


Suggested Best Practices for Design-Build in Transportation Construction



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Introduction

Design Build (DB) is a construction project delivery process that places responsibility for design, engineering, and construction under one contract. Due to its single point responsibility (and in the proper application), the process offers multiple advantages over traditional methods including faster delivery. ARTBA supports design build as a viable tool in the industry's effort to accelerate the time duration in which transportation projects are delivered and to minimize the potential for disputes during the project delivery.

The purpose of this document is to present the perspective of ARTBA with regard to application and details of the design build process. It is not intended to endorse design build, but rather offer its contents as a "white paper" to be used after this selection method has

been chosen as the most suitable for a specific project and conditions. It is also to be emphasized that treatment of other alternative delivery methods such as Construction Management at Risk (CM@Risk) fall outside of the purview of this work.

This document, originally developed by ARTBA's Bridge Policy & Promotion Council in 2009, was reviewed and discussed thoroughly by the ARTBA membership, including the Contractors, and Planning & Design Divisions. It was approved by the ARTBA Board in May 2012. Special thanks are due to the following industry leaders for their many hours of work in crafting the language on the following pages: Mike Cegelis, American Bridge Company; John Buchheit, Gannett Fleming; Ed Nyland, Nyland Construction Consulting; and Pete Getchell, PKF-Mark III.



Procurement

The following contains a list of major elements in the Design–Build process.

Design–build transportation projects are procured via a public process similar to their traditional counterparts. With some exceptions, most will involve some combination of quality based selection (QBS) and price components that are familiar to engineering consultants and contractors. One of the most important, initial steps in procurement is early notification. Assembly of a design–build team (DB Team) takes more time than for a traditional project. Nuances related to insurance, teaming agreements, sweat equity, etc., take time to resolve unless the prime contractor and lead designer have an extensive past history. Early notification is easily accomplished with advanced notices published by the Owner or industry forums that are generally reserved for larger contracts.

Two most commonly used procurement techniques are the single–step and two–step processes. Single step selection is made from one proposal submission usually based on the lowest price (“hard bid”). Occasionally, the bid will be accompanied by a brief technical proposal that is graded as pass/fail. Hard bid procurement is acceptable for smaller projects and those where the scope can be well defined without preliminary engineering performed by the DB Teams. The chief advantages are simplicity and a very short duration proposal (procurement) period.

The mechanics of a two–step (or “best value”) process involve advertisement of an Request for Qualifications (RFQ) (step one) followed by issuance of an Request for Proposal (RFP) (step two). Design–build teams prepare responses for each step with the latter being more detailed. Selection is typically made from an adjusted price that takes into consideration bid, technical score, and schedule components. For the process to operate efficiently, it is important to recognize the distinct purposes between the RFQ and RFP stages and not mix them in requirements. The purpose of the RFQ stage is to identify and rank the most qualified teams possessing the best personnel and relevant experience combination. In contrast, the RFP stage is meant to evaluate the specific technical approach each team proposes and the associated cost. The two should not be mixed. Requiring innovative ideas and technical details to be presented in the RFQ response or key staff descriptions and project experience to be included in the technical proposals is redundant and adds unnecessarily to pursuit costs.

To be fair and transparent, the pursuit process needs to maintain a measure of flexibility. Setting up an effective, useful Q&A process is a good start. Ideally, an online system works best where DB Teams can post questions to the Owner to assist in clarification of the RFP requirements, provisions, and scope of work. Responses need to be specific and timely to be of value. This type of arrangement is especially critical when one–on–one meetings are not being conducted throughout the pursuit period (see Dialogue Period

Meetings, or DPMs). Another mechanism for adjustment and clarification of the proposal process is through issuance of addenda. While it is recognized that addenda provided subsequent to release of the original RFP are necessary, it must also be recognized that release of too many throughout the pursuit duration becomes disruptive (to both the proposers and reviewers). Publishing an addendum late in the proposal preparation process should be avoided unless accompanied by a time extension on the submission.

Beyond a “hard bid,” DB procurement methods become highly varied and controversial with the chief debate centered on whether or not to shortlist. The chart to the right presents several options currently in use within the industry.

All methods have their respective merits. The owner must choose one that best suits the local competitive climate and will produce the most qualified team to execute the project.

