusetts Highway Administration (MassDOT)
- Minnesota Department of Transportation (Mn/DOT)
- New Jersey Transit (NJ TRANSIT)
- Pennsylvania Department of Transportation (PennDOT)

The primary survey responses indicate that

- All agencies reported that the benefits of their DB program include time savings and reduction in change orders.
- All the state DOTs surveyed included innovative design as an achieved benefit.
- All agencies—except PennDOT—have a dedicated in-house DB project manager. PennDOT has a DB Pro-Team at its central office that reviews DB projects and contracts that are developed by district offices.
- The majority of agencies use a best value approach to contractor selection. However, PennDOT only uses lowest bid. Mn/DOT and MSHA stated that they may also use a lowest bid approach. Colorado has the option to use a modified pass/fail lowest bid approach.
- Only PennDOT and Mn/DOT responded that they have a modified permitting process for environmental or other permits.
- All agencies reported that using DB has had a positive or no impact on small contractors in their state. The agencies also stated that they worked with local construction organizations when they developed their DB program.
- No state surveyed reported any issues with local labor unions.

CONNECTICUT DESIGN-BUILD CHALLENGES

The use of DB has been successful in other states. These DB programs have many common practices that guide implementation to achieve desired outcomes and results in the use of DB contracting. However, in developing a DB program, Connecticut should consider unique factors such as its transportation systems, ethical issues in contracting, and political history and culture. Challenges ConnDOT will need to address in developing and implementing a DB program include the following:

- Permitting: For projects that require environmental permits, the Connecticut Department of Environmental Protection (DEP) anticipates that project designs will be virtually complete (approximately 90% complete) prior to issuance of permits. Therefore, under DB the DEP would need to be able to issue permits without necessarily having reviewed the completed project designs.
- Training and Staffing: ConnDOT staff and design/engineering companies and contractors in the state need to gain experience in DB contracting through training. This training can be provided by several national DB organizations. ConnDOT needs to commit dedicated staff to overseeing and supporting DB projects. ConnDOT should also appoint a DB project manager that oversees all DB projects and is active in project selection, while the department maintains traditional DBB processes and practices for a majority of projects.
- Contractor Experience: Many Connecticut construction and design/engineering companies may not have DB contracting experience. However, the Connecticut Department of Public Works has been using DB for over 17 years so some Connecticut contractors are familiar with DB. If DB is to succeed, ConnDOT will need to support, help train and advise contractors on DB risks and methods.
- Best Value Contractor Selection: Best value contractor selection includes price and technical proposal considerations that involves subjectivity in contract award decisions.

SUMMARY OF RECOMMENDATIONS

Connecticut Design-Build Methods:

- ConnDOT should designate staff to develop, implement, maintain, and lead the department's DB program. Training should be provided to ConnDOT staff to assure project and program success. Training should not be limited to dedicated DB staff, but should extend to staff from all areas of the department with project-related responsibilities such as design, construction, inspection, properties/rights of way, and contracting.
- ConnDOT staff should develop an understanding of the risks assumed by the department and contractor for DB projects. DB project contractors assume more risk than for typical DBB projects. ConnDOT project delivery practices should be adapted to support the responsibilities assumed by the DB contractor, while at the same time protecting the interests and risk assumed by the department.

- ConnDOT should develop a DB procedure manual that will serve as a guide for DB project operations. This manual will also serve as an educational outreach tool for department staff, as well as to inform potential contractors of how ConnDOT will manage DB projects.
- Implementation of ConnDOT's DB program should include outreach to both engineering consulting companies and contractors, including smaller and mid-size contractors, to inform them about the DB contracting program and process.
- For DB projects that involve third parties for environmental permitting (such as DEP, EPA, US Army Corps of Engineers), utility relocation (utility companies), or system scheduling (such as AMTRAK and Metro-North), as well as for other issues, it is suggested that these entities be involved early in the project concept development process to limit the risk assumed by DB contractors who are offered the opportunity to submit project proposals.
- ConnDOT should incorporate stipends into the project selection process. The issuing of stipends should follow federal policy 23 CFR 636.112. All shortlisted proposers that submit acceptable proposals should receive compensation for their design/proposal efforts. In return, ConnDOT would have ownership rights to the designs prepared by all proposers and have the ability to incorporate proposed design elements into the final design regardless of the contractor selected.
- Key criteria in DB project selection should include the need for design innovation and reduction in project duration. ConnDOT's DB program needs to provide flexibility to allow for design innovation, since that is one of the key advantages of DB.

Future Use of Design-Build in Connecticut:

- Vertical construction (buildings) and horizontal transportation construction projects should be considered for DB contracting.
- Vertical construction projects should be considered as a possibility for initial DB contracting. The Connecticut Department of Public Works' (DPW) experience utilizing DB contracting for its projects should provide valuable lessons learned in the Connecticut context for this type of project, as well as contractor familiarity with DB contracting.
- Horizontal construction should not be excluded from any pilot projects.
- Initially, DB should be utilized on projects that have little or no environmental impact. However, DB contracting could be used on more complex projects, including those with environmental issues, after ConnDOT and the other agencies and contractors involved gain some experience with DB, especially where a project is expected to benefit from innovative project design.

CONCLUDING REMARKS

The Design-Build contracting methodology for transportation projects represents a significant change in the way projects are managed and delivered by transportation agencies. An important aspect of the DB contracting methodology is developing collaboration and the

business relationship between the project engineering/architect and construction contractor. The interaction of the construction contractor with the designer working as a team represents a culture shift from the traditional design and construction project delivery methodology (DBB). Responsibilities of the DB contractor team demand that the project team work together to resolve project design and constructability issues to deliver a quality product in an efficient manner.

When there is a need to perform quickly on projects—as in emergencies—owners put teams together to get the job done. Complex problems are always solved more efficiently and with optimal solutions through collaboration. Collaboration occurs throughout a DB project, not only within the DB design/construction team, but also with the owner.

DB provides for single source responsibility with incorporation of opportunity for innovation. A well managed process is essential to protect interests of the owner. To assure project quality and success, owner oversight and inspection are critical to protect the state's interests. Also, the owner must trust the DB contractor team to deliver a project on time and on budget while maintaining the owner's profit margin. This requires communication in a seamless system for optimum efficiency for project design and construction with practices that are designed for timely decision-making to keep projects on schedule and within budget.

While many transportation agencies currently use DB for only a small percentage of projects, the DB method should be considered as an additional contracting tool when the benefits warrant its use. ConnDOT's implementation of DB will require a commitment of staff resources and changes in the department's procedures and practices to accommodate the special requirements of design-build contracting.

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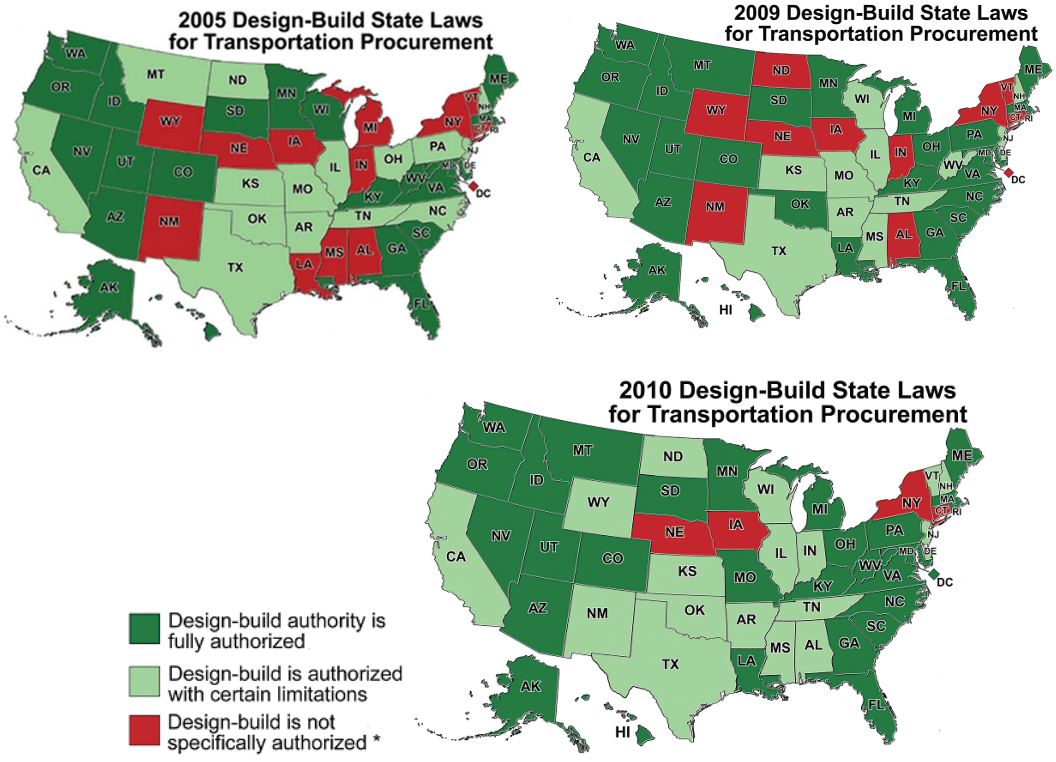
I: INTRODUCTION

Transportation agencies are always looking to lower the costs and time required to design and construct transportation infrastructure while maintaining or improving project quality. One of these strategies is design-build (DB) project delivery. In 1990, the Federal Highway Administration (FHWA) established the Special Experimental Project Number 14 (SEP-14) – Innovative Contracting. This act allowed state transportation agencies to test and evaluate a variety of approved alternative project contracting methods. In 2007, section 1503 of the "Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users" (SAFETEA-LU) included revised regulations that allow contracting agencies to issue DB request-for-proposal documents, award contracts, and issue notices-to-proceed for preliminary design work prior to the conclusion of the National Environmental Policy Act (NEPA) process (FHWA, 2006). Consequently, transportation departments across the nation have begun to implement DB programs. However, there are still state transportation agencies that have not received legislative approval to use the DB method.

The Design-Build Institute of America (DBIA) has been tracking states which have adopted DB legislation. Figure 1 displays an overview of states that have adopted DB legislation over the last five years. As of 2010 only four states have yet to adopt DB legislation for transportation projects, including Connecticut. According to the DBIA the increase in authorizing legislation from 2009 to 2010 was due to the release of federal stimulus funds for transportation projects and the need to construct these projects in a timely manner.



SOURCE: DESIGN-BUILD INSTITUTE OF AMERICA

FIGURE 1: DESIGN-BUILD FOR TRANSPORTATION LEGISLATION: 2005, 2009, 2010

The objective of this study was to conduct a literature review to identify how using a design-build (DB) contracting methodology may benefit the state of Connecticut. The literature review is intended to establish known issues and advantages with the DB process with regard to its use for transportation infrastructure projects. Furthermore, the research team explored previous DB projects throughout the United States to determine if there are certain situations or transportation-related projects where the DB method would be preferred over the traditional design-bid-build (DBB) method. There are well documented advantages and disadvantages to both methods. This report explores the pros and cons of each method with respect to transportation projects in Connecticut. Furthermore, this report focuses specifically on the challenges DB must overcome to be viable in Connecticut. Additionally, if DB is suggested as a contracting methodology that would provide benefits to Connecticut, then implementation strategies will be explored, as well as concepts for legislation that may be necessary to provide ConnDOT with authorization to utilize DB. This study was conducted by the Connecticut Academy of Science and Engineering (CASE) for the Connecticut Department of Transportation.

II: BACKGROUND

There are two primary methods that most state transportation agencies use to design and build infrastructure. The first, DBB, is a project delivery method under which a project owner (for the purposes of this report the "owner" will be considered a department of transportation [DOT]) executes multiple contracts for architectural/engineering services and construction. The second method, DB, is a project delivery method under which the DOT issues a single contract for both the architectural/engineering design services and construction services. Figure 2 is a simplified organizational chart to illustrate the primary difference between DB and DBB. There are benefits to each of these design and construction methodologies. Currently, design-bid-build is the only project delivery method available to the Connecticut Department of Transportation (ConnDOT), since the department does not have legislative authority to use the DB method.

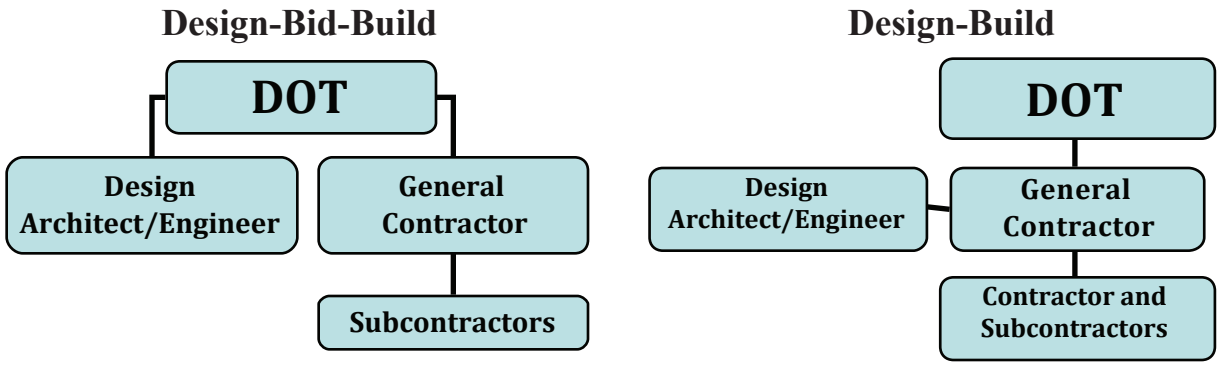


FIGURE 2: DBB AND DB ORGANIZATIONAL CHARTS

The following sections of the report outline how DBB is currently employed by ConnDOT and how DB is used by other transportation agencies.

THE DESIGN-BID-BUILD METHOD

This section outlines ConnDOT's current construction methodology, DBB. This method is not unique to ConnDOT and has been the traditional contract methodology used by transportation agencies, although each state may approach the DBB method differently.

DBB is a project delivery method in which the DOT contracts with separate entities for the **design** and **construction** of a project. The four main sequential phases to the DBB delivery method are planning, design, bidding, and construction.

Planning Phase

The planning phase consists of the preliminary design process where the DOT either contracts with a consulting firm or conducts an in-house preliminary feasibility study of the proposed project. During this phase the DOT seeks to establish a well-defined scope of work, desired

product, look and/or functionality. Acceptable projects are then selected for the design phase based on need and availability of funds.

Design Phase

In this phase, ConnDOT may perform the design in-house or retain an architect or engineer to supplement their in-house design capabilities. The design cost generally accounts for a relatively small portion of the project's total costs. Based on a review of 657 ConnDOT DBB construction projects, on average, 9% of the total project budget was committed to design, and on 83% of the projects, less than 25% of the total project cost went to design services. When ConnDOT does not design a project in-house, it selects a design consultant from a list of prequalified consulting firms that it maintains in accordance with Connecticut General Statutes, Section 13b-20e.

