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IMPLEMENTING ALTERNATIVE TECHNICAL CONCEPTS IN DESIGN-BIDBUILD PROJECTS

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Abstract: This paper details the results of two in-depth case studies conducted on agencies that implemented Alternative Technical Concepts (ATC) in conjunction with the procurement of low bid Design-BiDBuild (DBB) construction projects. The Missouri and Michigan Departments of Transportation (DOT) each chose to pursue early contractor involvement in DBB projects but used two completely different approaches. Missouri allowed ATCs to be proposed virtually without limitation on seven DBB projects; whereas, Michigan chose to only consider ATCs on the Maintenance of Traffic (MOT) Plan for two DBB projects. The paper found both approaches to be successful, generating tangible cost and/or time savings for each DOT. It also proposes two frameworks for developing ATC procurements using either a limited or full scope approach. The paper's primary finding is that ATCs can be implemented at any level if the agency thoughtfully develops the project's solicitation documents. It also finds that limited scope ATCs, like the MOT ones in Michigan provide a mechanism to experiment with the DBB ATC process and gain the required understanding of the mechanics of the procurement without increasing the risk the agency must assume.

1 INTRODUCTION

The rapid spread of alternative project delivery methods for delivering infrastructure projects is the result of the critical requirement to rapidly rebuild the deteriorating transportation infrastructure of the United States (US). Specifically, state DOTs are using design-build (DB), construction manager/general contractor (CMGC), or construction manager at-risk (CMR), and at times design-biDBuild best-value (DBB-BV) contracts to take advantage of the design and construction industry's ideas for alternative design and construction solutions to highway projects. In 2010, the US FHWA implemented its *Every Day Counts* (EDC) program, which is designed to identify and deploy technical and procedural innovations that promote the "*shortening project delivery*, enhancing the safety of our roadways, and protecting the environment… it's imperative we pursue better, faster, and *smarter ways of doing business*" (Mendez 2010 emphasis added). The EDC program offers to reduce the amount of state matching funds required for a federal-aid highway project if the DOT employs one or more of the approved EDC innovations. Both DB and CMGC delivery are on that list as are Alternative Technical Concepts (ATC).

An ATC is defined by the FHWA as "a request by a proposer to modify a contract requirement, specifically for that proposer's use in gaining competitive benefit during the bidding or proposal process… [and] must provide a solution that is equal to or better than the owner's base design requirements in the invitation for bid (IFB for DBB) or request for proposal (RFP for DB) document." (FHWA 2012). Entertaining ATCs as a part of the pre-award procurement process is one method that has proven to yield novel solutions to

complex design and construction problems on a wide range of projects. ATCs are definitely a *smarter way of doing business* by bringing the collective experience and creativity of all project stakeholders to bear on a given project.

ATCs have been used on US DB projects since 2002 and as such, are a well-tested approach to soliciting competing technical solutions for a given design problem. Their use in DBB projects was first seen in 2011 when the Missouri DOT (MoDOT), impressed with the quality of their DB projects, decided to include ATCs on certain traditional DBB projects. At a meeting for interested contractors, MoDOT explained its motivation for including ATCs in the DBB project to replace the structurally deficient Hurricane Deck Bridge over the Lake of the Ozarks in the form of the following equation:

"**BOLD** Approach = Industry + MoDOT = One Team = Best Value" (MoDOT 2011)

The meeting stimulated several *bold* ATCs including two that proposed to completely realign the bridge from its baseline alignment. The low bidder's ATC realignment permitted it to bid $8.0 million below the engineer's estimate for the baseline design. Two of the five bidders did not propose ATCs and their bids were roughly $10 million more than the low bidder. The results clearly showed the promise found by permitting the construction contractor to make substantive changes to a project's final design and proved that the process accrues tangible savings to both the agency and the taxpayer. Therefore, the objective of this paper is to detail the ATC process applied to DBB projects in Missouri and Michigan. It will also propose a framework for a generic DBB ATC that is founded on the outcome of the two case studies.

