U.S. Department of Transportation

Federal Highway Administration

Program Review

Program Management Improvement Team

Oversight of Design – Build Projects

May 6, 2016

FINAL REPORT

U.S. Department of Transportation
Federal Highway Administration

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Executive Summary

In 1990, Special Experimental Project Number 14 (SEP-14), "Innovative Contracting," was established by the FHWA to allow each State Department of Transportation (State DOT) to test and evaluate a variety of alternative project contracting methods that provided the potential to expedite highway projects in a more cost-effective manner, without jeopardizing product quality or contractor profitability. One of these methods was the Design-Build (D-B) contracting method. With passage of the Transportation Equity Act for the 21st Century in 1998, FHWA was required to issue regulations describing FHWA's approval criteria and procedures for the use of D-B contracting on federally funded transportation projects. FHWA's D-B regulations were developed and became effective on January 9, 2003.

We were asked by the FHWA's Office of Infrastructure to conduct a review to examine the Divisions' and State DOTs' oversight of D-B projects. As part of this review we attempted to evaluate the effectiveness of oversight and quality assurance policies and practices in order to identify any opportunities to improve that oversight and quality assurance (QA), to share lessons learned and to identify successful practices.

The objectives for this review are:

• Determine how Divisions are providing technical assistance and oversight of State DOT contract administration and QA policies and practices associated with D-B projects.
• Determine how State DOTs are providing contract administration and QA for D-B projects, with emphasis on environmental commitments and permitting, right-of-way, scheduling and payment of work.
• Evaluate the effectiveness of Division and State DOT D-B related technical assistance, oversight, contract administration and QA policies and practices, as well as any gaps [or opportunities for improvement] in such activities, identifying lessons learned, and successful practices encountered.

We conducted site visits in five randomly selected States, based on the known presence of active D-B federal-aid transportation projects. We interviewed FHWA Division and State DOT officials and reviewed project documentation of randomly selected, State DOT administered projects. As needed, we conducted follow-up interviews with each Division to clarify and corroborate information collected during the site visits.

We found that for the States visited, the Division's level and degree of technical assistance and oversight of their State DOT's D-B projects is related to the maturity, variability and complexity of their State's D-B program. The Divisions provide technical

assistance and oversight of their State DOT's contract administration and QA policies and practices associated with Design-Build projects through the use of the following:

- Documented policies & procedures
- Project & program actions taken by Divisions
- Training

In reviewing the States' administration and oversight of D-B projects we saw use of a variety of D-B contracting methods. 23 CFR 636 permits the use of the following criteria as a basis for awarding D-B contracts: best-value, low-bid or some variation of these two methods. Three of the five States visited use the best-value D-B contracting method for the purpose of encouraging proposers to develop innovative solutions to meet their project's goals. In addition, four of the State DOTs use the low-bid D-B contracting method for their less complex projects. In one state we also learned about a variation of the low-bid D-B contracting method known as "partial" or "nested" D-B; where only a segment of a project utilizes a low-bid based D-B contracting method. In three of the states visited, we learned that statutory, legal, or policy restrictions challenged the State DOT's ability to more fully explore the use of the D-B contracting methodology in the delivery of Federal-aid projects.

We determined that with, the exception of one State DOT, the State DOTs visited have not formally evaluated their D-B programs to determine if they are realizing the benefits expected in the use of the D-B contracting method. We found no significant non-compliance trends with the State DOTs' existing D-B contracting processes and oversight procedures. We believe that with the continued appropriate level of FHWA Division oversight, the five State DOT D-B programs will continue to comply with federal requirements.

We recommend the following to the Office of Infrastructure:

1. The Resource Center should continue to promote the availability and use of the D-B guidance materials to Divisions and State DOTs with a focus on FHWA's TechBrief "Construction Quality Assurance for Design-Build Highway Projects."

2. The Office of Infrastructure in collaboration with the Resource Center should encourage State DOTs to evaluate their D-B programs to verify that benefits of D-B contracting are obtained.

Background

Since 1990, a number of transportation agencies have been experimenting with a wide variety of innovative project delivery methods aimed at lowering the costs and reducing time to deliver transportation construction projects, while maintaining or improving project quality and performance. One of these project delivery methods is Design-Build (D-B). D-B is a contracting method used to deliver transportation projects in which the design and construction phases of the project are combined into one contract, usually awarded on either a low-bid or best-value basis. This is in contrast to the traditional design-bid-build (D-B-B) approach used by transportation agencies in which project design, procurement and construction phases must be undertaken in sequence to deliver the project.

In 1990, Special Experimental Project Number 14 (SEP-14), "Innovative Contracting," was established by the FHWA to allow each State Department of Transportation (State DOT) to test and evaluate a variety of alternative project contracting methods that provided the potential to expedite highway projects in a more cost-effective manner, without jeopardizing product quality or contractor profitability. One of these methods was D-B contracting. Between 1990 and 2002, approximately 300 projects representing $14 billion were proposed for D-B contracting under SEP-14 by State DOTs in 32 States, the District of Columbia, and the Virgin Islands. Of this total, 140 projects representing $5.5 billion were completed by the end of 2002.

In 1998, the Transportation Equity Act for the 21st Century (TEA-21) became the new authorization legislation for the nation's surface transportation programs. Included in TEA-21 was Section 1307 (c), which required FHWA to develop and issue regulations describing FHWA's approval criteria and procedures for D-B contracting. FHWA's final rule on D-B contracting was published in the Federal Register on December 10, 2002 and became effective on January 9, 2003.

Today, all but a few State DOTs have legislative authority allowing D-B contracting methods for transportation projects. D-B contracting opens up flexibility for innovation by contractors but the State DOTs are still responsible to provide oversight. Oversight processes in place should ensure the procurement and administration of D-B projects are carried out in the public's interest and that they meet federal requirements. Title 23 Code of Federal Regulations (CFR) part 636 contains FHWA's regulatory policy for the D-B contracting method. The regulations cover the letting of contracts, selection procedures, award criteria and other applicable regulations to ensure the eligibility of federally reimbursed costs for a highway construction project.

Purpose and Objective

The purpose of this review was to examine the FHWA Divisions' and State DOTs' oversight of D-B projects. Our review of D-B oversight focused on State DOTs' contract administration and quality assurance (QA) activities associated with D-B projects. The Division responsibilities we reviewed related to their oversight of State DOT D-B contracting policies and procedures and the application of these policies and procedures on Federal-aid D-B projects.

State DOTs have used D-B project delivery for many years. FHWA had not previously conducted a national review on how its Divisions and State DOTs are providing oversight on D-B projects. This review evaluated the effectiveness of oversight and quality assurance policies and practices in order to identify any opportunities for improvement in that oversight and QA, to share lessons learned and to identify successful practices, and to consider any guidance that the Office of Infrastructure may deem beneficial as a result.

The review Objectives for this review were as follows:

1. Determine how Divisions are providing technical assistance and oversight of State DOT contract administration and QA policies and practices associated with D-B projects.

2. Determine how State DOTs are providing contract administration and QA for D-B projects, with emphasis on environmental commitments and permitting, right-of-way, scheduling and payment of work.

3. Evaluate the effectiveness of Division and State DOT D-B related technical assistance, oversight, contract administration and QA policies and practices, as well as any gaps [opportunities for improvement] in such activities, identifying lessons learned, and successful practices encountered.

Scope and Methodology

We conducted site visits for this review beginning in early January 2015 through mid-March 2015. We randomly selected five states, based on the known presence of active D-B Federal-aid highway projects. Additionally, we vetted the selected states with the Office of Infrastructure. We accomplished this review by visiting the states selected, interviewing FHWA Division and State DOT officials, and reviewing project documentation of randomly selected, State DOT administered projects.

The review scope included Projects of Division Interest (PoDIs), as well as those where the State DOTs assumed Title 23 responsibilities but excluded Projects of Corporate Interest (PoCIs). The review centered on "traditional" D-B, meaning we did not include Design-Build-Operate-Maintain (D-B-O-M) or other variations of alternate project delivery methods such as Public Private Partnerships (P3) or Construction Manager/General Contractor (CM/GC). The review examined oversight processes and practices in these areas: contract administration and QA. Contract administration considerations for this review included right-of-way (including utilities), environmental commitments, scheduling, and payment of work. With a separate national program review recently concluded, the scope of this review did not address disadvantage business enterprise (DBE) related topics. For QA, we addressed the processes in place to assure overall quality of the contract.

We sampled three federally funded D-B projects from each state. We did not conduct project site visits, as this review centered on D-B contract administration oversight activities. In addition to the Division/State DOT office site visits, we conducted follow-up interviews with each Division to clarify and corroborate information collected during the site visits.

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Observations and Recommendations

Observation 1: **The level of technical assistance and oversight of D-B projects that is provided by the Divisions is tied to one or more of the following: maturity, variability and complexity of the State's D-B program.**

Title 23 Code of Federal Regulations (CFR) part 636 contains FHWA's regulatory policy for the D-B contracting method. Under the D-B contracting method, , the State DOT being the contracting agency for this review, selects an entity, typically a contractor, to complete both design and construction under a single contract. Specifically, once the contracting agency identifies the end result parameters and establishes the design criteria, the prospective design-builders develop proposals. The contracting agency then typically conducts a technical analysis, based on cost and technical factors, such as estimated cost, design quality, timelines, and management capability. Once the contract is awarded, the design-builder becomes responsible for completing the design and all construction at the contract's fixed price, usually on a lump sum basis, and within the stated contract time. An excerpt from one of the visited State DOT's D-B contracting manuals regarding their technical analysis process and scoring criteria is provided in Appendix A.

All the Divisions visited were providing assistance and were providing oversight of State DOT contract administration and QA policies and practices associated with D-B projects. However, the Division's level and degree of technical assistance and oversight of their State DOT's D-B projects is related to the maturity, variability and complexity of their State's D-B program. The Divisions provide technical assistance and oversight through a combination of project and program actions that are outlined in documented policies and procedures. They also provide State DOTs with training related to various aspects of Design-Build contracting on Federal-aid highway projects.

Documented Policies & Procedures:

All Divisions visited have documented policies and procedures for providing technical assistance and oversight of the State DOT contract administration and QA policies and practices associated with oversight of their State DOT D-B projects. The Divisions' documented policies and procedures vary in level of oversight required and are directly related to their state's maturity, variability and complexity of those programs.

For example, we found that the two Divisions with State DOTs having the most maturity, in their D-B program had documented policies and procedures containing minimal guidance for oversight of D-B projects. This was because the State DOT's D-B programs are mature and over time have become a part of their normal business practices and the Divisions, State DOTs, consultants and contractor staffs are very

familiar with the programs. We were told by the staff of these two Divisions that both the Division and the State DOT treat D-B projects as they would any other Federal-aid projects that use D-B-B procedures, so there is no need to have separate documented policies & procedures specific to D-B projects. This is because both of these State DOTs have a long history of using the D-B contracting method in delivering their projects. Since 1988, one of these State DOTs has used the D-B procurement method on over 500 projects. This State DOT has also evolved in the variability of its D-B program because they not only use the traditional D-B contracting method, but they also have a long history of using varying D-B contracting methods such as D-B finance. For D-B finance projects the contractor is responsible not only for designing and constructing the project, but for financing its construction. This approach is commonly used with projects that reliably produce revenue, such as new toll roads and/or bridges. This State DOT has used the D-B contracting method on all types of projects; including their complex projects such as major projects and politically sensitive projects.

In one of the Divisions their documented policies & procedures included a reference to their State DOT's project specific Quality Oversight Plans (QOP) applicable to all D-B projects that are identified by that Division as PoDIs. We found that this State DOT has used D-B contracting on only eight projects to date. As a result, the Division considers the State DOT's limited eight project experience in the use of D-B as a prime factor in considering this a higher risk program area. To address this risk, the Division has developed and documented policies and procedures specific to all D-B projects, which describe the approval actions, roles and responsibilities and other project level activities that the Division will conduct on each D-B project. As part of these procedures, the Division and their State DOT jointly develop a QOP for every D-B project that outlines the State DOT's plan for assuring quality. The QOP spells out the State DOT's materials sampling and testing program, inspection/auditing process, and the Independent Assurance program, and describes how the requirements of 23 CFR 637 will be met. The QOP also addresses the D-B contracting process, the NEPA process as it relates to D-B, the Access Justification Report (AJR) process and other approval requirements during contract execution. For more information regarding a D-B project's QOP see the sample provided in Appendix B.

The remaining two Divisions have no separate policies and procedures specific to D-B projects. These two Divisions treat D-B projects the same as D-B-B projects with Division approval actions and other Division responsibilities included in the stewardship and oversight (S&O) agreement. One of these two Divisions has documented D-B contracting in their internal standard operating procedures (SOP) covering PoDIs. In this SOP, whether or not the contracting method is D-B is mentioned as one of seventeen project screening criteria when considering a project as a PoDI. Although this State DOT had been utilizing D-B since the late 1990's, this State DOT is not aggressive on their application of the traditional best-value D-B contracting method. We discovered that this State DOT D-B program was not very complex, because we were told by both

the Division and the State DOT that the State DOT primarily uses the one-step process or low-bid D-B contracting method, which is done on simple straight forward projects. In addition, their two-step best-value method is in reality low-bid because cost is the primary factor that drives the use of this method; however, the technical qualifications can be an influencing factor. Their final category of a D-B contracting method is called the hybrid method which they began using last year, and has been completed on only three projects. It has a simplified statement of qualifications, involves minimal innovation with the three highest scoring bidders submitting bids, but cost still drives the use of this method. While they have variability in their D-B program, their three categories of D-B methods end up being driven by lowest cost. The other State DOT, by statute, can only use low-bid D-B contracting.

Project & Program Actions taken by the Division:

Similarly, we found that four Divisions provide oversight to D-B projects using the same approach as Federal-aid D-B-B projects with a few minor exceptions. In these four Divisions, D-B is treated the same as D-B-B for contract administration which includes the typical Division involvement in right of way (ROW), environmental, utilities, scheduling and payment of work activities. Two of these four Divisions did not perceive their State DOT's D-B contracting method as higher risk, because the State DOT had a long history, of application and use of quality-based D-B programs. The other two Divisions considered their State DOT's D-B programs a low risk because they primarily applied the low-bid based D-B contracting method which is similar to D-B-B contracting method in how the contract is awarded, i.e., project cost.

The Division that perceives D-B contracting method as higher risk does so because of their State DOT's limited and varied use of this method. Accordingly, their project and program actions on D-B projects differ compared to D-B-B projects in their state. This Division recognizes that D-B projects in this state are unique, requiring unique treatment when compared to D-B-B projects. This Division designates every D-B project as a PoDI. In addition, their transportation engineer (TE) is involved with their State DOT's D-B teams from the inception of the D-B project. The TE's involvement includes attending regular meetings with the State DOT and D-B contractor, conducting NEPA reviews and re-evaluations as needed, reviewing and commenting on the draft Request for Qualifications (RFQ) and Request for Proposals (RFP), holding risk discussions, as deemed necessary, and continuing to be involved through the life of the project. They conduct more construction inspections on D-B projects than on their D-B-B projects, doing so at least quarterly. Unlike their D-B-B projects, the Division staff authorizes D-B projects based on the RFP and does not conditionally approve pending review of other project documents such as plans, etc. Furthermore, as part of their State DOT's request for authorization, the State DOT provides an accompanying RFP certification letter that documents the State DOT's certification that the project meets the requirements (23

CFR 635.309(p)) for the authorization of federal funds for the D-B project. For their D-B projects, the Division reviews and comments on the project's design and/or construction plans concurrently with the State DOT's receipt from the D-B contractor. The Division provides their comments for consideration but does not formally approve those plans, though responses to their comments are required. The Division also approves a State DOT prepared Quality Oversight Plan (QOP) submitted to the Division for every D-B project. The QOP describes the project's specific quality and oversight processes to be applied on the project. An example of the State DOT's project specific QOP is provided in Appendix B.

Even with the differences discussed above, we noted the following similar project review characteristics by all the Divisions visited:

- The area engineers/transportation engineers (AE/TE) have the primary project specific responsibilities for providing project oversight on D-B projects.

- Each Division identifies D-B projects as potential PoDIs, but only one Division designates every D-B project as a PoDI due to the perceived risk associated with the D-B contracting method in their state. We were told by one Division that they are still transitioning from "oversight" so they still have a few remaining D-B projects under the previous "oversight" procedures and when those projects are completed, they will transition fully to PoDI procedures for risk-based stewardship and oversight.