Consulting firms must submit credentials and qualifications to ConnDOT annually if they are interested in being considered to provide services to ConnDOT. Based on the prequalification documents, consultants are categorized and sent ConnDOT project need solicitations. Only firms prequalified in a calendar year in respective categories are eligible to submit a letter of interest. Based on the firms which respond to a solicitation, a shortlist of eligible firms is finalized and/or a selection is made. Consultant selection is guided by the evaluation criteria set forth in Sections 13b-20b through 13b-20k of the Connecticut General Statutes.

Assuming an outside consultant is utilized for project design, once the consultant is selected, ConnDOT works closely with them to ensure their design is in compliance with public interest, design standards and federal/state regulations. ConnDOT conducts design document progress reviews at 30%, 60%, 90% and 100% completion. Once the design is at least 75% complete, ConnDOT initiates the environmental permitting process, although DEP is receptive to permit discussions at an earlier stage of design. DEP anticipates that project designs will be virtually complete (approximately 90% complete) prior to issuance of permits. At the end of the design phase, the construction plans generated by ConnDOT or a design consultant are used in the next two phases of the DBB method.

Bidding Phase

ConnDOT issues a request for bids based on the design that is completed by in-house staff or consultants. ConnDOT also includes a request for bids or proposals along with the design specifications for review and consideration of prequalified contractors. The only exceptions to this requirement are projects that do not require prequalified bidders; in such cases, this will be noted in the bid specifications for the project.

Questions may arise during the bidding phase, and ConnDOT typically issues clarifications or addenda to the request for bids. From the design drawings created in the design phase of the project, the contractor estimates its bid price (ConnDOT may request and bidders may submit either unit price bids, lump sum bids or a combination of the two) for submission by the closing date based on the estimated quantity of materials needed to complete the project. ConnDOT may use lump sum items for a significant percent of the overall project cost for vertical projects. Once bids are received, ConnDOT reviews the bids and must award the construction contract to

the lowest qualified bid. However, potential contractors may be excluded if they do not submit the required documentation. If the bids received greatly exceed the price range estimated by ConnDOT, a project may be withdrawn to be scaled back, put on hold, or canceled.

Construction Phase

Before actual operations are started by the contractor, ConnDOT holds a preconstruction meeting to review the contract and discuss any potential issues either party may have before construction begins. A Chief Project Engineer assigned to the project by ConnDOT must become familiar with all phases of the project and learn of any extraordinary features involved.

A critical component of the construction phase is the inspection process. The Chief Project Inspector, assigned by the Assistant District Engineer, must make a careful study of the plans, contract(s), special provisions, property agreements, utility agreements, permit applications, permits, survey and design reports, and specifications for the project. The Chief Project Inspector is also responsible for maintaining a daily diary that is required for every calendar day from the actual project start date to the completion date.

The inspection process consists of a review and critical examination of all aspects of the construction of transportation projects. This process is designed to ensure that proper materials and details of construction are followed as specified by the design plans, state construction standards, or special provisions as set forth by ConnDOT. The project inspectors are also responsible for tracking and reporting the number of units of materials used during construction. These unit tallies are used by ConnDOT for authorization of payments to contractors when a contract is based on unit pricing. ConnDOT reserves the right to perform detailed inspection entirely by state employees or by hiring a private firm. Private, independent firms represent the Commissioner and act as an agent of the state in accordance with the terms of their agreements with ConnDOT. They must act in accordance with ConnDOT's established policies and in the best interest of the state. ConnDOT also performs materials testing to ensure that materials used on construction projects meet or exceed the design standards of the state and the project.

During the construction phase of a project, the contractor may find it necessary to request design changes based on field conditions, constructability issues or errors/omissions. These change orders must be approved by ConnDOT. They could result in a significant increase in final project cost and may result in significant time delays in construction if a redesign is necessary. Once the construction of a project is complete, final project inspection is conducted, including code inspections and issuance of Certificates of Occupancy if required, and ConnDOT then issues the final payment to the contractor. ConnDOT also currently employs a system of incentives and penalties based on the quality and timeliness of the contractor. Contractors may receive a prorated bonus if a construction project is finished ahead of schedule. Conversely, ConnDOT may penalize contractors on a project if the materials used do not meet standards, construction is not timely, or if the final project does not meet the standards set forth in the contract. In this case, ConnDOT penalizes the contractor by reducing project payment by a percentage specified in the construction contract.

THE DESIGN-BUILD METHOD

This section outlines the general structure of the DB method. Since ConnDOT does not have legislative authority to use this contracting method, this section describes the method in general terms. However, the Connecticut Department of Public Works (DPW) has the legislative authority to use the DB method and has been using the method on select projects for over 15 years.

DB is a project delivery method in which the DOT contracts with a single design-build contractor for the engineering/architectural design and construction of a project. The design-builder may be a single firm, a consortium, joint venture, or other organization (FHWA, 2009). Regardless of how the design-builder is organized, one entity assumes primary responsibility for design and construction of the project. According to the FHWA (2006), the primary benefit of the DB process is reduced project delivery schedule, with maintenance of the same level of quality as the traditional DBB method. "The objective of design-build contracting is to deliver projects better, faster, with fewer Department resources than the conventional design-bid-build method" (WSDOT, 2004).

Project Selection

Not every project is suitable for the DB method. This section outlines the characteristics of a project that might make it suitable or unsuitable for DB.

Assessment of benefits is the starting point for DB consideration. An agency must objectively evaluate what can be gained from using DB over the traditional DBB method. DB can be used to promote innovation, allowing the designer and builder to combine their strengths to develop new design and construction techniques (FHWA, 2009). Projects best suited to achieve maximum benefits utilizing DB are those where

- significant time savings can be realized through concurrent activities;
- designs tailored to a contractor's capability will produce a higher-quality, lower-cost product;
- an expedited construction process will reduce the impact to the public;
- environmental impacts are minimal, if any, requiring only basic or no permitting. However, in certain cases, projects with complex environmental conditions may benefit from use of DB, since this method allows for innovative construction methodologies and design to potentially limit environmental impacts;
- right-of-way and utility impacts are minimal;
- DOT staff are able to provide quick turnaround on reviews and approvals;
- the agency is committed to and decisive about the overall look and function of a project from the planning phase;
- there is opportunity for risk transfer. In design-build the primary risk is transferred from the state to the DB contractor.

Project size and complexity can play a major role in project selection for DB contracting. Projects that are very complex or costly offer the greatest potential for benefit. The integration of the designer and builder on large or complex projects allows for innovation and cost-saving construction techniques to be integrated into the design. However, selection of smaller projects may also benefit an agency. With smaller, lower-cost projects, the risk to the DOT is even lower, the project schedule may be reduced, contracting costs may be reduced, and smaller firms can compete and gain experience in using the DB method. Many agencies have a minimum project cost threshold, where DB cannot legally be used if the estimated project cost is lower than the state-sanctioned minimum. This threshold varies from state to state. Washington has a $10 million threshold while Massachusetts has a $5 million threshold.

Construction schedule is another major consideration for the selection of a DB project. DB is often chosen for projects where fast track implementation is a high priority (FHWA, 2009). If a project must be completed on a restricted time schedule or if traffic impacts are substantial, the DB method may be advantageous due to a projected shorter construction period than that estimated for the DBB method. However, DB may not be the best method where there are outside constraints such as environmental permits, extensive right of way acquisition, complex third-party agreements, and/or extensive utility relocations.

Assessment of project risk is the main consideration in DB project selection. When considering a project for DB, the DOT should evaluate its risk and how that relates to the use of DB. Potential risk factors that an agency should consider when selecting a project for DB (WSDOT 2004) include the following:

• Construction administration	• Liability for design
• Permit requirements	• Site conditions/Differing site conditions
• Utility relocations	• Contract changes
• Funding	• Liquidated damages
• QC/QA responsibilities	• Performance schedule
• Labor disputes	• Ability to compete
• Weather conditions	• Ownership of ideas
• Inflation	• Cost of proposing
• Hazardous materials	• Contract terms
• Third-party involvement	• Payment methodology
• Third-party claims	• Incentives/disincentives
• Schedule	• Assignment of risk
• Incremental acceptance of work	• Bonding requirements
• Performance guarantees/warranties	• Errors and Omissions
• Force majeure	• Insurance requirements
• Design reviews/approvals	

Planning Phase

Similar to DBB, the planning phase in DB consists of a preliminary design process involving a contracted consulting firm or in-house design staff. Early in the planning phase, the DOT decides if the project is suitable for the DB method. During this phase, the DOT seeks to establish a well-defined scope of work, desired product, and look and/or functionality. In the DB method this phase is critical for a successful project. Since a full design is not in place during the bidding process for construction, the DOT bears a larger responsibility for fact-finding and background research to ensure bidders can accurately estimate project cost. To develop an adequate request for bidders, the DOT typically completes 15%–30% of the preliminary design. At this level of design, the DOT should be able to present a well-defined project that provides potential design-builders with enough information to formulate an accurate bid to complete project design and construction. At this stage of the design development process, the DOT must also describe minimum quality and standards and/or prepare a performance specification. This reduces the DOT's risk and helps to assure that the end product is of the desired quality and that the use of unique materials that are more costly to maintain than would be provided in a DBB project is avoided. However, the DOT needs to recognize that after completing the preliminary design, they need to be completely satisfied with the plan. This is because changes to the design after contractors submit bids could require the selected design-builder to submit change orders that could result in significant impacts on project cost and schedule.

Procurement Phase

Once a project is well defined and the DOT is satisfied with the preliminary design, the procurement process begins. The selection of a design-builder is often completed in two stages. The first is a request for qualifications (RFQ) and the second is a request for proposals (RFP). However, FHWA's regulations (23 CFR 636.202) provide guidance on selecting a two-phase or a single-phase procurement. The single-phase procurement process is typically used in emergency situations where a rapid delivery schedule is critical. Furthermore, the FHWA requires an agency to evaluate price in the DB procurement process. The exception to this regulation allows an agency to award a DB contract on non-price factors when an agency elects to release the final RFP and award the contract before the conclusion of the National Environmental Policy Act (NEPA) process (FHWA, 2009). Federal-aid projects released under that procurement process may require a price reasonableness determination (See 23 CFR 636.109 and 636.302) (FHWA, 2009).

A literature review was conducted to determine the "Best Practice" for procurement for DB projects (NYDOT, 2003; Strong and Juliana, 2005; WSDOT, 2004). The following sections outline the common steps identified in the review that states employ in their procurement process.

REQUEST FOR QUALIFICATIONS

The RFQ is the first step in the two-step selection process. The purpose of the RFQ is to solicit a well-defined qualifications package from parties interested in submitting a proposal for a project. The RFQ then serves as an instrument to select the potential bidders for a project at the RFP stage. The DB selection process complements the DBB process in that prequalification is required for a proposer to submit a bid. Those interested in being considered for the RFP are asked to submit documents supporting their capabilities, experience and past performance on issues pertinent to the DB project. The RFQ should also include requests for project team

organization, quality control/quality assurance (QC/QA) approach, and current safety record. To minimize the cost to proposers and increase the number of respondents to the RFQ, an "approach" section should not be included in the RFQ. Since research of solutions is expensive, any proposed solution in the RFQ will most likely not be well researched and not beneficial to the RFQ shortlist selection process. The approach to the project will be addressed in the RFP where the proposers are comfortable spending the effort to adequately research a solution. WSDOT (2004) states that a uniform RFQ is critical and should include specific details such as maximum number of pages, font size, submittal layout and publicly available scoring criteria to ensure proposers are aware of project and design priorities.

Based on the responses to the RFQ, a technical committee creates a shortlist of three to five qualified bidders. This committee should consist of individuals from a broad array of offices within the DOT and with experience in varying project delivery methods. To help ensure scoring accuracy, it may be appropriate to have committee members with little to no expertise in certain areas abstain from those areas. The committee should also be given scoring criteria that defines the ideal DB team. A team approach using members with a broad background will help reduce the need for outside research by the committee. The committee should generate a shortlist of no more than five qualified bidders. WSDOT (2004) recommends that no more than three proposers be placed on the shortlist due to the extremely high cost of preparing a response to the RFP.

In discussions between the CASE Study Committee and a local DB contractor, it was noted that the cost for proposal development alone can exceed $200,000 for a typical DB project. Consequently, the proposers who are not selected will spend a significant amount of time, money and resources developing a proposal. Shortlisting more than three firms might cause some teams to withdraw from the final selection process due simply to increased odds of not being selected.

REQUEST FOR PROPOSALS

The primary purpose of the RFP is to explicitly outline the DOT's desired outcomes and specific requirements for the project. Furthermore, the DOT must provide potential bidders with specific information that may impact their technical approach and therefore their proposed cost to design and construct the proposed project. The DOT should also request information regarding specific design and construction actions, intended final products, construction staging, traffic control, and project management. The RFP may also request descriptions or design development of specific elements to a specified level. These preliminary designs will allow the DOT to evaluate the intent of the design-builder. However, the DOT should recognize the cost in resources and efforts that will be required of potential bidders. If preliminary design requests are substantial, potential bidders may not submit a bid for fear of large cost and risk of not being awarded the contract. The RFP may also request an outline for other items, such as safety plans and public information plans; however, fully complete documents might not be submitted by the proposer until after the contract is awarded.

The WSDOT (2004) requires that the RFP document contain the following sections and sequence:

Proposal Requirements. The RFQ should be a standard document that requires minimal modification for each DB RFP. Proposers should refer to this document for explicit instructions on how to respond to the RFP and formulate the final proposal.

Proposal Contents and Evaluation Criteria. This section of the RFP should outline what each bidder is required to include in the final proposal and outline how each of these items will be evaluated in the procurement process. It should be a standard document that requires minor modifications for each DB project RFP. A well designed RFP should require the proposers to demonstrate their approach to the project through management plans, a draft QC/QA program, narratives, sketches, technical drawings, charts, and graphs to support the description of their concepts. Since the proposal becomes part of the contract documents, requesting submission of critical information upfront assures the DOT that the contractor has thought out and can implement the proposed work. The level of detail required for specified tasks should be directly related to the technical scoring criteria. Therefore, the contractor should have access to the evaluation criteria while preparing its proposal. This will ensure the proposer provides the DOT with sufficient information on items that the DOT identifies as critical to the contractor section.

Scope of Work. The primary goal of the scope of work is to develop and describe performance-based criteria for the design-builder to use in designing and constructing project features. This section should clearly communicate the DOT's envisioned design and construction progression as well as the desired final product. The scope of work should include operational requirements, performance expectations, design standards, project limits, available budget, regulatory requirements, and schedule restrictions. Project requirements from third-party partners also should be included. However, using too many restrictions may hinder innovation or design flexibility. The level of detail required in a DB scope of work document is significantly greater than for a DBB contract. In DB, the scope of work needs to emphasize the DOT's role in the design review and construction process since a contract award leads directly to construction of the project with no opportunity for DOT refinement. For this reason any changes to or ambiguities in the scope of work could result in change orders, which may lead to increased cost and delayed project delivery.

