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
This study was initiated at the request of the Connecticut Department of Transportation on May 15, 2009. The project was conducted by an Academy Study Committee with the support of Study Managers Eric Jackson, PhD, and James Mahoney. The content of this report lies within the province of the Academy’s Transportation Systems Technical Board. The report has been reviewed by Academy Member Gale Hoffnagle. Martha Sherman, the Academy’s Managing Editor, edited the report. The report is hereby released with the approval of the Academy Council.

Richard H. Strauss
Executive Director

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<td>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.</td>
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THE DESIGN-BUILD CONTRACTING METHODOLOGY FOR TRANSPORTATION PROJECTS:
A REVIEW OF PRACTICE AND EVALUATION FOR CONNECTICUT APPLICATIONS

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A REVIEW OF PRACTICE AND EVALUATION FOR CONNECTICUT APPLICATIONS

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CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING
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
THE DESIGN-BUILD CONTRACTING METHODOLOGY FOR TRANSPORTATION PROJECTS:
A REVIEW OF PRACTICE AND EVALUATION FOR CONNECTICUT APPLICATIONS
EXECUTIVE SUMMARY

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.

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