2 BACKGROUND

Many of the studies on construction procurement have found that early contractor involvement in the project's planning and design yield benefits to the owner in terms of constructability, which in turn saves both time and cost (Hoffman et al. 2009; McMinimee, et al. 2009; Carpenter 2012; Coblentz 2012; Hitt 2012; Horn 2012). The literature also shows that contractor design input contributes to a more effective design with reduced errors and omissions via the direct application of construction knowledge (Yates and Battersby 2002). Furthermore, West (2012) argues that "contractor design input is [a] benefit… because it enhances constructability and innovation and creates potential for cost savings through effective design solutions." The Massachusetts DOT (2012) chose to implement ATCs "to avoid delays and potential conflicts in the design." Taking these findings with the enhanced quality of final construction documents leads to the conclusion that implementing ATCs effectively provides a new level of design quality control through the involvement of the contractor in reviewing the solicitation and design documents and identifying errors, omissions, and ambiguities. In West's (2012) words, the practice creates a "form of price clarification, eliminating confusion and potential misunderstanding by mandating information-rich communications."

2.1 Confidential One-on-One ATC Meetings

NCHRP Synthesis 455 on ATCs (Gransberg et al. 2014) found that that most agencies implementing ATCs conduct confidential one-on-one meetings where competing contractors are allowed to present ideas for potential ATCs. The objective of these meetings is first to permit contractors to float their ideas for ATCs past the owner and get a quick decision as to whether or not the agency was likely to approve the change. Secondly, if the response is positive, the one-on-one meeting provides a mechanism where the owner and the contractor can discuss the details of the potential change and reach agreement on whether the proposed ATC is "equal to or better than" the baseline design as required by federal regulations. The confidentiality of these communications is the key to success as competing contractors will not offer up their good ideas if they believe the concepts will become known to their competitors (Smith 2012). Randy Hitt, PE of the MoDOT describes his agency's approach to confidential ATC meetings by saying: "Confidentiality in the ATC process is very important for the success of the ATC process. Great care needs to be taken when exchanging files and emails" (Hitt 2012). Another paper written by a contractor expressed the same sentiment from the other perspective: "Trust in the Owner's confidentiality, objectivity and fairness is paramount" (Smith 2012).

In the agencies where one-on-one meetings are not authorized, the competitors were typically asked to submit a written ATC proposal for review and approval. In most cases, there was a deadline established for submission and either a one or two week period for the owner's review and decision to be returned to the competitors. Regardless of the presence of one-on-one meetings, most DOT policies provide for confidentiality of the outcome of the ATC review/approval process.

2.2 Applying ATCs to DBB Procurements

Implementing DBB ATCs entails a shift in the procurement culture to permit contractors to confidentially propose changes to a project's scope and get the full benefit of their innovation by allowing them to be the only competitor that is allowed to submit a bid on the project as modified by the approved ATC. NCHRP Synthesis 455 (Gransberg et al. 2014) found that guaranteeing confidentiality permits competing contractors to build a competitive edge with their ATCs and is widely used in DB projects. The synthesis also found that it stimulates innovative approaches to delivering a project that were not considered by the agency during the baseline planning and design process.

At this point, it must be noted that the aim of the paper is not to advocate the use of ATCs on every DBB project. The ATCs, like alternative project delivery methods, should be applied to a specific project after careful thought and a determination that the project stands to benefit from the construction contractor's pre-bid input to the project's design. In most cases, this means that the transportation agency engineer has found that there are several promising options for the contractor's means and methods, which once identified, will drive one or more of the details of the final design. Knowing the information before award could conceivably accrue benefits in terms of cost and/or time savings. An example would be designing the size and length of bridge members based on a contractor's actual reach and pick constraints for a barge-mounted crane.