The developed scope of work should be supplemental to and reference design guidelines and design/construction standards. The design-builder is ultimately bound by specified materials or construction processes outlined in the scope of work or the special provisions section of the RFP. However, for DB projects, performance specifications are more appropriate since they do not dictate how to do the work but define the expected product. Performance specifications may address capacity, life span, toughness, ride quality, durability, appearance, conformance with standards, and other measurable features. The project requirements should also include how the DOT will determine whether or not the standards are met. Performance specifications also can include the use of warranties to provide the DOT with confidence in project quality and success. Warranties also provide the DOT with legal recourse in the event of unsatisfactory project delivery. However, warranty terms can be limited by the ability of the contractor to obtain appropriate insurance or extend their bond at a reasonable cost. The warranty or maintenance contracts should ensure that the product functions within the tolerances of the performance standard until the end of a stated warranty period. WSDOT (2004) states that warranties are requested for certain manufactured products regardless of whether the project is DB or DBB.

In addition to design and construction specifications, the scope of work should also include provisions for the administrative, operational and progress reporting components of the DB contract.

As part of the scope of work, the DOT should include a description of the proposed project. The project description can be thought of as an executive summary of the project that describes who, what, when, where, and how much; proposers will describe the how (WSDOT 2004). This document also contains limited construction criteria that the DOT considers relative to the project. The project description should clearly define the purpose of the project, its limits, unique conditions, required design criteria, design elements, physical components, schedule issues, and other items as necessary to fully describe the project (WSDOT 2004). Third-party responsibilities such as right-of-way acquisition, utility relocations, environmental mitigation, railroad facilities, and public information should be clearly assigned so the proposer is aware of the DOT's role and expectations. The proposer should be asked to clearly state the references, methodologies, QC/QA plan, contract administration, construction maintenance, and product warranties. The DOT should describe any significant issues related to the project in this section. The project description is often a redundant source of information for the proposers. Therefore, contract, design and construction requirements should be restricted to the design criteria or specifications section. WSDOT (2004) recommends the following:

> Write the Project Description early in the development of the project, after the project scope has been set but prior to preliminary work by the [Agency]. It represents the mission statement for the [Agency]. The most important aspect of the Project Description is that it provides the vehicle to ensure that the [Agency] understands the complete project and concurs with the expected products and intended outcomes. It provides a common basis for distribution of [Agency] work tasks. It will continue to function as a focus point for the [Agency], evolving as the project evolves.

According to WSDOT (2004), the Project Description typically contains the following subsections:

- General Overview and Funding Limit
- Project Purpose and Expectations
- Project Components and Limits
- Project Requirements and Constraints
- Expected Design Work
- Expected Construction Work
- Warranty or Maintenance Considerations

Design-Build Standard Specifications and Special Provisions. Since there are fundamental differences between DBB and DB, standard specifications need to be written specifically for DB contracting due to simultaneous design and construction techniques. The DB standard specifications are expected to be relevant to all DB projects. Any project-specific changes or amendments that are necessary to the standard specifications are specified in a special provisions section.

Assignment of Risk and Responsibility. In the DB method, risk is shifted from the DOT to the contractor. However, it is vital that both parties be aware of how risk is allocated. This may vary on a project by project basis, reflecting the specifics of the project and the environment. The WSDOT (2004) requires that an RFP include a Risk/Responsibility Chart. This chart outlines items the DOT is responsible for and items for which the DB contractor must assume the risk. Appendix A contains an example of a Risk/Responsibility Chart from WSDOT (2004).

Technical Documents. In order for a proposer to submit an accurate proposal, they will need to have access to documents prepared by the DOT. These documents should be well defined in the scope of work and included in the RFP package. These materials may include maps, traffic forecasts, technical reports, design details, and environmental documentation.

PROPOSAL INVITATIONS AND INFORMATIONAL MEETING(S)

Based on the technical committee recommendations, the shortlisted bidders from the RFQ phase are invited to bid on the design and construction of the project. The RFP is published and the DOT designates a sole contact person for information requests. The technical committee should establish a policy before the RFP is released regarding how to respond to requests for information and what information will be made available. Project information that is released to interested parties should be consistent for all that inquire. This can be done through amendments to the RFP or informational meetings hosted by the DOT to address proposers' questions. Any questions raised and answers or clarifications provided must be shared with other proposers. However, due to the competitive nature of the contract procurement, the identity of the proposers should remain confidential and posted questions and responses should not disclose who posed the question.

PROPOSAL EVALUATION AND DESIGN-BUILDER SELECTION

The majority of DB programs are set up to operate under a "Best Value" selection process. However, the awards can be made based on lowest bid, fixed price, and stipulated sum or modified methods specific to DB. In a Best Value approach, design-builders submit two sealed proposals: Technical Proposal and Price Proposal.

Technical Proposals. In the DB process, the review and evaluation of the technical proposal is the most important task the committee will undertake. Determination of acceptable proposals is equivalent to the "Design Approval" of the DBB process. However, in DB, the DOT also needs to evaluate the proposed construction process. The technical proposal should also be reviewed for compliance with the contract requirements, including the relevant codes and manuals. The technical proposal contains the required documentation and any preliminary designs prepared by the DB team. This package should not contain any information regarding project cost. The contents of the technical proposal are evaluated based on the review criteria established in the RFP. The technical committee scores the proposal based on these criteria. If any members of the technical review committee do not have experience with a particular portion of the review criteria, they should abstain from assigning a score to that portion of the criteria. This ensures that scores obtained from the review criteria are justified and of the highest quality. Once the technical proposals have been reviewed, the committee may wish to have each proposer present their proposal to the committee to clarify any issues raised in the proposal review process. However, these presentations should not be used to allow proposers to fill or revise missing or incomplete areas of their proposal. Since the written proposal will become a part of the award

contract, the committee needs to ensure their decision is based on the written proposal and not discussions held with proposers. Therefore, scoring of the technical proposal should be done before meeting with the proposer. The committee may wish to incorporate a small portion of the final technical proposal score to be completed after the meeting with the proposer to account for significant clarifications. However, if a proposal needs significant clarification, the committee may not wish to proceed with that proposal and may reject it based on lack of information, incomplete documentation, unacceptable design, etc.

Price Proposals. The price proposal contains the price associated with the proposed design. Once the scores have been assigned to the technical proposal, only then should the sealed price quote be opened and evaluated. The price proposals should be stored in a locked vault on receipt and opened publicly at a predetermined and advertised time. The prices should be read aloud and entered into the scoring matrix with the technical scores obtained earlier. This ensures that the review of the technical proposal is not biased by price to construct the project.

Contract Award. The scores from the technical review and the price review are then entered into the evaluation criteria and a final score is calculated. Figure 3 is an example of how the final score is calculated by WSDOT (2004) using the Best Value contractor selection methodology. Total score equals the proposal technical score determined by a proposal review committee multiplied by 1,000,000 and divided by the bid price. The technical score is based on how the proposing contractor addressed a set list of design elements. The key design elements are provided to potential contractors in the RFQ. In this example, Team D is the lowest bidder and Team C has the highest technical proposal score. However, Team B would be awarded the contract since their proposal was rated to provide a perceived higher quality design than Team D, but at a lower cost than teams A and C. The design-builder is chosen based on a balance of design and price. Under this scenario, if the projects were awarded solely based on lowest price, the DOT would receive a design that was scored the lowest in the technical proposal. This is where innovative design becomes vital to the DB method and the DOT. Innovations included in proposals allow proposers to gain a competitive advantage in the selection process, reduce design and construction costs, speed implementation, or gain benefits from any incentive programs (FHWA, 2009). Under DBB, contractors and designers only meet after the design is finalized. Then the contractor has to comply with, or request potentially costly changes to, the agency-approved design.

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

An example of calculation scenarios follows:

Scoring

Team	Technical Proposal Score	Proposal Price
A	930	10,937,200
B	890	9,000,000
C	940	9,600,000
D	820	8,700,000

Calculations

A	$\frac{930 \times 10^6}{10{,}937{,}200}$	=	85
B	$\frac{890 \times 10^6}{9{,}000{,}000}$	=	99
C	$\frac{940 \times 10^6}{9{,}600{,}000}$	=	98
D	$\frac{820 \times 10^6}{8{,}700{,}000}$	=	94

FIGURE 3: EXAMPLE DESIGN-BUILD PROPOSAL SCORE

QC/QA Plan. In DB, inspection, quality assurance, and design reviews will be the metrics that the DOT uses to gauge compliance. Therefore, before awarding the DB contract, the QC/QA plan submitted by the contractor should be reviewed and any issues with QC/QA resolved and finalized before a design and construction contract is awarded.

Design and Construction Phase

After selection of a design-builder and execution of the contract, the contractor's project manager will be responsible for management activities, including progress reports, scheduling, communication, project direction, project scope changes, and oversight of the quality control program. Typically the DOT assumes the responsibility for monitoring contract compliance and schedules, processing progress payments, performing quality assurance activities, assisting in permitting and right-of-way acquisitions, negotiating contract amendments, and resolving disputes. However, a well-written project RFP will specify the exact responsibilities and risks assumed by the DOT and contractor. In terms of quality assurance, the DOT is responsible for assessing product compliance with contract documents, verification of the design-builder's quality control measures, meeting federal quality requirements and any other requirements outlined in the negotiated quality control plan.

At the onset of the project, the DOT should establish a DB project team to manage the project and ensure timely completion. A typical project team may include: Project Engineer, Assistant Project Engineer, Designer(s), Inspector(s), Material Tester, QA Specialist and administration staff. The assigned staff should be familiar with the DB process, since the design phase is typically fast-paced and requires rapid turnaround by the DOT to ensure timely construction. Specialized training should be offered in the DB method for DOT staff who will be involved in DB project oversight. Agencies that use DB often have a DB office within the DOT to ensure that their staff is adequately trained and thoroughly familiar with the DB processes, procedures

and policies and is dedicated to the success and timely completion of DB projects. During the construction phase, the design-builder must submit many of the same documents required for a DBB project that utilizes separate contracts for professional services and construction.

DESIGN PHASE

In DB, the design risk is assumed by the design-builder. The DOT's responsibility will be to determine if the proposed design conforms to the contract.

The responsibility of the design-builder is to design and construct a product that meets the intended outcome of the DOT. The DOT, per the contract, ensures that the design and construction meet the standards and requirements outlined in the RFP. Therefore, comments by the DOT concerning design elements that do not conform to the contract must be incorporated by the design-builder. Any comments and requests from the DOT outside of the requirements of the contract are at the design-builder's discretion only. The DOT must keep in mind that such requests may result in change orders from the design-builder that may also include project cost adjustments.

For the design-builder, the design effort begins by completing the necessary background studies required by their proposed design. Right-of-way, utility relocations and permitting issues should be addressed immediately since these will be critical to the project timeline. The DOT is responsible for right-of-way acquisition and should have started the process based on their conceptual design. It is the responsibility of the design-builder to notify the DOT if any revisions to conceptual design require additional right-of-way or permits. Environmental permitting is a significant challenge in the DB process and will be discussed in detail in Section IV of this report.

CONSTRUCTION PHASE

Since design and construction can occur simultaneously in DB, the design-builder can begin preparing the construction documents once they have obtained the necessary background material. Since the DOT has already approved the contractor's design by selecting their proposal for contract award, there is typically no further design approval requirement. The DOT may wish to review plans and provide over-the-shoulder reviews as the project progresses. However, the DOT should not hinder the design and construction process, and reviews should have a rapid turnaround. The design-builder will use a phased design technique. By phasing the design, construction can begin before the design is finalized. Therefore, construction could commence very near the start date of the contract. Under DB, the contractor is responsible for hosting the preconstruction meeting to discuss contract administration and work coordination with outside parties, such as local agencies, utilities and permitting agencies.

Inspection and Materials Testing. Under DB, the inspection process is typically less demanding of the DOT than in DBB. However, the authority of the inspector is the same. The primary job of the inspector is to ensure that construction of the project follows the design submitted by the design-builder. The design-builder may be required to hire an independent inspector and the DOT's inspectors should work closely with the design-builder's inspectors to ensure all of the quality control specifications are met.

In terms of materials testing, there is no difference in function under DBB as compared to DB. However, there is a change from the prescriptive specifications of a DBB project to performance specifications of a DB project. This change may require changes in methods of quality measurement. This is dependent on the current materials testing program utilized by the DOT. Also, much of the construction documentation currently being collected under DBB is still necessary under a DB contract.

Project Completion. Once the DB contractor has fulfilled all conditions of the contract, a final inspection will be conducted to provide the design-builder with a list of corrective or incomplete work items to close out the contract. If necessary, the design-builder must correct any outstanding issues that are identified during the final inspection. Once all issues have been resolved, the contract is closed and the project is considered complete. In DB projects with performance specifications, warranty or maintenance contracts, the design-builder will still be held responsible for repair, retrofit and replacement, or held liable for premature failure of specified components of the project for the period as specified in the contract.

If the DOT included provisions in the contract for bonuses for early completion or other performance related incentives or penalties, the design-builder's final payment may be adjusted, in accordance with the terms of the contract.

Delivery Method Comparisons

This section compares the advantages and disadvantages of the DBB method to the DB method. Each of these project delivery methods has its strengths and weaknesses. These observations are not limited to ConnDOT's experience. A review of literature was conducted to generate the following observations. It is important to recognize that the DB method is not a replacement to DBB, but an additional tool an agency can use when deemed advantageous. DB is not for every project, just as DBB may not be the best method for every project. Table 1 contains a list of advantages and disadvantages of each project delivery method.

TABLE 1: ADVANTAGES AND DISADVANTAGES OF EACH CONTRACTING METHOD

Advantages	Disadvantages
Design-Bid-Build	
• Owner-Loyal Design Team • Contract Award Objectivity (Lowest Price is the Only Consideration) • Design Is "Fully" Defined Before Contractor Bids • Reduced Project Monetary Cost through Competitive Lowest Bid Process • Quality and Quantity Control and Inspection • Opportunities for Small or New Contractors	• Low Bid Contract Award May Impact Project Quality • Agency is a Middleman Between Designer and Contractor • Contractor is Not Involved in the Design Process • Project Timetable Subject to Additional Contracts and Change Orders • Changes in Design and Constructability May Significantly Increase Final Price
Design-Build	
• Potentially Shorter Project Timeline • Reduced Number of Change Orders • Price Certainty, If Fixed Price is Used • Agency Not Involved in Contractor/ Designer Disputes • Contractor and Designer Work Together Early in the Project and Throughout the Project • Potential for Innovative Design • Reduced Legal Claims Against Owners	• Subjective Contract Award • High Cost for Contractors to Prepare a Bid • Environmental Permitting, Utility Relocation and ROW Acquisition Can be Significant Challenges • Agency limited in controlling quality unless performance specifications are used.

Another benefit to DB is potential cost savings. According to FHWA (2006), a review of SEP-14 DB projects indicated a 3% cost savings over DBB projects. However, the cost savings varied based on project type, complexity and size, and were not seen on every project. Therefore, selection of DB or DBB as the contracting methodology for a project should take into consideration the various factors and goals of each project.