METHOD

Two-step process with shortlist to three minimum teams.

Selection made from a best value evaluation of technical and price proposals combined.

FEATURES

- Most commonly used method.
- Typically used with a stipend.
- Reduced proposal review effort on the Owner side.

METHOD

Two-step process without shortlist. Submitted Letter of Interest (LOI) are scored numerically—all responsive teams eligible to submit for second phase.

Selection made from combining LOI scores (1st stage) with technical/price proposal scores (2nd stage).

FEATURES

- Pursuit open to all qualified teams throughout procurement phase.
- Can include a stipend.
- Proposers have interim rankings prior to advancing to second stage.

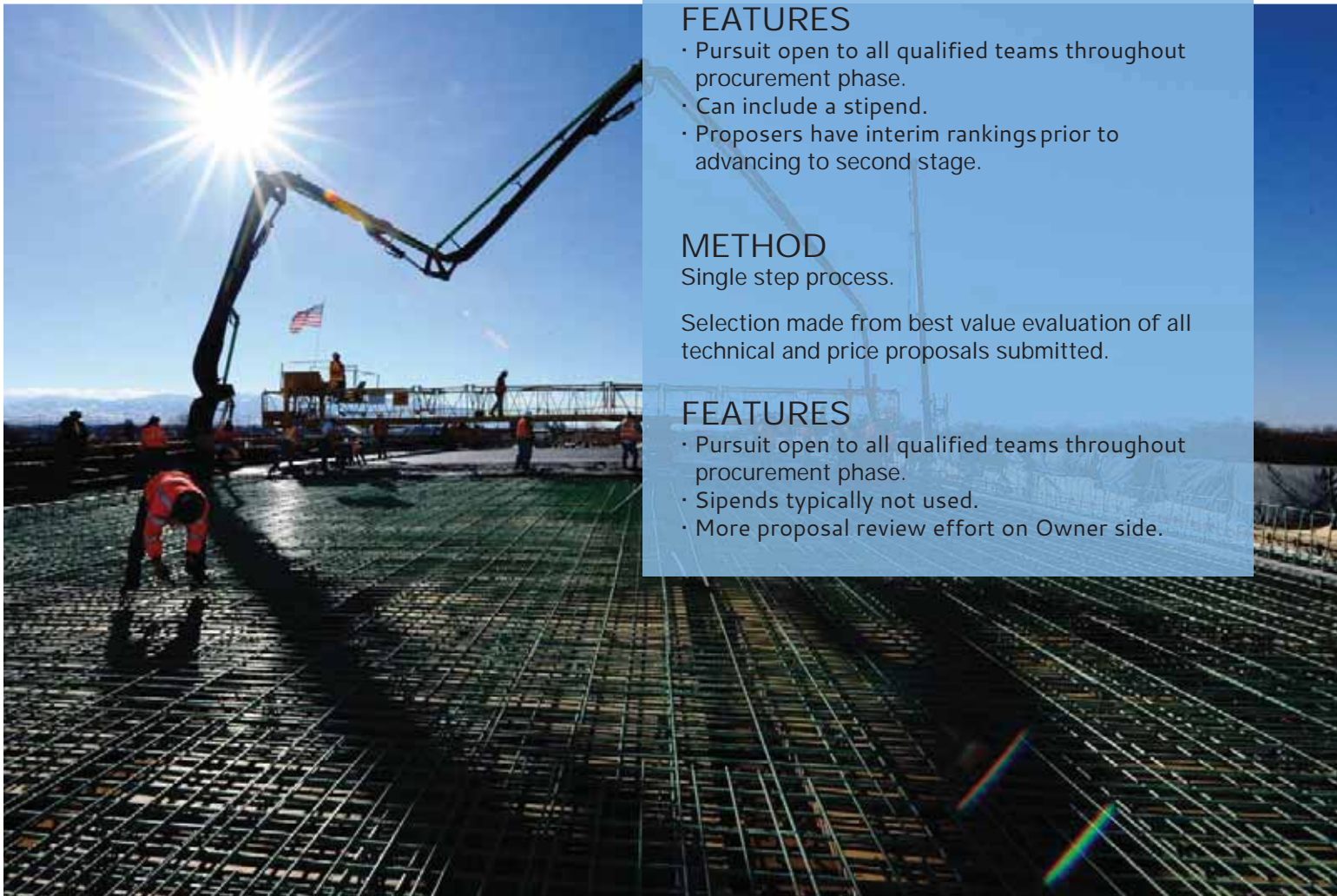
METHOD

Single step process.