- Every Division is involved in their State DOT's RFP. In one state, the RFP is referred to as the scoping process. But the degree of involvement by the Division in their State DOT's RFP process varied from Division to Division:

  - In two Divisions, for the projects that are D-B that are also designated as PoDIs, the AE/TE evaluates the RFP for these projects by reviewing their State DOT's draft RFP and providing their comments and feedback.
  - In the other two Divisions, the AE/TE is also involved in the up front development of the RFQ/RFP for D-B projects designated as PoDIs, and later provides comments on the RFP before being finalized by the State DOT.
  - In the fifth Division, the D-B projects are treated like D-B-B projects. If a D-B project is designated as PoDI, the AE/TE provides the same oversight as required for any PoDI project. The AE/TE reviews the RFPs and is involved with other project development activities including reviewing plans, special provisions and the bid package, just as they would be for any D-B-B project. After contract award, the AE/TE continues their oversight through construction.

Recommendation: None.

Observation 2: There is a large degree of variability and complexity in State DOTs' use of D-B contracting for project contract administration, QA, environmental commitments, permitting, right of way (including utility relocation), scheduling, and payment for completed work.

In all of the States we visited, we saw a variety of D-B contracting methods. The D-B regulation, 23 CFR 636, permits the State DOTs to use the following contracting methods for project delivery: best-value, low-bid and/or some variation of these two methods. Three of the five States we visited use the best-value D-B method for the purpose of encouraging proposers to develop innovative solutions to meet their project's goals. Four of the State DOTs use the low-bid D-B contracting method for their less complex projects. The low-bid D-B contracting method only considers the cost of the proposal during the evaluation process. The State DOTs' reasons for using the low-bid D-B method include industry opposition to best-value and a court ruling interpreting existing State legislation allowing award based only on low-bid. We also learned about a variation of the low-bid D-B contracting method known as "partial" or "nested" D-B; where only a portion of a project uses the low-bid D-B contracting method. This State DOT told us that this D-B contracting method allows the D-B contractor to begin project construction while simultaneously allowing the D-B contractor to continue design of remaining project components. The State DOTs are using the D-B contracting method that best suits their needs and perceived risks.

Contract Administration and QA:

All of the states visited had documented procedures describing the requirements for providing D-B contract administration (design and construction phases) and QA. Some of the State DOT's documentation was more extensive than others; each had requirements for both the design and construction aspects of their D-B projects. The RFP or bid package for a D-B project is the primary method used to describe the procurement process and project requirements. Each State DOT has processes in place defining their RFP development process. For best-value D-B contracts, the RFP also defines the method by which proposals are scored. For an example of how proposals are scored by one State DOT, see Appendix A. Each State DOT also has a process to first screen projects and evaluate risk during the selection of the project delivery method to determine whether the project is a good candidate for D-B contracting. If the State DOT selects the D-B contracting method, they then identify the potential risks associated with the D-B approach and allocate these risks to either the D-B contractor or the State DOT.

State DOTs provided project QA (design and construction phases) on D-B projects using similar methods to those used on traditional D-B-B projects. The primary difference we noted between QA for D-B and D-B-B projects is that for D-B projects, the

design and construction QA activities are covered under one contract and take place concurrently.

For the design QA phase, each State DOT's processes describe the frequency of plan reviews and the requirements for approval. For the two State DOTs that only allow the use of low-bid D-B, these design reviews sometimes took place in an identical fashion to that of a traditional D-B-B project and construction work did not start until the entire design was completed. This was especially the case for less complex projects. The benefits of the use of the D-B contracting method on these types of projects were limited to meeting established contract letting dates. The design reviews on D-B projects take place throughout the contract duration as design packages are completed and released for construction.

For construction QA each State DOT focuses on visual inspection of completed work and includes all activities used for sampling and testing of materials to ensure compliance with material specifications. Since D-B projects are not bid with estimated quantities, each State DOT requires the contractor to break their work down into smaller defined parts. These were referenced by different names depending on the state, with some referring to them as a Work Breakdown Structure and others as a Schedule of Values. In order to conduct QA sampling and testing on construction materials (23 CFR 637), the State DOTs found it necessary to monitor the quantities for each of the contractor's work items to ensure the appropriate sampling and testing frequencies were achieved.

Environmental Commitments:

The environmental commitments contained in a project's NEPA document are required to be implemented on the project per 23 CFR 771.109(b). Each of the States visited had requirements for environmental commitments to be included in the RFP for their design-build contracts. We found that in all States visited environmental commitments on D-B projects are incorporated into the work like done for D-B-B projects. The State DOTs provide environmental commitments to their D-B contractor as they would to a consultant (or in-house staff) responsible for the design of a D-B-B project. The State DOTs review the D-B project documents during the design phase to ensure that environmental commitments have been properly incorporated into the work just as they would for an in-house or a consultant designed D-B-B project. We noted two of the five State DOTs have developed a single form for tracking and monitoring of environmental commitments to ensure they are incorporated into the project design and properly constructed. The other three State DOTs rely on their construction staff to monitor the commitments similar to any other contract requirement. The following is an excerpt of the requirements contained in one State DOT's D-B Manual:

> "Mitigation commitments are binding, and project personnel should be made aware of the mitigation commitments made and incorporated into the project's design. Project personnel must have a thorough understanding of the Department's responsibilities and must know clearly their role in fulfilling those responsibilities. Publication 10X (Design Manual, Part 1X, Appendices to Design Manuals 1, 1A, 1B, and 1C, Appendix T) outlines the Environmental Commitments and Mitigation Tracking System (ECMTS) Process which is a tool to monitor and document the successful implementation of environmental commitments and mitigation measures agreed to during a project's environmental compliance and approval process. The matrix template is set up to identify project team members, including Department personnel, consultants, and contractors assigned with the responsibilities to ensure compliance is achieved".

Permitting (environmental):

The State DOTs we visited handled environmental permitting for D-B projects in a variety of ways. Two of the State DOTs choose to manage the risks associated with permitting by placing those requirements with the D-B contractor. The State DOTs believed this allowed them to manage their own limited resources more effectively. They also believed that prospective D-B contractors had the expertise or could acquire the expertise to secure needed permits. Two other State DOTs have processes to evaluate the risks associated with permitting to determine whether to place those requirements on the D-B contractor. If during the evaluation, permitting is determined to be a higher risk, the State DOTs will obtain the permits and stay involved in the permitting process throughout the life of the project. Another State DOT believes they are often in the best position to handle the original permits, but the D-B contractor is required to obtain any new or revised permits uniquely necessary to implement their proposal. The State DOT believes this prevents the D-B contractor from making changes to the project that only benefit the contractor without any commensurate and measurable benefit to the project.

Right-of-way (including utilities):

The right-of-way (ROW) requirements for D-B contracts are the same as those for traditional D-B-B projects and can be found in 23 CFR 635.309(p). Each of the State DOTs requires a ROW certification prior to requesting FHWA to authorize the project and release the RFP. All five State DOTs consider risk allocation for D-B contracts and ROW is one of the key factors they evaluate. Two of the State DOTs place responsibilities for ROW acquisition on the D-B contractor as their way of allocating risks. The other three State DOTs keep that responsibility in-house due to the complex requirements of the Uniform Act. One State DOT had included ROW acquisition in the RFP for a past project, but discovered that the D-B contractor did not have the expertise required to ensure the Uniform Act provisions would be met. Consequently this State

DOT no longer includes responsibilities for ROW acquisition in the RFP and now handles in-house all ROW acquisition on D-B projects.

Scheduling:

We examined how State DOTs establish and address contract time on D-B contracts and this was one area in which we found very little variability among the five State DOTs interviewed. According to the FHWA Contract Administration Core Curriculum (CACC) Manual, contract time is defined as the maximum time allowed in the contract for completion of all work contained in the contract documents. For D-B projects, contract time may be specified in the RFP or requested as part of a contractor's technical proposal. Once the contract is awarded and the contract time is established, the State DOT monitors the contractor's schedule to ensure the project remains on schedule. Each of the State DOTs visited had processes in place requiring the contractor to submit a baseline schedule and provide monthly updates.

Payment for Completed Work:

For traditional D-B-B projects, sampling and testing of materials are conducted to determine if materials meet specifications. On D-B-B projects material bid items are listed in measurable quantities; for example structural concrete is typically shown in cubic yards, asphalt concrete in tons and guardrail in linear feet. When samples are taken (and tested) they can be easily related to measured quantity of material. With a passing test result the State DOT can pay the contractor for the specific measured quantity of material. Also, if there is a failing test result, the State DOT can determine corrective action for the material in question. D-B projects differ from traditional D-B-B projects in that they are bid with several lump sum (LS) items rather than a large number of standard bid items with measurable quantities. This requires that State DOTs implement a process that enables them to make appropriate payments as items of work are completed. The challenge for visited State DOTs on D-B projects is to convert the lump sum items into measurable quantities so that they can use the same material sampling and testing procedures used on D-B-B projects. To do this State DOTs use various terminologies such as "schedule of values", "work breakdown structure" and "work packages" to define the items of work that the design-builder will complete. Payment for completed work is made on a percentage of these items of work as construction progresses and is based on the State DOT's acceptance program which includes sampling, testing, and inspection. The State DOTs approve payment for completed work using a combination of inspection, sampling and testing in their acceptance decision. Each of the five State DOTs visited used material quantities, which are either provided by the contractor or calculated by the State DOT, to determine sampling and testing frequencies. One State DOT utilizes a payment process that pays 20% of the cost of an item once work starts on that item, but withholds the remaining 80% of the payment until that item of work is completed and accepted for payment. The

State DOT believes this approach motivates the contractor to begin and complete the work item in a timely manner and assists in keeping the project on schedule. The remaining four State DOTs base contractor progress payments on measured quantities placed and accepted as a percentage of total quantities estimated for that work item as they would for D-B-B projects.[1]

According to 23 CFR 637.207, the contractor's quality control sampling and testing can be used in the acceptance decision and each of the State DOTs employed this as part of their QA program. In our site visits, we discussed the State DOTs' approach to complying with the requirements of this regulation. In one state their staff performed two sets of tests on the project materials. The State DOT's first set of tests confirmed that required project testing procedures were being met. During this time, the contractor also performed his required quality control tests. The State DOT's first test results and contractor test results indicated acceptable material quality. However, the State DOT's second set of test results came in lower than their first test results and below contract requirements. Since both sets of State DOT tests were performed on samples taken at the same time, the State DOT staff concluded that their second sample had most likely been damaged or contaminated. The State DOT concluded that the first set of their test results along with the contractor's quality control test results provided them with assurance that the material met quality standards. As a result, the State DOT reminded its sampling and testing staff of the importance in following proper procedures when obtaining samples. The material in question was accepted by the State DOT and the Division concurred with this decision.

In another case, the State DOT requires the contractor to employ a QA manager to oversee all aspects of inspection, sampling and testing. We were told during the project level discussions that the QA manager is also used by the State DOT to ensure material tests are conducted and any deficiencies are corrected. Since the quality assurance manager was under contract to the contractor, this may conflict with 23 CFR 637.205(d), which requires that verification sampling and testing be performed by the State DOT or its agent, excluding the contractor. As part of this discussion, we were told that the QA manager could not be replaced by the D-B contractor without approval from the State DOT. These type of issues are addressed in the FHWA TechBrief "Construction Quality Assurance for Design-Build Highway Projects".[2] A copy of the FHWA TechBrief is in Appendix C.

Recommendation: The Resource Center should continue to promote the availability and use of the D-B guidance materials to Divisions and State DOTs with a focus on FHWA's TechBrief "Construction Quality Assurance for Design-Build Highway Projects.

[1] For D-B projects requirements for progress payments can be found in 23 CFR §635.122(c)
[2] This document can also be found at: http://www.fhwa.dot.gov/publications/research/infrastructure/12039/

Observation 3: **Opportunities exist to enhance the effectiveness of the Division and State DOTs' oversight of D-B projects.**

All five states visited have D-B contracting procedures in place designed to comply with the federal requirements governing the specific program areas reviewed during the site visits. We found no significant non-compliance trends with the State DOT's existing D-B contracting processes and procedures for the selected program areas. We believe that with continued Division oversight the five State DOT D-B programs should continue to comply with the requirements identified for the selected four program areas. Our assessment is based on discussions with Division office and State DOT staff and our evaluation of the State's D-B contracting procedures and their related technical guidance documents.

Effectiveness of the State DOT's D-B programs:

FHWA promotes the benefits of using the D-B contracting method as: (1) providing faster project delivery, (2) offering the potential to reduce project costs, and (3) encouraging contractor innovation. FHWA does not currently have national criteria to evaluate the effectiveness of a State DOT's D-B program. But promoted benefits of D-B contracting can be used as an informal gauge to evaluate whether a State D-B program is realizing the benefits of the D-B contracting method while still complying with all federal requirements. In the absence of established national criteria, realizing D-B benefits can be used to identify an effective State DOT D-B program.

Of the five states we visited only the one State DOT, who also had the most experience with D-B contracting, has formally evaluated their program. This State DOT has contracted with a state university to evaluate their D-B program to identify and assess the benefits. The results of the university studies indicate an average reduction in project duration time of 36 percent for D-B projects versus D-B-B projects with an average increase in D-B project cost of approximately five percent. This State DOT began using the D-B contracting method in 1988 and since that time estimates the D-B contracting method has been used on over 500 transportation projects statewide. During 2014 this State DOT estimates the D-B contracting has been used on approximately 59 percent of its capital funding for road and bridge improvements. Last year the State DOT estimates D-B contracting use to be approximately 45 percent of its capital funding for road and bridge improvements. The other four State DOTs have used D-B contracting to a much lesser degree. These four State DOTs have not conducted any formal studies of their D-B programs to identify benefits obtained such as project cost and time savings. But we were told by these four State DOTs that they believe their D-B program provides faster project delivery and as cheaply as D-B-B projects; while maintaining the same project level quality. Also, all five states agreed that D-B offers more contracting opportunities for smaller businesses as it does not necessarily limit

them due to bonding capacity requirements if and when they want to work on larger projects.

Successful Practices:

We identified several successful practices used by four of the five State DOTs in administering D-B projects. These are discussed below and are offered only to describe a successful practice used in their state and may not be suitable in other State DOT programs.

Florida State DOT

The State DOT uses boiler plate language in their RFQs and RFPs as a way of ensuring consistency and to reduce the potential for D-B bid protests by unsuccessful firms. The State DOT also requires their construction engineering and inspection firms and State project staff to complete and submit all project documentation within 20 calendar days after project completion. The State DOT believes this requirement results in faster project closeout and facilitates an ongoing documentation effort throughout the life of the project. Another practice used by this State DOT is to separate state funded landscape and plant establishment contracts to allow for faster closeout of the federal-aid project. The State DOT also makes use of contractor performance rating (CPR) data and stores this information in a statewide database. The State DOT staff believes using this CPR data keeps their contractors focused on performance. The State DOT also allows potential D-B firms to submit alternate technical concepts.[3] They believe that ATCs allow industry to bring new ideas and concepts for these projects. The state has calculated time and cost savings for the use of D-B projects. They have used a state university on three different occasions to document D-B project savings and evaluate effectiveness. For an example of one of these evaluations, please refer to this web site: Florida DOT Design-Build Evaluation Report.pdf. The State DOT has also established a resource library on their external website to assist potential D-B firms when preparing their bids.

Missouri State DOT

The Division and State DOT have developed a D-B Programmatic Agreement document that describes the roles and responsibilities of the State DOT and FHWA in administering D-B projects. This agreement is included in the State DOT policy guidance. The document contains standard forms and describes specific procedures to be used on D-B projects. The document also contains the time frames to complete

[3] Alternative Technical Concept is defined as a flexible contracting procurement method that contractors can use to submit innovative, cost-effective solutions that are equal to or better than the state's design and/or construction criteria. (source: http://www.fhwa.dot.gov/construction/contracts/acm/atc.cfm)

various project actions. The State DOT has delegated authority and accountability to the D-B Project Director to comply with all federal and state laws regulations and policies. The State DOT piloted a provision in a recent D-B RFP designed to encourage D-B firms to review ROW needs for possible savings. If the D-B contractor can reduce the project's ROW needs then the State DOT allows the firm to use the cost savings to provide additional scope that otherwise could not be constructed within the allocated project budget. The State also dedicates a utility coordinator to assist the D-B contractor in strengthening utility coordination.

