NTTA
NORTH TEXAS TOLLWAY AUTHORITY

Project Delivery Method
Implementation Manual

KEEPING PACE WITH THE REGIONAL DEMAND FOR TRANSPORTATION

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1. PURPOSE

The North Texas Tollway Authority (NTTA) is presented with different options for their project delivery process, which include the traditional design-bid-build (D-B-B), construction management at risk (CM@R), and design-build (D-B) delivery. This Implementation Manual (Manual) introduces each of these project delivery methods, applicable selection types, and outlines factors that should be considered in selection of a specific project delivery method. Although none of these three project delivery options is perfect, one may be better suited than another based on the surrounding factors, requirements, and goals of a particular project. Additional project delivery methods are also discussed briefly, but only to show that there are other methods, as well as variations to all methods that may be utilized to deliver a project. This manual will primarily focus on the three main methods, D-B-B, CM@R, and D-B.

This Manual is not intended to be a step-by-step procedure, but rather guidance in selection of a project delivery method. It is not intended to substitute for sound advice from your own experts or persons or firms experienced in alternative delivery methods. Each project will have its own needs and requirements, which should be addressed in each case by persons knowledgeable about the NTTA's special circumstances.

2. INTRODUCTION

There are several project delivery methods with different variations to them available for the Authority to choose. This Manual focuses on a high-level on three of them:

- Design-Bid-Build,
- Construction Management at Risk, and
- Design-Build.

Each of these methods is introduced in **Chapter 3 – "Delivery Methods Defined"**, along with its distinct advantages and disadvantages and when it could be applied.

Chapter 4 – "Selection Types Defined", offers a brief overview of low bid, best value and qualification based selection procurement methods, which are anticipated in conjunction with the three project delivery methods introduced in this Manual.

Chapter 5 – "Selecting Best Delivery Method", begins highlighting various project specific issues with the intent of getting the user to think about the project in a different manner so as to select the project delivery method that best suits the surrounding factors, requirements and goals of the particular project.

Chapter 6 – "Evaluation & Selection Considerations", outlines areas that the Authority should consider during the evaluation and selection of the designer, contractor, or design-builder.

Chapter 7 – "Risk Management" - risk plays such a large role on alternative delivery projects and therefore this chapter expands upon various risk management issues and discusses the development of a Risk Register for projects.

Chapter 8 – "Best Practice for QA/QC", contains some lessons learned on QA/QC that were gained from experiences on past alternative delivery projects, in particular, for scenarios where the contractor performs QC and the Owner performs the QA, and for scenarios where the owner does both.

Chapter 9 – "Project Controls", recommends some control tools, specifically procedures and software, that the Authority would need to successfully implement an alternative delivery type project. The differences between the controls that are needed for the various alternative delivery type methods are also highlighted.

Chapter 10 – "Project Delivery Timelines", provides the user of the manual with some typical projects and the delivery timelines that might be needed given various alternative delivery method. The intent is to highlight where the differences between the methodologies are and where the advantages may be gained.

Chapter 11 – "Summary" recaps the major differentiators between the discussed delivery methods.

Within **Appendix A**, a Delivery Methodology Tool (Tool) has been created to assist the user in thinking about the various aspects that go into selecting a project delivery methodology. Again, similar to the Manual, this Tool will not select a project delivery method for the user; it is intended to assist the user in evaluating the various surrounding factors, requirements, and goals of the particular project.

3. DELIVERY METHODS

3.1 DESIGN-BID-BUILD

3.1.1 D-B-B Definition

Design-Bid-Build (D-B-B) is a method in which the owner typically enters into a minimum of two distinct, sequential contracts: one with an engineering firm (designer) responsible for preparation of design plans and specifications, and a second one with a general contractor (contractor) who is responsible for constructing the project as designed. Some owners perform design in-house, in which case they enter into one contract for construction.

Upon completion of the design and typically following Right-of-Way (ROW) acquisition and utility relocation, the construction contract is awarded to a contractor to perform construction under a separate contract with an owner. The construction contract typically "warrants" the information provided and the contractor "warrants" that the work was constructed according to the contract documents. The engineering contract typically provides that the engineer will perform their services with the standard of care. The standard of care is a negligence standard. Note that the owner accepts the risk between standard of care and the warranted information. The result is that in some cases the changes required are not the result of an error or omission but a changed condition, most prevalently geotechnical or utilities.

D-B-B is also commonly referred to as the traditional approach or competitive bid. The procurement method for construction services most commonly used with this delivery type is a low bid process.

3.1.2 D-B-B Structure

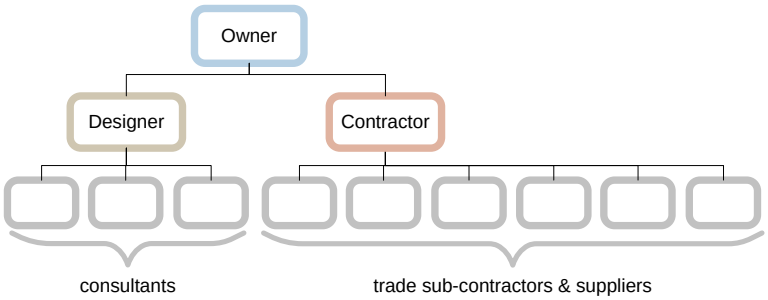

Figure 1. Design-bid-build organizational structure.

The above figure represents the most common structure used when utilizing the D-B-B method. Each designer and contractor has a separate contract with the owner. There is minimal interaction between the designer and the contractor. The role of the owner is mostly administration and inspection.

3.1.3 D-B-B Timeline & Payment Method

D-B-B contracts proceed in a linear fashion with design fully completed before construction. Oftentimes, ROW acquisition and third party utility relocation are completed before bidding, and bidding is completed before commencement of construction.

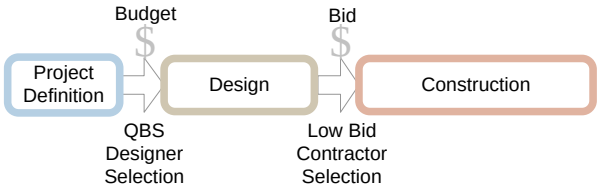

Figure 2. Most common contractor selection method and payment type used in design-bid-build.

The designer is selected on the basis of qualifications, followed by fee negotiations. Most prevalent contracting method for highways and bridges is unit price contracting. Some owners use the D-B-B method combined with a lump sum low bid as basis for payment during construction. Most D-B-B contracts have documents which call for the award of the contract to the lowest responsive and responsible bidder. By requiring bonds in this method, the owner is in effect relying on the surety industry to filter out unqualified contractors. Note that you can obtain a bond if you provide cash or securities to a bonding company for the full amount of the bond as opposed to buying the insured value. While rare this can happen.

Several variations in contractor selection or payment type may be used with this method. HB 1886, 2007 Texas Legislature, allows a public sector owner to use Competitive Sealed Proposals (CSP) to select a construction contractor. Under a CSP selection the owner can consider factors other than low bid in selecting the construction contractor. For example, the contractor may be selected based on past performance and paid under a Guaranteed Maximum Price (GMP) with incentives for being under schedule. Pay items for construction are generally established on a unit price basis.

3.1.4 When to Use D-B-B

D-B-B method is commonly used when:

- Lowest capital cost as exhibited by low bid is important to owner;
- The owner seeks a "checks and balances" approach;
- Projects are not schedule sensitive; however schedule incentives/disincentives can be utilized;
- Creativity is not sought from proposers/bidders;
- Major changes to the project are unlikely;
- Owner can completely control the design;

3.1.5 D-B-B Advantages

Key advantages of D-B-B approach include:

- Typically lowest initial construction cost possible;
- Design fully developed before money spent on construction;
- Lowest price proposed, including contractor fee and overhead, developed competitively and accepted as "best price";
- Creates the most bidding opportunities for general contractors and subcontractors;
- Designer hired by owner to perform at owner's direction and act in owner's best interest;
- Owner can be actively involved in the design process;
- Completed plans, specifications, and estimate used to measure construction performance;
- Owner retains remaining contingency funds in the event risks do not develop;
- Predictable rights & responsibilities (known process);
- Permitting, ROW acquisition, utility relocation, and third-party consultations are typically completed before issuance of the construction contract; and
- Extensive Case Law for Claims etc. is available in case of disputes.

3.1.6 D-B-B Disadvantages

Key disadvantages of D-B-B approach are outlined below:

- Sequential schedule lengthens project completion time;
- Owner assumes major project risks that may be better managed by the contractor;
- Anticipated construction cost not determined until after design completed;
- Price not established until bids are received (may require redesign and re-bid should the bids exceed owner's budget);
- Contractor not involved in design or conceptual pricing;
- Contractor has little incentive to invest more upfront to keep ongoing costs low. Owner carries the additional cost;
- Least ability to preclude poor performers or dishonest contractors from bidding;
- Least cost approach triggers increased oversight and quality review by owner;
- Challenges in obtaining high quality product (largely mitigated on roadway projects in Texas given prescriptive specifications and standards);
- Owner warrants sufficiency of plans and specifications to contractor;
- High potential for adversarial relationships, which increases probability of disputes; and
- Contractor innovation/collaboration not tapped during design phase.

Note: some of these disadvantages can be mitigated with Competitive Sealed Proposal approach, where factors other than low bid are considered in selection of the contractor.

3.2 Construction Management @ Risk

3.2.1 CM@R Definition

Construction Management at Risk (CM@R) is a method in which the owner enters into two distinct contacts: one with the designer responsible for design, and a second one with the general contractor (contractor), who under this delivery method is also referred to as the construction manager (CM). Similar to D-B-B, the designer is selected separately and reports directly to the owner. The CM is also selected separately and reports directly to the owner, however the contract with the CM is actually done around the 30% complete design stage rather than the 100% complete design. This method also allows the owner to interview and select a fee-based CM, based upon qualifications and experience, before the design and bidding documents are fully completed.

The selected CM provides schedule, budget and constructability advice during design development and subsequently provides the owner with a guaranteed maximum price (GMP) at around the 60% complete design stage or may manage bidding on packages of work throughout the construction process. If the GMP is accepted, the construction manager then receives proposals from and awards subcontracts to subcontractors. The final construction price is the sum of the construction manager's fee, overhead, and contingencies and the subcontractors' proposals. Any unused contingency at the end of the project reverts to the owner, or in some instances is shared between the owner and the CM. If the GMP is high and not competitive and therefore rejected, the owner typically releases the construction manager, completes the design and awards the contract using traditional D-B-B.

3.2.2 CM@R Structure

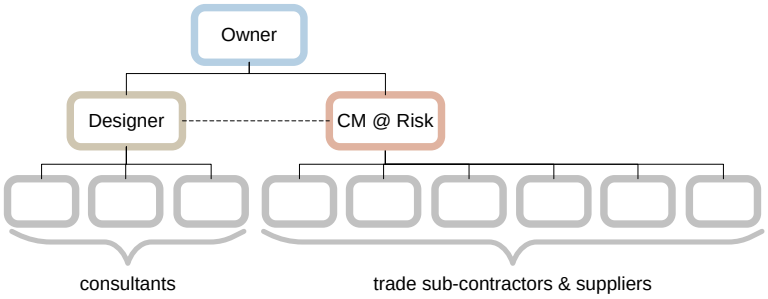

Figure 3. Construction management at risk organizational structure.

The above figure represents the most common structure used when utilizing the CM@R method. The dotted line indicates the coordination between the designer and the CM during the design phase.

3.2.3 CM@R Timeline & Payment Method

The CM@R contracts proceed in a linear fashion with the difference being that design is not completed prior to bringing the CM on board and the design could potentially still be ongoing while the ROW acquisition, utility relocation or construction begins.

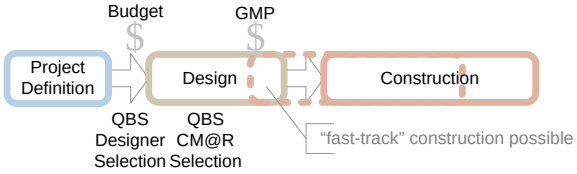

Figure 4. Most common contractor selection method and payment type used in CM@R.