Selection made from best value evaluation of all technical and price proposals submitted.

FEATURES

- Pursuit open to all qualified teams throughout procurement phase.
- Stipends typically not used.
- More proposal review effort on Owner side.



Proposal Evaluation

A clear definition of evaluation criteria is imperative, and should be explicitly detailed in the RFP package including points and weighting of each of the criteria. While scoring methods are varied, the recommended approach is an adjusted bid scoring formula that includes parameters for price, technical score, and schedule efficiency. Whatever method used, it is incumbent upon the Owner to follow a transparent and objective evaluation process to minimize chances of a bid protest. This requires elimination of all subjective elements or “grey” areas within the scoring process and using an effective Q&A procedure that allows DB Teams to present questions regarding the RFP documents with timely responses. It is good practice for the Owners to be prepared to publish notes from the technical evaluation committee (TEC) evaluations and be receptive to debrief meetings to give DB Teams *useful* critique of their proposal efforts for future improvement.

The number of TEC members should be established to ensure a fair and impartial assessment of all submitted proposals. Expertise backgrounds of the TEC members should be individually matched to the scope of the project and the required disciplines. Any committee members with a conflicted interest or a unique relationship to any of the shortlisted teams should be substituted.

Technical and price proposals should be evaluated *separately*. For best value—adjusted price selection, the technical proposal should be evaluated (scored) independently of the bid price. In this process, the technical proposal is reviewed “blind” without any influence or knowledge of the associated cost. Price proposals should be submitted at least four weeks after the technical proposal due date. Staggering technical and price proposal submissions allows sufficient review time for technical proposals while the DB Team finalizes its price proposal. This avoids necessity of finalizing both technical design and pricing simultaneously.

Precluded Participation (Conflict of Interest)

Owner requirements for precluded participation in design–build should be clearly defined and strictly enforced. In applying the conflict of interest criteria, the Owner should preclude the participation of any firm who has, due to either the firm or its employees’ exposure to project information that may in any way provide them with an unfair advantage in the bidding competition.

The two most contentious areas for conflict of interest are:

1. How far back in the project development process to set the trigger for determining involvement. Participation in the early planning and environmental phases often yields no measurable, unfair advantage.
2. Whether or not to exempt lower tier subconsultants such as those who performed field surveys or subsurface investigations.

How an Owner decides on these two is of lesser importance than ensuring the criteria (once set) are applied consistently and without exception. The criteria should be transparent and published leaving no room (or need) for individual petitions on a project-by-project basis by the design or construction communities.

Stipends

Reasonable stipends should be furnished in all cases where engineering or significant proposal effort is required. From an industry perspective, stipends are critical for controlling overhead (especially on the design side) and giving shortlisted DB Teams the financial means necessary to put forth quality proposals to the Owner’s benefit. The absence of a stipend reduces competition and discourages the best designers and contractors from participating.

When offered, stipends need to be paid only when proposals meet all of the RFP requirements and are considered “responsive;” however, the proposal requirements must be very clear in defining all responsive criteria. Disputes often arise when a DB Team “pushes” the RFP provisions in the interest of furnishing an innovative/competitive solution that can, ultimately, benefit the Owner. Without clear definition, disqualification under these circumstances can lead to a bid protest. Stipend amounts should be commensurate with the level of effort required and the size and complexity of the project, and in return for ownership of the DB Team’s intellectual property exhibited in their technical proposal.

Apart from the industry benefit from stipends, advantages to the Owner include:

- Maximized competition enticing the most qualified designers and contractors to participate
- Sole retention of all innovative ideas/concepts derived from the technical proposals

- Contribution to lowering consultant and contractor overhead resulting in pricing benefits on traditional design and construction projects

Rules for stipend payment should be clearly documented in the Request for Qualifications (RFQ) so that prospective DB Teams may properly evaluate the investment required for the pursuit.