Project Delivery Timetable. The DBB process typically takes longer to complete than the DB process (Figure 4). In DBB, the design must be completed to entertain construction bids and award a construction contract. Then the contractor may need to submit potentially costly and schedule-altering change orders to the approved design. Failure of the design team to consider construction techniques and associated costs could cause project delays if the construction documents must be modified to reduce costs or ensure a project can be built as designed. Lessons learned during the petroleum spikes and economic downturn of 2008 and 2009 are examples where a one-year project delay may equal a significant increase in project cost. Furthermore, if the architect's contract does not contain an explicit redesign clause, disputes over changes to a finalized design may arise.

In DB, by overlapping design and construction and removing the agency from conflicts between designer and builder, the DB method can usually deliver a project faster than the DBB approach (Figure 4). Based on the study conducted by Ernzen, et al (2004), a similar DB project can be completed approximately 20% (≈200 days) faster than a DBB project. Shortening the project timescale by nearly a year can have significant financial impacts and can also reduce the inconvenience to the traveling public. The DB method may allow the agency to implement new construction projects more rapidly.

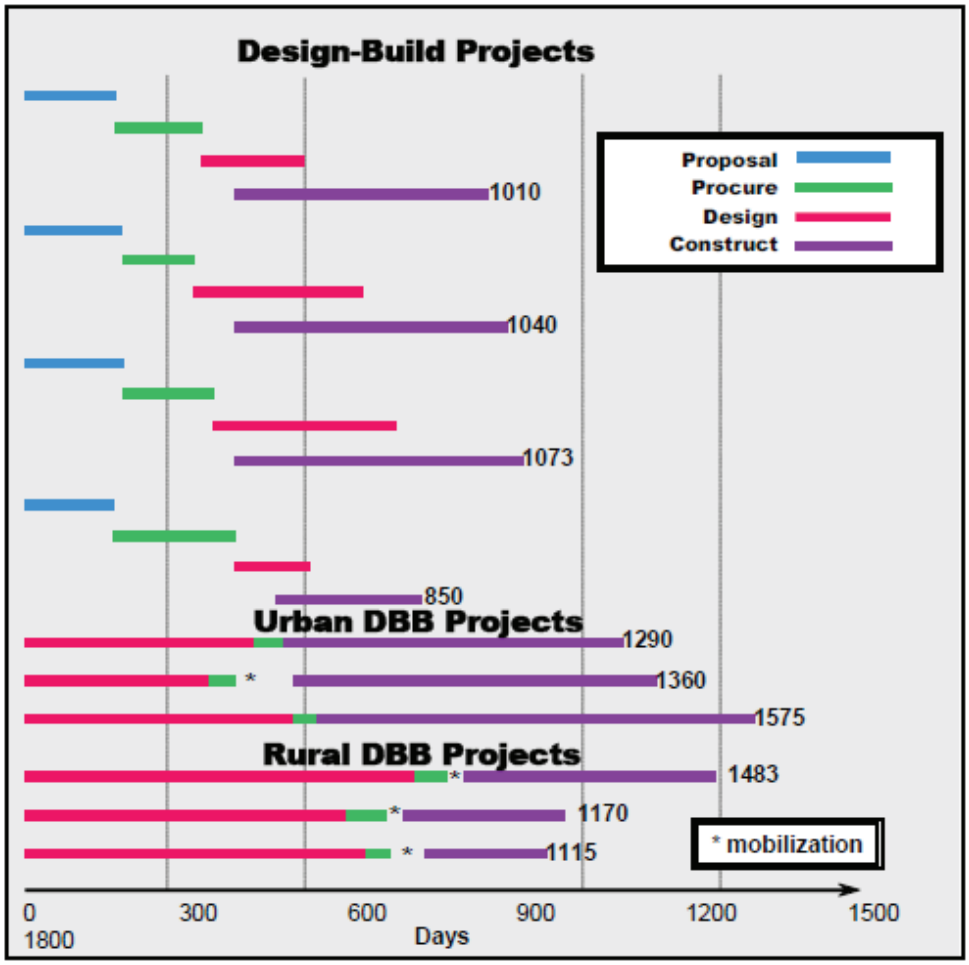


FIGURE 4: DESIGN-BUILD VS. DESIGN-BID-BUILD TIMELINES (FROM ERNZEN ET AL 2004)

Design Team Loyalty. In DBB, the design team is under contract to and reports directly to the DOT. Since the design and construction contracts are separate, contractors are not solicited until the design is complete. Therefore, the designer has no loyalty or financial ties to the contractor and is able to objectively evaluate and protect the interests of the DOT. In DB, the designer works for or directly with the contractor and may have a financial interest in cost savings to increase profit. However, the agency still has control through the RFP and contract to enforce requested and agreed upon design components and quality.

Contract Award Objectivity. Under DBB, the architect/engineer contracts are awarded on subjective criteria of experience and qualifications. However, the design contract usually represents only 5%–10% of the total project cost. Therefore, the majority of the total project budget (>90%) is awarded to a construction contractor based on competitive bidding and the objective selection method of lowest cost. Construction contract awards that are based on low-bid selection criteria reduce the opportunity for bias and inappropriate influence in contractor selection (Hill, 2005). In DB, the entire project may be awarded on a more subjective qualifications and "Best Value" basis. In order to ensure ethical and legal selection of a design-builder, the agency needs to follow a strict selection process and maintain confidentiality throughout the process. For an agency, the selection process is much more labor intensive in DB as compared to DBB.

Design Stage. In DBB, since the DOT has a fully developed design at the time a contractor is awarded the contract, there is little uncertainty about exactly what the DOT requires of the contractor. Furthermore, as the design goes through the request for bids process, incorrect or missed items are usually discovered and addressed before construction begins. In DB, the final design is ambiguous for the contractor at the contract award phase. In the RFP, the DOT must adequately describe the overall structure they expect the contractor to deliver. A contractor's proposal in response to an RFP includes a preliminary design upon which the DOT awards the contract without a completed final design. However, the agency can provide the design-builder with input during the design and construction phase with no impact on project price as long as the agency's comments and requests are within the scope of the RFP.

Competitive Bidding. In Connecticut, a DBB contract is awarded solely on a lowest price basis. Therefore, competition motivates bidders to submit their lowest possible price because they know price is the sole basis for contract award. In DB, contracts can also be based on the lowest bid, but most often are based on "Best Value." The best values method increases competition not only in price reduction but also for innovative design and solutions. Therefore, contractors need to be able to balance the needs and desires of an agency while also considering project cost.

Quality Control. In DBB, the detailed working drawings and specifications developed by the architect/engineer are the basis of the contract between the construction contractor and agency. In DB, without a contract that is based on detailed working drawings, an agency may be limited in controlling the quality of the contractor's work. To address this issue, DB employs performance specifications to establish more control on construction quality.

Opportunities for Small or New Contractors. In DBB, small and newly established contractors with lower overhead may be able to compete with larger companies. This provides qualified small and new contractors the opportunity to compete for government contracts. In DB there is a concern that small contractors will not be able to compete with larger DB firms and that they will be forced out of the market or business. Furthermore, with DB request for bids there is a significant amount of design work that needs to be completed to generate an accurate cost estimate. Smaller firms may not wish or be able to invest significant resources and effort into a design and bid without an assurance of return. To address this issue many states have provided authorization for agencies to provide stipends to compensate proposers for the cost of proposal development. The owner is then free to request the incorporation of elements from any contractor's proposed design in the final design.

Cost Vs. Quality. In Connecticut's DBB procurement process, the lowest bidder is awarded the contract. In economically difficult times, a general contractor's desire for work may force them to select the lowest-cost sub-contractors in an attempt to submit the lowest possible bid so they will be awarded the contract. This increases the risk to the general contractor and can compromise the quality of construction. In extreme cases, the bankruptcy of a sub-contractor or a contractor on the brink of insolvency can lead to serious disputes involving final product quality, or possibly cause the project to be delayed. In such cases, the DOT may be required to take action to assure project completion that could require the hiring of another contractor to complete the job while becoming legally entangled in costly litigation. Furthermore, the general contractor is brought to the team post design, where their input on cost-effective innovative construction methods and cost-saving construction techniques related to design alternates is limited. In the DB selection process the DOT has the ability to select a contractor based on the cost and quality of their design through a "Best Value" approach.

Agency as a Middleman. The design and construction of a structure is an extremely complex undertaking. Even with the most prudent architect/engineer, there is the potential for errors and omissions in the working drawings and specifications. These situations may lead to time-consuming disputes and costly legal action. Disputes between the architect/engineer and contractor are present no matter what construction delivery process is used. However, in the DBB process, the public agency hires the architect/engineer and then sequentially selects a contractor to build the design. Legally the agency is guarantor of the completeness and accuracy of the architect/engineer's work, since the contractor has no agreement with the architect/engineer. Therefore, if there are major errors or omissions in the design the contractor may incur major reconstruction cost or time delays to correct the design. The agency may then become heavily involved in the dispute between the architect/engineer and contractor. The DOT may also be the target of litigation because of its perceived "deep pockets." In DB, the public agency is not legally the guarantor of design completeness and accuracy. The DB team, via the architect/engineer, legally assumes that risk. Therefore the agency may avoid conflicts and disputes between the architect/engineer and construction contractor since they are not the middleman between the design and construction company.

Builder Role in the Design Process. With DBB, the request for bids for construction is not issued until after a full design has been finalized. Therefore, the contractor has limited input on how to improve the project design, functionality, cost, construction materials and methods. In DB, the contractor and designer work together from the first stages of project design and can provide input on how to design a structure for constructability or innovative construction solutions with consideration of cost, schedule, environmental impact and quality, as well as other factors.

Confidence in Final Price. During the planning and design phase of a DBB project, the architect/engineer prepares cost estimates typically when the design is 10%, 35%, and 100% complete. These estimates provide the agency with an early indication of a project's cost. However, until design is completed and construction bids have been received, the agency cannot be certain how much the project will cost. Furthermore, any significant change orders to the design once construction has started could cause major increases in project total cost. In DB, the price is fixed at the time of contract award. This is particularly beneficial for projects with limited budgets and can be a key factor in obtaining project funding financing (FHWA, 2009). If bids received for a DB project are significantly higher than the anticipated budget, the agency can place a project on hold before significant costs are incurred on a design that is too expensive to build.

In terms of project cost, since the design-builder is taking on more risk, the overall contracted project cost may be higher for a DB project than a DBB project. However, DB projects typically have few or no change orders unless the agency requests a change outside the scope of the RFP, or the agency did not provide due diligence in the planning phase of project development and significant unknowns hinder the project. Change orders can increase a project's construction cost significantly. They can delay construction and can potentially be the source of litigation against an agency by a contractor. According to FHWA (2009):

> "Perhaps the most significant reason why Design-Build results in greater cost certainty is that it involves a single point of responsibility for both design and construction. Design-builder claims against project owners, based on design defects, are essentially eliminated."

Permitting. In both DBB and DB, permitting, utility relocation and right-of-way acquisition requires significant resources and effort. In DBB, the contractor and local authorities are provided with a full set of plans before construction starts. Thus environmental impacts can be evaluated for permitting purposes. However, in DB, at the time construction is scheduled to start, construction plans are not complete. This requires the environmental enforcement and protection agency with jurisdiction to consider permit applications and make permitting decisions without a completed project design. Depending on the project, the responsible environmental enforcement and protection agency may determine that it will not issue the necessary permits and may require that construction be stopped until design plans are finalized A delay in environmental permitting, unless planned for in the project schedule, would have a negative impact on the anticipated time savings advantage of DB contracting. Environmental permitting will be a significant challenge in Connecticut. Section IV outlines the specific challenges ConnDOT will face if DB is to gain legislative approval.

III: DESIGN-BUILD SURVEY

A DB survey was developed to gather information from a select group of states with well-defined and documented DB programs. The following criteria were used to select states to be surveyed. The goal of the criteria was to identify four or five states to be surveyed regarding their DB programs. For a state to be selected for detailed analysis, it must meet the first criteria. However, the second two criteria are optional but desired for the state to be included in the survey process.

1) Identify states with sufficient transportation DB experience. For a state to be included in the detailed analysis, it must have experience in multiple DB projects. Ideally each state selected should have experience with a breadth of DB projects and with many of these projects in transportation-related fields. These projects should vary not only in scale but complexity, with at least one DB project that faced great challenges or even failed. The selected states should also have an established DB contracting procedure that they are willing to share. This will help to ensure that the projects selected and states reviewed give an objective view of DB and its limitations. Understanding how a state can apply the DB methodology to a wide range of projects is critical to allowing transferability of this method, and lessons learned, to Connecticut.

2) Identify states with a multimodal Department of Transportation (DOT) structure and operation. Each state has structured their DOT differently. The Connecticut DOT is responsible for design and construction of facilities for all modes of transportation in the state (rail, highway, airports, etc.). Multimodal DOTs should have a larger variety of DB experience that will provide examples of how they approach the construction of a variety of transportation facilities.

3) Include states with strong unionized workforces. Connecticut has a strong unionized labor workforce. Therefore, when investigating the success and failures of DB, it is important to ensure labor unions in other states are present and comparable. Public employees unions are assumed to be the main opposition to DB. However, contractor union support is important for passage of DB legislation. Including state(s) with strong unionized workforces will provide insight regarding union support, criticism and activism for and against the DB methodology.

The agencies identified using the above criteria were

- Colorado Department of Transportation (CDOT)
- Maryland State Highway Administration (MSHA)
- Massachusetts Highway Administration (MassDOT)
- Minnesota Department of Transportation (Mn/DOT)
- New Jersey Transit (NJ TRANSIT)
- Pennsylvania Department of Transportation (PennDOT)

This section summarizes responses to the survey and any additional information obtained through followup conversations with each agency. Appendix B contains a list of questions asked of each agency and their responses to each question.

SURVEY SUMMARY

The following is a summary of key survey findings.

- The majority of transportation agencies surveyed were only responsible for highways in their state. CDOT is also responsible for airports in the Colorado. Therefore several mass transit agencies in the Northeast were sent the survey. Only NJ TRANSIT responded.
- Most agencies completed more than five DB projects with a similar number currently in progress. The exception was PennDOT, which reported they have completed 77 projects to date and currently have 200 projects at various stages of design and construction.
- All agencies reported that the benefits of their DB program include time savings and reduction in change orders.
- All the state DOTs surveyed included innovative design as an achieved benefit. All agencies—except for PennDOT—have a dedicated in-house DB project manager. PennDOT has a DB Pro-Team at its central office that reviews DB projects and contracts developed by district offices.
- The majority of agencies use a best value approach to contractor selection. However, PennDOT responded that they only use lowest bid. Mn/DOT and MSHA stated that they may also use a lowest bid approach. Colorado responded that they have the option to use a modified pass/fail lowest bid approach.
- Only PennDOT and Mn/DOT responded that they have a modified permitting process for environmental or other permits.
- All agencies reported that using DB has had a positive or no impact on small contractors in their state. The agencies also stated that they worked with local construction organizations when they developed their DB program.
- No state surveyed reported any issues with local labor unions.