The State DOT develops a Quality Oversight Plan (see Appendix B) for each D-B project describing the roles and responsibilities of project and contractor staff including expected timelines for resolving issues. The State DOT allows a D-B contractor to propose alternative technical concepts which allows the bidder to propose changes to the State DOT supplied base design configurations, project scope, design criteria or construction criteria.

In order to avoid going to condemnation, the State DOT allows the D-B contractors the option to offer the difference between the Just Compensation determination of a ROW parcel and the landowner's asking price. The State DOT believes that this flexibility can potentially save six months or more in time.

The State also assigns at least one project staff throughout the life of the project to maintain continuity and knowledge of the project decision from design through construction. The State DOT attempts to assign D-B Project Directors and Deputy Project Directors that have different technical backgrounds; preferably, one having experience in design and the other having experience in construction. In addition, the State DOT develops project specific goals for all of its D-B projects and continually communicates these goals throughout the project life for the purpose of promoting innovation and reminding staff of the specific performance goals established for the project.

Virginia State DOT:

The State DOT pays the contractor 20% for specific pay items when work on those items begin. The State DOT pays the remaining 80% when the work items are completed and accepted by the project staff. The benefit of this process is simplicity in tracking and documenting completed work items. The 20% is paid based on visual inspection by the project inspector that work has begun. The remaining 80% is paid after all field measurements, material certifications, sampling and testing have been completed and accepted by the State DOT. The State DOT believes this motivates the contractor to complete the work items as soon as possible in order to receive full pay.

Pennsylvania State DOT:

The State DOT has developed a modified contracting technique based on the D-B contracting method. The State DOT refers to this modified technique as “partial” or “nested” D-B. The State DOT begins by developing a project using the traditional D-B-B contracting method. During the project development process the State designates one or more of the project’s work items as a D-B component (e.g., structures, retaining wall, etc.). The D-B component is advertised and awarded as part of the overall D-B-B project leading to the term “partial”. The significant benefit of this D-B variation is that this allows the State DOT can keep the project on schedule. The State DOT designs the simple components of the project that do not require a time consuming and/or specialized engineering expertise (e.g., grading, drainage and/or pavement sections) while assigning the more specialized and time consuming components (e.g., retaining walls or deep foundations for structures) to the D-B bidder(s).

Lessons Learned:

We asked State DOT staff what lessons have they have learned in using D-B contracting in their program. All State DOT staff provided feedback to us on our question. Some of the lessons learned were common to several State DOT programs and others were project specific. Several common lessons learned identified as a result of our discussions with State DOT staff include:

- Use boiler plate language in the RFQs and the RFPs. This practice would help ensure consistency from project to project and statewide. The benefit is that D-B contractors are provided the same information to prepare their bids, which will minimize the potential for disputes later in the award process.
- A proposed D-B project’s scope should be well defined. This ensures that D-B bidders know the scope of work and related services they are expected to provide. This should also minimize the potential for extra work or change orders that often lead to increased project costs.
- Adequately fund the D-B project including allocating sufficient funds to cover construction engineering costs and including contingencies to cover cost increases due to design change reviews performed by the State’s DOT staff.
- Assign the same State DOT staff to the D-B project beginning with design and use the same staff through construction. This “cradle to grave” practice will ensure that State DOT project staff are knowledgeable about past project decisions and will help them to address future project issues.
- If the project’s footprint is fixed, acquire all of the ROW needed prior to awarding the D-B contract. If this is not possible then State DOTs should dedicate staff to

the D-B project to coordinate ROW acquisition and provide assistance to the D-B contractor when needed.

The lessons learned listed above are several common themes noted during our interviews with State DOT. Additional lessons learned from all five State DOTs are found in Appendix D.

Opportunities for Improvement:

The team observed a number of issues regarding project construction contract administration, State DOT statutory, legal and policy restrictions, and the lack of formal studies quantifying the benefits realized through use of D-B. For example, in one State, the project staff relies heavily on the contractor's quality assurance manager (QAM) to identify, resolve and report on workmanship and materials issues such as failing material test results. The State DOT defines the QAM as:

> "The Design-Builder's designee responsible for providing Quality Assurance and Quality Control of the Work, and ensuring conformance with the Contract Documents is the individual with overall responsibility for the development of and adherence to the Design- Build QA/QC Plan. The QAM is responsible for supervising the performance of all field materials tests performed by the Design-Builder including but not limited to, density, moisture, air content of concrete, slump, and other required materials field tests."[4]

The State DOT project staff told us they consider the contractor's QAM as critical support to assist them in fulfilling their oversight responsibilities. We were told that the contractor's selection of the QAM must be approved by the State DOT and that removal of the QAM must also receive State DOT approval. The State DOT staff also told us that they do perform independent verification of project activities during critical construction activities and also when investigating project issues. This issue of roles and responsibilities for the owner agency and the D-B contractor is discussed in the FHWA TechBrief Quality Assurance for Design-Build Highway Projects previously cited in this report (contained in Appendix C). Also noted in the TechBrief, the term QA/QC is discouraged and replaced solely with QA – Quality Assurance Plan as the overarching requirement since a contractor's quality control (QC) is an element thereof.

Statutory, legal and policy restrictions also challenged some State DOTs' use of D-B more fully. One State DOT is limited in the number of active D-B construction projects it can have statewide. Specifically, the number of D-B projects cannot exceed two percent

[4] Source: State DOT manual **on** "Minimum Requirements for Quality Assurance & Quality Control On Design Build & Public-Private Transportation Act Projects, August 2008"

of all active constructions projects per year. The state legislature passed legislation creating this two percent limitation. This limitation does inhibit the State DOT's ability to mainstream D-B as a project delivery alternative. We were told by another State DOT that as a result of a court ruling, the DOT could only award D-B contracts based on the lowest bid. We learned from another State DOT that internal policy governs their use of D-B projects. This State DOT uses quality-based factors to shortlist potential D-B contractors but uses only the lowest cost as the determining factor in awarding a D-B contract.

The benefits of using the D-B contracting method have been promoted extensively by FHWA. But only one State DOT has documented studies on time and cost savings they have experienced using D-B contracting. This State DOT is the most advanced of the five states visited in using D-B contracting method and has been using D-B since the 1988. The other four State DOTs told us that they have not conducted any studies to evaluate the benefits of using D-B contracting method in their program.

The issues described above warrant further consideration by the Office of Infrastructure and Resource Center as they continue to promote the use of D-B contracting methods by State DOTs. We believe that the lack of State DOT conducted studies that verify the effectiveness of their D-B program is the most significant opportunity observed during our visits. These studies could serve as a valuable technical resource for other State DOTs considering use of the D-B contracting methods in their program and could also be used by FHWA to establish national standards. State DOTs could then use these national criteria to assess their D-B programs.

Recommendation: The Office of Infrastructure in collaboration with the Resource Center should encourage State DOTs to evaluate their D-B programs to determine and quantify the benefits of D-B contracting.

Appendices

A. State DOT Design-Build RFP Evaluation and Selection Criteria
B. State DOT Project Specific Quality Oversight Plan
C. FHWA TechBrief “Construction Quality Assurance for Design-Build Highway Projects”
D. State DOTs’ “Lessons Learned”

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Appendix A

Excerpt from State DOT Design- Build Selection Criteria Manual

3.0 VALUE BASED SELECTION

3.1 SELECTION PROCEDURE

The final selection of a DBT from the short-listed candidates will be based upon the technical quality of its Technical Proposal, the Project Duration listed in the Technical Proposal (Section 4.13), as well as the price contained in its Price Proposal.

After Technical and Price Proposals are submitted, the Technical Proposals will be sent to the Technical Proposal Advisory Group for evaluation. Price Proposals will be retained, unopened, until after the Technical Proposals have been scored.

The Technical Proposal Advisory Group will review the submitted Technical Proposals to determine if they are responsive to the requirements of the RFP.

Failure to attend required meetings may disqualify a DBT from further consideration in the selection process.

Each responsive Technical Proposal will be evaluated and scored by the members of the Technical Proposal Advisory Group on the basis of the criteria provided in this Selection Criteria. The Technical Proposal Advisory Group is anticipated to consist of Departmental representatives in the following areas:

1. Office of Contracts
2. District 6
3. Division of Construction Management
4. Division of Highway Operations
5. Division of Production Management

The Technical Proposal Advisory Group may be assisted by any number of subgroups and/or subject matter experts within the Department, City of Columbus, FHWA, other involved agencies, and/or contracted by the Department.

3.2 RESPONSIVENESS

A Technical Proposal may be deemed non-responsive at the sole discretion of the Director if any of the following apply:

1. The Technical Proposal fails to achieve a total score of at least 70 points; not including bonus points.
2. The Technical Proposal receives a score of less than 60 percent of the available points in any one of the Evaluation Criteria (A through I) listed in Section 4.11.
3. The Technical Proposal receives a score of less than 70 percent of the available points in three or more of the Evaluation Criteria listed in Section 4.1 (A through I).

4. The Project Duration listed in the bidder's Technical Proposal (see Section 4.13) is in excess of 183 weeks (42 months).
5. The Technical Proposal does not respond to the bid documents in a material respect.

3.3 SCORING

The Price Proposals will be publicly opened on the date indicated the Project Proposal. The Price Proposal will reflect the requirements of the Project Scope and the prospective DBTs Technical Proposal. The Technical Proposal Score and Project Duration will be announced prior to the opening of the Price Proposals.

Scoring of the Technical and Price Proposals will be combined using a normalized weighted formula as follows:

Provide appropriate scoring criteria.

Bidders Score =

35 x Bidder's Technical Proposal Score / Highest Technical Proposal Score* +
60 x Lowest Price Proposal* / Bidder's Price Proposal +
5 x Shortest Project Duration* / Bidders Project Duration

* All responsive bidders.

The Technical Proposal Score and Bidders Scores will be rounded to a tenth of a point. Rounding of Scores to the nearest tenth of a point will be accomplished by the round-up method: e.g. - 75.45, 75.46, 75.47, 75.48, and 75.49 would be rounded up to 75.5; and 75.41, 75.42, 75.43, and 75.44 will be rounded to 75.4.

The Director has final authority to determine the best interests of the Department and may reject any or all Technical/Price Proposals.

4.0 TECHNICAL PROPOSALS

4.1 TECHNICAL PROPOSAL EVALUATION

The Technical Proposal shall be developed using narratives, tables, charts, plots, drawings and sketches as appropriate. The purpose of the Technical Proposal is to document the proposed DBT's understanding of the project, its selection of appropriate design criteria and its approach for completing all design, quality management and construction activities. The design approach will reflect a single unified design concept for the project.

Resubmit an updated form A2 located in the Appendix. Provide an updated organizational chart showing the interrelationship of the DBT.

The Technical Proposal will be evaluated on how well each of the following items is addressed:

Part	Evaluation Criteria	Maximum Points
A	*Maintenance of Traffic and Construction Access*	*20*
B	*Design Management*	*5*
C	*Proposed Design*	*20*
D	*Construction Management*	*5*
E	*Construction*	*15*
F	*Quality Management*	*15*
G	*Outreach to the Disadvantaged Enterprise Community and On the Job Training*	*5*
H	*Community Relations & Aesthetic Enhancements*	*10*
I	*Sustainability Plan*	*5*
J	*Prequalification*	*Not scored*
TOTAL – Technical Proposal		*100*
K	*?????? (Bonus Evaluation Criteria)*	*5*
L	*Project Duration*	*Scored Separately (See Section 3.3)*

Technical Proposal content requirements are found in the following sections as well as within the Project Scope. Points awarded for Section K will be considered bonus points. Non-participation in Part K (Bonus Evaluation Criteria) will not be considered as a non-responsive submission.

In an appendix, provide a resume meeting the requirements of Section 2.5, Part C, #6, for all staff listed in the Technical Proposal.

The DBT shall not make changes to the personnel listed in the SOQ in response to minimum staffing requirements without written permission from the Department. Written requests shall indicate why staffing changes are necessary and demonstrate that the revised staffing plan will be equal to or better than the staff listed in the SOQ.

4.2 MAINTENANCE OF TRAFFIC AND CONSTRUCTION ACCESS (PART A)

For the Maintenance of Traffic and Construction Access provide the following for all affected transportation facilities, including, but not limited to, Interstate mainline, ramps, local streets, and transit facilities.

	Component of Maintenance of Traffic (MOT)	Percentage of MOT Points
A.1	Proposed Phasing and Overall Plan Design	35
A.2	Construction Access Plan	20

A.3	Minimization of Public Inconvenience	35
A.4	MOT Staffing	10

4.3 DESIGN MANAGEMENT (PART B)

Describe the DBT's concept of design management. Identify a staffing plan including specific responsible personnel and organizational units. Provide a design organization chart for the project, showing the relationships between functions shown on the chart and the functional relationships with subconsultants.

At a minimum, address the following personnel assigned to manage the design development:

1. DB Project Manager
2. DB Designer Project Manager
3. DB Lead Structural Engineer
4. DB Lead Roadway Engineer
5. DB Geotechnical Engineer
6. DB Drainage Engineer
7. DB Traffic Control Engineer
8. DB Lighting Engineer

Describe the qualifications and experience of the individuals assigned to these tasks and describe the specific management tasks they will perform. Include information relative to each individual's familiarity with the proposed design.

Individuals must be currently employed by a member of the DBT.

Provide a narrative description of the proposed plan for developing and furnishing the design work for the project. This plan shall include at least the following items:

1. Description of how the designs developed by different firms and offices will be integrated into overall design development.
2. Description of how design personnel will interface with construction personnel. Indicate where project design personnel will be located relative to the project site (e.g., on site, within 5 miles of the site, etc.) and time periods they will be at these locations (e.g., for the entire project, during the first year, as needed, etc.).
3. Description of the DBT's internal design checking process (separate from the Department's review process and reviews by the Independent Quality Firm as defined by the Project Scope).

The Department will use the following criteria to distribute Design Management points:

	Component of Design Management	**Percentage of Proposed Design Points**
B.1	Design Management Staffing	60
B.2	Integration of Management Team (e.g.,	20

	location, interface with construction, etc.)	
B.3	Design Checking	20

4.4 PROPOSED DESIGN (PART C)

The Technical Proposal shall address the following issues:

1) Demonstrate an understanding of the Project Scope.
   a) Provide Stage 1 plans as per the Bridge Design Manual.
   b) Provide the following information for each proposed retaining wall. If there are multiple proposed wall types within the retaining wall length, (ie: cast-in-place, soil nail, MSE, secant or tangent drilled shaft, etc), provide the following information for each proposed type:
      i) Limits
      ii) Type
      iii) Typical Cross Section(s)
      iv) Elevation View
   c) Provide roadway sheets including:
      i) Plan and Profile sheets containing: existing topography, horizontal alignment (including curve data), profile, and general drainage layout. Scale = 40 to 1 (preferred) on 11" x 17" plan sheets.
      ii) Typical Sections showing pavement widths and slopes.
      iii) Superelevation tables.
   1. Demonstrate that the proposed design meets or exceeds the Department's general and project specific requirements and criteria.
   2. Demonstrate that the proposed design is in keeping with the environmental commitments listed in the Project Scope.
   3. Describe any specific design features that would reduce the need for maintenance or would make inspection/maintenance procedures more efficient, safer and/or less costly.
   4. Discuss solutions to manage the risks associated with the DBT's Technical Proposal based on limited design information.
   5. Discuss how proposed designs for roadway, bridges, retaining wall systems, and stormwater drainage minimize life cycle costs while meeting or exceeding project requirements.
   6. Describe how the final design elements of the Long Street Cap will allow for flexibility for future development and use.
   7. Provide a listing of all utility facilities required to be relocated by the DBT's proposed work. This listing may be provided in an appendix to the Technical Proposal. The required format of this listing will match that shown in the utility

impact matrices. At a minimum, the DBT will complete the “facility impact” column with a “yes”, “no”, or “possible.”

The Department will use the following criteria to distribute Proposed Design points:

	Component of Proposed Design	Percentage of Proposed Design Points
C.1	Bridge Designs	35
C.2	Retaining wall Designs	30
C.3	General Roadway, Roadway Drainage	30
C.4	Other (including Utility Coordination and Relocation)	5

4.5 CONSTRUCTION MANAGEMENT (PART D)

Describe the DBT’s concept of the project construction management organization and how it interrelates with the other elements of the DBT’s organization for the project.