Numerous sources exist providing guidance on recommended stipends amounts based on specific project parameters. Typically, these range between 0.8% and 1.2% of estimated contract value. Higher amounts are warranted when the RFP requirements call for bid options; significant proposal plan development; oral presentations; etc. If the Owner elects to cancel the pursuit or not award the contract after selection, short-listed DB Teams should be entitled to full recovery of all labor and indirect costs expended toward the pursuit.

As a final note, it must be emphasized that stipends do not (nor should they) cover all labor and expense costs necessary for a design-build pursuit.



Photo Courtesy of John Green, Dulles Transit Partners.

Funding

Projects should only be advertised after funding is approved and committed, or with a description of the process by which funding will be secured and the procedures to be followed in the event that it is not obtained.

Advancing through the selection process with known uncertainties in the project funding mechanisms that could delay the award is poor practice that unnecessarily encumbers both Owner and DB Team resources. This becomes especially critical with respect to contractor bonding capacity.

Projects not awarded or canceled late in the procurement process (due to finding inadequacy) present conditions where DB Teams should be fully compensated for their pursuit efforts. Refer to the *Stipends* section.

Requirements for Proposal Design Submittals

Requirements for proposal design submittals should be limited to what is required to demonstrate intent and compliance with design criteria.

Requiring proposal plans in greater detail than is intended to be evaluated is a misdirection of critical resources that are best focused on solving and optimizing the critical elements of the project.

Plans submitted as part of a detailed technical proposal should be used only to define intent of the design and support the text describing technical approach and understanding. Overly extensive proposal requirements that are financially burdensome can discourage qualified teams from participating. Therefore, RFPs should require only enough material to fairly judge the best proposers.

In order to properly direct the DB Team's work during the proposal process, the Owner should consider placing caps on the number of plan sheets required for a technical proposal response package. Sheet limits should be broken down by discipline (roadway; Maintenance of traffic (MOT); structures; etc.). The total limit should be a function of project size or contract value. Some indication of the intended level of detail in the bridging documents is very helpful. This may be presented by a minimum percent complete or example drawings in the RFP.

The required deliverables should be calibrated to the specific project scope and complexity. If an element won't be used for evaluation as a means to selection, then it should not be requested.



Bridging Documents

At a minimum the bridging documents should provide final geometry, right of way, detailed geotechnical reports, utility locations, environmental constraints (from Environmental Assessment/Environmental Impact Statement), hazardous material contamination locations, aesthetic requirements, and archeological deposits. Permits should be acquired by the Owner and be fully identified. A definition or conceptual design less than 30% complete that presents the Owner's minimum requirements for environmental commitments; right of way; envelopes, clearances and restrictions, access requirements, structure concepts, coatings and treatments, etc. is ideal. Aesthetic directions required by the Owner should also be included in this definition drawing set. The bridging documents should also contain the listing of applicable standards, along with the hierarchy of these criteria.

While design-build has been a successful delivery method on projects where the Owner's design has ranged from minimal to nearly complete, the major benefits of design build occur when the DB Teams have the greatest flexibility. Design-Build is not recommended for projects where design is complete or nearly complete. Furthermore, minimal levels of design advancement provide the DB Teams the most flexibility (and Owners the best opportunity) to benefit from an innovative approach. Well advanced designs hinder innovation and limit a DB Team's ability to tailor the design to suit competitive means, methods, and equipment.

Overly prescriptive design specifications and plans ("draw-build") are discouraged. These greatly reduce the potential for innovation, and serve only as an improper transfer of design risk away from the originator onto the DB Team without commensurate resources to manage.

Dialogue Period Meetings

Dialogue Period Meetings (DPM) are crucial elements to a successful design-build proposal process. In these meetings DB Teams present their developing design solutions to the Owner on a confidential basis. These meetings enable the Owner to evaluate and monitor the DB Teams' direction, and to indicate where a design may be falling short of requirements. They also provide a forum for asking questions and obtaining Owner input and direction. Dialogue period meetings should ideally be held monthly throughout the proposal process and are best scheduled in advance with input from the DB Teams. The first meeting should serve as a general overview of the DPM process. A tentative agenda for future meetings should be proposed by that meeting. This may include the submission of specified deliverables. Topics may include ground investigations, technical overviews, insurances and bonds, design reviews, project management system reviews, quality system reviews, aesthetic reviews, etc. The DPMs can also provide a foundation for discussion and approval of Pre Accepted Elements (PAEs) and Alternative Technical Concepts (ATC), to adjudicate on pass/fail items, and to provide direction on Owner preferences of alternatives that DB Teams may be considering.