Colorado

The Colorado DOT (CDOT) is authorized to use DB for surface transportation projects. Legislation adopted in 1999 authorized CDOT to use a best value procurement process for DB contracts. Previously, they used a low-bid process on a few smaller DB interstate projects (< $50 million). Best value contractor selection was first used by CDOT in 2001 for the $1.186 billion T-REX highway and light rail DB project. CDOT recently modified their DB procurement process. Currently, DB proposals are generally evaluated based on a two-part scoring process that includes lowest price and a technically acceptable design. A two-phase "adjusted score" process is used to select a DB contractor. Contractors are shortlisted by RFQ, then followed by proposals. CDOT gives preference to Colorado resident contractors. However, this scoring metric is removed if it would cause denial of federal funds. Then the project is awarded to the contractor whose proposal provides best value to department.

During the legislative process and DB program inception, CDOT shared concerns about the impact of DB on small and local contractors. Consultants and contractors feared smaller contractors would not have the opportunity to compete against larger, out-of-state contractors. There were also fears that contractor/consultant relationships and disadvantaged business involvement would be adversely affected. CDOT addressed these concerns by involving stakeholders in the formal rule-making process through task forces. Involving stakeholders allowed CDOT to address most of the issues raised.

Over the past 15 years, CDOT has used the DB project delivery method on two major projects: the previously mentioned T-REX project in the Denver Metro area, and the COSMIX project ($130 million) in Colorado Springs. Due to the absence of mega projects, CDOT is currently attempting to normalize the DB project delivery method for small- to medium-size projects (less than $50 million). CDOT reported the following major benefits in using DB:

- accelerated project delivery
- innovation
- improved quality
- improved project control
- better risk management
- single source accountability
- partnering
- value-based project feedback

Also, CDOT recognized the need to educate the public, contractors and internal CDOT staff about DB processes and techniques and continually works to refine and promote the use of DB in Colorado.

Maryland

The Maryland State Highway Administration (MSHA) has completed 23 DB projects and 8 DB projects were in the construction phase at the time of the CASE survey. In Maryland, governmental organizations, such as MSHA, have legislative DB authorization for capital projects. Their selection process is based on a competitive sealed proposal and bid process that allows for a best value selection. The subsequent award must be deemed advantageous to the state. Best value is determined as a function of price and an evaluation of how well the proposal addressed critical design factors identified by the department's preliminary design team as disclosed in the request for proposals.

Completed DB projects in Maryland ranged in cost from $1.5 million to $40 million. However, MSHA is in the process of awarding a DB contract on a major project valued at over $1.5 billion. This project, the Intercounty Connector, will link existing and proposed development areas between the I-270/I-370 and I-95/US 1 corridors within central and eastern Montgomery County and northwestern Prince George's County with a state-of-the-art, multimodal east-west highway that limits access and accommodates the movement of passengers and goods. The project has been broken into five construction contracts; the first three contracts are valued between $400 million and $520 million individually, and are currently under construction. The

last two contracts are valued between $50 million and $80 million individually and are currently under review.

Massachusetts

In 1998, the Massachusetts legislature authorized MassDOT to use DB for the Route 3 North Transportation Improvement project. In 2004, authority to use DB was further expanded to include all project types. MassDOT has completed two DB projects and currently has four projects in progress. MassDOT's DB process involves prequalification, request for proposals, and possibly an oral presentation. Contracts are awarded to the team that best meets the selection criteria for the benefit of the Commonwealth. The agency has the authority to select a project on a value engineering basis. The formula for contractor selection is included in the RFP for the project. MassDOT may also include a stipend for the shortlisted contractors that submit an acceptable bid. This helps to offset the significant cost and effort required to develop a proposal.

Minnesota

The Minnesota Department of Transportation (Mn/DOT) began using DB in 1996 and constructed three projects using a low-bid process for contractor selection. However, in 2001, Mn/DOT obtained legislative approval to use a best value procurement process for DB projects. Mn/DOT has awarded contracts for 10 best value DB projects totaling more than $860 million and currently has three more projects in progress. Mn/DOT is authorized to award DB contracts using either a two-step best value selection process or a low-bid process. However, since the best value contractor selection approach was authorized, Mn/DOT has not used a lowest-bidder approach for awarding contracts. MnDOT cites the following as major benefits of DB: time savings, design innovation, reduced change orders, improved public relations, and more project cost certainty. MnDOT has completed projects ranging from $1 million to $234 million dollars. Also, at the county level, the Hennepin County Board of Commissioners is authorized to use DB for not more than 10% of its total projects in any fiscal year.

New Jersey TRANSIT

New Jersey Transit (NJT) was asked to complete the DB survey to gain information from a rail and transit authority. NJT has been using DB for over 10 years and currently has five DB projects under contract. Followup conversations with NJT indicate they are very satisfied with the DB method and claim major success in implementation. A dedicated DB project manager oversees all NJT DB projects. They require the DB contractor to award 50% of a project's contract cost to sub-contractors, which includes requirements for use of DBE/WBE/SBE companies. One of NJT's most important, and time critical construction projects, the Mass Transit Tunnel (MTT), is being constructed as a DB project. In June 2009, the MTT project was estimated to cost $8.7 billion. They are offering innovative stipends of up to $375,000 to each firm that submits a responsive contract proposal and sealed bid. The stipend is expected to increase competition and thus reduce the cost to the public. The stipend also entitles NJT to the rights of all submitted designs so they can request that design elements and innovations from unsuccessful bids be incorporated into the final design.

Pennsylvania

The Pennsylvania DOT (PennDOT) currently does not have specific legislative authority to use DB. However, the state's Department of General Services does have DB authority and PennDOT operates under their authority. According to PennDOT's survey responses, they have completed 77 DB projects and have another 200 projects currently in progress. However, PennDOT uses a modified DB process that they call "Modified Turnkey." This is a hybrid DB method because the department conducts a much larger portion of project design (up to 40%). The Modified Turnkey approach allows the department to do the majority of the environmental, right-of-way, utility and preliminary design before the contractor is selected. However, many would argue that this is not a true DB process since a large portion of the design is done before the contractor is involved. The PennDOT process can be considered a hybrid DB method.

IV: DB EXAMPLES OF INNOVATION AND CHALLENGE

Throughout the United States, transportation departments have been using DB as a project delivery method. This section summarizes some unique DB projects. These projects represent the innovation and challenges that are associated with DB. Appendix C is a table of lessons learned from the FHWA's Design-Build effectiveness report (FHWA 2006). The FHWA surveyed their entire Special Experimental Project 14 (SEP-14): Alternative Contracting applicants for feedback on their respective DB projects. Since 1990, the FHWA has allowed state DOTs to use DB (and other experimental contracting methods) after applying for SEP-14 permission. This enabled the FHWA to track the success or failure of DB projects. The FHWA no longer requires SEP-14 permission since DB has been shown suitable for use in transportation projects.

Summaries of two contrasting examples of DB projects are provided below. The first project, the Washington Bypass Bridge in North Carolina, is an example of DB innovation. Even though environmental permitting may be a concern in DB, this contracting method also allows for innovation in finding minimal impact solutions. The second project, dormitory construction at the University of Connecticut, is an example of a DB contracting failure that is provided to understand why DB failed at UConn. Specifics as to why this project failed and lessons ConnDOT should learn from this experience were obtained through interviews with UConn staff. These two examples were chosen to show how DB can be extremely successful when appropriate projects are selected, but can have major challenges and potential failure if not managed carefully.

NORTH CAROLINA: WASHINGTON BYPASS BRIDGE

The US 17 Washington Bypass was Beaufort County's first DB project (Figure 5). Construction on the bypass started in March of 2007. The roadway alignment required that a three-mile-long bridge be built over an extensive wetland area. To streamline the construction sequencing, reduce the construction costs, minimize short- and long-term wetland impacts due to construction of the bridge, a "top down" construction method was used. This innovative approach was possible due to collaboration between contractor and designer. Two custom-built, overhead, self-launching truss systems were able to drive piles, erect the bent caps and girders, and enable the deck to be poured from the gantry system. This system eliminated the need to erect a temporary work bridge which would have further impacted the wetlands. Unlike traditional pile-driving, this is a semi-automated approach with a machine that drives piles, and then creates the bridge afterward (ENR, 2008). While environmental permitting and regulations can make DB projects challenging, the Washington Bypass Bridge project demonstrates that DB provides opportunities for innovation.

FIGURE 5: NORTH CAROLINA WASHINGTON BYPASS BRIDGE:
DESIGN-BUILD INNOVATION

UCONN'S DESIGN-BUILD EXPERIENCE

Representatives from the CASE study team interviewed the university's Engineering Services department along with others knowledgeable about the UConn DB project to gain an understanding of UConn's DB experience so that ConnDOT can benefit from lessons learned from UConn's experience. The UConn 2000 construction program utilized DB for several dormitories on UConn's Storrs campus. These were Hilltop Apartments, Charter Oak Apartments and the Husky Village, ranging in cost from $25 million to $30 million each. The Hilltop and Charter Oak dormitories were originally proposed as Design-Build-Lease projects by the contractor. At UConn's request, these projects were converted to traditional Design-Build projects. The DB methodology was used due to a housing shortage on Storrs Campus that created a need to build the dormitories and provide them for use as soon as possible.

In accordance with the terms of the contract, the project architect on the DB team was responsible for code compliance. This resulted in the contractor having control over code interpretation. The out-of-state contractor interpreted the Connecticut building code as allowing code exemptions based on building height. Therefore, the contractor designed all the buildings under the required height in an attempt to circumvent the building codes. However, this led to numerous code violations that needed to be fixed at a substantial cost. Water heaters and furnaces were not properly vented, causing high carbon monoxide levels and odors in living

areas. Firewalls were also not properly installed and codes involving piping in stairwells were not followed. All of these violations could have been prevented by preliminary design oversight by UConn. Our conversations indicated the following:

1. UConn was under pressure to build housing rapidly due to increased enrollment and need for housing. Dormitories needed to be built before the start of the next academic year.
2. Performance criteria were not established by UConn during the preliminary phase of the project. Additionally, since the project was under Connecticut's threshold limits, the responsibility for and certification of code compliance was the responsibility of the architect and builder.
3. UConn was short on staff for managing the project and the contractor was trusted to provide code compliance construction oversight.
4. The originally proposed finance-build-manage project delivery method was an issue for the state treasurer, as this concept, if implemented, might have had a negative impact on state bond rating. The "manage" aspect of the original proposal was rejected; however, the project was approved as a DB project.

As a result of the issues encountered on these dormitory construction projects, UConn is legislatively prohibited from using DB in the future. However, this result was not due to a failure of the DB methodology in general. The following resulted from the UConn DB projects:

1. Code issues drove resistance to DB contracting, and led to prohibition for use of DB by UConn.
2. Proposed legislation was developed to impose a public building committee on UConn, which was opposed by UConn.
3. UConn negotiated provisions of the legislation that created two committees:
    - Construction Oversight Committee comprised of UConn Board of Governors, with public representation. UConn 2000 projects over $500K are subjected to oversight by this committee.
    - Voluntary Building and Grounds Committee of the UConn Board of Governors
4. State Auditor review of the DB projects resulted in support for proposed creative solution for UConn 2000, with the understanding that they would not be able to support DB.

In summary, from the information gathered it appears that the UConn 2000 project issues were unique and should not be used as a reason for the state to prohibit the use of DB. Understaffing and inexperience with DB at UConn were two of the main reasons DB was not successful for the referenced projects. Based on UConn's experience, the following should be considered for the development of a successful DB program:

1. establishing clearly defined project performance criteria
2. assuring owner trust and confidence in a qualified contractor team
3. utilizing an in-house architect/engineering team or consultant to assure adherence with established performance criteria and construction in accordance with owner expectations

V: CONNECTICUT CONSIDERATIONS FOR DESIGN-BUILD

The use of DB has been successful in other states. These DB programs have many common practices that guide implementation to achieve desired outcomes and results. However, in developing a DB program, a state should consider unique factors such as its transportation systems, ethical issues in contracting, and political history and culture. This section outlines current critical issues for ConnDOT to consider in developing and implementing a DB program. Challenges ConnDOT will need to address include:

- Permitting: For projects that require environmental permits, DEP anticipates that project designs will be virtually completed (approximately 90% complete) prior to issuance of permits. Under DB, the DEP would need to be able to issue permits without reviewing completed designs.
- Training and Staffing: ConnDOT staff and design/engineering companies and contractors in the state need to gain experience in DB contracting through training. This training can be provided by several national DB organizations. ConnDOT needs to commit dedicated staff to overseeing and supporting DB projects. ConnDOT should also appoint a DB project manager that oversees all DB projects and is active in project selection, while the department maintains traditional DBB processes and practices for a majority of projects.
- Contractor Experience: Many Connecticut construction and design/engineering companies may not have DB contracting experience. However, the Connecticut Department of Public Works has been using DB for over 17 years so some Connecticut contractors are familiar with DB. If DB is to succeed, ConnDOT will need to support, help train and advise contractors on DB risks and methods.
- Best Value Contractor Selection: Best value contractor selection includes price and technical proposal considerations that involves subjectivity in contract award decisions.

PERMITTING

Environmental permitting, right-of-way, and utility relocation can be significant challenges in the implementation of DB. Adapting practices for use on DB projects should be considered to accommodate the shift in project design and construction tasks and responsibilities from ConnDOT to the DB contractor.

Accordingly, ConnDOT and DEP should review the permitting process to determine if a process could be developed to meet DEP's needs while at the same time accommodating ConnDOT's interest in utilizing DB contracting that includes the start of construction prior to completion of project design. Timely review and granting of permits with known conditions and requirements is important for the success of DB projects involving environmental permitting.

TRAINING

The development and implementation of a successful DB program will require that ConnDOT staff, as well as construction contractors and design/engineering companies interested in undertaking DB projects, become familiar with DB practices and responsibilities. All ConnDOT staff assigned with DB project responsibilities should receive training appropriate for their specific discipline as well as for DB program practices in general. Contractors also need training that will provide them with information and guidance regarding their roles and responsibilities for proposal development, and design and construction. A cultural change in the way that both ConnDOT and contractors approach project design, construction, and inspection is needed to adapt to the change in project roles and responsibilities for DB contracting as compared to traditional DBB contracting.

ConnDOT should consider dedicating staff to DB projects and assigning a DB manager to oversee all DB projects. The manager will need to be well versed in the differences between DB and DBB and the processes and practices required within the department to assure project success. DB training programs are available from several organizations to assist the department in planning, implementing and managing its DB program.

BEST VALUE CONTRACTOR SELECTION

The common practice of best value engineering used in DB is a much more subjective procurement method than selection based on lowest bidder. The subjectivity in best value engineering can lead to allegations of bid rigging or favoritism, especially when the lowest bid is not selected. Therefore, the design of a best value contractor selection process needs to be thorough, transparent and supportable. Involving stakeholders in development of the procurement process may be helpful.