Provide a construction organization chart for the project, showing the relationships between functions shown on the chart and the functional relationships with subcontractors. The chart shall indicate how the DBT intends to divide the project into work segments to enable optimum construction performance.

Describe how subcontractors will be managed.

Identify a staffing plan including specific responsible personnel and organizational units that cover the following work areas and or specialties. At a minimum, identify individuals responsible for the following areas:

1. DB Project Manager
2. DB Construction Project Manager/Engineer
3. Bridge Construction
4. Retaining Wall Construction
5. Drainage & Environmental Construction
6. Public Safety
7. Project Safety
8. Utility Coordination
9. Micro Tunneling Engineer/Manager

Specifically address each individual’s familiarity with construction management of similar projects, preferably Design-Build projects of similar size and scope. Provide specific project examples and the relevance/similarity to the proposed project.

Specifically address the Micro Tunneling Engineer/Manager’s experience on projects with similar microtunneling requirements and geology.

The Department will use the following criteria to distribute Construction Management points:

	Component of Construction Management	Percentage of Proposed Construction Management Points
D.1	Construction Management Staffing	50
D.2	Construction Management Plan	50

4.6 CONSTRUCTION (PART E)

Address the following construction issues:

1. Provide a brief narrative description of the DBT's plan for constructing the project. Describe the construction concept that will be used for each construction phase. Describe the methodologies planned to identify and avoid delays or impacts.

2. Provide a preliminary Critical Path Method (CPM) Schedule for the project including both design and construction. The CPM Schedule shall show the sequence and continuity of operations, as well as delivery of anticipated buildable units. Buildable units should be defined clearly in design phases as well as construction phases.

   The CPM Schedule is intended to be somewhat general in nature however, it should be detailed sufficiently to convey the intent of the DBT by noting major design phases and major work items. The CPM Schedule shall calculate the proposed final completion date of the project. The longest path to project completion shall be clearly defined. All durations of major MOT phases noted in the Technical Proposal's Maintenance of Traffic section shall be shown. The durations of ramp closures and detours shall be shown. Show the calculated planned durations of the Spring Street closure, Long Street closure, the closures to I670 Eastbound and Westbound from I 71NB ramps closures, I670EB to Cleveland Ave ramp closure, Cleveland Ave ramp to I670EB closure, I670EB to I71SB Ramp closure, and I670WB ramp to Cleveland Ave closure. Demonstrate that the DBT has considered safety, utilities, permitting, constructability, anticipated fabrication durations, and maintenance of traffic activities in determining the proposed CPM Schedule.

   The CPM Schedule section shall also include an overall schedule narrative describing the planned sequence of work. This narrative shall correspond to any of the submitted CPM Schedule printouts, and shall also be able to stand as a separate document describing the conceptual planned working sequence. MOT closures and detour durations for major MOT phases shall be included. The narrative shall not be an appendix to the Technical Proposal.

   The DBT shall address the methodology planned to recover time caused by non-excusable delays. The DBT shall address the planned methodology to recover time due to excusable delays if so requested by ODOT.

3. Describe the DBT's anticipated workforce required during construction phases and the DBT's plan to ensure availability of skilled personnel. Describe the

DBT's plan to ensure the availability of major pieces of equipment to meet the requirements of the CPM Schedule and project timeframes.

4. Describe the safety considerations specific to this project. Discuss the DBT's goals and overall approach to safety. Describe the DBT's method for measuring safety.
5. Describe the proposed coordination with owners of utility facilities.
6. Describe the DBT's plans and procedures to ensure timely deliveries of materials to achieve the project CPM Schedule and project timeframes.
7. Describe the DBT's plan and procedures during the installation of the Micro Tunnel Drainage installation. Describe the methods planned to avoid delays and disruptions from possible obstruction encountered during tunneling operations. Describe plans to remove obstructions, including emergency short term MOT considerations and backfilling of any excavations need for the removal of obstructions. Describe techniques planned to eliminate settlement of nearby structures and active I-71roadway.

The Department will use the following criteria to distribute Construction points:

	Component of Construction	**Percentage of Construction Points**
E.1	Construction Integration, Sequencing and Logistics	55
E.2	Safety	15
E.3	Utility Coordination	10
E.4	Micro tunnel Logistics	20

4.7 QUALITY MANAGEMENT (PART F)

Describe how the DBT intends to fulfill the requirements for Quality Assurance/Quality Control as defined by the Project Scope.

Identify the Independent Quality Firm (IQF) and the following key quality personnel:

1. Independent Quality Manager
2. Independent Construction Quality Manager
3. Independent Design Quality Manager
4. Independent Lead Structural Inspector
5. Independent Lead Highway Inspector

Specifically address these individuals' familiarity with design, design review, construction, inspection and/or testing on similar projects, their professional registrations, and professional certifications. Resumes shall be included with the Technical Proposal submittal.

Provide a draft of the Quality Management Plan (QMP) required in the Project Scope. The draft QMP should follow the organizational format for the QMP in the Project Scope and, at a minimum, address the following areas:

Describe the interrelationship between the IQF, the DBT, and ODOT during the design and construction phases to ensure a quality project delivered within the project timeframes.

Describe the IQFs methodology in ensuring design reviews, inspections, material sampling and testing are performed timely and reported accurately.

Describe the methodology planned to determine adequate IQF staffing to ensure proper design review and proper construction inspection.

Describe methods of inspection and materials control for field construction items such as: earthwork, pavement and/or pavement repair, structural items (such as foundations, concrete, reinforcing, decking), retaining walls, drainage, lighting, pavement markings and/or other major D-B components. The description will include concepts for documentation methods, reporting methods, frequency of inspection and testing, equipment used, and resolution methods for typical defects.

The Department will use the following criteria to distribute Quality Management points:

	Component of Quality Management	**Percentage of Quality Management Points**
F.1	Overall Quality Management Approach and Plan	30
F.2	Design Quality/Reviews	20
F.3	Construction Quality/Inspection	30
F.4	Materials Testing	20

4.8 OUTREACH TO THE DISADVANTAGED ENTERPRISE COMMUNITY AND ON THE JOB TRAINING GOAL (PART G)

Describe the DBT's plan to employ an independent Diversity and Inclusion Consultant.

The DBE goal for this project is set at ?????. The DBT should submit a plan that clearly articulates the methods it intends to employ to meet the goal or make good faith efforts to meet the goal. Include innovative and aggressive strategies including the use of the Diversity and Inclusion Consultant. Describe the DBT's efforts to reach out to DBEs and potential DBEs eligible for certification that may be impacted by, or benefit from, the project.

The Technical Proposal should explain how the DBT intends to address goal attainment for the On the Job Training (OJT) Program; including the following information:

1. Minimum number of trainees:
    a. Describe the minimum number of trainees the DBT intends to obtain. A minimum of ???? trainees must be included.

2. Describe the OJT Program including:
    a. Recruiting;

b. Retention and tenure;
c. White Collar OJT;
d. Blue Collar OJT, including specific crafts;
e. Project/Labor Agreements;
f. On-site and/or off-site training; and
g. Number of hours per trainee and/or trade.

The Department will use the following criteria to distribute Outreach To The Disadvantaged Enterprise Community And On-The-Job-Training Goal points:

	Component of Outreach to the Disadvantaged Enterprise Community and On the Job Training Goal	**Percentage of DBE Outreach and OJT Points**
G.1	Plan to Achieve DBE Goal of ????	25
G.2	Plan Outreach to the Disadvantaged Community	25
G.3	Plan to Achieve ???? Trainees	25
G.4	Plan for Training, Retention and Tenure of Trainees	25

4.9 COMMUNITY RELATIONS & AESTHETIC ENHANCEMENTS (PART H)

Describe the DBT's plan to establish and maintain a positive relationship with residents, businesses, institutions, organizations and others inconvenienced by the construction for the project.

Describe the DBT's plan to inform the public with respect to the status of the project and identify the Aesthetics and Enhancements Manager.

Describe the DBT's plan to communicate the project's intent to minimize the inconvenience to the travelers, residents, businesses, institutions, organizations, motorists and others.

Submit the Aesthetics and Enhancement Management Plan that describes how the DBT intends to fulfill the requirements of the project scope. Summarize the DBT's approach to incorporating aesthetics and enhancements throughout project development and incorporating stakeholder and public feedback into the final design. Define the responsibilities and authority of the Aesthetics and Enhancements Manager. Describe the proposed range of options/alternatives (narrative discussion and/or sketches/graphics) that the DBT will present to the stakeholders and public for feedback and selection.

The Department will use the following criteria to distribute Community Relations points:

	Community Relations Components	**Percentage of Community Relations**

		Points
H.1	Public Communication and Community Relations Approach	50
H.2	Aesthetics and Enhancement Management Plan	50

4.10 SUSTAINABILITY (PART I)

Submit a Sustainability Plan in accordance with the Project Scope that describes the DBT's approach and commitment to sustainable design and construction practices.

	Sustainability Plan Components	Percentage of Sustainability Plan Points
I.1	Sustainability Plan	100

Technical Proposals that include a Sustainability Plan that minimally addresses the requirements of the Project Scope (Section 1.19.1 Sustainability Plan) will receive a score of no less than 70 percent for this criteria.

The Sustainability Plan will be evaluated in four areas:

A. Energy and Energy Efficiency
B. Community Environment
C. Green Building
D. Recycling / Reuse / Material Reduction

Scores higher than 70 percent will be achieved by demonstrating clear advantages, benefits or added value to the Department relative to the following:

1. Initiatives that result in permanent benefits vs. temporary benefits.

2. Initiatives that result in benefits that can be easily verified, quantified and documented.

3. Initiatives that clearly demonstrate return on investment.

4.11 PREQUALIFICATION (PART J)

Provide the following information for all work type listed in the Project Proposal (see Proposal Note 090):

Work Type Code	Work Type Description	Contractor/Subcontractor(s) to Perform the Work

Provide the following information for all designer prequalification categories listed in the Project Proposal.

Prequalification Category	Consultant/Subconsultant to Perform the Design Work

Alternative Technical Concepts and/or allowable options in the Project Scope may eliminate the need for an individual work type and/or prequalification category (More than one firm may be listed as performing the work.)

A Technical Proposal that fails to meet prequalification requirements may be declared non-responsive.

4.12 NEIGHBORHOOD ACCESS (Bonus Evaluation Criteria) (PART K)

Non-participation in this evaluation criteria will not constitute non-responsiveness.

The reconstruction of the I-71/I-670 interchange will impact access to, from, and through nearby neighborhoods.

Describe the DBT's plan to reduce or eliminate the adverse access impacts to and from the adjacent districts due to the durations of the following closures during construction:

- Traffic movements along the existing and proposed Spring Street Bridge.
- Traffic movements along the existing proposed Long Street Bridge.
- Closure of the Long Street and Broad Street onramps to I-71 Northbound.
- Closure of the I-71SB exit ramp to Spring Street.
- Cleveland Ave entrance ramps to I-71.

	Neighborhood Access	Percentage of Neighborhood Access Points
K.1	Plan to reduce Spring-Long Street Bridge Construction period and maintain neighborhood connectivity.	50
K.2	Plan to reduce Broad St / Long St / Spring St / Cleveland ramp closure period and maintain traffic movements during construction.	50

Bonus points for Neighborhood access will be awarded on a scale of 0-5 points, to the nearest tenth of a point, and added to the total of the Technical Proposal points. A Technical Proposal which receives no bonus points will still be considered responsive provided that all other criteria herein are met.

4.13 Project Duration (PART L)

Submit the total Project Duration in weeks from the execution of the contract to completion date. This duration will be used to calculate the best value score as indicated in Section 3.3.

If the DBT proposed a shorter Project Duration in the SOQ submittal than what is published in the Project Proposal, the shorter duration must be reflected in the Technical Proposal. If the DBT proposes a shorter duration than what is published in the Project Proposal, the shorter duration will be used to calculate the contractual project completion date.

4.14 ADDENDA

Acknowledge receipt of all project Addenda as outlined in the Project Proposal.

4.15 TECHNICAL PROPOSAL SCORING

The following table provides a general indication of anticipated scoring of each evaluation criteria; not including bonus points or duration.

Definition	Scoring Range (percentage)
The Technical Proposal demonstrates an approach that is considered to significantly exceed the RFP requirements/objectives in a beneficial way (providing advantages, benefits, or added value to the Project) and that provides a consistently outstanding level of quality. In order to meet the criteria for this scoring range the Technical Proposal must have at least one of the following: - Two or more significant strengths even though a single minor weakness may exist. - A significant strength and no weaknesses. - Three or more strengths and no weaknesses.	90-100
The Technical Proposal demonstrates an approach that is considered to exceed the RFP requirements/objectives in a beneficial way (providing advantages, benefits, or added value to the Project) and offers a generally better than acceptable quality. In order to meet the criteria for this scoring range the Technical Proposal must be determined to have at least one of the following: - A significant strength even though minor weakness may exist. - At least three strengths and no significant weaknesses.	80-89
The Technical Proposal demonstrates an approach that is considered to meet the RFP requirements/objectives and offers an acceptable level of quality. In order to meet the criteria for this scoring range the Technical Proposal must be determined to have one or more strengths even though minor weaknesses may exist. Technical Proposals with no strengths and no weaknesses will also fall in this category and receive a score of 70.	70-79
The Technical Proposal demonstrates an approach which is marginally acceptable. In order to meet the criteria for this scoring range the Technical Proposal must be determined to have one of the following: - No strengths and minor weaknesses. - One strength and a significant weakness.	60-69
The Technical Proposal demonstrates an approach that demonstrates an unacceptable level of quality. In order to meet the criteria for the scoring range the Technical Proposal must have one of the following: - No strengths and one or more significant weaknesses. - No strengths and three or more minor weaknesses The Technical Proposal demonstrates an approach that contains no strengths and minor and/or significant weaknesses.	0-59

Within each scoring range, points will be based on a balance of the relative significance of the strengths and weaknesses. Points may be assigned to the nearest tenth of a point. DBTs are encouraged to exceed the scope if they seek a score above 70.

4.16 FORMAT OF TECHNICAL PROPOSALS

Technical Proposal text shall be limited to 75 pages. An unlimited number of additional exhibits, plans, CPM Schedule printouts, resumes and figures will be accepted as appendices. However, the DBTs are encouraged to be as concise as possible.

Technical Proposals must be organized based on the Parts (e.g., A, B, C, etc.) and components (e.g., A.1, A.2, etc.) listed in Section 4.

A page shall be 11” x 17” printed on one side only. Font should be at least 12 point in Times New Roman or similar. Margins should be at least 1” all around.

If dividers are used and contain project information, they will be counted towards the maximum number of pages. Foldout pages are not allowed.

Submissions exceeding the page limitations or failing to follow the section format instructions outlined above will be rejected.

Graphics should conform to the other format requirements listed.

Submit fifty (50) sequentially numbered paper copies of the Technical Proposal and one CDs/DVDs containing the Technical Proposal in PDF or TIF format.

Appendix B

MoDOT Quality Oversight Plan

I-64 Daniel Boone Bridge Design-Build Project
J6P1436, Rte. I-64, St. Louis County and St. Charles County

Sampling and Testing

Minimum frequencies for materials testing are defined in Appendix A - Schedule of Testing. These tests will be random in that MoDOT will not focus the testing on this schedule on suspected compliance or non-compliance. These frequencies are a bare minimum and the sampling and testing will be more frequent, particularly at the beginning of the project. In addition to random sampling and testing, MoDOT may sample and test any material that appears suspect. Independent Assurance Sampling and Testing frequencies are defined in Appendix B – Independent Assurance Sampling and Testing. Testing of materials that don't have specific frequencies based upon quantity will be included within scheduled audits.

MoDOT has a team of highly experienced auditors whose backgrounds include construction inspection, materials inspection, highway design, drainage design, and bridge maintenance. All MoDOT personnel (verification and IAS) performing sampling and testing will be certified by the MoDOT Technician Certification Program for the tests they are performing.

Audits

MoDOT will use an audit approach for assessing the Contractor's performance. This will entail checking on a sampling basis whether the Work is complying with the requirements of the Contract Documents.