A second aspect of the ATC method that was found by those DOTs that used the tool is that the decision to include ATCs should be made as early in the project development process as practical. Ideally, it would be made before the project's National Environmental Policy Act (NEPA) clearance is completed to minimize the chances that public commitments made during the NEPA process do not reduce ATC potential benefits or stifle them altogether. The Missouri DOT learned this lesson on its Hurricane Deck Bridge project and the details of their experience are contained in the subsequent case study discussion. In essence, a project with a high potential for beneficial ATCs must pass through the NEPA process with as much flexibility of final design configuration as possible. This constitutes a shift in the environmental permitting process away from the current mode of "be as specific as possible" to a less restrictive mode that provides the agency as much latitude as possible while remaining in full compliance with the laws of both the State and the Federal Government. The net result is that planners, designers, and construction personnel must be jointly involved in the ATC decision at the earliest point--when the project scope is defined.

Thus, to maximize the value made possible by implementing ATCs, a much higher level of internal collaboration is needed for a longer period of time by the agency. This means that agency planners may need training to recognize the features of a project that make it a good candidate for ATC solicitation. Deciding to change an agency's culture with respect to environmental commitments requires a certain amount of moral courage and the willingness of upper management to support bold changes in historic agency design standards. It also requires support to allow a low-bid construction contractor to furnish options for changing the design.

2.3 ATC Process Models Found in the Literature

NCHRP Synthesis 455 found that DBB ATCs can be implemented in two different forms. The first, called a "full scope ATC," allows interested contractors the freedom to propose ATCs on the entire scope of work. The second is called a "limited scope ATC" and specifies those portions of the scope of work on which ATCs are being solicited. Table 1 lists the advantages and disadvantages of both types. To highlight a few, limited scope ATCs may not be able to improve the construction schedule or realize significant cost savings as opposed to full scope ATCs where large number of options are proposed for

time and cost savings. However, the issue of confidentiality and environmental commitments - that could be impacted significantly- is more complex in the full scope compared to the limited scope ATC. In addition, in terms of maintenance of traffic in the limited scope approach, the impact to MOT is easier to measure due to highly focused scope of ATCs compared to the full scope ATC where the entire project might be eligible to modification to optimize MOT and the baseline MOT design may not be compatible with the ATCs proposed. In essence, while both ATC approaches have been implemented successfully, NCHRP Synthesis 455 found that the limited scope ATC was a less radical change to the traditional DBB procurement process and indicated that as DBB ATCs proliferate that most will probably be the limited scope variety (Gransberg et al. 2014).

Table 1 Advantages and Disadvantages of Full Scope vs. Limited Scope ATCs (FHWA 2012)

Issue	Full Scope ATC		Limited Scope ATC	
	Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Project delivery schedule	Large number of options to save time during construction	ATC review process might delay award	ATC review process minimized.	May not be able to improve schedule due to scope limitations
Construction cost	Large number of options to save money	Difficult to verify potential savings before award	Focus on cost savings in a critical feature of scope	May not be able to realize savings due to scope limitations
Confidentiality before award	--	Large number of ATCs increases the active efforts to maintain confidentiality.	Reduces active efforts to maintain confidentiality.	May drive all competitors to the same ATC solution if limitation is too narrow
Environmental commitments	Expands opportunities to implement innovative protection measures	Requires a thorough analysis to ensure commitments are not impacted	Reduced chance of unintentional violation of commitments.	--
Right of way acquisition	May reduce the amount of ROW required for temporary access during construction	Approving an attractive ATC may require additional ROW	May reduce the amount of ROW required for temporary access during construction	Approving an attractive ATC may require additional ROW
Utility Coordination	May reduce the amount of utility coordination and relocation required.	Approving an attractive ATC may require additional utility coordination and/or relocation effort.	May reduce the amount of utility coordination and relocation required.	Approving an attractive ATC may require additional utility coordination and/or relocation effort.
Maintenance of traffic	Makes the entire project eligible to modification to optimize MOT	Baseline MOT design may not be compatible with some ATCs	Easier to measure impact to MOT due to highly focused scope of ATCs	--
Construction staging	Makes the entire project eligible to modification to optimize staging	--	--	Can only optimize staging within ATC scope limitations

3 METHODOLOGY

The study utilized two primary research instruments: literature review, including a content analysis of agency ATC solicitation documents, and formal case studies of projects in Missouri and Michigan. The primary objective of the case study protocol was to supplement the knowledge framework created through the literature reviews and agency solicitation documents with the deeper knowledge of the project participants. Literature review and content analysis provide the researcher with the “what” of a given project, but structured interviews with case study project participants provide the “why” for the decisions made and the events observed in the project.