Confidentiality and fairness are crucial to the success of DPMs. A breach in either threatens effectiveness of the meeting strategy and undermines the design-build process. Exhaustive measures, including strict confidentiality agreements signed by all involved parties must be taken to prevent the passing of ideas or information from one DB Team to another. Although a challenge, it is essential to separate the principles of confidentiality from fairness. The Owner must recognize the balance between protecting sensitive information and ideas brought forth from each DB Team, while ensuring that no single team gains an unfair advantage through relaxation or flexible interpretation of contract provisions in the RFP or bidding documents. Any perceived change in project scope or requirements arising from a DPM must be broadcast to all DB Teams in the interest of a fair solicitation process. Timing of these notifications must also be taken into consideration. Alerting all teams of an accepted proposed change in the specifications could still present an unfair advantage if

done very late in the solicitation schedule leaving insufficient time for other teams to capitalize.

An obvious example of a violation of the principle of fairness would be the changing of force majeure terms for one team and not for the other. A less obvious violation, but equally injurious and unfair, would be the Owner's acceptance of environmental risk late in the proposal process. Even when this risk reduction is made available to all DB Teams, it is unfair to those that have developed their preliminary designs (perhaps resulting in a higher cost) to minimize environmental exposure, and who now may have limited time to modify their approach to remain competitive.

Alternative Technical Concepts

Alternative Technical Concepts (ATCs) are proposed alternatives to a prescriptive conceptual design. An ATC process is a formal proceeding during the technical proposal phase that allows DB Teams to "test" innovative ideas without expending excessive engineering and estimating effort. During the process, DB Teams present their ideas to gauge Owner acceptance eliminating risk of being disqualified or deemed "Non Responsive" in the technical proposal evaluation. For the Owner, it provides a glimpse of the creative ideas and innovations being developed by their shortlisted teams toward meeting the stated project objectives before submission of detailed technical proposals.

An example of an ATC would be a multi-span bridge with a specified pier arrangement on the conceptual design furnished by the Owner. A DB Team may propose to relocate the piers to better suit construction sequencing or erection methods leading to lower project cost. During the ATC process, the DB Team may learn that the Owner set the pier locations because they are consistent with the hydraulic analysis and permit approval documents; however, the Owner may indicate that the alternate could be accepted if the DB Team revised the hydraulic analysis and took responsibility for securing an updated permit.

Similar to the discussion on DPMs the Owner has two responsibilities with respect to administering an Alternative Technical Concept process:

1. Any willingness or acknowledgement for changing the project scope of work or RFP requirements must be conveyed to all DB Teams so that no single team attains an unfair advantage.
2. Strict confidentiality must be maintained relative to intellectual property and ideas presented by each DB Team during the ATC process.