The CM assumes the risk for construction by providing a guaranteed maximum price (GMP) and provides design phase consultation in evaluating costs, schedule, and implications of alternative designs, systems and materials during and after the design of the project.

If in-scope change orders are issued, the CM is responsible and the contingency is reduced. If however out-of-scope change orders are issued, the owner must increase the GMP.

3.2.4 When to Use CM@R

CM@R is best used when:

- The compression of the overall project schedule is important or the schedule is difficult to define;
- Owner needs to maintain a set budget number or needs to know the financial cost guarantee earlier in the process;
- Performance is desired; not confrontation with designer and builder;
- Early construction input is sought (construction is expected to be difficult to manage);
- Owner wishes to influence selection of equipment, material or subcontractors,
- Owner is looking to transition to DB ultimately; or
- Open-book and joint decision-making with contractor may be desired.

3.2.5 CM@R Advantages

Major advantages of the CM@R approach include:

- Early contractor involvement – ability to incorporate constructability review into the design process;
- Ability to fast-track through issuance of design packages at direction of the CM prior to completion of final design;
- Early determination of maximum construction cost;
- Ability to consider qualifications in contractor selection;
- Owner flexibility in scheduling; and
- Ability to order long-lead materials prior to design completion.

3.2.6 CM@R Disadvantages

Disadvantages of the CM@R approach include:

- Perceived lack of competitive bidding;
- Lack of single point of responsibility;
- Need for owner to have the ability to successfully negotiate the Guaranteed Maximum Price; and
- Increased likelihood of adversarial relationships and "finger pointing" once construction is underway and the CM converts from a professional advisor to the contractual role of general contractor.

3.3 DESIGN-BUILD

3.3.1 D-B Definition

Design-Build (D-B) is a procurement process in which both the design and construction of a project are procured from a single entity, who provides the best value to the owner. This single-point accountability is one of the most important features of the D-B delivery method.

This concept allows the contractor maximum flexibility for innovation in the selection of design, materials, and construction methods. End result project parameters are identified and minimum design criteria are established by the owner. The proposers then develop design proposals that optimize their construction abilities. The owner and/or Independent Engineer typically provide design and construction oversight services.

Another significant feature of the D-B method is the best-value selection. The evaluation typically consists of three main areas: qualifications of the proposing team (registrations, past experience, financial situation), technical review of proposed design solution and schedule (responsiveness to the RFP requirements and fulfillment of functional requirements of the project), and price proposal evaluation to ensure its reasonableness. For more information about best-value selection, refer to Chapter 4 - Selection Types.

Development of a Request for Proposals (RFP) for a D-B project is driven by specific project requirements, and award procedures are constrained by both legal and policy restrictions. Law: Title 23 U.S.C. 112(b)(3) provides the FHWA's statutory requirements for the design-build project delivery method; Regulation: Title 23 C.F.R. Part 636 provides the FHWA's regulatory policy for the design-build project delivery method; Policy: The revised regulation allows contracting agencies to issue D-B Request for Proposal documents, award contracts, and issue Notices to Proceed for preliminary design work prior to the conclusion of the National Environmental Policy Act (NEPA) process.

Senate Bill 792 (2007 Texas Legislature) grants D-B authority to NTTA provided that NTTA follow the procurement procedures outlined in HB 1886.

3.3.2 D-B Structure

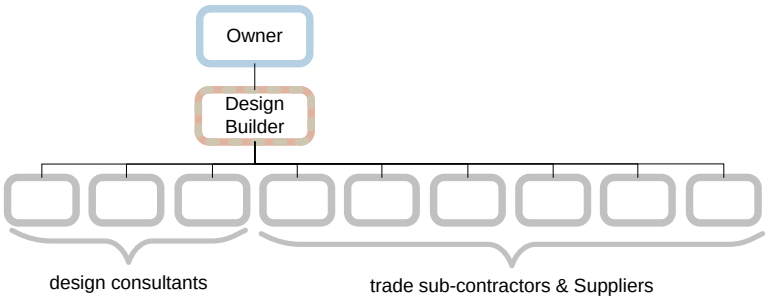

Figure 5. Design Build organizational structure.

A single organization provides the owner with single-point accountability for both design and construction services through one contract. The designer typically serves as a subconsultant to the general contractor. However, there are occasions where a designer will take on a joint venture relationship with a contractor. If the owner chooses, they may enter into an additional contract with an independent firm to provide oversight.

3.3.3 D-B Timeline & Payment Method

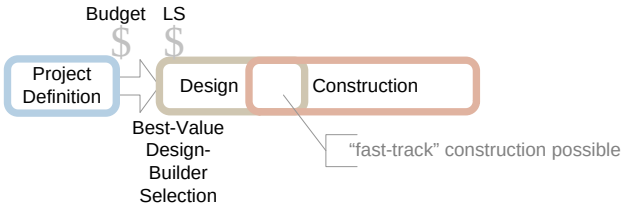

Figure 6. Most common contractor selection method and payment type used in D-B.

D-B contracts proceed in a quasi-parallel fashion, wherein construction starts before design is complete. Factors contributing to D-B's time and potential cost savings include single procurement for designer and contractor, potential to reduce cost through early procurement, a "fast-track" of design and construction schedule, and the early integration of design and construction. The single procurement, although longer in D-B, is typically offset by fast-track design or overlap of design and construction.

3.3.4 When to Use D-B

This method is best to use when:

- Owner is seeking potential cost reductions (the D-B contractor performing the design has a better feel for the construction cost of various alternatives, i.e. value engineering occurs throughout the proposal process);
- Shortened project completion timeframes are desired ("fast-track" construction possible)
- Reduced exposure to claims is desired (the D-B entity is responsible for preparing the plans and specifications and depending on the terms of the contract may be responsible for differing site conditions);
- Owner is looking for innovation and incorporation of new technologies, possibly through paying a stipend to get the intellectual property and creative design ideas from the unsuccessful proposers to incorporate in the project;

- Owner is looking to reduce his administrative cost; or
- The project has significant complexities and the owner seeks to assign the risk to entity better able to manage it (eliminates contractor claims to owner for field issues that result from design or constructability issues).

3.3.5 D-B Advantages

Advantages of the D-B approach include:

- Single point of responsibility minimizing need for owner resources;
- Shorter time to develop project;
- Project risks shift to those better able to mitigate them;
- Total project cost can be determined very early with high degree of certainty. Potential change orders or claims could affect the cost;
- Integration of design and construction may result in streamlined processes and efficiencies (reduction of change orders etc);
- High level of accountability may improve quality;
- Owner flexibility in selection criteria – "value"-based selection;
- Potential for reduced conflict; and
- Permitting, ROW acquisition, utility relocation, and third-party consultations may be adapted to specific means and methods employed by the design-builder.

3.3.6 D-B Disadvantages

Disadvantages of the D-B approach include:

- Time and cost of implementing the competitive procurement process;
- Overly involved owner may impact the design-builder, preference-based direction may result in change order or claim;
- Owner must select a team rather than the best designer and best contractor;
- Owner may have to pay stipends for intellectual property or design ideas from unsuccessful proposers not incorporated into project;
- Designer doesn't work directly for the owner (less control of design);
- Owner pays a premium for transfer of risk regardless of whether the risks materialize; and
- Owner may have to address public concerns if best-value selection results in award to team that does not have lowest price.

3.4 Additional Delivery Methods

3.4.1 Progressive Design-Build

A variation of CM@R is a methodology called Progressive Design-Build, in which both the design and construction of a project are procured from a single entity primarily based on qualifications. This qualification based selection for the design-builder is one of the most important features of the Progressive Design-Build delivery method. The selected design-builder completes the design to between 30 and 60 percent and then submits a lump sum or guaranteed maximum price for the project to the owner for approval.

Another significant feature of the Progressive Design-Build contract is the fact that should the owner and design-builder not be able to reach agreement on an acceptable price, the owner can negotiate with another qualified design-build team or take the partially completed design and use it as the basis for completing the design and proceeding with a D-B-B procurement.

This concept allows the contractor and owner maximum flexibility for innovation in the selection of design, materials, and construction methods. The owner and/or Independent Engineer typically provide design and construction oversight services. This delivery method is often used in vertical construction and has been used in Arizona for horizontal construction.

3.4.2 Multiple Prime Contracts

In multiple prime contracts, the owner typically divides a project into several parts/phases and then enters into a separate contract for each part/phase, e.g. site development, excavation, structural, mechanical, electrical. Multiple prime contracts require careful coordination because several contractors are involved, and no single contractor is responsible for the entire project. The owner, or its CM, manages the overall schedule and budget during the entire process giving the owner the total control over the schedule, since it is the owner who sets the letting schedule for each part. Although there are some advantages if the owner desired a "hands on" approach, there are many disadvantages, such as the coordination challenge which typically impacts the schedule, the impact of quality where one element of construction performed by one prime contractor may impact the ability of another prime to advance his portion of the work (e.g. one contractor building embankment and another installing base), or the fact that the final cost of the project is not known until the final prime contract is procured. It also requires the owner to be available to plan, coordinate, oversee, and control. This coordination may be the single biggest challenge and consequently although the owner has control over setting the initial schedule, contractors' delays are not uncommon in this method.

The Multiple Prime Contracting method is typically used on vertical construction. Therefore, very careful consideration needs to be given to how projects are divided among multiple primes on roadway projects.

3.4.3 Performance-Based Delivery

Industry has been using performance-based contracting since the 1980's to streamline the procurement cycle, achieve lower costs and higher quality and to move away from audit and inspection at the end of the procurement to building in the performance expectation at the beginning of the cycle. Dramatic improvements have been made by allowing providers to be innovative in how they deliver the desired end product and focusing on what the purchaser wants as an end product. Performance-based contracts hold the owner accountable for establishing clear performance expectations and the contractor accountable for achieving those expectations.

Performance-based contracting structures procurement around the purpose of the work to be performed, as opposed to either the manner in which the contractor must perform the work or the means and methods that must be used by the contractor. This allows leveraging the creativity of industry while providing the owner with access to the innovative and cost-effective commercial services or products.

In performance-based design-build procurement, the Request for Proposals generally does not include any design drawings. But rather it sets forth standard construction specifications to establish minimum quality standards and focuses as much as possible on, measurable performance criteria or objectives for operations, rather than on specific design approaches to achieve those objectives.

4. SELECTION TYPES

In today's construction environment, owners are finding themselves under increasing demands to improve project performance and get projects finished faster, while lowering the cost associated with administration of the construction and the construction itself. In response to these pressures, the industry has experimented with alternative procurement and contracting methods.

The difference between a selection or procurement method and a project delivery method is related to scope. A selection method is concerned with purchasing services. A project delivery method is a process where components of the project, like design and construction (along with roles and responsibilities, schedule, cost etc) are combined to complete the project.

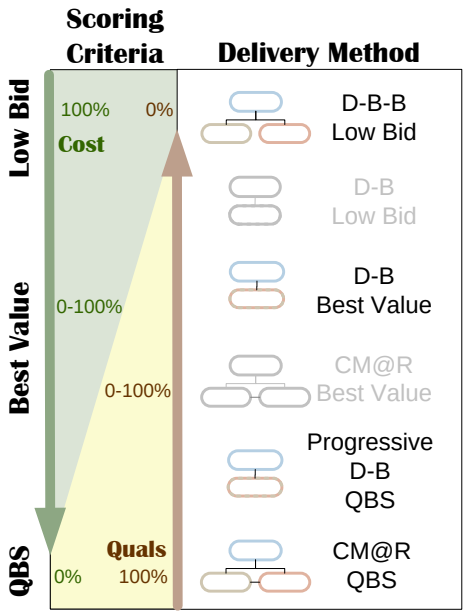

Figure 7. Combination of delivery methods and selection types.