3.1 Case Study Protocol

The literature review and content analysis drove the case study data collection and the sought to identify with information collected in the literature review to validate case study conclusions. The choice of projects to further investigate as in-depth case studies was determined based on the availability of participants and documentation on DBB ATC projects. Only two US states, Missouri and Michigan, have implemented ATCs on DBB projects. At the time of this writing, Missouri has completed roughly ten projects and Michigan has done two. In-depth case studies will serve as a critical source of information in this research. The analysis will be conducted on the following three levels:

1. Analysis of DBB ATC projects of different sizes, different states, and different methodologies as identified in the literature review.

2. Interviews of public transportation agency personnel, contractors, and consultants with DBB ATC project management experience.

3. Published reports of DBB ATC case study projects from the highway sector.

3.2 Case Study Selection

The primary input to the case studies was gathered through structured interviews with agency personnel, contractors, and consultants that have been part of teams involved with DBB ATC projects. The structured interview outlines were developed using the method prescribed by the US Government Accountability Office (GAO 1991). The GAO method states that structured interviews can be used where "information must be obtained from program participants or members of a comparison group… or when essentially the same information must be obtained from numerous people for a multiple case-study evaluation" (GAO 1991). Both these conditions apply to this study; therefore, the tool is appropriate for the research.

The process involves developing a questionnaire that was made available to each interviewee prior to the interview and then collecting responses in the same order using the same questions for each interviewee. The information was gathered using both face-to-face and telephonic interviews. Per the GAO method time is allotted to ensure that the interviewee understands each question and that the data collector understands the answer. Additionally, interviewees were also allowed to digress as desired, allowing the researchers to collect potentially valuable information that was not originally contemplated. The output is used to present the agencies' perspective on various points analyzed in the subsequent tasks.

The case study details were collected using Yin's methodology (Yin, 2004). The use of these instruments in conjunction with the comprehensive review of the literature allows the researcher to not only maintain a high level of technical rigor in the research but also follow Yin's three principles in the process of research data collection: 1) Use of multiple sources, 2) Creation of a database, and 3) Maintaining a chain of evidence (Yin, 2004).

Based on the page limitations for this paper, the Hurricane Deck Bridge Replacement Project in Missouri and the US-10 Rehabilitation Project in Michigan were selected. The fundamental rationale was to be able to compare to a project that utilized a full scope ATC with one that used a limited scope ATC process. Additionally, the Missouri project ATC extensively changed the baseline bridge design and can be compared to the Michigan project where only the MOT plan was changed from the baseline. The result provides a basis for proposing frameworks for each ATC process type.

3.3 Case Study Project Details and Background.

Two case study projects were selected to evaluate the differences in the Missouri and Michigan DBB ATC processes. Table 2 contains a synopsis of each project's details. It shows that the MoDOT Hurricane Deck Bridge project ATC was the most comprehensive as it not only changed the bridge's structural design, but also changed its alignment. Alignments of federal-aid highway projects that have received NEPA clearance are considered to be fixed and a change triggers a potential re-review (Hitt 2012). To

compound the complexity of implementing this alternative, MoDOT had chosen to avoid potential design liability issues by advancing approved ATC designs to the point where biddable quantities could be generated. Hence, the issue of confidentiality became very complicated as a NEPA re-review puts the technical details of the ATC into the public domain. Additionally, since three contractors submitted ATCs, MoDOT's design consultant had to maintain three separate design teams for each of the ATCs to protect against accidental revelation of one contractor's ATC to another.

Table 2 Case Study Project Details. (adapted from Gransberg et al. 2014).