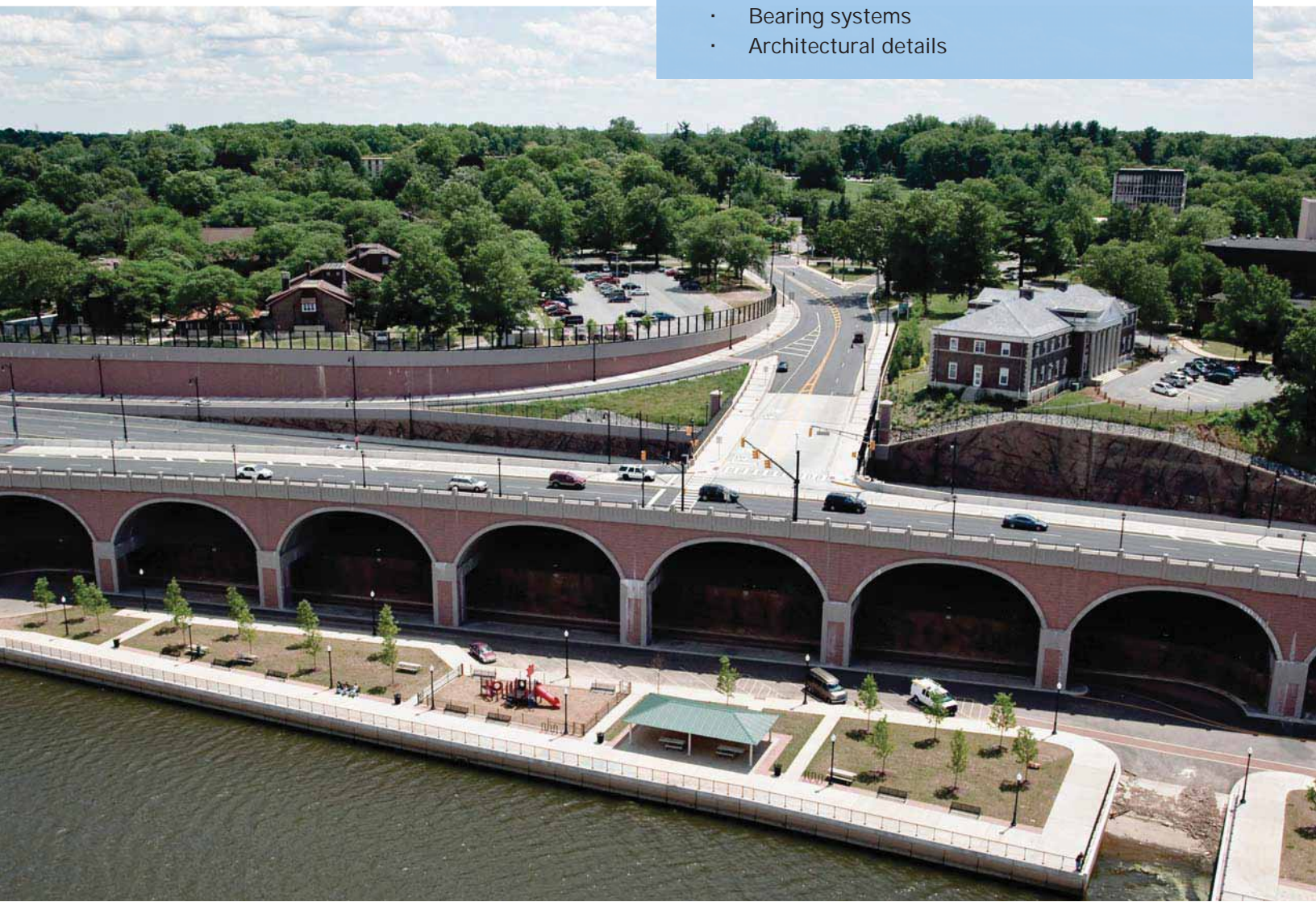
ATCs function like value engineering except that the process precedes the “bid”. The Alternative Technical Concept process allows DB Teams to innovate and propose possibly unconsidered methods for achieving the project objectives. The Owner is in full control as to the approval or rejection of any ATC concept. When ATCs are to be accepted, both the RFQ and RFP should indicate accordingly. Rules and responsibilities should be clearly presented. There may be design items for which the Owner will not allow change, such as aesthetic elements or for life-cycle purposes. The rules must also specify who will retain design responsibility for an accepted ATC.

Use of Alternative Technical Concepts can be an effective tool to control pursuit costs and encourage maximum innovation without compromising any of the Owner’s requirements or objectives.

Pre-Accepted Elements

Pre-Accepted Elements (PAEs) are concepts that are presented during the proposal phase prior to submission of a technical proposal at the Owner’s request. Review of these elements enables the Owner to confirm that requirements are being met and that the DB Teams have a clear understanding of what is expected for critical elements on the project. Intermediate review steps using PAE’s are very effective in keeping all teams on track throughout long, complicated proposal durations on large projects. Feedback on the PAE submissions must be timely enough for a DB Team to make any necessary adjustments or revisions before submission of a formal, technical proposal package. Examples include:

- Bridge piers
- Bearing systems
- Architectural details



Predefined Maximum Price

A Predefined Maximum Price (PMP) is an upper limit placed on a bid to be considered responsive. While recognized as valuable to help Owners in setting program funding and budgets, use of PMP limits is to be discouraged; especially when used to deem proposals non-responsive. DB Teams that earnestly prepare technical and price proposals meeting the RFP requirements and promoting innovative ideas backed by sound engineering should not be disqualified (and therefore have their stipend eliminated) because their specific means / methods or approach results in a bid above a pre-set limit that was defined in the absence of specific construction input.