In an effort to provide transparency, most states that use a best value contractor selection process use a two-step process. Proposals are submitted in two parts—a technical proposal and a sealed price proposal. Technical proposals are scored first by a department proposal review team. Price proposals remain sealed until bid opening at a public meeting. The publicly available scoring system is then used to calculate total proposal rankings with the contractor being selected based on a combination of technical score and price. The subjectivity of technical scores, which impacts contractor selection, may provide an opportunity for contract award challenges. While DB contracts can be awarded on the basis of low bid, this impairs the ability for a department to benefit from design innovation which has been identified as a key benefit of DB.

VI: FINDINGS, RECOMMENDATIONS AND CONCLUDING REMARKS

FINDINGS

The following section outlines the key study findings. The findings are divided into groups based on general DB findings and those that are relevant to Connecticut.

General Design-Build Contracting:

- The DB contracting methodology for project delivery has been implemented successfully by several other states and the federal government. DB is used for both vertical (buildings) and horizontal (all modes of transportation) projects of varying size, cost, and complexity.
- Use of DB has been shown to save time in project duration, reduce project change orders, and increase the potential for innovative design.
- DB offers a potential for cost savings that could take the form of lower project cost, reduced construction time, increased project lifespan, reduced environmental impacts, less inconvenience to the traveling public, fewer lawsuits, fewer change orders, greater public satisfaction, and cost savings from innovative design that might not have been considered under DBB.
- Most states that utilize DB have not identified a minimum cost threshold for DB projects.
- The insurance industry assumes more risk when bonding DB contractors because the contractor assumes responsibility for both design and construction. This may result in sureties being more cautious in bonding contractors for DB projects, leading to bonding challenges for smaller contractors.
- Some states provide stipends to shortlisted companies that submit acceptable project proposals for consideration.

Design-Build in Connecticut:

ConnDOT uses DBB for all of its projects, except an occasional emergency declaration project. In-state contractors and engineering/design companies are most familiar with DBB contracting for transportation projects. Some companies, however, have DB experience on public projects undertaken on behalf of DPW.

Companies interested in providing construction and engineering/design services for DB projects should become familiar with DB responsibilities and risks associated with DB contracting. Construction and engineering/design companies will need to form project partnerships to qualify as proposers. Effective communication between ConnDOT and contractors; strategic initial project selection; ConnDOT and contractor staff training; and

effective collaboration between contractors and subcontractors will be important for successful project delivery.

- The Connecticut Department of Public Works (DPW) has used DB contracting methodology successfully for over 15 years for vertical construction. DPW reports having best success on projects where performance requirements are rather simple and straightforward. Prisons, dormitories and courthouses were identified as examples of project types that have been successful under DB.
- ConnDOT currently uses a process similar to DB contracting for emergency projects.
- A DB school construction pilot program was created by action of the General Assembly. It provided for the use of DB for several school construction projects. Only one school was built under this program. The Capitol Region Education Council (CREC) used DB to construct a new school in Hartford. CREC created a DB support team to oversee the project and contractor. The site was difficult and much work was done upfront in the preliminary design phase in preparation for selection of the DB contractor team. The project was considered a success. In general, with regard to school districts considering DB for projects, there was a lack of understanding about what DB contracting was, and therefore not much interest by others in participating in the pilot program. As a result of a report produced on the initial pilot by the Connecticut Department of Education, the pilot program ended and was not renewed, and DB has not developed into an option used by school districts for projects.

Design-Build Findings Critical to Connecticut:

- Most entities award DB projects on a best value basis that considers both technical and cost aspects of project proposals. Many states that utilize a best value selection method have generally awarded projects to the lowest bidder.
- Transportation departments in many of the states who use DB have assigned staff who are dedicated to DB and a DB program office within the department.
- Use of DB has been shown to save time in project duration, reduce project change orders, and increase the potential for innovative design.
- DB requires the development of a clearly defined scope of work before conducting an initial RFP to shortlist contractors. Owners may complete up to 30% of a project's design, with the majority completing less than 15% of the design. Leaving more of the design to the design-builder provides more opportunity for innovation in the final design.
- Some states have established special environmental permitting processes when utilizing DB.
- Environmental permitting is a challenging issue that needs to be carefully considered for DB projects because of the risk that is assumed by the contractor. Maintaining ongoing communication and coordination regarding environmental issues and permitting between a state DOT and state and federal environmental agencies are important factors for DB projects.

BRIEF STATEMENT OF PRIMARY CONCLUSION

ConnDOT should be able to utilize the DB contracting methodology for design and construction of transportation-related projects. It is noted that DB is not entirely new to ConnDOT, as the commissioner has the authority to modify or eliminate the bidding process for emergency declaration projects. The General Assembly should adopt legislation permitting use of DB contracting as an option for transportation projects. The legislation should require ConnDOT to periodically report on its experience in utilizing DB contracting to the Transportation Committee and other relevant committees of the General Assembly for the purposes of determining the value and benefits of this method of contracting to the state and the public.

RECOMMENDATIONS

Based on the research conducted, the CASE study committee offers the following recommendations for the use of DB contracting by ConnDOT for transportation projects in Connecticut.

Design-Build Project Selection:

- A minimum project cost threshold should not be required. All projects should be eligible for DB consideration.
- DB projects should be awarded on a best value basis that includes consideration of the quality of a contractor's technical proposal as well as project cost. Specific formulas for best value proposal analysis have been developed by others and will be useful in formulating the Connecticut model.
- ConnDOT should develop a process, similar to those used by other state DOTs, for identifying projects that are suitable candidates for DB. While initially it is likely that only a small number of projects would be selected as DB projects, all proposed ConnDOT projects should be evaluated for selection as DB projects.

Connecticut Design-Build Methods:

- ConnDOT should identify staff to develop, implement, maintain, and lead the department's DB program. Training should be provided to ConnDOT staff who will need an understanding of the DB methodology to assure project and program success. Training should not be limited to dedicated DB staff, but would extend to staff from all areas of the department with project related responsibilities such as design, construction, inspection, properties/rights of way, and contracting.
- ConnDOT staff should develop an understanding of risks assumed by the department and contractor for DB projects. DB project contractors assume more risk than for typical DBB projects. ConnDOT project delivery practices should be adapted to support the responsibilities assumed by the DB contractor, while at the same time protecting the interests and risk assumed by the department.
- Several state transportation agencies such as New York DOT (https://www.nysdot.gov/divisions/engineering/design/dqab/design-build/dbpm) and North Carolina DOT

(http://www.ncdot.org/doh/PRECONSTRUCT/altern/design_ build/policy07.pdf) have developed DB procedure manuals. ConnDOT should develop a DB procedure manual that will serve as a guide for DB project operations. This manual will also serve as an educational outreach tool for department staff, as well as a means to inform potential contractors of how ConnDOT will manage DB projects.

- Implementation of ConnDOT's DB program should include outreach to both engineering consulting companies and contractors, including smaller and mid-size contractors, to inform them about the DB contracting program and process.
- For DB projects that involve third-parties for environmental permitting (such as DEP, EPA, US Army Corps of Engineers); utility relocation (utility companies); or system scheduling (such as AMTRAK and Metro-North), as well as for other issues, it is suggested that these entities be involved early in the project concept development process so as to limit the risk assumed by DB contractors that are offered the opportunity to submit project proposals.
- ConnDOT should incorporate stipends into the project selection process. The issuing of stipends should follow federal policy 23 CFR 636.112. All shortlisted proposers that submit acceptable proposals should receive compensation for their design/proposal efforts. In return, ConnDOT would have ownership rights to the designs prepared by all proposers and have the ability to incorporate proposed design elements into the final design regardless of the contractor selected.
- Key criteria for consideration in DB project selection should include the need for design innovation and reduction in project duration. ConnDOT's DB program should provide flexibility to allow for design innovation, since that is one of the key advantages of DB.

Future Use of Design-Build in Connecticut

- Vertical construction (buildings) and horizontal transportation construction projects should be considered for DB contracting.
- Vertical construction projects should be considered as a possibility for initial DB contracting. DPW's experience utilizing DB contracting for its projects should provide valuable lessons learned in the Connecticut context for this type of project, as well as contractor familiarity with DB contracting.
- Horizontal construction should not be excluded from any pilot projects.
- Initially, DB should be utilized on projects that have little or no environmental impact. However, it is suggested that DB contracting be used on more complex projects, including those with environmental issues, after ConnDOT and the other agencies and contractors involved gain some experience with DB, especially where a project is expected to benefit from innovative project design.

CONCLUDING REMARKS

The Design-Build contracting methodology for transportation projects represents a significant change in the way projects are managed and delivered by transportation agencies. An important aspect of the DB contracting methodology is developing collaboration and the business

relationship between the project engineering/architect and construction contractor. The interaction of the construction contractor with the designer working as a team represents a culture shift from the traditional design and construction project delivery methodology (DBB). Responsibilities of the DB contractor team demands that the project team work together to resolve project design and constructability issues to deliver a quality product in an efficient manner.

When there is a need to perform quickly on projects, as in emergencies—owners put teams together to get the job done. Complex problems are always solved more efficiently and with optimal solutions through collaboration. Collaboration occurs throughout a DB project, not only within the DB design/construction team, but also with the owner.

DB provides for single source responsibility with incorporation of opportunity for innovation. A well managed process is essential to protect the interests of the owner. To assure project quality and success, owner oversight and inspection are critical to protect the state's interests. Also, the owner must trust the DB contractor team to deliver a project on-time and on-budget while maintaining their profit margin. This requires communication in a seamless system for optimum efficiency for project design and construction with practices that are designed for timely decision-making to keep projects on schedule and within budget.

While currently many transportation agencies use DB for only a small percentage of projects, the DB method should be considered as an additional contracting tool when the benefits warrant its use. ConnDOT's implementation of DB will require a commitment of staff resources and change in the department's procedures and practices to accommodate the special requirements of design-build contracting.

VII. ACKNOWLEDGEMENTS

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O&G Industries, Inc.

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Federal Highway Administration

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APPENDIX A:
WISCONSIN (WSDOT) RISK ALLOCATION MATRIX

3.3 DEVELOP PROJECT SCOPE

A design-build project differs from a traditional project in that the project team must establish the final project expectations, goals, and desired quality at the outset. Early in the project, all team members, stakeholders, and leadership should agree on project goals, quality, and the desired outcome of the project.