Item	Hurricane Deck Bridge	US-10 Rehabilitation
Agency	Missouri DOT	Michigan DOT
Initial Estimated Project Value	US$ 40.4 million	US$ 22.0 million
Contract Award Value w/ATCs	US$ 32.3 million	US$ 21.1 million
Type ATC	Full Scope	Limited Scope
Project Baseline Scope	Replace existing 2,260 foot bridge	Rehabilitation of 8 bridges and 6.9 miles existing roadway
Nature of ATC	Build bridge on new alignment; reduce steel quantities by 50%	Maintenance of traffic plan to complete project in 1 season instead of 2.
# ATC received	3 from 5 contractors	6 from 5 contractors
Cost Savings	US$ 8.1 million	US$ 0.9 million
Time Savings	2 weeks	12 months

MoDOT had several issues that needed to be handled differently than the standard DBB procurement process. For example, to address the environmental issues, MoDOT identified the selected alternative in the Environmental Assessment, while ensuring the environmental document made reference to the ATC process. This is in addition to having FHWA involved in the environmental discussions with MoDOT team from day one. The ATC team had open communication with the environmental office and even disclosed potential designs that could trigger a re-review of the NEPA document if they weren't originally covered. In terms of design liability, MoDOT decided to assume the design liability of the proposed ATC to avoid creating issues of transfer of design liability and eliminate the need to offer a stipend for the effort costs invested by unsuccessful bidders in ATC design. Since confidentiality for the contractors is considered key to the success of the ATC process, MoDOT took several measures to ensure confidentiality. First, the agency's design consultant assigned four individual design teams to work on the different ATC designs. The design teams had to also exercise great caution in keeping separate proposals independent of each other. Secondly, MoDOT created an external sharepoint site secure to each contractor engaged in the ATC process. This ensured that the proposers had no idea who the other proposers were and what ideas were being discussed. Finally, confidentiality imposed two major constraints on the normal bidding process, 1) the final proposed improvement could not be revealed to the public until the bidding stage and thus, MoDOT only advertised that they were allowing contractors to propose alternate ideas for construction and 2) MoDOT could not finalize the right of way negotiations as they couldn't share what the change in footprint impact with the property owners (Hitt 2011).

As for the US-10 project, MDOT provided contractors the opportunity to include pricing for a pre-approved ATC(s) in their proposals. Proposers were allowed to bid either the MDOT baseline design or their approved ATC(s). If the ATCs submitted by the proposers required NEPA re-review or modifications to previously approved permits, the proposer has to bring it up for MDOT and FHWA approval. Since this project presents a "limited scope" implementation of ATC, ATCs on this project were limited to staging and traffic control on US-10 mainline, in contrast to MoDOT Hurricane Deck Bridge project where the contractors were to assume the risk of preliminary and final design costs for their approved ATC. The issue of confidentiality was also addressed in the Notice to Bidders document by stating that "MDOT expressly reserves the right to adopt any specific [Conceptual ATC] CATC or ATC as standard practice for use on other contracts administered by MDOT, whether the CATC or ATC is accepted or rejected….

CATC or ATC shall not be used by MDOT until after the award of this project." MDOT considered all the ATCs submitted as confidential and as such were not to be shared with other bidders. In addition, the review team members were required to sign a confidentiality agreement to guarantee confidentiality (MDOT).

4 CASE STUDY ANALYSIS

4.1 Case Study Procurement Analysis

Table 3 shows that the time required to procure a full scope DBB ATC is roughly 10 months. Whereas, the limited scope DBB ATC was roughly 6 weeks. Thus, it can be concluded that the decision to permit full scope ATCs has a measurably longer time frame to permit interested contractors to generate their alternatives and to permit the DOT time to evaluate and approve those that it finds attractive.

Table 3 Case Study Project Timelines (Hitt 2012).