Application of maximum price limits is not realistic with 15%-30% concept designs and lump sum bidding. A hard-bid or best value design-build process ensures competitive pricing by virtue of the process alone. If a PMP limit is absolutely necessary, it should be accompanied by a formal process that allows proposers to challenge the value throughout the pursuit process without voiding entitlement to the stipend. It should be emphasized that in projects utilizing a PMP, the need to perform early and continuous cost estimating should be commensurate with a higher stipend. When a PMP is absolutely necessary, the Owner should publish the Engineer's Estimate for the project as part of the RFQ or RFP.

PMP is, however, an acceptable practice when the proposal criteria allows an adjustment of the scope of work by the DB Teams to meet the allowable maximum price. Refer also to section on bid options.

Bid Options

Requiring teams to address multiple options within the same proposal should generally be avoided as it complicates the scoring/evaluation process and increases pursuit costs. Bid options are employed when multiple project budgets or funding scenarios exist that may call for an upward (or downward) adjustment in project scope. Examples may include extending project limits for roadway work; adding a new interchange; and use of concrete pavement instead of asphalt.

Bid options present a challenge to maintain fairness in proposal evaluation and scoring since the best DB Team for one option may not be the best for another. They also result in added costs for proposal preparation, engineering, and estimating. When used, bid options should be accompanied with additional proposal preparation time and a corresponding increase in stipend amount.

Best and Final Offers

Use of Best-and-Final Offers (BAFOs) is strongly discouraged under all circumstances. The process results in a leveling of the competition after a first pricing round which undermines fair bidding practices. Evaluation methods employing a BAFO component increase the potential for leakage of proprietary proposal data to competing teams resulting in a compromised selection process vulnerable to challenge. Ultimately, this technique can discourage investment in engineering innovation on the premise that ideas will be distributed anyway. The end result is a normalization of competitive ideas and innovation that is counter to the fundamental precept of the design-build process.

Conflict Resolution

An effective conflict resolution plan is essential for success in design-build. The primary goal of the plan should be to resolve issues before they reach mediation, arbitration, or litigation. A well designed approach to conflict resolution becomes a valuable tool for risk mitigation.

The plan must address needs to handle issue escalation through mapping correct levels for communication within the Owner-DB Team-Construction Engineering Inspection (CEI) representatives. The plan should also have provisions that ensure issues are moved "up the chain" expediently.

While there are mixed perspectives and results across the industry regarding partnering, the process is still highly recommended for design-build. Executed properly, partnering can prove to be even more effective on design-build as opposed to traditional design-bid-build since the design is not fully developed; thus, involving more stakeholders and encompassing a broader list of issues. Permitting and public involvement are two such examples.

Risk

In simplest terms, individual risk items should lie with the entity [Owner or DB Team] best empowered to manage or control them. The overall objective is to seek balance; assigning risk outside of a DB Team's control can result in inflated bid costs as contractors do not accept risk—they price it.

The RFP should clearly define all risk elements on the project and the ownership of each. Ideally, this is effectively accomplished via a matrix listing each potential risk element on the project and the intended "owner." In the event the most appropriate course is joint or shared ownership, the matrix would stipulate the relevant terms or clarifying details.

Examples of common risk elements typically encountered would include:

- Third party utility relocations
- Securing permits
- Unforeseen subsurface conditions
- Remediation of contaminated soils or hazardous materials
- Right-of-way acquisition
- Archaeological discoveries
- Schedule delays caused by 3rd party reviews

Design-Build Teams would have the opportunity to provide commentary on the risk balance during one-on-one meetings; pre-proposal reviews; and normal Q&A periods.



Owner Requirements

Owner requirements are best conveyed via performance criteria rather than prescriptive specifications. Prescriptive requirements can increase project costs by hindering the DB Team's ability to tailor design and construction that best suits the team's means and methods.