Several variations of mixed uses of delivery methods and selection types exist. The combination that is to ultimately be utilized depends on several factors such as, the project characteristics, level of design advancement, availability of qualified contractors, budget constraints, desire for innovation, etc. For the purposes of this Manual, each of the below selection methods will typically refer to one delivery method, Low Bid for D-B-B contractor selection (designer is selected based on Qualification Based Selection), Qualification Based Selection for CM@R for both designer and Contactor, and Best Value for selection of a design-builder.

4.1 LOW BID

In the typical Low Bid procurement method, the Total Construction Cost is the only selection criteria, thus cost is weighted 100%. Contractors submit bids based on plans and specifications prepared by the owner and the contractor submitting the lowest bid is awarded the construction contract.

Low Bid is commonly known as the standard letting practice for construction not involving an alternative delivery process. Legislative requirements in many states require that highway construction contracts be awarded using the Low Bid method.

Note: The Federal Acquisitions Regulations (FAR) include commentary regarding how the Low Bid method fails to serve the public interest for the reason that the lowest offer may not result in the lowest overall cost to the public (FAR 2004).

4.2 Qualification Based Selection

In the true Qualification Based Selection (QBS), the cost of work is not a selection criterion, thus cost is weighted 0%. The QBS is a fair and objective selection process used by owners to select designers or other professionals, like land surveyors or even contractors based on the professionals' qualifications in relation to the scope and particular needs of the project. Through QBS, the owner obtains services of highly qualified professionals at a fair and reasonable cost.

The QBS process is the most widely endorsed method of selecting a design professional (designer), and an absolute requirement for public sector design professional selections in Texas. When selecting a designer an owner should consider the firm's qualifications such as its reputation, past performance, claims history, technical proficiency, and commitment to the owner's interests. This is very important, as this selection will have a major impact on the quality and the overall success of the project.

The QBS process usually involves an issuance of a Request for Qualifications, Statement of Qualifications review, possible interview, then short-list, Request for Proposals, receipt and review of proposals and possible interview, concluded with the selection of the most qualified firm. Some owners conduct visits of the firm's office, check references or even examine their control systems and procedures in detail. The owner and the top ranked firm then negotiate a fee to perform the work.

4.3 Best-Value Bid

In the Best Value Contracting method, the Total Construction Cost is a weighted selection criterion, and is therefore weighted between 0% & 100%. The term best value commonly refers to a process of selection in which the final selection criteria includes objective and subjective considerations and not just a low bid price or schedule time. Other objective factors may include contractor's experience with similar projects, life-cycle cost, ability to meet the schedule, past safety and performance records, compliance with applicable rules and regulations, technical innovation, commitment to meeting Minority or Women Owned Enterprise (M/WBE) or Historically Underutilized Business (HUB) contracting goals, commitment to quality or financial health. Subjective elements include effective management of subcontractors, proactive measures to mitigate impacts to adjacent properties and businesses, training and employee development programs, corporate commitment to achieving customer satisfaction, and client relations.

Best Value acknowledges that price is not equal to value. The difference is that price only accounts for the initial cost of the construction. On the other hand, the best value is based on an evaluation of the long-term or life-cycle performance and economic value of the work.

In Texas, as outlined in HB 1886, the local governmental entity should receive proposals and should evaluate each proposer's experience, technical competence, capability to perform, the past performance of the proposer's team and members of the team, and other appropriate factors submitted by the team or firm in response to the request for qualifications, except that cost-related or price-related evaluation factors are not permitted at this stage. In addition, each proposer must certify to the local governmental entity that each engineer that is a member of its team was selected based on

demonstrated competence and qualifications. Furthermore, the local governmental entity shall qualify a maximum of three proposers to submit additional information and, if the entity chooses, to interview for final selection. The law allows the Authority to select a design-build firm using qualifications-based selection or a combination of technical and price proposals.

Note: A recent Navy study comparing best-value procurement with traditional methods points to a reduction in cost growth from 5.7% to 2.5% and a reduction in claims and litigation of 86% (NAVFAC 1996).

5. SELECTING BEST DELIVERY METHOD

The ideal delivery method would result in a high quality facility at the earliest possible time for the lowest overall lifecycle cost (construction and operations & maintenance). This however, is oftentimes challenging to achieve as the owners end up choosing an optimal delivery method for a particular project. So how does the Authority find this optimal delivery method? As the owner of the facility, the Authority is in the best position to evaluate the specific issues surrounding the project. Things such as the stakeholders, schedule, budget constraints, ability to manage, oversee, the level of the Authority's involvement, goals, etc should be considered. Discussions with as many people as possible should be held so that a good overall understanding of the project is developed. This is when thinking about the big picture is extremely key. If you just focus on budget or schedule, you may end up with a delivery method that falls short on other key issues. What you are looking for is the best delivery method for this *specific* project.

The best place to start may be to sit down and write out what the goals of the project are. Then branch out and write out the goals of the NTTA, the designers, the contractors, the local politicians, the traveling public, the city, the county, the state, etc. Anyone you can think of. If you do not know what the goals are, do research to figure it out. The more you know about the *overall* goals of the project, the better off you will be in selecting the right delivery method. Again, this Manual is not intended to be a step-by-step procedure, but rather guidance in selection of a project delivery method. Also, these discussions may point out that one method is best for a certain item, but that does not mean that this is the case of all projects. For example, D-B usually accelerates the construction schedule, but depending on the project, the time difference could be negligible. The following sections breakout some key items to think about when selecting the best delivery method for a project.

We will start by looking at the first three items that were mentioned above, quality, schedule and cost, and then go into other areas that impact which delivery method is best suited for a project. By no means are these first three items the most important things to consider. While a quality facility built quickly and for a low cost may be the overriding goal, there are countless items that go into making this goal a reality.

5.1 QUALITY

One of the things the Authority needs to consider is how the quality of the project will be verified. In a traditional D-B-B project, the quality is typically controlled using detailed working drawings and specifications, which are the basis of the contract between the owner and a contractor. This allows the owner's inspector to compare the materials and workmanship of the project under construction with what is required. As one moves away from D-B-B towards D-B, the Authority would begin to give up some of the control on the quality of the project and must rely more on the contractor to provide a quality product. Because of this, the Authority must decide how much it wants to rely on the contractor. One of the benefits of D-B is that it gives the Authority this flexibility. The Authority may decide to rely entirely on the contractor for quality, they may hire an independent third party (Independent Engineer) to watch over the quality, or they may decide to perform their own QC/QA. In some instances the Authority may decide to require the contractor to maintain the road for a period of time, sort of a Product Warranty, essentially giving the contractor an incentive to build a quality product.

So, does the Authority desire flexibility in methodology in which the quality is managed? If yes then design-build would be the best delivery method to consider. CM@R will also offer some flexibility, while using the D-B-B the quality will be controlled using detailed working drawings and specification.

D-B-B	CM@R	D-B (Best Fit)

5.2 SCHEDULE

How fast can you get cars on the road? From the traveling public to the bond holders, that seems to be the question everyone wants answered. However, as the owner, getting the road open as fast as you can is not always the right answer. The Authority needs to look at the various factors that may be driving the project opening date. Some factors to consider are; does the traveling public want the facility open to relieve congestion, does the NTTA want the toll revenues as soon as possible, is there a potential for cost escalation, are there pending regulations that might take into effect, are there safety considerations (e.g. correction of an unsafe condition), etc.?

Why would you not want to deliver the project as soon as you can? There may be reason for this, such as a lack of resources to maintain the new facility, potential for increased cost, connecting facilities may not be available yet, funding may not be available yet, in order to lessen the impact of construction on traffic there may be phasing issues to consider, there may be multiple concurrent construction projects, there may be stakeholders concerns, etc. As an owner, the more you know about what is driving the delivery timetable of the project the better off you will be in selecting the right delivery method.

Is there a need to accelerate the completion of the project? If, yes…

D-B-B	CM@R	D-B (Best Fit)

5.3 COST

What will be the overall cost of the project? Cost could be broken out in many different ways; design costs, administration costs, construction costs, operation & maintenance costs, etc. Because of this, cost is actually a difficult item to consider when determining which delivery methodology to utilize. It is not just a dollar amount that needs to be considered. There are things like price certainty early on in the project development and Value Engineering savings that may play a role. The key to bringing cost into the delivery method selection process is to think about the various cost drivers for this particular project.

Are there budget constraints? Well of course there are you might say. But are there truly budget constraints that might force you into one delivery method over the other? While the Design Builder may price various risks into their cost estimate, the benefit of D-B is that the risks are typically allocated to those who can best manage it, therefore the added cost of this risk does not overshadow the cost savings that the D-B has by being able to control other aspects of the project design and construction.

Is there a need for cost certainty? Depending on the situation, there may be a need to know exactly, or as close as possible, what the final cost of the project will be due to funding constraints or other factors. One of the disadvantages of the traditional D-B-B methodology is that the price is not certain until construction bids are received. You may be able to obtain an early indication of the project cost, but not the final cost. As you move from D-B-B to CM@R and finally to D-B, you are able to narrow down the certainty of the final cost of the project much sooner. As an owner you need to determine if this is a factor and if so, how great of one.

What is the tolerance for change orders? One thing to consider is the ability to change order in items into the project. D-B gives you much more flexibility to do this than the traditional method. In D-B and CM@R, the contractor is involved early on with the design and so changes are able to be tolerated more than in D-B-B where the contractor has already bid on a certain design. You should get a feel for the Authorities tolerance for change orders for the particular project prior to selecting a delivery method.

D-B-B **CM@R** **D-B (Best Fit)**

Is there an opportunity for the lowest contract cost? What about reducing the Authority's cost during construction and value engineering savings? The type of delivery method could impact the potential for these items. Depending on the project, D-B-B would traditionally provide the Authority with the lowest initial contract cost. The owner contracts with a designer for a specific design and then contracts with a contractor who is competing based on low cost for the construction of a specific project. With an alternative delivery method, the contractors need to price various risk items and contingencies that may or may not come to fruition. This increases the cost of an alternative delivery project, which is typically offset by other cost efficiencies.

In addition, there may be an opportunity for the Authority to reduce their costs prior to and during construction through constructability reviews and through value engineering savings. CM@R and D-B have the advantage of the contractor being involved during the design process to provide input that may decrease the construction cost, or could result in a Value Engineering savings, if the contract allows for it. CM@R has an advantage over D-B in this instance, since the contractor is involved early in the design process and typically will provide a Guaranteed Maximum Price in the middle of the design process, once some of the unknowns and risk may be resolved rather than at the beginning. If there is a desire to have this flexibility rather than just the lowest cost, then an alternative delivery method may be a better choice.

D-B-B **D-B or CM@R (Best Fit)**

5.4 Risk Assessment

In order to discuss project risk, the Authority needs to think of it as two separate areas; risk assessment and risk mitigation or management. Risk assessment is done before selecting the delivery method. Various risks are identified and evaluated and then contractually assigned to the party best able to manage them. Risk mitigation should start with project planning and continue thru execution; it is done throughout the process.

For risk assessment in the evaluation of the project delivery method, the Authority needs to consider various factors. Is the project environmentally cleared? What is the amount of geotechnical information that has been gathered? Is there a high potential for hazardous materials? Is there a risk of material escalation? Does the Authority want to transfer the risks or, if permitted by law, is the Authority willing to hold on to them? In many cases, the design-builder may be better able to manage certain risks. However, an unreasonable transfer of risk to the party unable to manage it will have an impact on the cost of the project. While it is easier for an owner to put unknown risks on the design-builder, contractor contingencies will likely be large and the project will most likely be more costly than if the owner retained the unknown risks. Thus, the higher the risk, the better suited an alternative delivery method will be at delivering the project.

D-B-B **CM@R** **D-B (Best Fit)**

5.5 Owner Preferences

What are the goals of the Authority? What does the Authority really want to do and how involved does the Authority want to be? These are the types of questions that fall under the Owner Preferences category. Since the Authority is going to have to enforce the contract and ultimately live with the project, their preferences will play a substantial role in selecting the best delivery method for the particular project. The following lays out various Owner Preferences that may impact the selection of a delivery method.