Event	Hurricane Deck Bridge Date	US 10 Date
Contractor Information Meeting	February 10, 2011	April 10, 2013
Commission Confirms Base Design	March 1, 2011	-
30% Plans Posted on Website	March 1, 2011	-
Contractor CATC meetings start	March 1, 2011	April 10, 2013
60% Plans Posted on Website	May 27, 2011	
Last day to submit ATCs	August 15, 2011	May 3, 2013
Pre-bid deliverables due	November 10, 2011	May 10, 2013
Bids Due	December 10, 2011	May 22, 2013
Total Time Elapsed	303 days	42 days

4.2 Case Study Process Analysis

Figures 1 is a genric DBB ATC solicitation, submittal, evaluation and approval process seen in each DOT. MoDOT process occurs in four project development and delivery phases. The process starts with ATCs announcement inclusion on a given project together with the posting of current plans to permit contractors to get familiar with the project and begin developing ATCs. Conceptual ATCs (CATC) are then received and expeditiously reviewed and approved to provide contractors quick decisions on their ideas attractiveness to MoDOT. CATCs are discussed in confidential one-on-one meetings which are then followed by formal ATC submission, evaluation, and approval. Once approved, MoDOT advances the ATC-modified design to a stage where biddable quantities could be produced. It is then the contractor's decision whether or not to bid the approved ATC. If the contractor wins, MoDOT completes the redesign to finalize the construction documents (FHWA 2014). MDOT uses essentially the same process with the major difference being the amount of time allotted to evaluation and approval as shown in Table 3. Therefore, one can conclude that the amount of time allotted to the ATC process is directly related to the amount of scope that can be changed by ATCs.

4.3 Case Study Discussion

The case studies provide good examples of two different ATC approaches implemented successfully in DBB projects. The key motive for ATC implementation in both is early contractor involvement in generating scope changes and the cooperative effort to find a best value innovative solution. MoDOT's ATC approach showed that obtaining early contractor involvement is possible on a traditional low bid DBB highway project. Such an approach also was strongly supported by its local design and construction industry partners; in the words of one Missouri contractor, "We elected to pursue ATCs because we felt

we could derive a solution that would be more economical for us to build than the baseline design" (Hitt 2012).

However, based on the two cases, key elements emerge for ATCs successful implementation (1) environmental process, (2) time commitment for project delivery, (3) confidentiality, and (4) design liability. As NEPA came largely into play with an ATC that involved the realignment of the Hurricane Deck bridge, MoDOT had to handle environmental procedural issues in a manner that did not compromise the confidentiality of the ATCs. It also had to maintain high levels of internal collaboration between planners, designers, and construction personnel as well as continuous evaluation impending NEPA commitments against their possible impact on potential ATCs. One of the instrumental factors in an agency's culture with respect to environmental process change is the willingness of upper management to support fundamental changes in historic agency design standards.

The Figure 1 procurement framework shows that providing contractors adequate time to develop and refine their proposed ATCs is critical to the process. Contractors need more time than the amount in a routine bidding period to explore potential ATCs and to get approvals from the agency to proceed. It is seen how time frames are highly dependent on the scale and type of the project, together with the individual agency and contractor capabilities. Whether the process involves a full or the limited scope approach, confidential one-on-one meetings are instrumental in an ATC process to vet possible ATC concepts. Both agencies addressed confidentiality by different means such as having different teams on different design proposals in MoDOT's project or the confidentiality agreements used by MDOT. The last important aspect is the issue of design liability for the proposed ATC design. MoDOT assumed full liability of design development in its full scope approach, and MDOT decided to have the proposing contractors fully develop their designs using approved MDOT consultants. Lastly, both DOTs found that permitting contractors to bid the baseline design was important to keep contractors who don't understand/trust the ATC process in the competition.