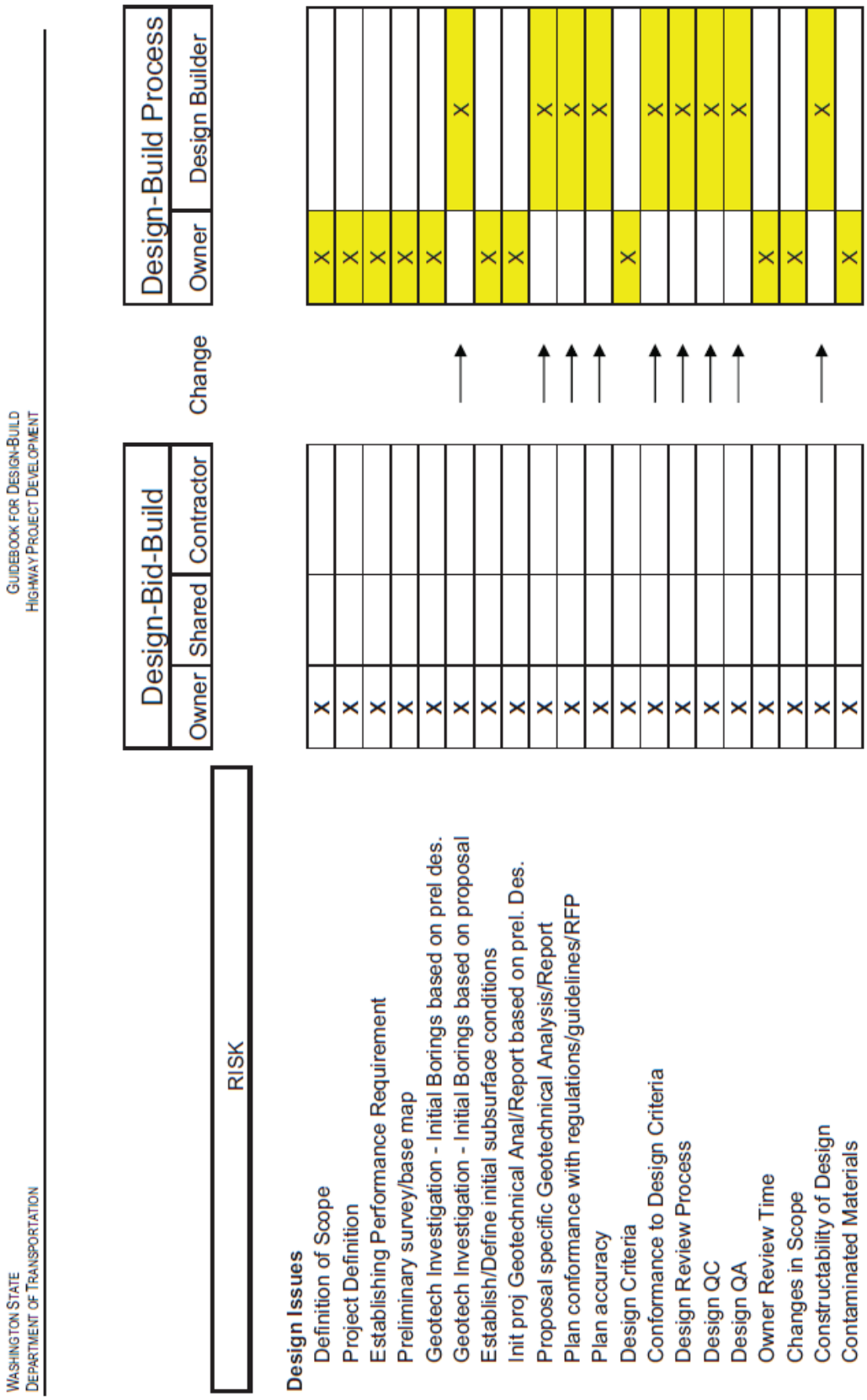
3.4 PROJECT RISK ALLOCATION MATRIX

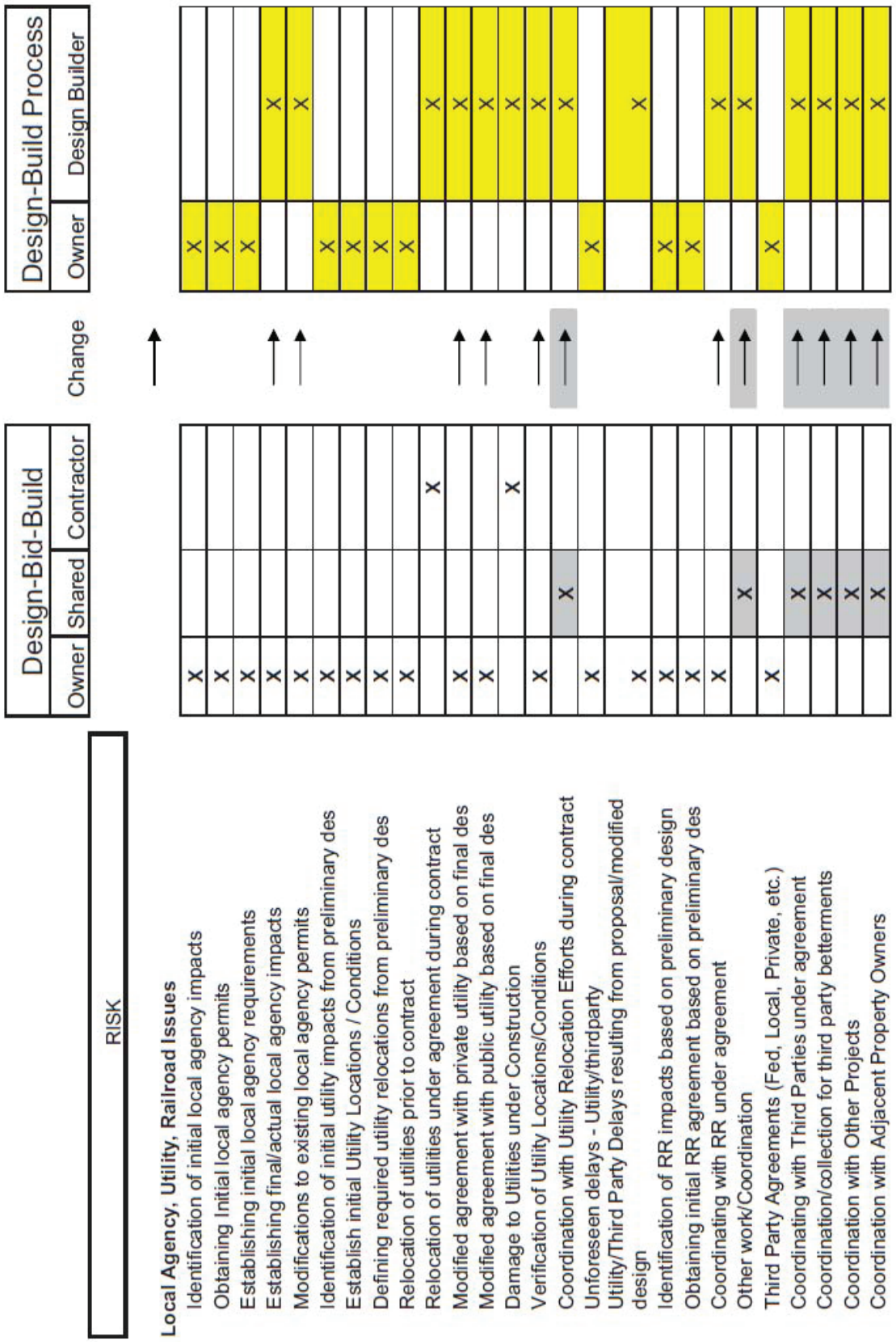
On each design-build project, the team must determine how far to carry the preliminary design. From extensive discussions between WSDOT and the design-build industry, contractors, and design consultants, it is apparent that development of a risk allocation matrix is the key to making this determination.

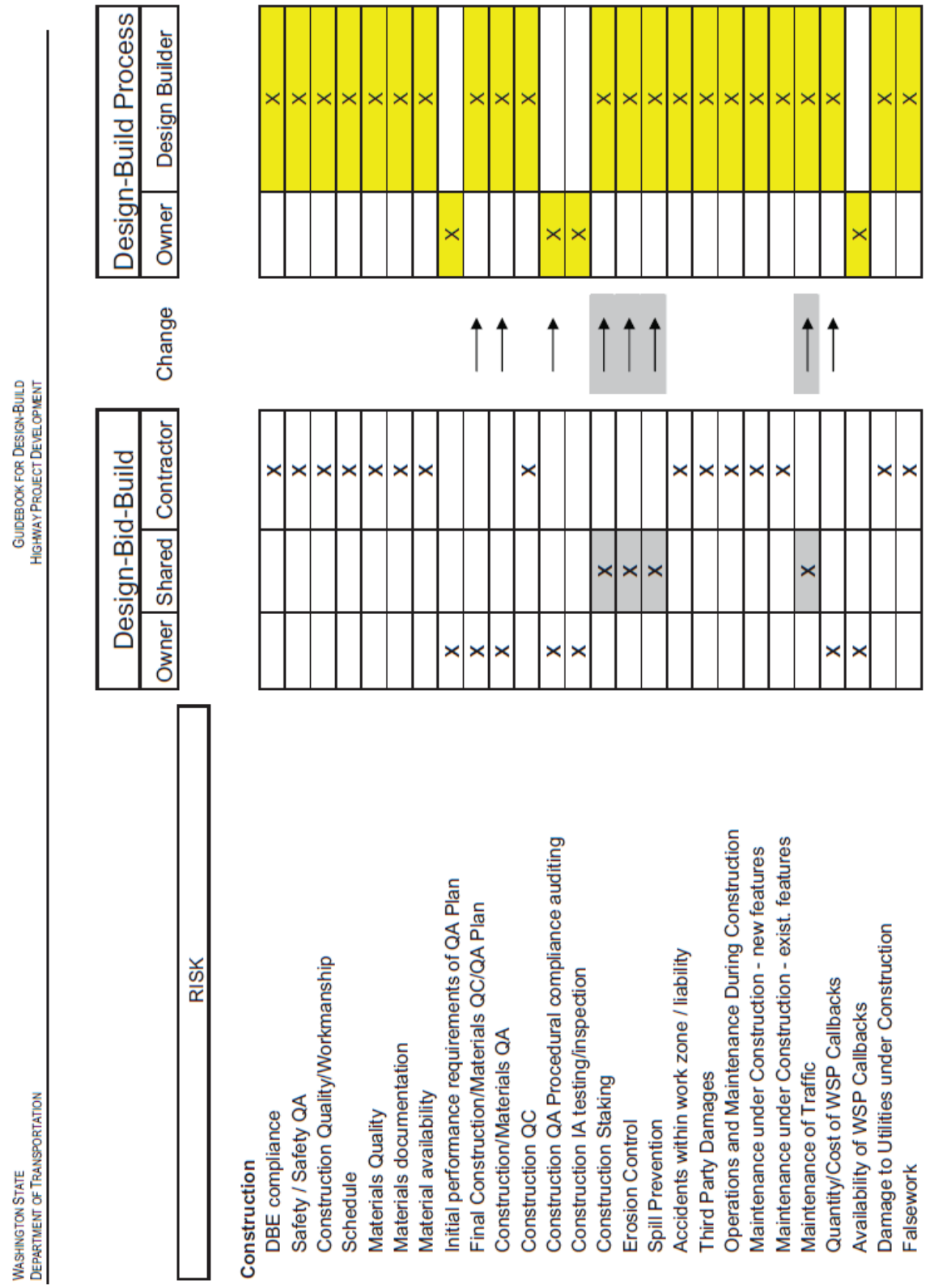
Early in the project, the design team needs to begin to identify potential risks associated with the project. Assign responsibility for each of these risks either to WSDOT or to the design-builder. This is not a one-time task. The project team should continually revisit it as more information becomes available about the project. Utilize the risk allocation matrix throughout development and implementation of the project.

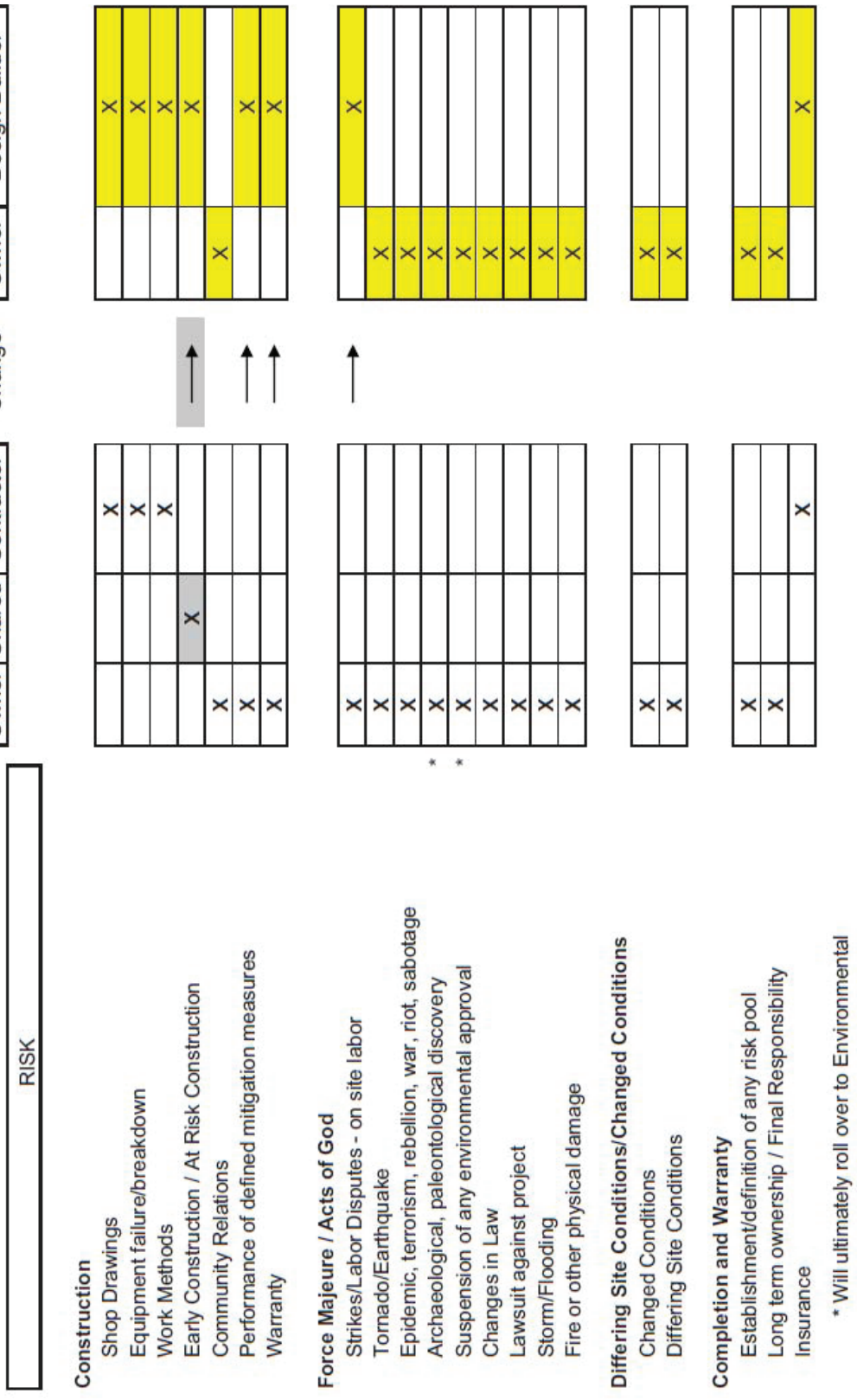
This matrix will not only govern which party is responsible for a given risk, but it will also help the project team determine how far to advance each technical element within the preliminary design during development of the RFP.

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


Washington State
Department of Transportation
Guidebook for Design-Build
Highway Project Development
RISK
Design-Bid-Build
Owner
Shared
Contractor
Change
Design-Build Process
Owner
Design Builder
Design Issues
Definition of Scope
Project Definition
Establishing Performance Requirement
Preliminary survey/base map
Geotech Investigation - Initial Borings based on prel des.
Geotech Investigation - Initial Borings based on proposal
Establish/Define initial subsurface conditions
Init proj Geotechnical Anal/Report based on prel. Des.
Proposal specific Geotechnical Analysis/Report
Plan conformance with regulations/guidelines/RFP
Plan accuracy
Design Criteria
Conformance to Design Criteria
Design Review Process
Design QC
Design QA
Owner Review Time
Changes in Scope
Constructability of Design
Contaminated Materials


RISK
Design-Bid-Build
Owner
Shared
Contractor
Change
Design-Build Process
Owner
Design Builder
Local Agency, Utility, Railroad Issues
Identification of initial local agency impacts
Obtaining Initial local agency permits
Establishing initial local agency requirements
Establishing final/actual local agency impacts
Modifications to existing local agency permits
Identification of initial utility impacts from preliminary des
Establish initial Utility Locations / Conditions
Defining required utility relocations from preliminary des
Relocation of utilities prior to contract
Relocation of utilities under agreement during contract
Modified agreement with private utility based on final des
Modified agreement with public utility based on final des
Damage to Utilities under Construction
Verification of Utility Locations/Conditions
Coordination with Utility Relocation Efforts during contract
Unforeseen delays - Utility/thirdparty
Utility/Third Party Delays resulting from proposal/modified design
Identification of RR impacts based on preliminary design
Obtaining initial RR agreement based on preliminary des
Coordinating with RR under agreement
Other work/Coordination
Third Party Agreements (Fed, Local, Private, etc.)
Coordinating with Third Parties under agreement
Coordination/collection for third party betterments
Coordination with Other Projects
Coordination with Adjacent Property Owners


Washington State
Department of Transportation
Guidebook for Design-Build
Highway Project Development
RISK
Design-Bid-Build
Owner
Shared
Contractor
Change
Design-Build Process
Owner
Design Builder
Construction
DBE compliance
Safety / Safety QA
Construction Quality/Workmanship
Schedule
Materials Quality
Materials documentation
Material availability
Initial performance requirements of QA Plan
Final Construction/Materials QC/QA Plan
Construction/Materials QA
Construction QC
Construction QA Procedural compliance auditing
Construction IA testing/inspection
Construction Staking
Erosion Control
Spill Prevention
Accidents within work zone / liability
Third Party Damages
Operations and Maintenance During Construction
Maintenance under Construction - new features
Maintenance under Construction - exist. features
Maintenance of Traffic
Quantity/Cost of WSP Callbacks
Availability of WSP Callbacks
Damage to Utilities under Construction
Falsework


Design-Bid-Build
Owner
Shared
Contractor
Change
Design-Build Process
Owner
Design Builder
RISK
Construction
Shop Drawings
Equipment failure/breakdown
Work Methods
Early Construction / At Risk Construction
Community Relations
Performance of defined mitigation measures
Warranty
Force Majeure / Acts of God
Strikes/Labor Disputes - on site labor
Tornado/Earthquake
Epidemic, terrorism, rebellion, war, riot, sabotage
Archaeological, paleontological discovery
Suspension of any environmental approval
Changes in Law
Lawsuit against project
Storm/Flooding
Fire or other physical damage
Differing Site Conditions/Changed Conditions
Changed Conditions
Differing Site Conditions
Completion and Warranty
Establishment/definition of any risk pool
Long term ownership / Final Responsibility
Insurance
* Will ultimately roll over to Environmental

WSDOT/DESIGN-BUILDER RESPONSIBILITY CHART				
ITEM	**SCOPE SECTION**	**DESIGN-BUILD**	**WSDOT**	**OTHERS**
A. AERIAL MAPPING				
Photogrammetric Control & Panels				
Aerial Photography				
Plotter Compilation				
• Planimetric Map				
• Contour				
• Topographic Map				
• Drainage Area Map				
• Right-of-Way Map				
B. CONTROL SURVEYS				
Horizontal				
Vertical				
Topographic Map				
Utility Locations				
Right-of-Way				
Roadway Cross Sections				
Drainage Cross Sections				
Structures Surveys				
C. ENVIRONMENTAL				
Environmental Analysis Document				
Air Quality Technical Report				
Noise Analysis Technical Report				
Cultural Resources Recovery				
Public Meeting				
• Advertisement				
• Presentation Materials				
• Moderator				
• Technical Questions				
• Transcript				
• Responses to Public Comments				