Auditing will entail the collection and documentation of objective evidence to confirm whether specified requirements have been met. The results of auditing will be documented on standardized audit report forms with copies provided to the Contractor via email. A copy of the MoDOT Audit Report Form is included in Appendix C. The audit results will be documented by the Contractor in an Excel spreadsheet stored in Sharepoint. Nonconforming Work will be tracked by the contractor to ensure a timely and satisfactory resolution is achieved. The Contractor's Quality Manager will be responsible for signing off on all nonconforming work before acceptance of work. Nonconforming work will also be discussed weekly at the Quality Focus Group Meetings.

Auditing will be performed on specific items of work. An audit checklist will include multiple items that can include the material, the methods, application rates, the end product, and the Contractor's inspection and testing. The Contractor's inspection and testing plans are included in the approved Construction Quality Management Plan.

MoDOT will hold an internal weekly meeting led by the Deputy Project Director to discuss the timing, frequency, and depth of auditing based upon the Contractor's Two Week Look-Ahead Schedule. The MoDOT Staff will hold informal meetings

daily to finalize the auditing schedule based upon the Contractor's daily schedule. The focus of audits will be on items with greater perceived risk based on engineering judgment. Items and activities that often fail to meet specifications or that have greater consequences of failure will be audited more intensely. Items that often meet specifications or have minimal consequences of failure will be audited less intensely. Audit priorities will be adjusted as the job progresses in order to focus resources where they are most needed.

Quantities necessary for sampling and testing frequencies will be tracked by the Contractor and reviewed weekly during the Quality Focus Group meeting. With this tracking log and the Two Week Look-Ahead Schedule, MoDOT will plan out sampling and testing activities to ensure at a minimum all frequencies are met. Materials incorporated into the project will be tracked on an Excel spreadsheet according to the definable feature of work and method of acceptance. The overall quality results will be reviewed at the Boone Bridge Executive Partnering meeting with the Contractor, MoDOT, and FHWA.

Materials Certification to FHWA

At the completion of the project, MoDOT is required by 23 CFR Part 637 to provide a materials certification for the project. The certification will conform in substance to Appendix A of 23 CFR Part 637 Subpart B. The certification will be prepared and submitted at the project level by persons intimately familiar with the project.

The basis for the materials certification will be upon implementation of a quality assurance program meeting the criteria of 23 CFR Part 637 as follows:

637.205 Policy

(a) Quality assurance program. Each STD shall develop a quality assurance program which will assure that the materials and workmanship incorporated into each Federal-aid highway construction project on the NHS are in conformity with the requirements of the approved plans and specifications, including approved changes. The program must meet the criteria in Sec. 637.207 and be approved by the FHWA. Quality assurance as defined in 637.203 Definitions is "All those planned and systematic actions necessary to provide confidence that a product or service will satisfy given requirements for quality." MoDOT has developed a Quality Assurance Program unique to this project. Quality Assurance includes the Contractor's activities, both "Quality Control" and "Quality Assurance", as defined in the Contractor's approved Quality Manual and MoDOT's Quality Oversight activities as defined above and in Appendix A - Schedule of Testing.

(b) STD capabilities. STD shall maintain an adequate, qualified staff to administer its quality assurance program. The State shall also maintain a central laboratory. The State's central laboratory shall meet the requirements in Sec. 637.209(a)(2). MoDOT has assembled a highly qualified staff to administer this project. This project will

utilize MoDOT's Central Laboratory for more specialized testing not performed in the field laboratory.

c) Independent assurance program. Independent assurance samples and tests or other procedures shall be performed by qualified sampling and testing personnel employed by the STD or its designated agent. MoDOT's St. Louis District Materials Office will perform Independent Assurance Sampling and Testing in Accordance with Appendix B – Independent Assurance Sampling and Testing.

(d) Verification sampling and testing. The verification sampling and testing are to be performed by qualified testing personnel employed by the STD or its designated agent, excluding the contractor and vendor. MoDOT's sampling and testing frequencies are listed in Appendix A - Schedule of Testing. All MoDOT personnel will be certified by MoDOT's Technician Certification Program for the tests they perform.

(e) Random samples. All samples used for quality control and verification sampling and testing shall be random samples. As stated above under Sampling and Testing, "…tests will be random in that MoDOT will not focus the testing on this schedule on suspected compliance or non-compliance." The Contractor's Quality Manual states that their Quality Control testing be random as well.

637.207 Quality assurance program

(a) Each STD's quality assurance program shall provide for an acceptance program and an independent assurance (IA) program consisting of the following:

(1) Acceptance program.

(i) Each STD's acceptance program shall consist of the following:

(A) Frequency guide schedules for verification sampling and testing which will give general guidance to personnel responsible for the program and allow adaptation to specific project conditions and needs. MoDOT's verification sampling and testing frequencies are defined in Appendix A - Schedule of Testing. The Contractor's QC and QA sampling and testing frequencies are defined in their approved Quality Manual.

(B) *Identification of the specific location in the construction or production operation at which verification sampling and testing is to be accomplished.* MoDOT's verification sampling and testing well be random at the frequency defined in Appendix A - Schedule of Testing. MoDOT will also follow the guidance provided in the Engineering Policy Guide (EPG).

(C) *Identification of the specific attributes to be inspected which reflect the quality of the finished product.* MoDOT will audit based upon risk assessment. This system is described under the Audits section above. The Contractor's QC and QA inspections are defined in their approved Quality Manual.

(ii) *Quality control sampling and testing results may be used as part of the acceptance decision provided that:*

(A) The sampling and testing has been performed by qualified laboratories and qualified sampling and testing personnel. The Contract Documents (Book 2, Section 3.1) requires the Contractor to use qualified laboratories and qualified personnel.

(B) The quality of the material has been validated by the verification sampling and testing. The verification testing shall be performed on samples that are taken independently of the quality control samples. MoDOT will take independent samples based upon the frequencies listed in Appendix A - Schedule of Testing.

(C) The quality control sampling and testing is evaluated by an IA program. The Contractor QC, Contractor QA, and MoDOT verification sampling and testing will be evaluated.

(iii) *If the results from the quality control sampling and testing are used in the acceptance program, the STD shall establish a dispute resolution system. The dispute resolution system shall address the resolution of discrepancies occurring between the verification sampling and testing and the quality control sampling and testing. The dispute resolution system may be administered entirely within the STD.* MoDOT has accepted the Test Dispute Resolution process proposed in the Contractor's Quality Management Plan.

(2) The IA program shall evaluate the qualified sampling and testing personnel and the testing equipment. The program shall cover sampling procedures, testing procedures, and testing equipment. Each IA program shall include a schedule of frequency for IA evaluation. The schedule may be established based on either a project basis or a system basis. The frequency can be based on either a unit of production or on a unit of time. MoDOT has in place a formal IA Program. This is described in MoDOT's EPG and included in Appendix B – Independent Assurance Sampling and Testing.

(i) *The testing equipment shall be evaluated by using one or more of the following: Calibration checks, split samples, or proficiency samples.* This is described in MoDOT's Engineering Policy Guide Section 123 with Table 123.3.1.3.2 modified for Design Build. The modified table is found in Appendix B – Independent Assurance Sampling and Testing.

(ii) *Testing personnel shall be evaluated by observations and split samples or proficiency samples.* MoDOT's Independent Assurance Sampling and Testing witnesses the sampling and testing or uses split samples. This is described in MoDOT's Engineering Policy Guide Section 123 with Table 123.3.1.3.2 modified for Design Build. The modified table is found in Appendix B – Independent Assurance Sampling and Testing.

(iii) *A prompt comparison and documentation shall be made of test results obtained by the tester being evaluated and the IA tester. The SHA shall develop guidelines including tolerance limits for the comparison of test results.* This is described in MoDOT's Engineering Policy Guide Section 123.

(iv) *If the SHA uses the system approach to the IA program, the SHA shall provide an annual report to the FHWA summarizing the results of the IA program.* N/A

(3) The preparation of a materials certification, conforming in substance to Appendix A of this subpart, shall be submitted to the FHWA Division Administrator for each construction project which is subject to FHWA construction oversight activities.
APPENDIX A TO SUBPART B OF PART 637—GUIDE LETTER OF CERTIFICATION BY STATE ENGINEER
Date
Project No.
This is to certify that: The results of the tests used in the acceptance program indicate that the materials incorporated in the construction work, and the construction operations controlled by sampling and testing, were in conformity with the approved plans and specifications. (The following sentence should be added if the IA testing frequencies are based on project quantities. All independent assurance samples and tests are within tolerance limits of the samples and tests that are used in the acceptance program.) Exceptions to the plans and specifications are explained on the back hereof (or on attached sheet).
Director of STD Laboratory or other appropriate STD Official.
Requirement will be met as stated above.

(b) *In the case of a design-build project funded under title 23, U.S. Code, the STD's quality assurance program should consider the specific contractual needs of the design-build project. All provisions of paragraph (a) of this section are applicable to design-build projects. In addition, the quality assurance program may include the following:*

(1) *Reliance on a combination of contractual provisions and acceptance methods;* Acceptance will be made through verification of independent samples based upon the frequencies listed in Appendix A - Schedule of Testing.

(2) *Reliance on quality control sampling and testing as part of the acceptance decision, provided that adequate verification of the design-builder's quality control sampling and testing is performed to ensure that the design-builder is providing the*

quality of materials and construction required by the contract documents. Acceptance will be made through verification of independent samples based upon the frequencies listed in Appendix A - Schedule of Testing.

(3) *Contractual provisions which require the operation of the completed facility for a specific time period.* The contract for this project (as included in Book 1, Section 21.1.3 of the contract document) states that "Warranties regarding all elements of the Project shall remain in effect until **one year** after… Acceptance." If MoDOT determines that any of the Work has not met the standards set by Book 1, Section 21.1 at any time during the Warranty period, then the Contractor shall correct such Work within the one year warranty term.

637.209 *Laboratory and sampling and testing personnel qualifications.*

(a) Laboratories.

(1) After June 29, 2000, all contractor, vendor, and STD testing used in the acceptance decision shall be performed by qualified laboratories. MoDOT's Central Laboratory is AASHTO accredited. The Contract Documents (Book 2, Section 3.1) require the Contractor to use qualified laboratories. MoDOT will verify the accreditation status of all laboratories used in the acceptance decision on an annual basis.

(2) After June 30, 1997, each STD shall have its central laboratory accredited by the AASHTO Accreditation Program or a comparable laboratory accreditation program approved by the FHWA. MoDOT's Central Laboratory is AASHTO accredited.

(3) After June 29, 2000, any non-STD designated laboratory which performs IA sampling and testing shall be accredited in the testing to be performed by the AASHTO Accreditation Program or a comparable laboratory accreditation program approved by the FHWA. MoDOT's Central Laboratory performs IA testing.

(4) After June 29, 2000, any non-STD laboratory that is used in dispute resolution sampling and testing shall be accredited in the testing to be performed by the AASHTO Accreditation Program or a comparable laboratory accreditation program approved by the FHWA. MoDOT has accepted the Test Dispute Resolution process proposed in the Contractor's Quality Manual (CQMP Sec 10.0).

(*b) Sampling and testing personnel. After June 29, 2000, all sampling and testing data to be used in the acceptance decision or the IA program shall be executed by qualified sampling and testing personnel.* All MoDOT personnel (verification and IAS) and Contractor personnel (QC/QA) performing sampling and testing will be certified by the MoDOT Technician Certification Program for the tests they are performing. The Contract Documents (Book 2, Section 3.1) require the Contractor's technicians to be certified.

(c) Conflict of interest. In order to avoid an appearance of a conflict of interest, any qualified non-STD laboratory shall perform only one of the following types of testing on the same project: Verification testing, quality control testing, IA testing, or dispute resolution testing. MoDOT will perform the verification testing and IA testing using MoDOT's Central Lab (1617 Missouri Blvd. Jefferson City, MO 65109), MoDOT's St. Louis District Lab (1590 Woodlake Dr. Chesterfield, MO 63017), and MoDOT's O'Fallon Project Office (6780 Old Highway N, St. Charles, MO 63304). MoDOT will not allow dispute resolution to be performed by the same lab as the quality control testing.

Appendices

Appendix A – Schedule of Testing

Appendix B – Independent Assurance Sampling and Testing

Appendix C – MoDOT Audit Report Form

MoDOT Quality Oversight Plan
The Daniel Boone Bridge Design-Build Project
J6P1436, I-64, St. Louis and St. Charles Counties

Appendix A - Schedule of Testing

Spec. Ref	.xx	Item Description	Parameter or Procedure	Requirements	Other Requirements	Frequency
203		Rdwy & Drainage Exc. Emb., Compaction	Subgrade & embankment	Soil Proctor		1 per soil type per projet
203		Rdwy & Drainage Exc. Emb., Compaction	Subgrade & embankment	Relative compaction and Moisture	Verify in accordance with 203.6.2 if too rocky to test	1 per 5 days of production
304		Aggregate Base Course	Relative compaction	T310		1 per 5 days of production
304		Aggregate Base Course	Gradation Test & Deleterious Material	T11, T27 & TM 71		1 per 10,000 tons of production
304		Aggregate Base Course	Plasticity Index	T89 & T90		1 per source
401		Aggregate	Gradation & Deleterious Material	T11, T27 & TM 71		1 per day
401		Bituminous	Asphalt Content	TM54		1 per day
401		Bituminous Base and Pavement	Mat Density	T269 and T166		1 per day
403		Aggregate	Gradation and Deleterious Material	T 11, T 27, & TM 71		1 per day
403		Bituminous	Asphalt Content	TM54		1 per day
403		Superpave	Mat Density	T269 and T166		1 per day
403		Aggregate	Aggregate Consensus Tests	T176, T304, ASTM 5821		1 / Project
403		Superpave Volumetric	Bulk SPG, Max SPG, Air Voids, VMA, VFA	T312, T209, T308, and T164		1 per lot
403		Superpave	TSR	T 283		1 / Mix / Project
501		Aggregate	Gradation of Coarse Aggregate	T 27 and T11		1 per 500/2500
501		Aggregate	Gradation of Fine Aggregate	T 27 and T11		1 per 500/2500
501		Aggregate	Deleterious Content	TM 71		1 per 500/2500
501		Aggregate	Absorption of Coarse Aggregate	T85		1 per 500/2500
501		Aggregate	Thin or Elongated Pieces	ASTM D4791		1 / Project
501		Concrete	Air, Slump, and Cylinders	T152, T119, T22		1 per 500 C.Y.
502/ 506		Aggregate	Fine/Coarse Aggregate Gradation	T 27 and T 11		1 / Year
502/ 506		Aggregate	Deleterious Material - Coarse	TM 71		1 per week during production

MoDOT Quality Oversight Plan
The Daniel Boone Bridge Design-Build Project
J6P1436, I-64, St. Louis and St. Charles Counties

Appendix A - Schedule of Testing

Spec. Ref	.xx	Item Description	Parameter or Procedure	Requirements	Other Requirements	Frequency
		Aggregate	Absorption	T 85		1 per 10,000 C.Y.
502/ 506		Concrete	Air and Slump	T52 and T 119		10% of QC
502/ 506		Concrete	Compressive Strength and Thickness	T22 and T148		10% of QC
720		MSE Wall	Relative compaction	T310		1 / wall
1010		Select Granular Backfill for Structural Systems	SGB - Gradation, PI, PH, Chlorides, Sulphates, and Resistivity	T27, T89, T90, T289, T290, T291 and T288		1 / source
1029		Fabricating Prestressed Concrete Members for Bridges	Quality Assurance			Follow MoDOT District Materials Quality Assurance Plan

MoDOT Quality Oversight Plan

The New I-64 Daniel Boone Bridge Design-Build Project
J6P1436, Rte. I-64, St. Louis County and St. Charles County
Appendix B – Independent Assurance Samples and Tests & Laboratory Requirements

123.3.1.1 SCOPE. To establish procedures for sampling, testing and reporting Independent Assurance Samples (IAS) on job number J6P1436.

123.3.1.2 GENERAL. These procedures do not change normal job control procedures for the project. NOTE: The term 'FAST' contained herein shall be interpreted to be samples and tests performed by project personnel (QC, QA, and MoDOT) for project control.

The intent of the IAS process is to confirm that inspectors know how to run the tests correctly and do so, and have equipment that is in good condition and is properly calibrated, where applicable. This IAS process is considered system based and the audit of a given inspector does not have to take place on the project.

The individual performing the IAS audit is herein referred to as the IAS Auditor. Any person can be assigned the duties of the IAS Auditor however the district must designate an individual or individuals who aggregately have Technician Certification in all areas covered by the IAS program. The individuals(s) must have been reviewed and compared favorably to another HQ Auditor within the last calendar year, and should have significant experience in materials inspection.