Is there a certain size or type of contractor preferred, e.g. DBE/local/large/small?

Does the Authority desire to consider other factors such as qualifications, safety record to the public, past performance, as opposed to low bid?

If the answers to some of the above questions are yes, then typically a CM@R type delivery method may provide the best fit.

D-B-B	D-B	CM@R (Best Fit)

Is there a desire for single point of accountability?

Does the Authority want the contractor and designer to manage their discrepancies?

Does the Authority desire to limit or eliminate the risk of design errors?

If the answers to these questions are yes, then typically CM@R or D-B will provide the best fit.

D-B-B	CM@R	D-B (Best Fit)

Does the Authority desire to collaborate and be closely involved?

Is there a desire for transparency (e.g. open book)?

Positive answers to these questions lend more toward CM@R, then D-B-B or D-B methodologies.

D-B	D-B-B	CM@R (Best Fit)

Is it the Authority's desire or a requirement to control/oversee?

Does the Authority desire to have control over design items, such as aesthetics?

Does the Authority desire to enforce more stringent specification than state and federal standards?

Is there Owner/Consultant staff availability to support the procurement, design and construction processes?

If these items are desired, then a more traditional approach may be the more appropriate delivery method.

D-B	CM@R	D-B-B (Best Fit)

5.6 Ability to Define Scope

The ability to define the overall scope of the project may play a role in the delivery method decision process. The more clearly defined the scope is, the more indication that a traditional delivery method would be appropriate.

D-B	CM@R	D-B-B (Best Fit)

On the other hand, the owner may want to be flexible and have the scope not clearly defined in order to obtain the contractor's input. Additionally, the owner may be aware of issues in the region that may call for changes to be made during the design of the project, such as an additional overpass. If this is the case, then an alternative delivery method better allows for this flexibility.

D-B-B	CM@R	D-B (Best Fit)

5.7 Project Complexity

As it has been mentioned throughout this Manual, there is not one right answer for all projects. Each project needs to be evaluated individually to determine the best method of delivery. Aside from specific project needs and goals, each delivery method will have a varying impact on different projects. A simple one-mile two-lane roadway would probably not benefit from the advantages of an alternative delivery method as much as a 5-level interchange or 10-mile roadway with numerous interchanges or crossings would.

Look at the project in detail and see if there is a level of complexity to the project that would benefit from additional engineering/construction industry competition input (e.g. innovation, best available technology, emerging technologies)?

Experienced D-B contractors may not want to go after a D-B project if the size of the project is too small. Often times the large projects provide the D-B contractors with opportunities to profit from risks that do not come to fruition. The small projects may not have these opportunities.

If your project has some of these complexities then an alternative delivery method just may be the right delivery method for that project.

D-B-B	CM@R	D-B (Best Fit)

If there are external stakeholders that may be of a challenge, does the Owner want to get involved in these discussions or would they rather the contractor deal with them? If they would rather be involved then the traditional D-B-B method may be the best alternative.

D-B	CM@R	D-B-B (Best Fit)

5.8 Stakeholder Issues

Stakeholders could range from the people within the Owner's own organization, to the traveling public and the governmental agencies that serve them. Identifying the various stakeholders could take some time, and figuring out what they really want could take even longer. However, knowing what these issues are and being prepared for them and even selecting a delivery method that will help you accomplish this can go a long way in making a project successful.

The design-builder typically bids a set scope. If the D-B contract contains provisions for stakeholder input and potential for scope change, the contractor will price this as contingency. If the Owner intends to get public input but does not write that into the D-B contract, the contractor may seek change orders for changes in scope that result from public input. This is not to say the D-B cannot be accomplished when stakeholder issue/input are a part of the project, it just needs to be understood and closely coordinated. In general, if the Owner prefers to have flexibility in dealing with the designer/contractor on stakeholder issues, then an alternative delivery method would be best.

D-B-B	CM@R	D-B (Best Fit)

6. EVALUATION & SELECTION CONSIDERATIONS

6.1 INTRODUCTION

With different options for their project delivery, NTTA will need to develop new strategies to evaluate and select Design-Build and CM@R entities. While many of the traditional evaluation criteria for procurement of engineering services may still apply, the ability to evaluate contractors on more than a "reasonable and responsive bid" will introduce a myriad of new challenges to the procurement process. To facilitate a smooth procurement process, and ultimately successful delivery, it is important to maintain two closely linked processes moving forward.

Ask for what's important to the success of the project – avoiding the tendency to include everything, such as those factors that are not vital, will help ensure a streamlined process that minimizes administrative review costs and allows the owner to more quickly arrive at a Best Value Determination. For example, when purchasing traditional consulting services it is not uncommon to ask for significant depth in a respondent's organization chart, such as geotechnical and drainage design leads. This information is certainly helpful in determining which consulting team provides the highest quality personnel, but may be going too far for design-build procurements. With the addition of the construction personnel, asking for this level of detail from a design-build team can greatly increase the time and complexity required to differentiate between competing teams. Therefore, it may be more productive to ask for more detail on the leadership roles of a design-build team as the level of coordination and communication between design and construction functions can often be one of the biggest challenges to project success. Spending review time checking references for key leadership roles may provide better insight into how well a particular team may perform. Further, if a project-specific issue demands attention from a lower-tiered organizational role, such as geotechnical or drainage engineering, then ask for that information in the context of the anticipated challenge to ensure you are getting a qualified individual who can develop solutions to your project's needs.

Be forthright about what is important to you as the owner – at first glance, providing design-build teams with three or four months to complete a proposal may seem like a lot of time, but it really depends on how well the owner has communicated their expectations. Transparency of project requirements, project challenges, and critical success factors will provide NTTA with project solutions, in the form of final proposals that facilitate an easier comparison of competing proposals, and ultimately a better project. For example, if you have two competing project challenges such as completing the project as quickly as possible and minimizing inconvenience to the traveling public, which will you consider more important. Would the NTTA rather have design-build teams develop solutions that maintain existing capacity but take longer to complete, or is it more beneficial to close a busy interchange and develop detour plans that finish the project as quickly as possible. Most of the time, the answers are not clear cut, but it is critically important to communicate the definition of "project success" to enable proposers to respond accordingly.

Moving forward with alternative delivery procurements does not have to be overly complicated, but it does require more upfront planning than traditional delivery. The subsections below provide additional assistance in developing selection criteria for

qualifications, technical proposals, cost proposals, and formulas to arrive at a best value determination for alternative delivery procurements.

To ensure the alternative delivery procurement process is most effective, each phase of the process, request for qualifications (RFQ) and request for proposals (RFP), should be drafted to fit NTTA's unique project situation. The most important prerequisite for alternative delivery competitions is to adequately describe NTTA's project-specific needs so that they are appropriately understood by competing teams. Unlike the typical procurement process for traditional delivery projects, alternative delivery procurements will require early effort from NTTA staff to identify and document project requirements in advance of the procurement process.

Important project-specific requirements include information on scheduling and budget requirements, project-specific technical challenges (social, environmental, technical, etc.), and internal NTTA project goals and delivery values (safety, quality, communication, etc.). This up front planning process will allow NTTA to develop a procurement process that will ensure selection of the most qualified design-builder or team of designers and constructors that will deliver a best-value proposition.

To help minimize the effort required to develop project-specific RFQs and RFPs, the following sections provide a discussion on common selection criteria and evaluation criteria that is typically applicable to all alternative delivery procurements, as well as additional criteria that can be incorporated to address specific project issues if they apply. One important consideration for NTTA to keep in mind is that while the selection criteria discussed below can typically be used as written, the corresponding evaluation criteria should be rewritten to specifically represent what is important to you and your project.

6.2 Request for Qualifications

The fundamental principle of an alternative delivery procurement process is that design-builders, teams of designers and contractors, and CM@R contractors will bring very different management styles and corporate cultures to the competition. While all teams may have the capabilities to design and/or construct a specific transportation facility, they may not all be able to complete the work in accordance with NTTA's requirements.

The RFQ phase of the procurement process provides NTTA with the opportunity to shortlist only the most qualified teams, as defined by NTTA, to progress to the best-value proposal phase. Therefore, it is of critical importance for NTTA to determine the minimum requirements, including experience, past performance, financial strength, and other qualification criteria, that will be needed to achieve successful project completion prior to requesting interest from the industry. If developed correctly, the RFQ will also become a sales tool for NTTA to attract only those companies that possess the required skills to complete projects according to NTTA's requirements – low price, and getting what you pay for, are no longer the single greatest factor in selecting your builder.

6.2.1 Important Qualifications Criteria for all Design-Build Projects

The following table provides common selection requirements used to assess the qualifications for alternative delivery teams. While many of the selection requirements shown in this section can be used as written, the corresponding evaluation criteria should be modified to address NTTA-specific values and project goals. Evaluation criteria should also be listed in order of importance or weighted to identify importance. In addition, the majority of the submittal requirements and corresponding evaluation criteria discussed here can be applied to both design-build and CM@R procurements with some modification (discussed in more detail in CM@R Requirements section below).

Submittal Requirement	Evaluation Criteria
Submitter History and Background Provide a concise written narrative of the Submitter's [other team members may be included, such as Designer of Record if not the Submitter] company background including years in business and history of completing similar work.	• Does the Submitter demonstrate a stable history of performing similar work within the transportation industry
Organization and Key Personnel Provide a concise written narrative of the Submitter's design-build team organization, including an organizational chart depicting major participants and key personnel, overall management philosophy for integrating the design and construction functions, and decision-making processes to be implemented during design and construction. Provide roles and responsibilities for key project personnel, including Design-Build Project Manager, Design Manager, and Construction Manager. Full resumes for key project personnel identified. Resumes shall be included at the end of this section and include two (2) client references for two (2) projects of similar size and scope, completed for state or municipal clients in the past seven (7) years for each key personnel. All references should identify the owner representative who is familiar with the Key Personnel that could best answer project specific questions. Project owner name, email address, and phone number should also be provided.	• How well does the Submitter integrate the design and construction organizations during all phases of the project to promote constructability, value engineering, and efficiency of design and construction? • How well does the Submitter's organizational approach ensure a single-point of responsibility throughout design and construction? • Do the key personnel provide the required licensing, certification, education, and experience on similar projects? • Key personnel references

Past Performance on Similar Projects
Provide experience with similar transportation infrastructure projects by providing a brief description of three (3) similar projects designed in the past five (5) years and three (3) similar projects constructed in the past five (5) years. Design-build projects where the Submitter was responsible for both design and construction can be used as both a design and construction project example. All major participants must have at least one project reference identified. Project descriptions must include the following information:
• Project Name and Location
• Total Cost, including:
  • Engineering fee for design projects
  • As bid and final contract costs (including reasons for change) for construction projects
  • As bid and final contract amount (including reasons for change) for design-build projects
	• Does the Submitter demonstrate involvement at similar levels of complexity on urban interstate or major highway projects within the past seven (7) years? All major participants must have at least one project identified. Job references must be provided for all projects listed. Design-build experience will be evaluated more favorably over traditional design-bid-build. In addition, the following evaluation criteria will be used to evaluate Submitter's past performance on the referenced projects.
	• Individual owner references
	• Does the Submitter's experience demonstrate techniques to meet or exceed the project schedule?
	• Does the Submitter's experience demonstrate effectiveness in minimizing impacts to the traveling public?
	• Does the Submitter's experience demonstrate evidence that technical requirements for design and construction