• Liability Insurance				
D. MATERIALS INVESTIGATION				
Provide Soil Survey				
• Roadway				
• Lateral Ditches				
• Earthwork				
• Retention/Detention Ponds				
Bridge Foundation Investigation				
Provide Testing and Analysis				
Provide Pavement Design				
Materials Memorandum				
E. DESIGN TRAFFIC DATA				
Gather Statistics				
• 2-Way ADT				
• Turning Movements				
• Cross Traffic				
Prepare Traffic Data Sheets				
Prepare Equivalent 18 Kips				
Prepare Traffic Analysis				
L.O.S. Analysis				
Composite Tfc Cont Device Plan				
F. RIGHT-OF-WAY				
Develop Requirements				
Secure Title Search				
Prepare R/W Plans and Legal Descriptions				
Prepare Transfer Documents				
Provide Appraisals				
Negotiate Right-of-Way				
Condemnation Proceedings				
Testify in Court				
R/W Cost Estimates				
Relocation Assistance				
Property Management				
Clearance Letter				
G. CONSTRUCTION PLANS				
Plot Design Survey				

Basic Roadway Plans Preparation				
Drainage Design				
Bridge Design				
Roadway Lighting Plans				
Traffic Signal Plans				
Signing & Pvmt. Marking Plans				
Utility Adjustment Plans				
Maintenance of Traffic Requirements				
Landscape Architectural Design				
H. SECTION 404 PERMIT				
Coordinate with Permitting Agencies				
Prepare Permit Application				
Forms				
Sketches				
Hydraulic Calculations				
Supporting Documents				
Process Permit Application				
I. UTILITY & RAILROAD				
Utilities Identification				
Submit Railroad Data				
Conduct Utility Pre-Design Conference				
Secure Utility Adjustment Plans				
Secure Utility Relocation Schedule				
Secure Utility Agreements				
Process Relocation Schedule & Agreement				
Clearance Letter				
J. CONSTRUCTION SPECIFICATIONS				
L. CONTRACT AND SPECIFICATIONS PROCESS				
Respond to questions on PS&E				
PS&E Revisions				
Addenda to PS&E, as required				
M. POST DESIGN SERVICES				

Respond to questions on final design				
Review and approve shop drawings				
Provide contact person				
Provide post construction design-build evaluation				
N. VALUE ANALYSIS				
Roadway Construction Plans Review				
Bridge Construction Plans Review				
R/W Plans Review				
P. REVIEWS AND SUBMITTALS				
Roadway Construction Plans Review				
Bridge Construction Plans Review				
Design Concept Report Submittal				
Environmental Reports				
Initial Design Submittal				
Preliminary Design Submittal				
Final Design Submittal				
As-Built Submittal				

APPENDIX B:
DESIGN-BUILD STATE SURVEY RESPONSES

Survey Question	Agency	NJ TRANSIT	PennDOT, Bureau of Design	Mn/DOT	Maryland State Highway Administration (MSHA)	masshighway	Colorado DOT
Please identify the modes of transportation your agency is responsible for:	Highways Public Transportation Rail Buses Ports Airports	Public Transportation Rail Buses	Highways	Highways	Highways	Highways	Highways Airports
How long has your agency used Design-Build for Transportation projects?	Response	10+ years	5-10 years Our agency has significantly increased our use of Design-Build during calendar year 2009.	10+ years	10+ years 1st project advertised May 1998	5-10 years	5-10 years
	Comment						
How many Design-Build projects has your agency completed? How	Completed	5	77	4 low bid; 10 best-value	23	2	5
	In progress	5	200	3 best value	8	4	3
Does your state have legislation specifically for transportation Design Build projects?	Response	YES	NO	YES	YES Pursuant to Maryland State Finance and Procurement Code Ann. § 3-602 (g)(1), the Maryland General Assembly authorized the use of Design-Build in State capital projects. Due to the use of Federal aid in the construction and reconstruction of Maryland roads, SHA use of the Design-Build process is also governed by the regulations promulgated at 23 CFR Parts 627, et seq, by the United States Department of Transportation, Federal Highway Administration. Additional regulation is pursuant to State procurement provisions set forth in the relevant sections of the Maryland State Finance and Procurement Article of the Annotated Code and the Code of Maryland Regulations (COMAR).	YES	YES
	If yes, please provide statute number(s), effective date(s) of legislation and internet link(s).			State Statute 161.3410 effective date of legislation: 2001 http://www.dot.state.mn.us/designbuild/db_law.pdf	www.dsd.state.md.us/comar/comar.aspx	chapter 149a	CRS Part 14, Article 1 of Title 43 Policy 2 of CCR 601-15
Does your state's legislation include a minimum project cost threshold for a project to be considered for	Response	N/A	NO	NO	NO	YES $5 million for non-accelerated bridge program projects	NO
	If yes, what is your legislation's threshold?	Don't know					
Which of the following are benefits your agency has achieved with Design-Build? Select all that apply.□	Time savings	Time savings	Time savings	Time savings	Time savings	Time savings	Time savings
	Cost savings	Cost savings			Cost savings		
	Improved budget control	Improved budget control				Improved budget control	
	Reduction in staff workload		Reduction in staff workload			Reduction in staff workload	
	Innovative design	Innovative design	Innovative design	Innovative design	Innovative design	Innovative design	Innovative design
	Reduced change orders	Reduced change orders	Reduced change orders	Reduced change orders	Reduced change orders	Reduced change orders	Reduced change orders
	Improved Public Relations			Improved Public Relations		Improved Public Relations	
	Other (please identify)			lower cost growth (more project cost certainty)			
How does your agency quantify or measure the benefits of its Design-Build program?					We track the percent of change orders compared to the construction value for each project. The percent of change orders on design-build projects are compared to the same on design-bid-build projects. We have found that on design-build projects, the amount of change orders are less than 2% of the construction value compared to 6% on our traditional design-bid-build projects.		
	Open-Ended Response	Generic comparision to design-bid-build	We are in the process of establishing metrics for Design-Build projects to quantify benefits.	Through the use of lessons learned reports after each project.			We have not done that yet as a Department. It's a case by case analysis

APPENDIX B (CONTINUED)

Survey Question	Agency	NJ TRANSIT	PennDOT, Bureau of Design	Mn/DOT	Maryland State Highway Administration (MSHA)	masshighway	Colorado DOT
For the following modes/types of projects, please indicate the success of your agency's Design-Build program.	Highway - Replacements		Successful	Very Successful	Very Successful		Very Successful
	Highway - Rehabilitation		Successful	No experience with this type of project.	Very Successful		Very Successful
	Highway - New Construction		No experience with this type of project.	Very Successful	Very Successful	Very Successful	No experience with this type of project.
	Bridge - Replacements		Successful	Very Successful	Successful		Successful
	Bridge - Rehabilitation		Successful	No experience with this type of project.	Very Successful		Very Successful
	Bridge - New Construction		Very Successful	Very Successful	Very Successful	Very Successful	Very Successful
	Airport - Replacements		No experience with this type of project.		No experience with this type of project.		No experience with this type of project.
	Airport - Rehabilitation		No experience with this type of project.		No experience with this type of project.		No experience with this type of project.
	Airport - New Construction		No experience with this type of project.		No experience with this type of project.	No experience with this type of project.	No experience with this type of project.
	Port - Replacements		No experience with this type of project.		No experience with this type of project.		No experience with this type of project.
	Port - Rehabilitation		No experience with this type of project.		No experience with this type of project.		No experience with this type of project.
	Port - New Construction		No experience with this type of project.		No experience with this type of project.	No experience with this type of project.	No experience with this type of project.
	Buildings - Replacements		No experience with this type of project.		Successful		No experience with this type of project.
	Buildings - Rehabilitation		No experience with this type of project.		Successful		No experience with this type of project.
	Buildings - New Construction		No experience with this type of project.		Successful	No experience with this type of project.	No experience with this type of project.
Does your agency have an in-house Design-Build manager or facilitator to manage the process?	Response	YES	NO	YES	YES	YES	YES
Describe your agency's organizational structure for Design-Build projects.	Open-Ended Response	For large d/b projects a dedicated project team is assigned. For smaller projects, a PM is assigned with appropriate matrix support.	Our District offices develop the design-build contracts and then submit to our Central Office for review by a Design-Build Pro-Team. The Pro-Team is comprised of personnel from various design and construction units to ensure contract documents are comprehensive and biddable.	All design build projects are run by the project specific DB Project Manager with design manager and construction manager underneath him/her. The DM and CM in turn have personnel working for them depending on the type of project.	Our agency has a division that oversees our design-build program. It is comprised of a divison chief and 3 staff members who assist the Project Engineer in the development of the design-build procurement documents and oversees the process from start to finish.	Manager for the program (Christine Mizioch) and reporting staff.	Each Region manages their own project We have an Innovative Contracting Program Manager in a centralized HQ locations that normalizes processes, shares experiences, educates, gives advice and coordinates between regions
How important is it to have the continuum aspect (one person or entity overseeing a project from start to finish)?	Response	Important	Relatively important	Extremely Important	Important	Relatively important	Important
In general, what is your agency's track record in administering Design-Build projects from beginning to end?	Response	All have been major successes	Majority have been successful but a few have been problematic	Majority have been successful but a few have been problematic	Majority have been successful but a few have been problematic	Majority have been successful but a few have been problematic	All have been major successes
	Comments	Successful except for lawsuits by contracts (on very large projects)		We have learned a great deal about our process after each design-build project.		One contractor went bankrupt unrelated to the project.	
What percentage of design is completed before a project goes out to bid? ☐	Response	>15%	>40%	>15%	>15%	>15%	>30%
In general on a Design-Build project, how much design is done in house?	Response	>15%	>40%	>15%	>15%	0%	>30%

APPENDIX B (CONTINUED)

Survey Question	Agency	NJ TRANSIT	PennDOT, Bureau of Design	Mn/DOT	Maryland State Highway Administration (MSHA)	masshighway	Colorado DOT
What is your agency's selection process for the Design-Build contractor? Select all that apply.	RFQ RFP Best Value Lowest Bid Other (please specify)	Best Value	Lowest Bid	RFQ RFP Best Value Lowest Bid	RFQ RFP Best Value Lowest Bid Stipulated Sum or Fixed Fee	Best Value	RFQ RFP Best Value Modified Design-Build (Pass/Fail-Low bid)
Does your agency utilize a modified environmental permitting process for Design-Build projects?	Response If YES, please explain:	NO	YES Environmental Clearance is obtained based an anticipated area of impact prior to bidding D/B project. Actual permitting may be included as Design Activities in D/B contract.	YES We begin the applications for as many permits as possible by identifying the most impacts from the perferred alternative.	NO	NO	NO
Does your agency utilize a modified process for other permits on Design-Build projects (i.e. ROW, Hasmat, STC, etc.)?	Response If YES, please explain.	NO	YES R/W - Conditional R/W clearance issued to advertise project (traditional projects require all R/W to be acquired prior to bidding). R/W acquisition activities and R/W plan preparation are included as Design Activities in D/B contract. PennDOT still acquires all R/W, even for D/B projects.		NO	NO	NO
Has your agency made an effort to assure that small and mid-size contractors have an opportunity to bid on projects?	Response If YES, please explain:	YES For large contracts 50% of contract must be subcontracted...as weel as DBE/WBE/SBE requirements.	YES PennDOT issues contracts of various sizes to ensure inclusion of small and mid-size contracts.	YES We have procured a variety of projects using design build from small $1 million sign replacement to $234 million major river crossing.	NO	YES Projects of all size are considered as candidates.	YES Constant coordination and industry review with the Contractor's Association
Has your agency's use of Design-Build had an impact on small and mid-size contractors?	Response Comments	No Impact	Positive Impact The use of D/B contracts has allowed PennDOT to substantially increase the number of contracts bid, thus increasing the potential for small and mid-size contractors to secure contracts.	Positive Impact We have had more small and mid-size contractors gain the experience of working on design-build projects.	No Impact	No Impact No feedback provided	Positive Impact
In developing your agency's Design-Build program were local construction organizations taken into consideration as stakeholders?	Response If YES, please explain:	NO	YES PennDOT worked closely with the Associated Pennsylvania Constructors to develop the manual for Design-Build projects.	YES Minnesota's Association of General Contractors was involved and continue to be involved as scoring members and through industry meetings/workshops.	YES Early on MSHA held workshops with representitives from our contracting community and our engineering community in order to gain feedback. As we try different procurement methods, we will always seek input from those same stakeholders.	YES CIM was an integral part.	YES Colorado Contractor's Association
Does your agency provide staff training regarding your Design-Build program?	Response If YES, please explain:	NO	YES Training sessions held with all District Offices when origninal D/B manual released; subsequent training will be held to discuss modifications to current policy.	YES On a project specific basis, depending on the experience of the staff with design-build.	YES MSHA has an inhouse training program that includes a session on Design-Build. MSHA also has developed a Design-Build Manual to be used as a resource.	YES Procurement training and contract implementation	YES Misc. D-B training courses and conferences
How would you rate labor union support of your agency's Design-Build program? ☐	Response If unsupportive, which unions opposed Design-Build?	Indifferent	Indifferent	Indifferent As long as prevailing wage rates are met, the workers don't have to be unionized.	Indifferent	Moderately supportive	Indifferent
Please provide any additional comments that you feel would be benficial to Connecticut in its establishment of a Design-Build program or Design-Build legislation.	Open-Ended Response		Low-Bid method is effective at producing time savings. Additional innovation in Design can be produced when using the Best Value approach. Any proposed legislation should provide for a 2 step Best Value Approach to allow shortlisting of proposers.		If you utilize consultants when developing projects, the potential can exist for conflict of interest (coi) in the context of design-build documents. Even if it is a perceived coi, bid protests may be based on a coi. We publish within the RFP a list of firms that are excluded from teaming. Maryland has legislation that defines the parameters of what can exclude a firm from teaming with a contracting enity. See COMAR 21.06.01.01 & 21.06.02.03 www.dsd.state.md.us/comar/comar.aspx		It's the trend of the future. Use it!

APPENDIX C:
CONCLUSIONS AND RECOMMENDATIONS FROM FHWA'S 2005 DESIGN-BUILD EFFECTIVENESS STUDY

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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

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Connecticut Academy of Science and Engineering

The Connecticut Academy is a non-profit institution patterned after the National Academy of Sciences to identify and study issues and technological advancements that are or should be of concern to the state of Connecticut. It was founded in 1976 by Special Act of the Connecticut General Assembly.

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- Provide information and advice on science and technology to the government, industry and people of Connecticut.
- Initiate activities that foster science and engineering education of the highest quality, and promote interest in science and engineering on the part of the public, especially young people.
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