123.3.1.3 GENERAL PROCEDURES.

123.3.1.31. IAS Auditors The District Construction and Materials Engineer designates district Auditors. The State Construction and Materials Engineer designates Central Office Auditors. An Auditor may only audit inspectors in the Technician Certification areas where his/her credentials are current. It is preferred that each Auditor be certified and competent in all areas.

123.3.1.3.2 AUDIT PROCEDURE. A MoDOT project representative will provide the IAS Auditor(s) with a list of personnel (QC, QA, and MoDOT) who have performed any testing on the project using the tests listed below. An IAS Audit should be performed on each inspector on this list. This representative will notify the IAS Auditor(s) and update the list with any additional or removed personnel or test methods for personnel.

General Description Test	Test Method
Deleterious	MoDOT TM 71
Gradation	AASHTO T2, T48, T11, T27
PI	MoDOT TM 79, AASHTO T89, T90
Density – Nuclear	AASHTO T310
Binder Content – Nuclear/Ignition	AASHTO T168, T329, T308, T287
Asphalt Core Density	AASHTO T166, T269
HMA Maximum Specific Gravity	AASHTO T168, T329, T209
Superpave Gyratory Compactor	AASHTO T166, T168, T329, T312
Thickness/Compressive Strength	AASHTO T148, T231, T22
Entrained Air Content/Slump	AASHTO T141, T119, T152, T23

123.3.1.3.2.1 If the inspector ran one or more of these tests on the project but did NOT have

the appropriate Technician Certifications to run the test(s), or some of the Technician Certifications were expired, notify the MoDOT project representative(s) that the inspector is not to perform testing without the required credentials. Create a record of the audit and indicate the insepctor as not comparing favorably.

123.3.1.3.2.2 If the inspector did have the appropriate Technician Certifications to run the test(s) and the Technician Certification was current at the time of the testing or is registered with MoDOT to run the test(s) under supervision until certification is obtained:

1. Schedule a meeting with the inspector.
2. Audit the equipment in accordance with 123.3.1.4.9. If the equipment is not suitable for testing, alternate equipment should be used. Unsuitable equipment should not be used for any testing until repaired, calibrated or otherwise made worthy.
3. Audit the various tests the inspector is certified to run (Audit means the inspector runs the test while the IAS Auditor observes, and for some tests the IAS Auditor runs companion tests for comparison.).
4. Discuss the test results. This may be done by phone if they compare favorably and the companion results were not yet determined at the time of the audit.
5. Create a record of the audit and indicate the inspector as comparing or not comparing favorably.
    - The record will include a list of each test run or observed, and the results for that test.
    - The MoDOT project representative will be notified of the inspector's audit results, and of any restrictions that exist following the audit, or recommendations that the inspector not be allowed to run certain tests.
    - The inspector may not be allowed to perform material testing in any deficient area(s) until a follow-up audit finds that the deficiency has been resolved. It will be the inspector's responsibility to contact Central Office and schedule the follow-up audit. Central Office personnel will perform any follow-up audits.
    - If a follow-up audit is required, and performed, and the inspector is still deficient on one or more of the designated tests, the applicable MoDOT Technician Certification will be suspended pending retraining.

123.3.1.3.3 The frequency at which IAS audits are to be performed is a minimum of once per calendar year per inspector on the list noted in 123.3.1.3.2.

123.3.1.3.4 It is not the intent that an IAS audit be performed at predetermined uniform intervals. A reasonable effort should be made to have the audits occur on a random basis while still meeting the requirements of 123.3.1.3.3.

123.3.1.3.5 An audit may involve material from a source that is unrelated to project work. The goal is to determine whether the inspector is capable of running the test or performing appropriate inspection. When practical, the audit will take place on the project, but this is not a requirement of a valid IAS audit. The Auditor may obtain "audit sample" material in advance of an audit for use in the audit process, see 123.3.1.5.7.

123.3.1.3.6 EQUIPMENT. Each inspector assigned to be an IAS Auditor is to be fully equipped or have ready access to the equipment necessary to perform all field tests listed in 123.3.1.3.2, except nuclear density tests, asphalt binder content with a nuclear gauge, asphalt binder content with binder ignition oven, gyratory compactor and maximum specific gravity testing equipment. This equipment is to be used on a portion of the tests performed. As a guide, it is recommended that approximately 80 percent of each type of field test specified be performed by the IAS Auditor using equipment other than that assigned to project personnel, except when

nuclear density testing, asphalt binder content by nuclear method, asphalt binder content by binder ignition method, gyratory compactor operation and maximum specific gravity testing are used. On the remaining tests to be made, the IAS Auditor may perform the test, or participate in the sampling and testing, or witness the sampling and testing.

123.3.1.4 Auditing Specified Tests The instructions for each of the specified tests are as follows.

123.3.1.4.1 When nuclear density testing methods are used for project job control, the IAS Auditor is not required to perform any of those tests. However, designation of the location for the test, witnessing the test, checking calculations, and reporting is required. As indicated above, it is acceptable for the test to be run at any location where a valid test could be completed. In addition, the IAS Auditor is to review the daily standardization check for the machine being used, if the checks are required by policy. The audit report needs to state whether the standardization check was examined. If the standardization check has not been performed as required, please note in the remarks.

123.3.1.4.1 When asphalt binder content, for normal job control, is determined by nuclear gauge or binder ignition oven , the IAS inspector is not required to perform any of those tests. However, observing the sample preparation, testing, checking calculations, and reporting are required. When the nuclear gauge is used, the IAS inspector is to review the statistical stability test records and the daily background check for the nuclear gauge being used. The report is to state that the statistical stability test and the background check were reviewed and found current and satisfactory, or not. The asphalt content by nuclear gauge or binder ignition oven is to be reported on the appropriate test template in SiteManager.

123.3.1.4.3 When a gyratory compactor is used for normal job control, the IAS Auditor is not required to perform any of those tests. However, if a gyratory compactor other than the one being used by the inspector is available, a split sample should be obtained and compacted on the alternate machine. In lieu of compacting a sample on an alternate machine the auditor may observe the required sample preparation, testing, and reporting. When a gyratory compactor is used, the IAS Auditor is to review the calibration records for the gyratory compactor being used. The report is to state that the calibration records were reviewed and found current and satisfactory, or not.

123.3.1.4.4 Independent Assurance tests may be performed at any suitable location in the field, district laboratory, or Central Laboratory in Jefferson City as condition and need dictates, unless otherwise directed.

123.3.1.4.5 Test results are to be rounded off for reporting in conformance with the procedures set out in Section 106.20 of the EPG.

123.3.1.4.6 All IAS aggregate gradation tests are to be “washed” and are to include each sieve specified. The size of sample and method of sieve analysis of fine and coarse aggregate is to be in accordance with EPG 1001.4.1.2, except: (1) the size of hot bin gradation samples for bituminous mixtures shall be as shown in Division 400 of the specifications, and (2) for coarse aggregate, the nominal maximum size of particle is to be considered as the largest sieve size on which material is retained.

123.3.1.4.7 IAS requirements for gradation, PI, or liquid limit tests on aggregates and base materials are to be fulfilled by obtaining the sample by one of the following methods.

(a) By the inspector taking a sample in the presence of the IAS Auditor and then furnishing

one-half of the sample to the IAS Auditor. The inspector is to perform the required tests in the presence of the IAS Auditor and report the results to the IAS Auditor. The IAS Auditor will perform the required IAS tests on the other one-half sample, recording the results obtained by both the inspector and the IAS Auditor in SiteManager.

(b) By the IAS Auditor taking or bringing a sample and furnishing one-half of the sample to the inspector, who will then perform the required tests and report the results to the IAS Auditor. The IAS Auditor will perform or will have previously performed the required IAS tests on the other one-half sample.

123.3.1.4.8 The IAS Auditor may designate samples to be sent to the Central Laboratory. These samples are to be designated "IAS" in the Sample Type field of SiteManager. The sample record is to contain the prescribed information regarding the location and shall indicate the person designating the location and performing or witnessing the sampling. The IAS Auditor will record the Sample ID(s) of such samples sent to the Central Lab, review the results, and will make a final sample record regarding the results of the inspector audit.

123.3.1.4.9 The test equipment used by the inspector must be reviewed for status of calibration, general condition, and appropriateness for the test performed. The inspector being audited is to make the initial determination of condition/calibration of the equipment and the auditor is to confirm this information. If the inspector is in error, the nature of the error should be recorded as part of the audit of the inspector. The inspector is to confirm that the calibrated equipment records are kept current, including notation of equipment taken out of service.

123.3.1.5 TEST PROCEDURES

The following tests are described as though the IAS Auditor and the individual are working on the project. It is not necessary that the material be taken from, or for, the project. The individual will describe appropriate site selection and sampling, on the basis of the material be tested. When possible, the sampling site will be typical of that to be selected for the project.

123.3.1.5.1 Grading

The location of tests, for both embankment and subgrade preparation are to be selected so as to be typical of that which might occur on the project.

IAS Auditor performed density tests, other than nuclear, are to be located in the very near vicinity of the density test performed by the inspector and are to be performed by the same method used by the inspector.

123.3.1.5.2 Aggregate, Sand-Soil, Soil-Cement, or Soil-Lime Bases

IAS Auditor performed density tests, other than nuclear, are to be located in the very near vicinity of the density test performed by the inspector and are to be performed by the same method used by the inspector.

Care should be taken to show the location of IAS tests by roadway, station, distance right or left of centerline or of the edge of pavement, number and nominal thickness of the lift or lifts identified shall be shown. The purpose of this part of the process, with regard to system based IAS is to confirm that the inspector is capable of making such a determination.

Samples of material for gradation or PI are to be obtained at a point just prior to use, i.e., stockpile, pug mill, spreader, belt feeder or bin discharge. The place of sampling and the

approximate roadway station number where the material is laid is to be shown on the report. The samples are to be taken by one of the methods described EPG 123.3.1.4.7.

123.3.1.5.3 Crushed Stone or Gravel Surfacing

Samples for gradation are to be taken at a point just prior to use. The samples are to be taken by one of the methods described in EPG 123.3.1.4.7.

The report is to show the roadway, approximate station number where the aggregate is placed and the place of sampling if this applies.

123.3.1.5.4 Bituminous Mixtures

The asphalt plant inspector may obtain the IAS samples for gradation provided the IAS Auditor observes the sampling. The sample is to be split and the IAS test performed on one-half the sample. The inspector would test the other one-half of the sample and the results may be for acceptance purposes. The IAS Auditor may perform the IAS test at the project using equipment other than project equipment, except, both inspectors may use the same scale if the scale has been calibrated within the immediate past 12 months, or the IAS test may be performed in the district laboratory.

Road mix gradation samples of aggregate should be taken at a point just prior to use, however, for IAS, this is not a requirement.

The inspector may obtain the IAS samples for maximum specific gravity provided the IAS Auditor observes the sampling. The sample is to be split and the IAS test performed on one-half the sample. The inspector would test the other one-half of the sample and the results may be used for acceptance purposes. The IAS Auditor may perform the IAS test at the project using project equipment. Both inspectors may use the same scale if the scale has been calibrated within the past 12 months. The IAS Auditor is to review calibration records for the maximum specific gravity testing equipment being used. The report is to state whether the calibration records were reviewed and found current and satisfactory, or not.

Volumetrics (specific gravity of gyratory compacted specimens) should be determined on a set of specimens (pills) compacted by the inspector using a gyratory compactor. The IAS Auditor should review the inspector's use of the gyratory compactor. The IAS Auditor may use the specimens produced by the inspector.

IAS tests of compacted SuperPave asphaltic concrete pavement, plant mix bituminous pavement or plant mix bituminous base are to be performed on the same samples taken by the project inspector. The tests may be performed in the district laboratory or the Central Laboratory. When tests are performed in the district laboratory, the test report is to show the location by roadway, station, distance and direction from centerline, and the lift designation of the course. If submitted to the Central Laboratory for testing, the identification sheet is to also show this information.

When performing IAS on bituminous mixes using RAP, the combined gradation will be calculated using the RAP gradation being determined daily by the project personnel and the aggregate gradation determined from the cold feeds or the hot bins. At some batch plants, the RAP may be added prior to the hot bins. In that case, the combined gradation will be

determined from the hot bins only. Project personnel should be consulted, prior to testing, to determine where the RAP is being added.

If the contractor elects to use the binder ignition method to determine the combined gradation for job control, the IAS Auditor shall witness the testing process to ensure proper testing procedures are being used.

123.3.1.5.5 Portland Cement Concrete Pavement and Base

Aggregates are to be obtained at the batching plant from the belt or the bin discharge as they are proportioned for use and are to be taken by one of the methods described in EPG 123.3.1.4.7. The place of sampling and the approximate roadway station number where the aggregate is used is to be shown on the report. For coarse aggregate produced in more than one fraction, the gradation of each fraction, percent of each used and the combined gradation shall be shown.

The concrete sample for IAS for air and slump is to be from the same concrete sample taken by the project inspector for an acceptance test.

When a compression testing machine is used for normal job control, the IAS Auditor is not required to perform any of those tests. However, observing the sample preparation, testing, and reporting are required. When a compression testing machine is used, the IAS Auditor is to review the calibration records for the compression testing machine being used. The report is to state that the calibration records were reviewed and found current and satisfactory, or not.

When a thickness measuring device is used for normal job control, the IAS Auditor is not required to perform any of those tests. However, observing the sample preparation, testing, and reporting are required.

123.3.1.5.6 Concrete Masonry

Aggregates are to be obtained at the batching plant from belt or bin discharge as they are proportioned for use and are to be taken by one of the methods described in EPG 123.3.1.4.7. The place of sampling, class of concrete, structure and structure elements are to be shown on the report.
The concrete sample for air, slump, and cylinders is to be from the same concrete sample taken by the inspector for the acceptance test.

A compressive strength test shall consist of the molding and testing of a cylinder. Molding and testing need not be performed on the same specimen. The testing of IAS comparison cylinders is to be performed on a machine independent of the machine used by the inspector, or sent to the Central Laboratory at 28 days. IAS comparison cylinders are to represent routine compressive strength tests, not tests made for a specific operational control such as form removal, heat removal, etc.

123.3.1.5.7 Prepared Audit Standard Samples

To accommodate the process of auditing inspectors when no project is active, or when the active project work does not include the type of work being audited, the auditor may provide previously prepared and tested samples. The inspector is prompted to run the appropriate tests on the sample as though the sample had been obtained on the project by the inspector. It is not

necessary that audit sample material be specification compliant however it should be reasonably representative of the target material such that a valid test can be completed.

If possible, the inspector will actually obtain a sample of the target material as the auditor observes to confirm the use of correct sampling procedure. That sample may be discarded, or the inspector can use the sample for routine job control testing. The auditor may witness the inspector sample and test any sample taken for acceptance purposes. At a minimum, the inspector will explain to the auditor the correct procedure for obtaining the sample under normal inspection practice.

123.3.1.6 Comparison of Test Results

All test results obtained by the IAS Auditor, including those not meeting specifications and those from samples submitted to the Laboratory for testing, are to be compared with the companion results obtained by the inspector using established guidelines as soon as possible and the results reported. The IAS Auditor's test result and the inspector's test result should compare within the limits shown in established guidelines. If the two tests do not compare within those limits the inspector should be found as not comparing favorably and test procedures are to be reviewed, equipment checked, and if necessary, the test repeated to determine the reason(s). Results of the audit should be reported to the project's manager and owner.

123.3.1.7 Sample Record

Results of IAS are to be reported on the appropriate form in SiteManager with complete information shown. The reports should be submitted promptly after tests are completed, within ten working days of the determination of the final test results, when multiple tests were involved. The sample record described in Automation Section is also required.

IAS tests are not to be reported as "accepted" or "rejected". The IAS test result is not to be used for purposes of acceptance or rejection of material. When IAS testing compares with acceptance testing or when IAS confirms equipment calibrations are current and proper testing procedures were utilized, the SM report will show the status as "Compared Favorably/Compliant (IAS only)". When IAS testing does not compare with acceptance testing or when IAS finds equipment calibrations are not current or proper testing procedures were not utilized, the SM report will show the status as "Not Compared Favorably/Not Comply (IAS only)".