• Originally contracted project start and completion dates • Actual Project Start and Completion Dates (including reasons for differences between original dates and actual dates) • Client Contact Name and Telephone Number In addition to the reference project above, provide a list all transportation projects completed or under way within the last seven (7) years by each Major Participant. List the contractor or design firm being referenced, the Major Participant's role on the project, project start date and completion date (or anticipated completion date), budget, and type of contract (Design-Build or Design-Bid-Build).	were exceeded? • Does the Submitter demonstrate successful design and construction experience over the last seven (7) years within the transportation industry?
Past Performance Meeting MBE/DBE Goals Provide demonstrated experience meeting MBE/DBE goals for similar projects or BOPP goals on NTTA projects.	• Demonstrated successful experience providing opportunities for disadvantaged business enterprises will be ranked favorably. • Does the Submitter demonstrate experience meeting or exceeding DBE goals on similar projects? • Does the Submitter demonstrate a corporate commitment to providing opportunities for MBE/DBE firms? • Does the Submitter provide demonstrated experience providing opportunities for DBE firms when it was not a contract requirement?
Capability to Perform Demonstrate capability to perform this project within the schedule for each Major Participant, including current workload and future commitments of each Major Participant.	• Does the Submitter demonstrate sufficient capacity with their current backlog of work to successfully complete this project?
Safety Record Provide the Experience Modification Rating (EMR) for the past three (3) years for each construction Major Participant on Insurance Company letterhead and signed by Insurance Company official.	• Submitters with the highest safety record as indicated by EMR over the past three (3) years will receive the maximum points allowable. The scoring for the other Submitters will be fairly applied in relation to the highest scoring Submitter.
Surety Information Provide a letter from a surety or insurance company stating whether or not the Submitter is capable of obtaining 100 percent performance and payment bonds for this project (printed on Surety letterhead and signed by Surety Company official). Letter shall be based on $XX million project. The letter shall also specifically state that the surety/insurance company has evaluated the backlog and work in progress of the Submitter and its principal members in determining the Submitter's capability to obtain bonds. Letters	• Does the Submitter provide evidence from a surety or insurance company authorized to do business in the State of Texas, with a A.M Best Co. "Best's Rating" of A- or better, that the Submitter is capable of obtaining 100 percent performance and payment bonds in the amount of $XX million dollars based on an evaluation of the Submitters backlog and work in progress.

indicating "unlimited" bonding capability are not acceptable. The surety or insurance company providing such letter must be authorized to do business in the State of Texas with an A.M. Best Co. "Best's Rating" of A- or better. If the Submitter is a joint venture, provide a surety letter for each entity involved.	
History of Claims and Litigation For projects designed or constructed by the Respondent, and any other Major Participant, disclose all litigation and arbitration against the Owner, where the value of which was in excess of $XX million, in the past 5 years on transportation projects over $XX million.	• Submitters with a favorable claims and litigation track record within the transportation industry will be ranked more favorably.

6.2.2 Alternative Qualifications Criteria for Project-Specific Issues

Many project-specific challenges can be addressed during the RFQ phase to assess Submitters' experience dealing with similar challenges on other projects. Early project planning activities will allow NTTA to identify these challenges and incorporate them into the selection process to shortlist only the most qualified teams to move forward in the competition. Examples of project-specific challenges and how they can be incorporated into the RFQ phase include the following.

Complex maintenance of traffic issues:

- Personnel - Require the inclusion of the engineering traffic lead, as well as the individual responsible for maintenance of traffic during construction.
- Past Performance - Emphasize evaluation criteria that require demonstration of successful traffic control during construction on past projects.
- Organization and Management Approach – Emphasize evaluation criteria that elicit input on the Submitters' management philosophy to address traffic challenges.

Challenging environmental conditions:

- Personnel – Require the inclusion of the environmental permitting lead during design development and the environmental compliance manager during construction with evaluation criteria for demonstrated experience developing and implementing environmental mitigation strategies.
- Environmental Compliance Subsection – Include an additional subsection requirement for Submitters to demonstrate past performance meeting or exceeding environmental requirements on similar projects.
- Organization and Management Approach – Emphasize evaluation criteria that elicit input on the Submitters' management philosophy to address environmental concerns and challenges.

During procurement planning activities, it will be possible to generate a very long list of project-specific challenges. The balancing act required during the development of the RFQ is to include only the most critical project-specific challenges to maintain a streamlined process, keep costs down, and develop an RFQ that effectively produces a shortlist of the most qualified Submitters to advance to the second phase of the procurement process.

6.2.3 CM@R Requirements

Under Texas law it is not required to use a two-step procurement process for CM@R competitions. However, gaining insight into potential CM@R contractors' experience and qualifications is very important. The NTTA therefore has the option of either generating a separate RFQ for CM@R projects or incorporating the qualifications selection criteria into the request for proposal.

When evaluating the qualifications of a CM@R contractor it will be important to carefully define the scope of services to ensure that the NTTA receives interest from appropriate companies or teams of companies. Typically CM@R includes a preconstruction phase to provide constructability input to the design and develop the projects construction estimate (either a Guaranteed Maximum Price or a lump sum). In many other industries however, the emergence of a Value Engineering component is becoming increasingly popular. On a case-by-case basis, the NTTA will need to identify the level of design review required from a CM@R contractor prior to developing an RFQ or RFP. If Value Engineering is a required component, above and beyond constructability reviews, the composition of a CM@R contractor team will need to include either internal engineering capabilities or an engineering partner.

With that said, many of the qualification requirements listed above will apply to CM@R procurement with the exception of the organization and management component. Unlike design-build, there will be no contractual relationship between the engineering consultant and the CM@R contractor. Taking steps to evaluate the qualifications of a Comer's ability to work with the design engineer without the contractual relationship becomes paramount especially if there is a desire to begin construction prior to final design completion.

6.3 Request for Proposals

As the RFP may become the part of the contractual agreement between the NTTA and the selected alternative delivery team, the importance for project-specific selection requirements and evaluation criteria within the Instructions to Proposers (ITP) is increased. The following discussion of selection requirements includes minimum selection requirements for all alternative delivery projects followed by a discussion on additional project-specific selection requirements that can and should be developed and included when appropriate. Due to the contractual nature of the RFP documents and final technical proposals, evaluation criteria must be developed to address project-specific issues and challenges as Submitters will use the evaluation criteria as a guide to the development of their project commitments made within their proposals.

6.3.1 Minimum Selection Requirements for all Design-Build and CM@R Projects

Minimum selection requirements for alternative delivery projects with an at-risk contractual relationship between the NTTA and the selected team need to cover everything from the legal structure of the Submitter to specific management and delivery commitments required to ensure successful project delivery in accordance with all of the NTTA's project requirements. The following discussion provides an overview of the general requirements Submitters should be required to respond to for all alternative delivery projects. Level of detail provided for each of these requirements should be commensurate with the specific type of contract (lump sum Design-Build, progressive Design-Build, and CM@R). In addition, evaluation criteria should be developed to reflect the uniqueness of each individual project and weighted to reflect relative importance for achieving project success.

Legal Structure of Submitter

Regardless of the type of contract, it is important to fully understand the legal structure of the Submitting entity. At-risk contractors can be represented by different forms of legal entities, including:

Design-Builder – internal capabilities to perform both design and construction services within one company and providing required performance and payment bonds.

Contractor Lead – single construction entity providing required performance and payment bonds with Engineer of Record as subconsultant.

Engineer Lead – single engineering entity providing required performance and payment bonds with all construction subcontracted (not typical).

Joint Venture – multiple entities combined to deliver the required performance and payment bonds. Engineer of Record may be part of the Joint Venture or subcontracted.

While it can be argued that one legal entity structure may provide benefits over another, the underlying purpose for this identification is to ensure legal guarantee by the Submitter to enter into the alternative delivery contract. Authorized authority to enter into the at-risk contract must be demonstrated and in the case of the joint venture include identification of partial ownership, authorizations for each participating party, and authorized letters of joint and severable liability.

Management Plan

In design-build project delivery all functional disciplines required to design and build the transportation facility will be managed by a single entity. Therefore, the organizational and management approach employed to integrate all of these functions to provide the NTTA with a best-value proposition requires extensive coordination and communication processes and must serve as the focal point for evaluating a Submitter's management plan. The Submitter's delivery team should be logically organized to deliver all aspects of the project with roles and responsibilities of key positions well defined.

Project-specific selection requirements and evaluation criteria should be further developed to assess the Submitter's plan for dealing with the myriad of management issues that will be important for project success. Project-specific selection requirements and corresponding evaluation criteria may include:

- Demonstrated integration between the engineering and construction functions.
- Strategies to ensure effective communications with the NTTA or other stakeholders.
- Approach to dispute resolution and change management.
- Subconsultant and subcontractor integration.

The list of management issues that may be developed is potentially inexhaustible so it will be in the NTTA's best interest to rank order issues by importance and only include those that are vital to project success. A general, overarching criterion to incorporate is how well the overall management plan demonstrates delivery of the commitments contained within the rest of the proposal, including scheduled milestones, maintenance of traffic, and specific subcontracting goals.

Solutions to Project Challenges (Project Understanding)

Requiring Submitters to identify and provide solutions to anticipated project problems is a requirement of Texas law. Typically this "Project Understanding" component is used in lump sum Design-Build procurements to assess the Submitter's knowledge of the technical challenges of a project, including design, permitting, environmental, and traffic control for example. In Progressive Design-Build procurements this component can be used in conjunction with the management approach to assess the Submitter's understanding of the contract requirements and associated challenges encountered when

developing a continuously evolving open-book project estimate as design progresses and the coordination and teamwork required to optimize the design to the NTTA's project goals. CM@R procurements can use a mix of the two approaches as design should be somewhat advanced to identify initial challenges or improvements, as well as identify anticipated problems with schedule, budget, or even design development progress.

Preliminary Baseline Schedule

The requirement for a preliminary baseline schedule can serve many purposes. Typically this schedule becomes a contractual requirement. The number of days may also be used to adjust the bid amount for analysis of the best value (i.e. (A+B)/C). The most obvious is to demonstrate each Submitter's understanding and approach for completing the work and the level of thought that has gone into producing a design and construction work plan. The level of required detail for a preliminary baseline schedule should however be commensurate with the size and complexity of the project as well as the alternative delivery contracting mechanism. For large lump sum Design-Build procurements it is not uncommon for owners to request detailed critical path method schedules that include 300 to 500 line items or more, in both hard-copy and electronic-copy formats. Design-builders and CM@R contractors will not baulk at this level of detail for large lump-sum procurements as this is a critical component for accurately estimating the project to provide their lump sum contract price.

With progressive Design-Build or CM@R procurements, this level of schedule development is much more difficult and in most cases not necessary as the final construction lump sum price will not be negotiated until much later in the process. In these cases all that may be necessary is commitments to major milestones, such as lump sum development milestones and the final completion deadline.

For large, complex lump sum design-build procurements the schedule requirements can also elicit commitments from Submitters for specific completion milestones, such as completion of a particular roadway segment by a certain date or commitments to roadway and ramp closure restrictions identified within the Technical Provisions of the RFP.

Technical Design and Construction Innovations

The technical innovations requirements for alternative delivery procurements allow Submitters to demonstrate ideas for project improvements. The actual format for developing the selection requirements will depend on the individual project goals and requirements as well as the type of contracting mechanism.

For large, complex lump sum procurements that employ an Alternative Technical Concept (ATC) process, this section provides a place for Submitters to include the approved ATCs that they have included within their bid, as well as other ideas or innovations that can not be classified as ATCs, but provide additional project benefits or advance NTTA's goals and values for delivery. In many procurements, ATC's are submitted prior to the proposal for review by the owner. The owner may disapprove, approve or conditionally approve an ATC. Examples of additional technical innovations may include design improvements or construction means and methods that provide benefit to drainage, bridges, walls, maintenance of traffic, worker and motorist safety, or community impacts to name a few.

Technical innovations for CM@R procurements may include early constructability improvements to the current design and early ideas for progressing the construction work to meet project-specific goals defined by the NTTA. Due to the typically limited level of design completion requirements to advance procurement under progressive design-build these requirements are generally not needed to select the best value proposition.