Owner preferences not disclosed in the RFP are not enforceable. The project requirements are best conveyed through a combination of specific language in the RFP accompanied by a set of definition drawings that present geometric data; clearance envelopes; hydraulic information; permit requirements; results of public involvement commitments including aesthetics, etc. To realize the full benefit of design-build project delivery, Owners must be willing to concede that strict control of the design [as typical with traditional projects] is not practical.

Standards

Applicable standards should be clearly referenced and accompanied by a hierarchy that defines precedence in the event of conflicting provisions.

Use of Electronic Files

Electronic files of bridging documents should be made available to DB Teams during the pursuit phase instead of after award. This reduces the overall cost of proposal preparation and helps the industry operate with optimized efficiency.

It is helpful when survey, base mapping, and other preliminary CADD files are furnished for use by shortlisted teams in development of their technical proposals and bids. The data can be provided as "for information only."

Aesthetics

Aesthetic concepts in best value selection can be very subjective and must be presented clearly to avoid ambiguity or unfair interpretations. Ideally, architectural themes would be conceived outside of the design-build contract and presented graphically in the bridging documents as prepared by the owner's design criteria consultant.

If there is no strong preference for a specific aesthetic concept but an attractive design is still desired, evaluation of architectural value could be done as

pass/fail or with a low scoring weight.

Expensive architectural treatments or enhancements should be omitted from the RFP for projects where the owner's primary objective is least cost or when working under a predefined maximum price.

Railroad Coordination

Railroad requirements for clearance envelopes, temporary protections, temporary access, flagmen, and lift safety factors should be ascertained by the Owner and incorporated into the RFP. DB Teams dealing directly with rail operators during a pursuit phase is not recommended because of potential for conflicting direction or simply lack of equal response.

Right of Way Acquisition

Typically there is minimal to no responsibility for Right-of-Way (ROW) acquisition that should reside with the DB Teams. Under certain circumstances and particularly within PPP frameworks, DB Teams can provide acquisition appraisal services, but issues related to eminent domain and the schedule risks associated with clearing right-of-way place the Owner in best position to hold this responsibility. It is reasonable to expect a DB Team to establish the extent of ROW required for its design, or for identification of parcels that must be procured to enable the implementation of its design. This applies to both permanent and temporary ROW requirements.

Utilities

Utility issues are often contentious within design-build projects due to the 3rd party risks and sequencing of relocation operations. While not always feasible, the ideal scenario is to use "early works" contracts in advance of the design-build project to identify and clear all impacted utilities. Coordination of 3rd party utility design and/or relocation can fall within the purview of the DB Team scope but not without some acknowledgement for latitude in schedule or cost. Owner involvement can be especially helpful throughout this process to leverage toward a successful outcome.

Insurance

The requirements for project specific insurance policies and requirements should be well defined.

Warranties

Project warranties should be of reasonable duration—typically 12 to 24 months. Periods in excess of this can cause problems with sureties providing contractor bonding under some circumstances. In these cases, it is appropriate for an Owner to consider using a warranty bond for a predetermined, fixed amount. Exclusions to warranties must be recognized including routine maintenance; damage from 3rd parties; and other conditions that expose the component beyond the specified performance thresholds of the project. While often overlooked, it is important to declare a definitive start date when the warranty period is to begin. This becomes especially critical when the project is slated for a sequenced turnover. The RFP and/or DB Team technical proposal must clearly stipulate the requirements and provisions of the warranty for all affected project components keeping in mind that professional services can only be held to local, standard industry care under engineering E&O insurance policies. When the objective is to transfer all risk related to warranty, maintenance, and repair a Design-Build-Operate-Maintain (DBOM) procurement option will serve best.

Quality Assurance & Quality Control

In a single point delivery system like design-build, it is appropriate for the DB Team to take increased responsibility for the overall quality management program. As is the case with other components of DB, it is critical that quality control and quality assurance requirements are explicitly defined in the RFP including delineation between Owner and Design Builder responsibilities. This becomes especially important with respect to acceptance testing. Use of Project Specific Quality Assurance Plans prepared by the DB Team and approved by the Owner are highly encouraged. Comprehensive Quality Assurance (QA) Plans need to contain provisions for work product verification (both construction and engineering) and an effective risk management plan. The project staffing organization chart should include sub-groups dedicated to quality control oversight such as Executive Committees and independent peer review teams. On larger projects, assignment of a full time QA manager is usually a wise strategy.

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