5 CONCLUSIONS

The aim of this paper is to detail the ATC process applied to DBB projects in Missouri and Michigan and accordingly propose a framework for a generic DBB ATC founded on the outcome of the two case studies. Two projects were selected; Missouri's Hurricane Deck Bridge project in and Michigan's US-10 Rehabilitation project. Both projects implemented ATCs in DBB yet using two different approaches: a limited or full scope approach. MoDOT allowed contractors to propose ATCs without limitation while MDOT Michigan chose only to consider ATCs on the MOT. Through analyzing both projects, three major conclusions are reached. First, both approaches are proven to be successful through generating tangible cost and/or time savings for each DOT. However, limited scope ATCs will prove easier to implement on DBB projects for an agency trying it for its first time as it provides a mechanism to experiment with the DBB ATC process and gain the required understanding of the mechanics of the procurement without increasing the risk the agency must assume. The impact found by the Michigan limited scope approach case was to essentially extend the 30 day bidding period by 12 days. Second, ATCs can be implemented at any level if the agency thoughtfully develops the project's solicitation documents. The clarity of the instructions and the proposal requirements such as the EPA and permit requirements/constraints are key issues that need to be addressed in the solicitation documents. Finally, the analysis of the two cases emphasizes the importance of confidentiality and one-on-one meetings to the success of the ATC process.

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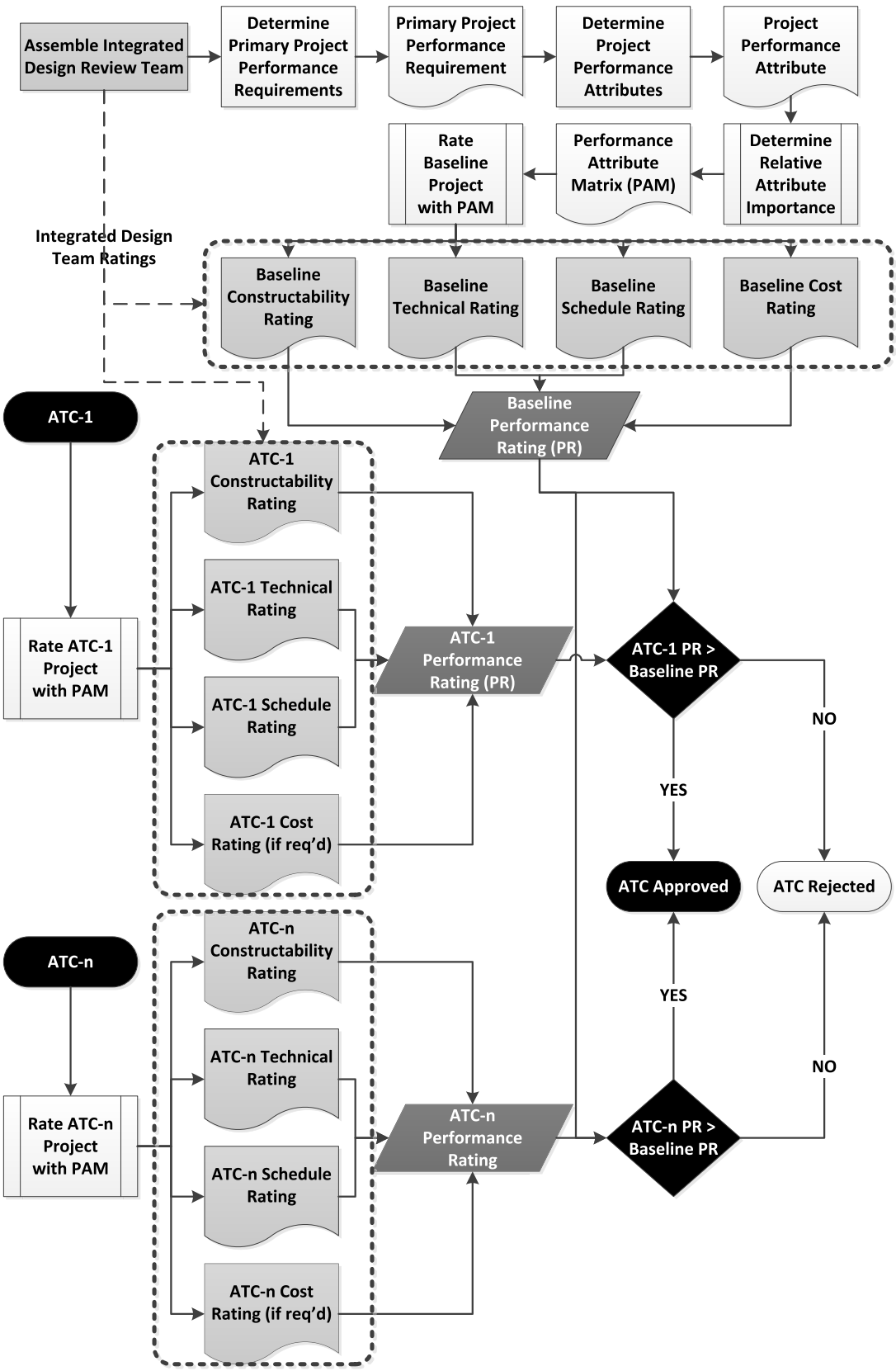