Construction Staging and Maintenance of Traffic

In conjunction with a preliminary baseline schedule on large lump sum design-build projects it is important to require detailed construction staging plans to assess each Submitter's approach for advancing construction and the corresponding impacts to operations and safety. With any transportation project it will be important that the traffic flow be maintained with minimal impact to the traveling public and adjoining property owners during the construction of the project. Less than optimum maintenance of traffic strategies can contribute to increased congestion and deterioration of the operation of the highway, thereby reducing the ability of the roadway to efficiently and safely move higher volumes of traffic. It is also important that the adjoining local street traffic be maintained. Any proposed disruption to local streets must be well planned and coordinated with the appropriate agencies. Selection requirements for construction staging and maintenance of traffic typically include maintenance of traffic plans accompanied by a narrative that highlights the associated benefits of the approach.

Requirements to include a construction staging and maintenance of traffic approach in progressive design-build or CM@R are not necessary as the owner will have involvement in the development of these plans at some future time.

Subcontracting Plan

For lump sum design-build and CM@R procurements it is important to gain an understanding of how contractors will select, procure, and subcontract portions of the construction work that they will not be self-performing. This is especially important for meeting MBE/DBE participation goals, if required. Many owners elect to require a signed commitment (legal form) from Submitters to agree to specific MBE/DBE goals; however this typically only binds your selected alternative delivery contractor to demonstrate a "good faith effort" to meet those goals during delivery. An improved methodology is to first assess the Submitters' past performance meeting MBE/DBE goals in the RFQ phase (see RFQ Selection Requirements above) and then to assess the actual plan they will use to meet or exceed those goals during the RFP phase.

Forms

Limiting requirements for forms within Submitters proposals will help facilitate a streamlined procurement process. The forms listed below should be considered the minimum requirements. Additional legal forms may be required during contract negotiation with your selected alternative delivery contractor, but if they are not required to assist with the evaluation the best value Submittal, they should be excluded during the RFP phase to minimize administrative costs for review.

Acknowledgement of Addendum – This signed form ensures that RFP addendum become part of the overall contract documents.

Form of Proposal - This signed form binds Submitters to the commitments made in their technical proposals.

Alternative Technical Criteria for Project-Specific Issues

Additional selection criteria and evaluation criteria should be developed (especially in lump sum design-build procurements) to evaluate Submitters on any additional project-specific challenges or the NTTA delivery goals and values identified during the project's procurement planning phase that are not covered in the minimal requirements. Examples could include approaches and commitments to safety, quality, and environmental compliance.

6.3.2 Price Proposal Selection Requirements

Texas law requires all agencies implementing design-build and CM@R procurements to include a price component within the RFP phase. While the law stipulates the inclusion of the price component, it allows tremendous owner flexibility in defining the specific requirements and relative importance or weight that the price component will have on the overall best value determination (see Best Value Determination below).

What is Important for Selection

In lump sum design-build procurement there are three main requirements, including the lump sum amount of the bid, a schedule of values for predetermined cost groups, and any warranty or performance and payment bond requirements. This section will not address warranty or performance and payment bond requirements as these will need to be developed by the NTTA on a case-by-case basis.

Of critical importance here is the relationship between lump sum bid amount and the schedule of values as defined below.

Price Proposal (Bid Form) – This signed form binds Submitters to the price components listed.

Schedule of Values – This signed form (for lump sum design-build only) provides a cost breakdown of the lump sum price according to the cost groups identified by the owner.

The total dollar value of the cost groups included in the schedule of values will need to equal the total lump sum amount included on the bid form, but do not need be broken out into significant detail during the RFP phase. A top-level breakdown of cost groups can be used to assess differences in Submitters bids, such as mobilization, structures, paving, maintenance of traffic, and other high level costs. While design-builders will develop a much more detailed breakdown of the cost groups to develop their estimates, the most important reason for the schedule of values requirement will be realized during contract negotiation so the inclusion of a further breakdown at the RFP phase is not warranted. During contract negotiation the NTTA's selected design-builder will need to use a detailed breakdown of the cost groups to generate a revenue loaded schedule and corresponding cash flow report that will become the basis of progress payments during project delivery.

In determining the requirements for the pricing components included in progressive design-build or CM@R, the NTTA has many options. Progressive design-build contracts typically have a two-phased pricing component with the first phase including engineering and preconstruction services to a set level of design development (i.e., 30 percent) and a second phase for completing design and construction under a negotiated lump sum or guaranteed maximum price. Therefore, the pricing component for progressive design-build procurements should only focus on the first phase as it will be the legally binding pricing component. Examples for the engineering and preconstruction pricing component can include a lump sum for completing engineering and preconstruction services to a point (i.e., 30 percent or 60 percent design) where the design-builder will be in a position to negotiate a lump sum contract for the completion of the work or some combination of engineering rates for design and a lump sum fee to complete the first phase of the contract. CM@R pricing components will typically include a lump sum fee or rate schedule for completing the preconstruction services.

6.3.3 Understanding Your Best Value Determination Process

Texas law requires all agencies to evaluate Submitters on both technical merit and cost to determine the best value proposition for each alternative delivery project. It further requires that all agencies disclose the actual weighting or value of the technical score and price component in relation to the each other. The law requires the Owner to evaluate and score the technical proposal before opening the price proposal.

The most prevalent method that can be used by the NTTA to determine best value is (A+B)/C:

Total Score = (A+B)/C

where A (Proposal Price) = Proposal Price

*and B (Proposed Time) = Days * Value of Day Established by the Authority*

and C (Quality) = Quality Score as a %

The apparent best value Proposal will be that with the lowest score.

Another example of the best value determination formula:

Total Score = (Quality weight) x Qf + (Price weight) x Pf

$$\text{where } Qf \text{ (Quality Factor)} = \frac{\text{Proposer's Total Quality Score}}{\text{Highest Proposal Quality Score}}$$

$$\text{and } Pf \text{ (Price Factor)} = \frac{\text{Lowest Proposal Price}}{\text{Proposer's Price Amount}}$$

and Quality weight = X%

and Price weight = 100-X%

The apparent best value Proposal will be that responsive Proposal with the highest Total Score derived from the equation above.

7. RISK MANAGEMENT

Effective risk management is essential to achieving a successful overall project. Therefore, incorporating risk analysis as an integral part of project delivery is a key to project success. Risk management begins with identification of risks, thorough understanding of their impact, and finally through developing and implementing risk mitigation measures.

Risk register, risk allocation matrices and probabilistic risk assessment are tools often used for identifying, analyzing, and managing risks. A risk register typically includes a listing of all identified risks, along with a unique identifier of each risk, risk description and how it can affect the project, likelihood of occurring, possible impact, risk grading, risk quantification, initial mitigating actions, contingent response, and who is responsible for managing the risk. Risk register (also referred to as risk log) should be maintained throughout the project as new risks are identified and added and existing risks are readjusted. More advanced risk registers that accompany computerized models for risk analysis include more data, like information tying the risks to the project schedule, functional area or project section.

Risk allocation matrix can be a simplified version of the risk register, focusing mainly on displaying information related to whom the risk is allocated, the owner or the contractor, and to what extent typically expressed in percent for both delay and cost associated with the risk.

Probabilistic risk assessment is a systematic and comprehensive methodology to evaluate risks associated with a project. This assessment is typically done with the use of computer tools.

Risk	D-B-B		CM@R		D-B	
	Owner	Designer/ Contractor	Owner	Designer/ Contractor	Owner	Design-Builder
Design	X	X		X		X
Environmental Approvals	X		X		X	X
Site Conditions	X		X		X	
Schedule	X	X	X	X		X
Cost	X		X			X
Project Performance/ Acceptance	X		X			X

Figure 8. Risk Allocation/Primary Responsibility in typical projects delivered by D-B-B, CM@R and D-B.

Several variations of these tools exist; some combine the two into one. This will depend on Owner's preferences and may vary throughout the project. For example a risk register may be created early on to identify all risk in order to allocate them appropriately in a risk allocation matrix. Once the allocation is completed and contracts are executed, the Owner can focus only on their own risks with the use of a detailed risk register.

Samples of these matrices are included in **Appendix B** – Risk Analysis Templates. Appendix B 1 - Risk Allocation Matrix Template may be utilized during the risk allocation and revised once the contract is executed. Appendix B 2 - Risk Register Template may be utilized to quantify the exposure to all risks prior to contract execution, and once the contract is executed, it could be utilized to capture and manage Owner's risks.

Initial risks should be identified and graded according to the likelihood and seriousness very early on the project. If the project continues to the next phases of development, the initial risk register should be fully developed and updated according to circumstances and stages of the

project. A well-completed risk register usually helps the owner to receive due consideration when trying to obtain financing for the project. Once the risk occurs, contingent response outlined in the risk register is the action that should be considered.

Risk assessment is an invaluable tool, but must be implemented correctly to produce meaningful results. Sample major risks by project phase are outlined below. More detailed listing of risks is included in Appendix B as a Sample Risk Allocation Matrix.

Project Development Phase	Risk
Advance Planning:	• Agreements with stakeholders • Early or advance right-of-way planning and/or acquisition • Refined scope • Project delivery strategy (including contracting method, contract size, and estimated cost and schedule) • Configuration of major project components • Structural design (e.g., bridge type, size, and location) • Other civil/roadway design elements
Final Design:	• Environmental permitting • Utility coordination, agreements, and early relocation • Final right-of-way • Construction staging
Procurement and Construction:	• Sources for potential delays, e.g. tolling system integration delays, weather conditions • Contract-related issues, e.g., allocation of risk, other terms and conditions • Construction cost escalation • Insurance & Bonding • Finalizing construction staging/phasing • Construction means and methods • Differing Site conditions • Disputes and claims • Force majeure during construction
Operations and Maintenance:	• Traffic levels • Sufficiency of revenue • Pavement degradation • O&M cost escalation • Force majeure during operations

In addition, HB 1886 outlines how risk is to be allotted between the Owner and the design-builder in the absence of specific allocation stated in the RFP and in the agreement.

8. BEST PRACTICES FOR QA/QC IN ALTERNATIVE DELIVERY METHODS

8.1 DESIGN QUALITY

For Alternative Delivery Methods the quality control of the design typically remains in the hands of the contractor or designer. The quality assurance however is typically done by an independent third party, the Owner's staff or a combination of both. One of the pitfalls that the quality assurance firms may run into is being lured into a QC role rather then QA. This can occur if an inadequate level of QC review is performed by the contractor and the independent QA firm is pressured to not return the submittal as incomplete. In order to combat this, the Owner needs to ensure that the design oversight process and the QC and QA roles are clearly defined in procurement documents for alternative delivery methods, particularly D-B. Along these lines, the Owner should consider contractual requirements for the quality assurance lead to report jointly to Owner and contractor.

Due to the enormity of some of these alternative delivery projects, the potential exists for a large amount of design review comments to be generated. The tracking of review comments can prove to be a difficult task. Spreadsheets and databases are recommended over marked-up plan sheets. These tools provide the designers with the ability to search and track the status of comments. While spreadsheets are preferred over marked-up plan sheets, they do have their drawbacks. On large projects spreadsheets may become cumbersome and may prove to be difficult in finding the status of previous comments. For these reasons it is recommended that a database be developed for the tracking of review comments.

Some other Design Quality Considerations are:

- Early development of Design Task Protocols to ensure consistency between various design sections
- Early collaborative development of a Design Quality Control / Quality Assurance Plan for the contractor, Independent Quality Assurance Firm and Owner to follow
- Open and frequent communication between designers and reviewers to ensure that review comments are brought forward into subsequent design sections in order to minimize repetitive comments and rework.

8.2 CONSTRUCTION QUALITY

8.2.1 Definitions

As outlined in HB 1886, the local governmental entity shall select or designate an engineer who is independent of the design-build firm to act as its representative for the procurement process and for the duration of the work. HB 1886 also requires that the local governmental entity should provide or contract for, independently of the design-build firm, the following services necessary for the acceptance of the civil works project by the entity: inspection services; construction materials engineering and testing; and verification testing services.