The following information is also to be on the IAS report:

The report shall state that the calculations were checked and are on file in the district office. It will not be necessary for intermediate calculations to be shown on the report, since only the final result for the particular test is required, however all calculations shall be carefully checked for accuracy and maintained on file in the district office.

The report shall state that test results of the IAS were compared with the inspector's test results. The sample record number (when used), date performed and test results of the companion tests are to be shown on the report. In addition, the comparison difference between the tests is to be shown for each test result obtained. The report shall state whether the comparison was favorable or not favorable. If the comparison was not favorable, the probable reason(s) and any corrective action taken shall be shown on the report. If the acceptance test does not have a sample record number, other information shall be shown to identify the comparison test. When

comparison testing is performed in whole or as part of an audit, the appropriate SiteManager template should be used.

If the IAS Auditor witnessed a test, state what parts of the tests were observed and include the statement “location designated, procedure and computations checked by the IAS Auditor.” The name of the project inspector performing the test is to be shown.

The report shall state where the tests were performed (field, district laboratory, or Central Laboratory) and what equipment was used (district Material’s or belonging to field personnel), e.g. “The test was performed in the district Laboratory using Materials equipment”.

Each audit sample record is to be authorized by the IAS inspector or the District Construction and Materials Engineer.

The IAS Inspector must be the creator of the sample record.

CONSTRUCTION INSPECTION GUIDELINES FOR SECTION 601

Laboratory Requirements (for Sec 601.2.2)

Laboratory approval is accomplished through accreditation by a MoDOT approved program, such as AMRL, or an annual verification of general condition, equipment calibration/verification records and Equipment Verification Samples testing (as needed) by MoDOT.

Condition review is ensuring that the lab adequately meets requirements set forth in the three Field Laboratory Type descriptions.

Equipment record review and physical check will be conducted to ensure equipment records meet the requirements set forth in Sec 403.17.3**.** This is accomplished by a site visit evaluating condition of equipment inventory and completeness of calibration/verification records.
Calibration/Verification records require:

1. Detailed results of the work performed (dimensions, mass, force, temperature, etc.
2. Description of the equipment calibrated including identifying number.
3. Date the work was performed.
4. Identification of the individual performing the work.
5. Identification of the calibration or verification procedure used.
6. The previous calibration or verification date and next due date.
7. Identification of any in-house calibration or verification device used (including identification to establish traceability of items such as standard masses, proving rings, standard thermometers, balances, etc.).

Lab Verification/Approval will be recorded in SiteManager under Qualified Labs.
The Central Lab will assign identification numbers.

The record will include the name of the lab and contact person responsible for the lab oversight. The company type, facility type, accreditation authority and approval date will also be recorded.

Equipment Verification Samples (Sec 601.2.2.1)

Equipment Verification Samples (EVS) are required when QC and QA testing is performed on the same equipment. Samples shall be tested on independent equipment upon startup and at a frequency of once/lab/quarter. The Central Laboratory or district laboratory may be used for this purpose. Equipment requiring a correction factor is exempt, in include Binder Ignition Ovens and Nuclear AC Content Gauges. EVS are not required for small quantities as set forth in Sec

Test Method	Sample Type
Gradation – T 27 and T 11	Split Sample, Aggregate
Mat Density (% of Theo. Max) TM 41 or T 166	Result of core(s)
FAA – T 304	Split Sample, Aggregate
CAA – D 5821	Split Sample, Aggregate
Clay Content – T 176	Split Sample, Aggregate
Thin & Elongated Particles D 4791	Split Sample, Aggregate
Bulk Specific Gravity – T 312 and T 166	Split Sample, Loose Mix
Theo. Max. Sp. Gr. – T 209	Split Sample, Loose Mix
Pavement Thickness – T 148	Retest of core(s)
Concrete Strength – T 22 and T 231	Cylinder set, Standard Cure 28 day

403.23 or Sec 502.15.8. EVS shall not be used in the acceptance decision. Records of EVS should be retained and available for review during lab verification.
Samples shall be submitted as follows for comparison:

Split samples for multiple test may be submitted as a single larger sample from which individual test can be prepared. (Example: A single sample of aggregate may be sent requesting Gradation, Thin and Elongated, FAA, and Clay content as long as the size is adequate to be reduced to the required size for all test requested. Also, a loose mix sample may be submitted for Bulk Specific Gravity and Theoretical Maximum Specific Gravity).
Comparison limits will be as follows:

Gradation, Total Percent Passing	100 - ≥ 95 ±1.0
	< 95 - ≥ 85 ±3.9
	< 85 - ≥ 80 ±5.4
	< 80 - ≥ 60 ±8.0
	< 60 - ≥ 20 ±5.6
	< 20 - ≥ 15 ±4.5
	< 15 - ≥ 10 ±4.2
	< 10 - ≥ 5 ±3.4
	< 5 - ≥ 2 ±3.0
	< 2 - ≥ 0 ±1.3
Bulk Specific Gravity (applies to both cut cores and compacted specimens)	Specific gravity ± 0.017
Maximum Specific Gravity	Maximum specific gravity ± 0.024 for Method A (Mechanical Agitation) or ± 0.029 for Method B (Manual Agitation)
Pavement Thickness	± 0.2”
Compressive Strength	± 14%

If an EVS does not compare favorably, a second sample will be submitted. If tolerances are met, the lab will be deemed satisfactory until the next sample is required. If tolerances are not met, equipment calibration/condition and testing procedures should be checked/reviewed to determine a possible cause for the discrepancy.

EVS samples are associated to the lab in the SiteManager record.

TECHBRIEF

Construction Quality Assurance For Design-Build Highway Projects

FHWA Publication No.: FHWA-HRT-12-039

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Introduction

A majority of State transportation agencies use the design-build (DB) contracting method to deliver some transportation projects. Documented benefits of DB include faster project delivery, improved constructability, less cost growth, early cost certainty, and fewer claims.

One area of DB contracting that requires closer examination is construction quality assurance (QA). DB is believed to provide a level of project quality equal to design-bid-build (DBB), as outlined in the Federal Highway Administration's (FHWA) *Design-Build Effectiveness Study*.[1] However, a recent examination of State agency DB procurement packages showed that roles and responsibilities for construction quality are not clearly defined in many instances. The paper "Does Design-Build Project Delivery Affect the Future of the Public Engineer?" examined 60 DB requests for proposals (RFPs) and found 23 cases in which assignment of responsibilities for verification and acceptance could not be determined.[2] National Cooperative Highway Research Program (NCHRP) Synthesis 376, *Quality Assurance in Design-Build Projects*, states "With the changing quality roles found in the DB delivery method, it is imperative that quality responsibilities and the responsible parties are clearly stated in the contract documents."[3] However, on DB projects, there is no change in the core QA functions of contractor quality control (QC) and agency acceptance. The design-builder still has a responsibility for QC, as does the contractor with DBB projects. The agency must retain its responsibility for the acceptance function, as required by Title 23, Code of Federal Regulations, Part 637 (23 CFR 637).[4]

One of the attributes of the DB delivery method is the single source of responsibility for design and construction issues.

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When preparing the RFP and contract documents, owners must clearly define the responsibilities of the design-builder and the contracting agency. The agency performs verification tests for compliance with RFP requirements and makes progress payments under the terms of the contract. However, by doing so, the agency does not assume responsibility for any design or construction issue. The design-builder remains fully responsible for the design and the construction of the final product.

Purpose

The purpose of this TechBrief is to help clarify the roles, responsibilities, and activities related to construction QA on DB projects. The specific topics discussed include QA, QC, and acceptance. Related topics such as independent assurance (IA), dispute resolution, personnel qualification, laboratory qualification, and warranties are also discussed. Some RFP and contract documents for DB projects have incorrectly assigned responsibility for acceptance to the design-builder, which is not in accordance with 23 CFR 637. Additionally, because the DB project delivery method is often used on large, complex, fast-paced projects, it presents some unique challenges that merit discussion.

Quality Assurance

The American Association of State Highway and Transportation Officials (AASHTO) defines *QA* as "(1) All those planned and systematic actions necessary to provide confidence that a product or facility will perform satisfactorily in service; or (2) making sure the quality of a product is what it should be." (p. 14)[5]

Historically, agencies used the term QC/QA with QC referring to the contractor's role and QA to the agency's role. This term implied that QC and QA are separate functions; in fact, QA refers to the overall system for assuring project quality, with QC being one element of a comprehensive QA program. Therefore, the transportation industry has moved away from the term QC/QA and now uses QA.

Construction QA Programs

A construction QA program consists of the following core elements:

- Contractor QC.
- Agency acceptance.
- IA.
- Dispute resolution.
- Personnel qualification.
- Laboratory accreditation/qualification.

These core elements of QA apply regardless of the project delivery method. The agency's responsibility for acceptance cannot be assigned to the design-builder (or to a consultant under contract to the design-builder) but, rather, remains with the agency. Each of the six core elements of a construction QA program for DB is discussed below.

Quality Control

FHWA's *Transportation Construction Quality Assurance Reference Manual* defines *QC* as "The system used by a contractor party to monitor, assess, and adjust their production or placement processes to ensure that the final product will meet the specified level of quality." (Section 2.3, p. 2–6)[6]

Use of QC Test Data in Acceptance Determination

While the primary purpose of QC sampling and testing is to provide timely information for the design-builder to monitor and guide each production or placement process, QC data for critical quality characteristics may also be used in the final acceptance determination. If QC test data are to be included in the agency acceptance decision, the QC data must be validated by agency verification test results. Lot and sublot sizes, sampling and testing methods, and sampling locations should be specified for each critical quality characteristic that will be verified by the agency. This information can be included directly in the DB contract documents,

or reference can be made to the agency's standard specifications or guide schedule of sampling/testing frequencies. Not all characteristics that are monitored by QC are required to be verified by the agency. Design-builders will often perform more than the minimum level of QC, including testing of material properties beyond those critical quality characteristics that will be used in the agency acceptance decision.

QC Organization

There are different approaches to QC organizational structure on DB projects. Some agencies specify that the design-builder must demonstrate, through lines of authority in the organizational chart, that QC personnel are allowed to operate independently of DB construction forces to ensure that decisions made as part of the QC process are not influenced by schedule or budget. Another approach used by some agencies (especially on large DB projects) requires the design-builder to employ an independent testing firm to conduct sampling and testing of those critical quality characteristics that will be verified by the agency as part of the acceptance decision while a separate QC team works in close coordination with the construction forces, performing sampling and testing to monitor and guide production and placement processes.

Regardless of the approach, it is important that the DB team member in charge of construction quality report to senior management of the design-builder. This will convey support for QC and minimize potential conflicts with the production staff. Senior management must realize that superior quality will not happen without the seamless interaction between the QC teams, production/placement teams, and administration. The DB contract should clearly identify requirements for the QC organization.

Use of Consultants to Perform QC

Consultant technicians and inspectors may be used to conduct QC inspection and testing on a DB project. However, responsibility for the acceptance function cannot be relinquished to the design-builder per the requirements of 23 CFR 637.207(b).[4] Use of a consultant firm hired by the design-builder for sampling, testing, and inspecting does not relieve the agency of its responsibility for verification testing.

QC Documentation and Records

The agency should specify the minimum level of QC documentation that must be provided by the design-builder as well as the timeframe and format for providing the information. This typically includes all QC test results intended for inclusion in the agency acceptance decision. QC test results that are used strictly for process control may not need to be submitted but should be available for review by the agency as part of monitoring the design-builder's QC system.

Design-Builder Quality Management Plans

It is good practice to require the design-builder to provide a comprehensive quality management plan (QMP) that outlines the overall quality system for both design and construction of the project. The construction QC section of the QMP should describe all of the QC activities that will be conducted to assure that the completed items of work will meet the specified level of quality. If a QMP is required, the DB contract should specify the format and minimum content requirements as well as the procedure for agency review and acceptance of the QMP, including any updates and changes submitted by the design-builder following initial plan acceptance. During construction, the agency and the design-builder should monitor adherence to and effectiveness of the QMP. Any weaknesses discovered in the QC system should be corrected, including revisions to the QMP. Some agencies specify that failure by the design-builder to follow the QMP will result in actions such as suspension of work or withholding of payment.

Acceptance

FHWA-NHI-08-067 defines *acceptance* as "All factors used by the Agency (i.e., sampling, testing, and inspection) to evaluate the degree

of compliance with contract requirements and to determine the corresponding value for a given product." (Section 2.3, p. 2–9)[6]

Agency Responsibility for Acceptance

According to 23 CFR 637.207(b), the agency's responsibility for acceptance does not change when using the DB delivery method.[4] While the design-builder is fully responsible for design, construction, and material selection, the agency is responsible for verifying RFP compliance and making progress payments by the acceptance of the work. As stated in FHWA-NHI-08-067, "All acceptance activities must be carried out by the agency or their designated agent (i.e., consultant under direct contract with the agency), independent of the contractor." (Section 2.3, p. 2–9)[6] This does not preclude the inclusion of design-builder QC data in the acceptance decision, provided that the QC data are validated by the agency's independently obtained verification data. It is important that the agency acceptance responsibilities be clearly defined in the DB contract documents.

Verification Sampling and Testing

23 CFR 637 defines *verification sampling and testing* as "Sampling and testing performed to validate the quality of the product."[4]

The highway agency (or its designated agent) is responsible for conducting verification sampling and testing to provide an assessment of product quality that is completely independent of the design-builder's QC process. As required in 23 CFR 637, "The verification testing shall be performed on samples that are taken independently of the quality control samples."[4] Splits of design-builder QC samples cannot be used for verification.

Verification sampling and testing may be performed at a lower frequency than the design-builder's QC testing, particularly on DB projects where QC data are included in the acceptance determination. On some large DB projects, agencies have used frequencies of 1 verification test for every 10 or more QC tests. In order for mathematical validation procedures to be reliable, it is suggested that a minimum of 7–10 agency verification results be obtained and used to validate the design-builder's QC data.

It may be necessary to adjust the frequency of verification testing to reflect the estimated number of QC tests for each item of work. Rates of verification testing may also differ based on the risks involved. For example, verification testing may be more frequent for structural concrete than for embankment materials.

On some DB projects, it may be challenging to conduct verification testing at the specified rate due to the quantities of material being placed and the fast-paced nature of the work. In addition, because DB projects are typically bid as a single lump sum amount or using a small number of lump sum pay items, agency tracking of material quantities can be more difficult than on DBB projects that use standard unit price items. This can make it more difficult to schedule verification activities and determine random sample locations. Agencies should take this into consideration when determining staffing levels for DB projects so as to provide sufficient verification testing. The agency and design-builder must work cooperatively to find solutions to these issues because quality cannot be sacrificed due to large material quantities or fast-paced work.

Validation of QC Data

Agencies that have not included QC data in the acceptance decision on DBB projects may choose to do so on DB projects. As previously stated, if the design-builder's random QC test data are to be included in the acceptance decision, the QC data must be mathematically "validated" against the agency verification test results for each lot of material. By including validated QC data in the acceptance decision, the frequency of verification testing by the agency (or its designated agent) can be reduced.

The DB contract documents should clearly outline the decisionmaking process that will be used for validation of the QC data. It is

important to specify the validation method (such as *F*- and *t*-tests), as well as actions that will be taken in the event that the design-builder QC test results are not validated by the agency verification results. There should be a well-defined process in place to resolve such an issue, including an investigation into the cause of the non-validation and increasing the rate of verification testing for the item. It is important to recognize that in some cases, even though the QC test data are not statistically validated, the material may be completely acceptable. In these cases, further investigation to determine the underlying cause of the non-validation is warranted. Also, it is necessary to specify the quality characteristics to which tests will be applied. Performing *F*- and *t*-tests on numerous quality characteristics for a particular material could make the analysis needlessly cumbersome. It is important that the agency identify the critical quality characteristics subject to the validation analysis for each material or work item.

Some materials, due to the small quantity being used, may not have a sufficient number of QC and verification tests to perform a statistical comparison. In these instances, use of an alternate method of acceptance may be necessary. To accept items requiring very few tests, it may be advisable to use only the agency's verification testing.

Quality Measures for Acceptance

Statistical quality measures used for acceptance, such as percent-within-limits (PWL), are well suited to DB projects, especially projects with work items having large quantities of materials. Agencies currently using PWL for work items on their DBB projects can easily incorporate it as the quality measure for the same items on DB projects. For agencies that do not use PWL, it may not be appropriate to utilize it on DB projects without first developing statistical specification limits that will provide a fair measure of quality. Statistical specification limits are typically developed by means of pilot projects completed over several years. Employing specification limits or procedures developed by another agency without proper evaluation could lead to unnecessary disputes.