Figure 1: Generic ATC Process

References

Carpenter, J. 2012. Annual Report on Alternate Technical Concept Programmatic Waiver, SEP-14 Progress Report. Washington State DOT, Olympia, WA, January 31, , 6pp.

Christensen, M.R. and L.E. Meeker. 2002. Design/Build Projects—Lessons Learned from the Contractor's Perspective. Proceedings, American Railway Engineering and Maintenance-of-Way Association, Lanham, MD. USA **1**:14.

Coblentz, M.A. 2012. Alternative Technical Concepts Used on the ICC Project. 2012 Transportation Research Board, Paper # 12-6806, National Academies, Washington, DC. USA, **1**:1-17

Federal Highway Administration (FHWA). 2012. Alternative Technical Concepts. Unpublished Presentation. Every Day Counts 2, US Department of Transportation.On-line, Available: http://www.fhwa.dot.gov/accelerating/presentations/atc/ [April 21, 2013].

Federal Highway Administration (FHWA). 2014. *Design-Bid-Build Alternative Technical Concepts Guidebook*, Unpublished draft, Washington, DC. USA.

Government Accountability Office (GAO) 1991. *Using Structured Interviewing Techniques*, GAO/PEMD-10.1.5, Government Accounting Office, Washington, DC. USA.

Hitt, R. 2012. Alternative Technical Concepts and Design-Bid-Build. Unpublished presentation, FHWA Every Day Counts Summit, Kansas City, MO.

Hoffman, B., Dillon, J., Kreienheder, B., Manka, D., and Chirpich, A. 2009. Early Contractor Involvement (ECI) for Civil Works. Presentation, Industry Workshop, US Army Corps of Engineers, New Orleans, LA.

Horn, G. 2010. *New Mississippi Bridge Project ATC Analysis*. SEP-14 Report, Missouri DOT. Jefferson City, MO, USA.

Massachusetts Department of Transportation, (MassDOT). 2012. *Longfellow Bridge Rehabilitation Phase II Request for Proposals*, Boston, Massachusetts, USA.

McMinimee, J.C. et al. 2009. *Best Practices In Project Delivery Management*. NCHRP Project 20-68A, Scan 07-01, Transportation Research Board. Washington, DC. USA.

Michigan Department of Transportation (MDOT). *Notice to Bidders, US-10 Midland County Alternate Technical Concept (ATC) Process for Maintaining Traffic along US-10*. 2012. C.S. 56045 (56044 & 37032) - J.N. 106848A (107607A, 108695A, 110434A, 115141A, 115135A), Lansing, Michigan. USA.

Missouri Department of Transportation (MoDOT).2011. *Hurricane Deck Bridge Replacement Project, ATC Meeting*. On-line: Available at: http://www.modot.org/central/major_projects/camden.htm

West, N.J.N., Gransberg, D.D., and McMinimee, J.C. 2012. Effective Tools for Projects Delivered Using the Construction Manager/General Contractor, *Transportation Research Record*, Journal of the Transportation Research Board, National Academies **2268**: 33-42.

Yates, J. K. and Battersby, L. C. 2002. Master Builder Project Delivery System and Designer Construction Knowledge. *Journal of Construction Engineering and Management*, ASCE, **129**: 62 -71.

Yin, R. K. 1994. *Case Study Research: Design and Methods*, Sage Publications. Beverly Hills, CA, USA.