There are several known definitions for Quality Assurance and Quality Control throughout the industry and in practice throughout United States. The terms are not interchangeable and due to the many agency definitions, there has been much confusion. Transportation Research Board (TRB) Circular E-C074 – Glossary of Quality Assurance Terms, Third Update, and dated May 2005 has defined these terms in an attempt to create a common practice.

Additionally, FHWA in 23 CFR 637 B and the Texas Department of Transportation (TxDOT) defines these terms in the state-wide Quality Assurance Program as follows:

- Quality Assurance (QA) – All those planned and systematic actions necessary to provide confidence that a product or service will satisfy given requirements for quality.
- Quality Control (QC) – All Developer (contractor) and vendor operational techniques and activities that are performed or conducted to fulfill the contract requirements.
- Quality Assurance is generally defined to be Acceptance and Quality Control is general known as Process Control.

These definitions, however, are somewhat blurred by FHWA. When an agency assigns the QA testing responsibilities to the contractor, the FHWA views the QA tests as QC tests. The FHWA has stated that even though the QA tests are performed by an (Independent) Construction Quality Assurance Firm (CQAF), the fact remains that the CQAF is on the contractor's team and they view the results as contractor produced which requires a verification or validation program if they are to be used as part of the acceptance decision.

In addition to these definitions, the industry continues to define terminology associated with quality related, contractor-produced deliverables such Quality Management Plans, Construction & Design Quality Management Plans, etc., as well as the individual titles of those personnel responsible for implementing, performing or managing these quality functions. Agency and consultant prepared documents for Alternative Delivery Projects to-date in Texas have used various forms of quality terminology. Consideration should be given to a uniform set of definitions either state-wide or Agency-wide in order for all participants to gain a better understanding of the required processes and responsibilities. TxDOT has undertaken an effort to do this in their development of the Programmatic Comprehensive Development Agreement (CDA) for Design Build projects.

8.2.2 Quality Control (QC)

Alternative Delivery Method projects performed in Texas to-date have required the contractor to perform Quality Control. There have been no real defined requirements for contactor quality control personnel, provided they are competent, knowledgeable, and receive training in the areas for which they are responsible. Often the contractor will utilize existing foremen or craft supervisors to perform quality control inspections and tests. Generally speaking, these observations and tests are not used in the acceptance decision. Additionally, there have not been prescriptive requirements regarding the frequency, amount or type of QC inspections and tests. It is recommended that the contract requires the assignment of a full-time, onsite Quality Control Manager to manage the Quality Control portion of the Quality Management Plan. It is also recommended that the Quality Control Manager be a registered professional engineer, however, this requirement may be waived by the owner, provided the proposed candidate can document adequate experience and performance in a similar role. The Quality Control Manager should not be a part of scheduling or production environments and should report to the contractor's management team and not production personnel.

8.2.3 Quality Assurance (QA)

Conversely, Quality Assurance personnel requirements must be more prescriptive than those of Quality Control. Testing personnel should be certified/qualified in the various test methods for which they will perform. If the project is to utilize TxDOT specifications, then it would be logical to utilize the corresponding TxDOT test methods for which the specifications were developed. Existing TxDOT certifications may be recognized provided they are current and the technician can document participation in an Annual Proficiency Program. For testing personnel, it is recommended that the agency not recognize certifications from other State Agencies (DOT's) and/or other nationally certification

programs (ex. NICET) as they are not based upon TxDOT Test Methods or don't have both written and practical demonstration components.

8.2.4 Considerations for Authority Performed QA

The Authority has traditionally performed the Quality Assurance testing for their projects. As such, the contracting and consulting community is familiar with the processes and requirements of this approach. Shifting the responsibility of Acceptance testing to the contractor can drive quality to the lowest level of staffing. Foremen and craft workers who in the past may have had little responsibility for their work are now tasked with performing and documenting QC inspections and tests as well as scheduling Acceptance inspection and tests. The QC program is continuously evaluated based upon the performance of the QC personnel. If QA inspection and tests reveal systemic deficiencies each time a QA test or inspection is requested, the QC program must be revisited to identify procedural breakdowns. This approach truly requires the Contractor to take ownership in and be responsible for Quality. When the Authority performs the QA, there is potential to lose this holistic approach to quality. The Authority should consider the following questions if contemplating Authority performed Quality Assurance (acceptance):

- Is the Authority willing to take on the personnel staffing risk? Can the Authority or their consultants adjust staffing levels appropriately to match the Contractor's schedule?
- Is the Authority willing to take on more of the quality risk?

8.2.5 Considerations for Contractor Performed QA

Many Agencies have begun to entertain placing the responsibility of Quality Assurance Testing (acceptance) with the contractor. This approach has been approved by the FHWA; however there are specific requirements which must be met.

If the project is to utilize federal funding (Title 6 or TIFIA) and the Authority desires to place QA testing responsibilities with the contractor, the following requirements must be met:

- A project specific Quality Assurance Plan (QAP) must be developed and submitted to both TxDOT and FHWA for review and approval. The existing FHWA approved TxDOT QAP was written around the traditional Design-Bid-Build delivery method and was not intended for use on Alternative Delivery Methods such as Design-Build and CM @ Risk. TxDOT has recognized the need for new QAPs that address the Alternative Delivery Methods and, with the assistance of FHWA, are currently developing QAP templates which can be used by Authorities and other agencies for their Alternative Delivery projects. These QAPs are considered as a contract or commitment by the Agency (TXDOT) to FHWA. The QAP is the highest level "quality" document and is not to be confused with the contractor's Quality Management Plan. It is important to have language in the contract documents that binds the contractor to the commitments identified in the QAP.
- The quality program must comply with 23 CFR 637B and FHWA Technical Advisory TA 6120.3. These documents outline requirements for personnel, laboratories, random sampling, dispute resolution, Owner Verification Testing (OVT), testing frequencies for both QA testing and OVT testing, independent assurance, etc. These requirements are typically addressed in the project specific QAP described above.

The Authority should consider the following questions if contemplating Contractor performed Quality Assurance (acceptance):

- Is the project of adequate size and duration to justify shifting the acceptance testing responsibilities to the Contractor?
- Is the Authority comfortable with relinquishing some or all of the acceptance decisions to the CQAF?

- Is the Contractor and CQAF familiar with this approach?
- Will the project have adequate time for pre-construction deliverables to be completed?
- Is the Authority willing to absorb the additional costs associated with this delivery method?
- Does the Authority desire to use this delivery method on traditional design-bid-build, design build, or both?
- If the design-build delivery method is used, will there be a Capital Maintenance Agreement?
- Does the Authority desire to shift a portion of the project risk to the contractor and willing to accept the cost of doing so?
- Is the Authority willing to accept work based purely on Owner Verification Testing when validation of the CQAF test results is not achieved?

Additionally, the following items should be considered and addressed in the project contract documents:

- Establishment of qualification requirements for the Contractor's materials testing laboratory, which functions as the project Construction Quality Assurance Firm (CQAF).
- Establishment of lines of dual and simultaneous reporting of test results by the CQAF to both the owner and the contractor.
- Establishment of test result reporting timeframe requirements.
- Establish the requirement for the reporting of required data and in a format that is compatible with the Authorities' materials/document management system.
- Establish the requirement for the CQAF laboratory to be available for Authority's review and inspection at anytime.
- Establish the requirement for the CQAF to be independent and not wholly or partially owned by the contractor, nor a subsidiary or sister company of the contractor's organization.
- Establish the requirements of the CQAF's laboratory and field testing personnel.
- Establish the requirement for adequate CQAF staffing levels and give the Authority the power to require additional staffing when it deems necessary.
- Establish the requirement for the designation of a Construction Quality Control Manager and a Construction Quality Assurance Manager. Consideration should be given on identifying these positions as key positions, requiring the Authorities approval and having potential penalties associated with the removal/replacement of individuals fulfilling these roles.
- Establish the requirement where the Contractor may not terminate the CQAF or the key individuals identified above, without the written consent of the Authority.
- Establish the requirement where the Contractor may not withhold payment to the CQAF.
- Establish the requirement for the contractor to prepare a comprehensive Construction Quality Management Plan for approval by the Authority. The CQMP is a defining document that if executed properly, will provide an excellent blueprint for quality on the project. Consideration should be given to outlining the minimum requirements that the CQMP must address.
- Establish a timeframe by which the Quality Management Plan must be submitted and approved by the Authority (prior to commencement of construction).
- Establish notification requirements for the contractor to notify the Authority of work that is ready for inspection or testing.
- Establish the requirements for testing frequencies of all construction materials anticipated to be utilized in the project.

- Establish the requirement for the CQAF to track and report material quantities to verify testing frequencies have been achieved.
- Establish the requirement for the use of random sampling and testing procedures and documentation of such for all acceptance tests.
- Establish the definition of "the Engineer" and define the process for delegating engineering authority to the CQAF by the Authority.
- Establish the requirement for a location (proximity) of the CQAF laboratory to the project site.
- Establish clear definition for Quality Assurance and Quality Control. Prohibit the CQAF from performing any QC functions.
- Establish the requirement for Hold Points which require mandatory sign off by the CQAF at certain phases of construction operations.
- Establish requirements for Owner Verification Testing and responsibilities.

9. PROJECT CONTROLS

Project Controls services are provided to ensure that the project is efficiently and effectively managed, regardless of the delivery method chosen. These services typically include at a minimum documentation of progress, review of pay requests, schedule reviews and schedule updates, maintenance of project correspondence and QA/QC results, conducting progress meetings, handling submittals and requests for information. Many of these services occur in a similar fashion regardless of the delivery method chosen.

9.1 PROGRESS PAYMENTS

In any delivery method the contractor is responsible for assessing and delivering progress claims for payment.

In Design-Build, these payments are typically made in accordance with the schedule of values for the lump sum work. The owner typically reviews and approves the earned value schedule which is tied to activities within the schedule. The contractor on a monthly basis submits his estimate of earned value which is reviewed and approved by the owner or modified to reflect the actual earned value of the work.

In D-B-B, the contractor submits a price based on unit rates. Those prices are, however, submitted pursuant to a schedule containing quantities, usually prepared by the owner, which indicates quantities within a certain limit of accuracy. Where the quantities are ultimately outside that limit of accuracy (whether or not that limit of accuracy is expressly provided in the contract) those rates may ultimately be inapplicable under the contract.

In CM@R, the payment is handled either like in D-B or D-B-B depending on contractual requirements. In some cases, it could be an open book with payments based on actual cost with mark-ups. In addition, in some contracts the Owner and CM@R contractors share savings resulting from resulting from cost savings suggestions incorporated into the project.

9.2 SCHEDULE REVIEWS AND SCHEDULE UPDATES

In Design-Build, cost and resource-loaded Critical Path Methodology (CPM) schedule is typically required and usually becomes the basis for payment. The design-builder usually assumes the risk for completing the project on time, and depending on how the contract is set up, it may include the risks of weather delays. In D-B-B, the schedule requirement is typically related to mandatory completion date, accompanied by completion incentives, such as the early completion bonus. However, the Owner typically retains the risk of unusual weather delays. Requirement for CPM schedules on smaller projects may be less strict, and tools like Primavera may not be required.

9.3 PROJECT MANAGEMENT TOOLS AND SOFTWARE

Project management tools and software used to assist with the administration of the project will vary based on Owner's preferences and requirements. Owners oftentimes require the contractor to utilize specific software to manage project correspondence, cost, requests for information, submittal logs, meeting minutes and other project documentation. Use of such tools brings structure and consistency. In addition to dictating the use of specific tools or minimum requirements for compatibility in D-B and CM@R, the Owner has the flexibility to ask for qualifications related to past experience regarding progress reporting, schedule and cost control, management plans and tools used. In D-B-B, although there are detailed

requirements related to payment, typically there are no requirements for a management plan. In some cases the Owner may require the contractor to include safety plan or insurance requirements using pass-fail criteria, however there is no requirement for Project Manager's experience or control systems used.