The acceptable quality level (AQL) applied to each work item should be specified in the DB contract documents along with requirements for appropriate corrective action (rework or replacement) when the quality level is not met. The AQL can be set at different levels for different work items based on the risk associated with lower-quality material. Since most DB projects do not utilize unit price pay items, pay adjustments for material quality are often not applied. However, some agencies do apply pay adjustments either by including a typical unit price in the DB contract for the work item being evaluated or by requiring in the RFP that proposers submit a breakdown of work items with a unit price for each item subject to pay adjustment. When pay adjustment for quality is included in the DB contract, it is important that the agency monitor and measure material quantities. For work items not suited for PWL as the quality measure, such as items with small quantities, the agency's verification test results should be evaluated against engineering limits to determine acceptance.

Inspection

Just as on DBB projects, visual inspection is a key part of agency acceptance on DB projects. Acceptance inspection must be performed by the agency or its designated agent, not the design-builder. "The State's acceptance program should provide a reasonable level of inspection to adequately assess the specific attributes which reflect the quality of the finished product. Acceptance inspection should include inspection of the component materials at the time of placement or installation, as well as the workmanship and quality of the finished product."[7]

Independent Assurance

23 CFR 637 defines *IA* as "Activities that are an unbiased and independent evaluation of all the sampling and testing procedures used in the acceptance program."[4]

The purpose of the IA system is to assure the reliability of all data used by the agency in the acceptance determination. This includes the agency's verification data and the design-builder's QC data when validated QC data are to be included in the final acceptance determination. IA is intended to confirm that the sampling and testing activities performed by the agency and the design-builder are conducted by qualified personnel using proper procedures and properly calibrated and functioning equipment. The results of IA testing should never be used to evaluate material quality.

The responsibility for IA lies with the agency. IA sampling and testing is performed by agency personnel (or by personnel of a designated agent directly contracted by the agency) that are independent of the project. IA personnel, whether employed by the agency or a designated agent, cannot perform both IA and acceptance activities. For agencies that do not routinely include QC test results in the acceptance determination, using this approach on DB projects may create new challenges for the IA system. The design-builder may not be familiar with IA requirements. The need for the design-builder QC staff to cooperate with IA personnel should be clearly stated in the DB contract. Scheduling IA activities to obtain the required level of IA evaluations is often a challenge, and keeping track of ongoing QC and verification activities and personnel on large DB projects can magnify this problem. Using the system approach to IA is an effective strategy for DB projects, since IA frequency is based on covering all active testers and equipment over a period of time, independent of the number of QC and verification tests completed on a project.

It is important that all parties involved be aware of the role that IA plays in the overall QA program and work cooperatively to assure that IA staff is kept informed of project testing schedules and personnel. Some agencies include language in the DB contract requiring the design-builder to provide the agency's project staff with updated schedules and lists of QC personnel for upcoming QC sampling and testing so that IA activities can be scheduled.

Dispute Resolution

If QC testing data will be included in the acceptance determination, agencies are required under 23 CFR 637 to have a dispute resolution system in place to resolve possible discrepancies between the design-builder's QC data and the agency's acceptance data.[4] While not required on projects where agency verification results will be used exclusively to determine acceptance, a dispute resolution system is highly recommended.

The dispute resolution process should be unbiased and timely. To address testing-related disputes, use of retained splits of samples used in the acceptance decision, alternate or third party laboratories, and a well-defined decision process to determine the outcome of the dispute are advisable. When retained splits are used, it is important that the dispute resolution split samples are properly labeled and that either the agency takes immediate possession of the dispute resolution split or proper sample security techniques, such as tamper-proof containers or security seals, are used.

Personnel Qualification

All personnel performing sampling and testing for QC used in the acceptance decision, verification, or IA are required to be qualified, per 23 CFR 637.209.[4] Agencies participate in State, regional, or national technician qualification or certification programs to ensure that technicians and inspectors are properly qualified. The DB contract documents should specify the minimum qualifications for DB personnel performing QC sampling, testing, and inspection. Minimum qualifications for the design-builder's quality management personnel should also be clearly stated to ensure they have a thorough understanding of QA principles and experience working under QA specifications.

Laboratory Qualification

Any laboratory used by the agency (or its designated agent) to perform verification testing and all design-builder laboratories that perform QC testing included in the acceptance

decision must be qualified, as outlined in 23 CFR 637.209.[4] Laboratories that conduct QC testing only for process control are not covered by the regulation, but some agencies require these laboratories to meet a minimum standard such as approval by the agency or a certification organization. Laboratories operated by a designated agent of the agency that are used for IA or dispute resolution must be accredited by AASHTO, through a comparable program approved by FHWA, or by an accreditation body approved by the National Cooperation for Laboratory Accreditation.[8]

Non-Conforming Materials and Workmanship

The DB contract should describe the process for documentation and disposition of non-conforming work. Whether discovered by the design-builder or the agency, materials or workmanship that do not meet the specified level of quality should be properly documented, including the nature of the non-conformance, location, extent, and disposition (e.g., removed and replaced, reworked, accepted based on engineering judgment, etc.). The authority to approve the final disposition of non-conforming materials or workmanship cannot be assigned to the design-builder. The agency's role in approving the disposition of non-conforming work should be clearly identified in the contract.

Warranties

Some DB contracts include warranty provisions for some items of work. Contract language should specify the warranty period and the enforcement process, including a detailed description of the measures that will be used to determine warranty compliance. These measures are typically maximum levels of various distress types that, when exceeded during the warranty period, require correction by the design-builder. Some warranty provisions also include specific corrective action for each distress type. The inspection procedure for determining warranty compliance should be clearly outlined and include provisions for notification so that a design-builder representative can observe the warranty inspections. A process for dispute of warranty inspection findings should also be included. Use of warranty provisions does not remove the need for an effective design-builder QC system; on projects where the warranty does not provide coverage for the anticipated life of the warranted product, some level of agency acceptance is still required. The requirements for warranties on DB projects are covered under 23 CFR 635.413.[9]

Summary

The DB project delivery system offers several documented benefits over the traditional DBB method on certain projects. While DB offers the design-builder more control over design, materials, and construction methods than DBB, the agency still has an important role in assuring quality. As agencies develop DB procurement documents, it is important that roles and responsibilities for design-builder QC and agency acceptance be clearly defined. The responsibility for acceptance by the agency (or their designated agent) is applicable regardless of the project delivery method used.

DB is often used on large, fast-paced projects, which can create challenges for conducting QA activities. Coordination and communication between the design-builder and the agency is essential for effective quality management. By working together within a well-defined QA program, the agency and design-builder can meet the goal of delivering a high quality project to the travelling public.

Further Information

The following resources provide further information on this topic:

- National Highway Institute Course 134064, "Transportation Construction Quality Assurance."
- Office of Pavement Technology. (2012). *Independent Assurance Programs*, TechBrief, Publication No. FHWA-HIF-12-001, Federal Highway Administration, Washington, DC.

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2. Gransberg, D. and Molenaar, K. (2008). "Does Design-Build Project Delivery Affect the Future of the Public Engineer?" *Transportation Research Record 2081*, Transportation Research Board, Washington, DC.

3. Gransberg, D., Datin, J., and Molenaar, K. (2008). *NCHRP Synthesis 376: Quality Assurance in Design-Build Projects*, Transportation Research Board, Washington, DC.

4. *Quality Assurance Procedures for Construction*, Code of Federal Regulations, Title 23, Part 637, Subpart B, U.S. Government Printing Office, Washington, DC.

5. American Association of State Highway and Transportation Officials. (2006). *Standard Recommended Practice for Definition of Terms Related to Quality and Statistics As Used in Highway Construction*, Washington, DC.

6. Federal Highway Administration. (2008). *Transportation Construction Quality Assurance Reference Manual*, Report No. FHWA-NHI-08-067, Arlington, VA.

7. Federal Highway Administration. (2006). "Non-Regulatory Supplement for 23 CFR Part 637, Subpart B." Accessed online: March 20, 2012. (http://www.fhwa.dot.gov/pavement/0637bsup.cfm)

8. Federal Highway Administration. (2011). "Non-Regulatory Guidance on Approval of Comparable Accreditation Bodies." Accessed online: March 20, 2012. (http://www.fhwa.dot.gov/pavement/materials/111007.cfm)

9. *Construction and Maintenance*, Code of Federal Regulations, Title 23, Part 635, U.S. Government Printing Office, Washington, DC.

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Distribution—The report covered in this TechBrief is being distributed according to a standard distribution. Direct distribution is being made to the Resource Centers and Divisions.

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Key Words—Quality assurance, Design-build, Acceptance, Quality control, Verification.

APRIL 2012

FHWA-HRT-12-039
HRDI-20/04-12(500)E

Appendix D

State DOT Lessons Learned

State DOT A:
Lesson learned:

- Scope the project properly
- Clear ROW acquisition in advance when possible
- Limit the use of partial D-B to appropriate projects
- The State DOT needs to stay involve with the contractor to make sure proper utility coordination is obtained
- The Construction unit should be responsible for the schedule. The Design Unit will work with the Construction unit to review, accept and monitor the schedule and notify the contractor's designer when they have missed key dates. Template letters are available.
- The Design unit will manage the review of the design submission from the D/B consultant.

Project Selection, Scoping and Programming:

- Follow the project selection procedures, i.e. do not select projects that have substantial or commercial ROW impacts or major utility relocations. Also, avoid partial design build projects where only certain components are D-B.
- On small bridge projects, pay particular attention to the off structure drainage in the area and specify this work in the contract if required.
- Consider grouping small bridges regional in one contract.
- Budget additional money for construction oversight to cover the cost to review the design submissions.

Design:

- Specify key milestone dates in a contract special provision that requires the contractor to provide a revised schedule and a corrective action plan once these dates are missed.
- Coordinate with Construction on whether a File Transfer Protocol (FTP) site will be required or if a construction software will be used to submit and review submissions. Revise the special provision accordingly.
- Provide a special provision to inform the contractor that the Notice to Proceed (NTP) given is for design activities only and a separate NTP will be given once the ROW, Utility, Permits are cleared and all designs are approved.
- Provide conceptual designs with permits, i.e., Type, Size & Location plans and Traffic Control Plan provided.
- Provide standalone items for undercut and any work that is unpredictable.

- Meet with all local officials, Emergency Medical Services personnel, Fire and Schools District staff and specify any restriction in the contract.
- Provide a minimum pavement design for small bridge projects.
- Provide a special provision to have the D-B team consultant review the shop drawings as the Designer of Record.
- Develop the design review flow chart/communication diagram and provide this to the contractor at the pre-job.

ROW:

- If ROW acquisition is required, consider having the consultant performing the conceptual design develop a preliminary ROW plan that can be advanced before the bid process and provide this plan for information only in the bid. Specify that the contractor will be restricted to design and work within these areas.

Schedule:

- Provide a contract special provision that requires the contractor to submit a schedule within 2 weeks of NTP and no design work can start prior to the acceptance of the schedule. The Construction unit will review the schedule with input for the Design Unit and accept the schedule prior to making any Design payments.

Utilities:

- Need to provide a special provision that clearly identifies the contractors responsibility for utility coordination
- If utility work is required that can restrict the contractor but they have utility clearance, remind the contractor that they have the utility coordination task and if he chooses to go to work prior to the utilities moving, this risk for delay cost are on them.
- At the pre job, discuss what the utility coordination task includes and what the responsibility of the D-B team.
- Construction must enforce the utility specification and require the contractor to start the utility coordination work early and often.

Design Review:

- Have the review agent develop a submission tracking spreadsheet with milestone dates.
- The Review Agent and the Design Project Manager should attend the monthly progress meetings.

Construction:

- Use project construction software that will function as the FTP site for the flow of submissions and have this owned and operated by the Department or a firm working directly for the Department.
- Monthly progress meeting should be held throughout the job starting with the start of the design process.
- The file sharing software or site must have a separate file for approved drawings only.
- Use a schedule of values for the project.
- Make sure entire D-B team is at the pre job as well as any Design Review Agents and Design Project Manager.
- At pre job, discuss the issue of additional/Extra Work as it applies to design. D-B team should be getting an authorization for anything they feel is above the requirements of the contract.
- At pre job, discuss the flow of submissions, shop drawing review, construction submission review, contact information.
- At pre job, discuss the FTP site vs. Share Point software and how you want the files set up, district access and partial approvals.
- At the pre job, discuss the construction schedule, the design milestone dated in the ROW Special and what they mean to the schedule.
- At the pre job, discuss the project Schedule of Values and how payment will be made. Remind contractor that items will only be paid once complete.
- At the pre job, explain to the contractor that NTP is for Design only and that they need ROW clearance, Permits, Utilities, and plan approvals before NTP will be given for physical construction.
- Area Construction Engineer (ACE) needs to monitor milestone dates and be proactive when dates are missed and require a recovery schedule. The Design PM will be monitoring the schedule also and will work with the ACE to send out notification letters.
- ACE needs to keep involved with utility clearances and make sure the contractor is performing their utility coordination duties. Utility delays are excusable and compensable unless the coordination was not provided in accordance with the contract.
- Temporary shoring needs to be reviewed, field viewed by the D-B Engineer and approved.
- Get the D-B Engineer involved in issues as they arise, this is one of the main benefits of this process.
- Pay particular attention to stand alone items in the contract that are not lump sum. Have seen contractors bidding them as $0.01 which is an indiction of an unbalanced bid.

- Pay attention to As Directed items and how they are presented in the plan and special provisions.
- Always compare claimed extras back to the design and what would have been acceptable vs. what is being offered/required.
- Drafting of the As-Built Drawings is the responsibility of the D-B team and time to complete this must be included in the schedule.

State DOT B:
Lessons Learned:

- The RFP must be well written. Even words like "a" and "the" come into discussion with proposers. "per pier" may be interpreted differently, as well.

State DOT C:
Lessons learned:

- Be willing to staff the project appropriately.
- Require Quality Assurance Manager to hold quarterly meetings on QA plan activities.
- Need to "define the box". If State doesn't know what it wants as an end product then the D-B firms will not either.
- Kick off meeting: Better define the hold points especially in the design phase.
- State DOT has a template for this meeting (get a copy)
- Identify the Subject matter experts early in the process.
- Cross training of staff is important, having continuity of at least one person throughout the project.
- Submittal schedule adjusted for Holidays to help meet turn-around time.
- Escrow documents for D-B proposers. Help establish baseline for analysis to defend against future claims.
- Don't be afraid to establish partnerships with industry or other third part stakeholders.
- Ensure that RFPs clearly establish project requirements. Items necessary to avoid claims such as 1) Geotechnical Data Report, 2) Updates data survey, 3) good utility evaluation (SUE)
- Issue RFP addendum on innovative ideas that may not be clearly allowed in the RFP (a recognized conservative approach).
- Manage the project with adequate staff including responsible charge.
- State DOT believes it achieves 1-2 years savings in project delivery time versus conventional DBB. This is based on staff experience.
- State DOT project manager should clearly define what he expects from D-B firm. Be transparent and up front regarding payment requirements.

State DOT D:

Lessons learned:

- Need central location for all D-B projects.
- Define the scope of the project; this ensures that a D-B firm knows the end product that agency wants. This also minimizes the potential for change orders which can lead to increased costs to the project.
- State DOT need to increase the use of the quality based D-B delivery method and make more use of ATCs
- Time savings have been realized in using D-B process. $$ savings harder to quantify since this is part of overall ODOT culture
- State DOT need to use same staff to review all D-B projects; this would increase experience and awareness on typical issues
- State DOT's believes the project engineer should be named early in the process rather than after sale of the project.
- State DOT indicated that we should require contractor to provide a basis of payment (schedule of values) with supporting documentation to support activity breakdown.
- State DOT has an escalation ladder for appeals, RFIs, etc; help the contractor meet his time sensitive needs.
- The use Subsurface Utility Evaluation is an option but not necessarily as a bid item.

State DOT E:

Lesson Learned:

- If railroad agreements are involved get started early since they are time consuming. When dealing with small town that own utilities you have to be flexible. Contractor agreed to do relocation in order to speed things up. State DOT was part of negotiated deal. They found one 3-inch water line with a backhoe. One line was off 30 feet horizontally, another water line was 17 feet deep.