9.4 PROJECT CLOSEOUT

Project closeout activities are related to review of the project to ensure orderly and timely completion, including development and implementation of punch lists, warranty periods, resolution of outstanding issues, review and analysis of claims or disputed issues. Project Closeout occurs in a similar fashion for each delivery method. Some differences could relate to warranty periods. D-B-B and CM@R projects usually contain a one-year warranty. In D-B warranty periods may be longer and may include items such as design defects. Caution should be taken not to unreasonably extend warranty periods since that may require the design-builder to incorporate expensive contingencies into the contract price. In addition D-B offers the flexibility to incorporate maintenance into the contract, which in turn motivates the design-builder to construct high-quality facilities.

The Owner should prepare lessons learned documentation at the close of each alternative delivery project for use in implementing future alternative delivery projects. This documentation should summarize critical experiences encountered on the project by project phase and should contain various sections, organized to reflect a general description of the topic within the section along with specific events that occurred on the project. After a general topic discussion, advantage and disadvantages should be discussed followed by recommendations. These recommendations should highlight suggestions that, if implemented, would improve future processes used by the Owner on alternative delivery projects.

The lessons learned document should include the following sections:

- Procurement phase
    - Contract documents (Request for Qualifications and Request for Proposal)
    - Proposal preparation
    - Proposal evaluation
    - Price proposal opening and award
- Post design phase
    - Focus on design, design review and contractual issues
    - Project partnering
- Construction phase
    - Quality Control
    - Quality Assurance
    - Contractual issues
    - Dispute Review Board/dispute resolution
- Project completion
    - Benchmarking report
    - Comparison of Design-Build to Design-Bid-Build process for this project

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10. PROJECT DELIVERY TIMELINES

How long will it take before the cars are on the road? This question is asked not only at the onset of a project, but also throughout, as the project progresses. A schedule is one of the most powerful tools a planner or manager can utilize to find an answer. In this section, we will briefly discuss the differences in delivering three distinct projects each using three different delivery methods, Design-Bid-Build, Construction Management @ Risk and Design-Build. Please note that timeframes presented are merely representational with the purpose to emphasize major differences in sequencing and durations. It is not intended to be a template to be used for future projects. Each project will have its own specific schedule with sequencing and durations matching its unique circumstances and characteristics.

The construction means and methods are assumed to be the same for all three delivery methods. In real world, these are impacted by the incentives/disincentives outlined in the contract. In addition, it can be assumed that should any of these project be located in an urban setting, the ROW acquisition and utility relocation would be more complex and would take longer than in a mixed or rural setting.

If Progressive Design-Build was utilized, the duration would be similar to that in CM@R and D-B. The sequence of the steps would mimic that in CM@R with a difference being that single procurement would take place. Procurement could be expected to take longer than selection of contractor in CM@R but somewhat shorter than procurement of a traditional, lump sum design-builder.

All of the sample timeframes assume environmental clearance and availability of the schematic design.

10.1 SAMPLE ROADWAY PROJECT

The first project discussed is a construction of five miles of a typical three-lane in each direction divided highway (refer to **Appendix C**, Timeline A1 - Detailed & Timeline A2 - Summary). This project assumes one major interchange and three on-off ramps.

Using **D-B-B** the project may take approximately 40 months to deliver. The sequence starts with the procurement planning and later the selection of designer. While the design is underway, the utility relocation and ROW acquisition are ongoing. Once all of these tasks are completed and the project is advertised and bid, the contractor is selected and the construction commences. The sequential design and construction is what extends the timeframe of this delivery method.

Using **CM@R** brings the most schedule benefits to this project by offering service commencement in 34 months. It starts out similar to the D-B-B; however before the design reaches 30% complete the contractor may be selected. Once the designer is 60% complete with design (sometimes even later), the contractor submits a GMP, and typically is able to begin construction at risk. The utility relocation and ROW acquisition occurs while the design, and sometimes the early construction, is ongoing. The early interaction of the designer and contractor and the ability to overlap the design and construction phases are key factors favoring this delivery method.

Using **D-B** the project could take approximately 36 months. This method shows a bit longer delivery than CM@R due to longer procurement phase. There is a substantial overlap of design and construction phases since the risk is not as big of a factor as it is in CM@R. Typically the longer the project design and construction are expected to take the more schedule benefits D-B approach may provide.

10.2 SAMPLE INTERCHANGE PROJECT

The second project discussed is a construction of major 4-level interchange (refer to **Appendix C**, Timeline B1 - Detailed & Timeline B2 - Summary).

Using **D-B-B** the project may take approximately 46 months to deliver. The duration is driven by longer, more complex design effort. The sequence starts with the procurement planning and later the selection of designer. While the design is underway, the utility relocation and ROW acquisition are ongoing. Once all of these tasks are completed, the contractor is selected and the construction starts. The sequential design and construction is what extends the timeframe of this delivery method.

Using **CM@R** the project may take approximately 38 months. It starts out similar to the D-B-B, however approximately before the design reaches 30% complete the contractor may be selected. Once the designer is approximately 60% complete with design, the contractor submits a GMP, and typically is able to begin construction at risk. The utility relocation and ROW acquisition occurs while the design, and sometimes the early construction, is ongoing.

Finally, using **D-B** brings the most schedule benefit to this project by offering service commencement in approximately 36 months, a nine-month difference over D-B-B. This is largely due to two factors. First, a single procurement takes place. Second, substantial overlap of design and construction phases since the risk is not as big of a factor as it is in CM@R. Typically, the longer the project design and construction are expected to take the more schedule benefits D-B approach may provide.

10.3 SAMPLE BRIDGE PROJECT

The third project discussed is a construction of a typical major 1,500 ft bridge crossing (refer to **Appendix C**, Timeline C1 - Detailed & Timeline C2 - Summary). Note, since design of a typical bridge can be fairly undemanding and therefore short, the ROW acquisition, utility relocation and associated permitting may become critical activities.

Using **D-B-B** the project is expected to take approximately 28 months from procurement through construction. The sequence starts with the procurement planning and later the selection of designer. While the design is underway, the utility relocation and ROW acquisition are ongoing. Once all of these tasks are completed, the contractor is selected and the construction Commences. The sequential design and construction is what extends the total duration of the project delivered using D-B-B.

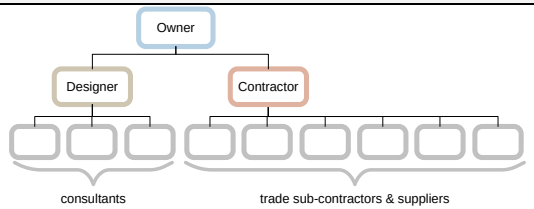
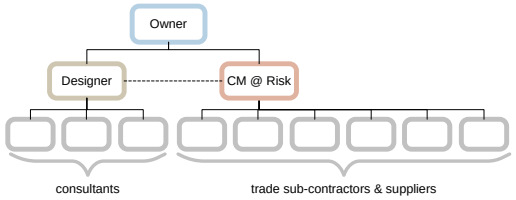
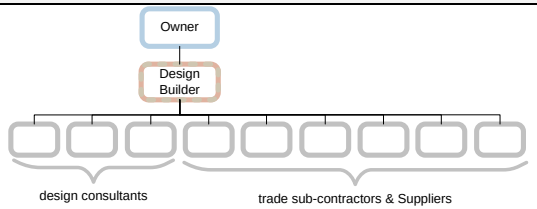
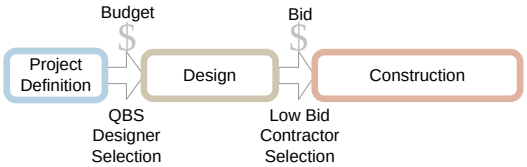
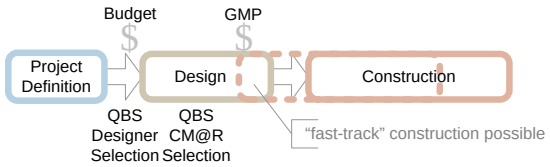
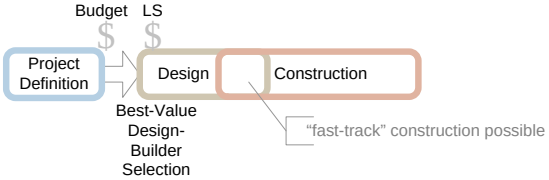
Using **CM@R** brings most benefits to the project offering service commencement in approximately 24 months. It starts out similar to the D-B-B, however approximately before the design reaches 30% complete the contractor may be selected. Once the designer is approximately 60% complete with design, the contractor submits a GMP, and typically is able to begin construction at risk. The utility relocation and ROW acquisition occur while the design, and sometimes the early construction, is ongoing. The early interaction of the designer and contractor and the ability to overlap the design and construction phases are key factors favoring this delivery method.

Finally, using **D-B** this project is expected to take 26 months, which indicates a longer timeframe than CM@R. This is largely due the lengthy design-build procurement, which couldn't be offset even by a higher (than in CM@R) degree of overlap between the design and construction phases. Typically, D-B may not be the best method for shorter/smaller projects, unless other aspects of the D-B delivery such as the need for price certainty early, single point of responsibility or improved quality are more significant. In such a case, Progressive Design-Build could be a better option.

11. SUMMARY

With the State Legislature providing new tools for the NTTA to utilize in delivering projects, it will become more complex to select the right method for the specific projects. Each one of these methods has its advantages and disadvantages, and so the intent of this Implementation Manual is to assist the Authority in selecting the best delivery method for each particular project. Just thinking about the various items that can impact the delivery of the project can get overwhelming and so the more thought is put into it up front, the smoother the delivery process.

The table on the next page provides a summary of the three main delivery methods discussed as a quick reference tool.

Delivery Method	Design-Bid-Build (D-B-B)	Construction Management @ Risk (CM@R)	Design-Build (D-B)
Structure			
Definition	Delivery method in which the owner sequentially enters into a minimum of two distinct contracts: one with the designer responsible for preparation of design plans and specification, and second one with the general contractor who is responsible for the trade contracts.	Delivery method in which the owner enters into two distinct contracts: one with the designer responsible for design, and second one with the general contractor, who is also referred to as construction manager. The selected construction manager provides schedule, budget and constructability advice during design development and subsequently provides the owner with a guaranteed maximum price.	Single entity is contracted to provide both design and construction. The most significant piece of the design-build contract is the evaluation, which typically consists of three main areas: qualifications of the proposing team (past experience, registrations, financial situation etc.), technical review of proposed design solution, and price proposal evaluation to ensure its reasonableness.
Timeline			
Major Pros	Creates the most bidding opportunities for general contractors and subcontractors. Lowest initial construction cost possible. Owner retains remaining contingency funds in the event risks do not develop.	Ability to incorporate constructability review into the design process. Ability to fast-track through issuance of design packages prior to completion of final design. Early determination of maximum construction cost. Possible shared savings.	Reduced change orders. Reduced schedule due to design and construction overlap and elimination of the contractor procurement phase. One contract results in decrease of administration cost. Possible incorporation of ideas from unsuccessful proposers.
Major Cons	Increased potential for claims and disputes. Longest duration.	Increased likelihood of adversarial relationships and "finger pointing" once construction is underway and the CM converts from a professional advisor to the contractual role of general contractor	Time and resource consuming procurement planning and execution. Less competition. Introduction of subjectivity in the procurement process may increase litigation risks.
Best Suited When…	New projects that are not schedule sensitive and have little potential for changes. Smaller projects.	Larger new or expansion projects that are difficult to define, are schedule sensitive or subject to change.	New or expansion projects that are larger and schedule sensitive. Owner is seeking innovative solutions. Owner is seeking to transfer risks to the contractor. Owner is experienced with the D-B process.
Least Suited When…	Projects are hard to define and are schedule sensitive.	Smaller projects with minimal constructability risk.	Project is in its advanced development phases (design nearly complete). Projects are not schedule sensitive. Smaller projects.

12. REFERENCES

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