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Submittal and Evaluation Procedures for Alternative Technical Concepts

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Abstract
Alternative technical concepts (ATCs) have yielded innovative solutions to complicated design issues in a wide range of highway projects. Through ATCs, proposers are allowed to suggest modifications to a contract requirement to provide a project design equal to or better than the one described in the solicitation. However, the realization of such benefits requires a well-structured ATC mechanism, and the project's solicitation documents need to be drafted in a manner that clearly communicates the owner's project goals and ensures fairness and confidentiality to competing contractors. This paper describes the submittal, evaluation, approval, and review procedures currently followed by state transportation agencies to implement ATCs. The study employed a survey that was sent to all state departments of transportation (42 of which responded), in addition to a content analysis of the solicitation documents of 65 ATC projects from 24 agencies. The paper finds that care must be taken to ensure that competing contractors are not discouraged from pursuing ATCs as a result of onerous documentation requirements for ATC submittals. The results also show that the ATC submittal procedures should provide detailed guidance on the conduct and character of one-on-one meetings with competitors, the content of a responsive ATC submittal, and the procedures for the rectification of errors, omissions, and ambiguities. The document should also be clear about what constitutes an ATC and describe the ATC evaluation and review process, as well as the process for presenting proposed ATCs. The ATC evaluation criteria should be known when the solicitation is first published.

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SUBMITTAL AND EVALUATION PROCEDURES FOR ALTERNATIVE TECHNICAL CONCEPTS

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ALTERNATIVE TECHNICAL CONCEPTS SUBMITTAL AND EVALUATION PROCEDURES: A CRITICAL ANALYSIS

ABSTRACT

Alternative technical concepts (ATCs) have proven to yield innovative solutions for complicated design issues in a wide range of highway projects. Through ATCs, proposers are allowed to suggest modifications to a contract requirement resulting in 'equal to or better' project design compared to the one described in the solicitation document. However, to realize such benefits requires a well-structured ATC mechanism, and the project's solicitation documents need to be drafted in a manner that both clearly communicates the owner's project goals and ensures fairness and confidentiality to competing contractors. This paper describes the submittal and evaluation/approval/review procedures currently followed by state transportation agencies to implement ATCs. The study employed a survey that was sent to all state departments of transportation (DOTs) (42 of which responded), in addition to content analysis of solicitation documents of 65 different ATC projects in 24 DOTs. The paper finds that care must be taken to ensure that competing contractors are not discouraged from pursuing ATCs due to onerous documentation requirements for ATC submittals. Results also show that the ATC submittal procedures should provide detailed guidance regarding the conduct and character of one-on-one meetings with competitors, content of a responsive ATC submittal, and procedures for rectifying errors, omissions, and ambiguities. The document should also be clear on the ATC evaluation and review process describing what constitutes an ATC, as well as the process for presenting proposed ATCs. Lastly, ATC evaluation criteria should be known when the solicitation is first published.

INTRODUCTION

The increased use of alternative delivery for transportation projects is the result of the need to rapidly renew the nation's deteriorating highway infrastructure. State DOTs are implementing design-build (DB), construction manager/general contractor (CMGC) (also termed construction manager at-risk or CMR) and design-bid-build best-value (DBB-BV) contracts to increase integration of the design and construction industry's ideas for alternative design and construction solutions to highway projects. The Federal Highway Administration's (FHWA) *Every Day Counts* program identified and encouraged the deployment of methods for decreasing project delivery duration, increasing roadways safety, and safeguarding the environment (*1*). Alternative Technical Concepts (ATCs) is one of the methods proven to yield substantial innovative design solutions for a wide range of construction projects problems (*2, 3, 4, 5*). Actis et al. (*6*) defines ATCs 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." An ATC 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 CMGC and DB) document.

In a pre-bid meeting, the Missouri Department of Transportation (MoDOT) explained its motivation for including ATC in the design-bid-build (DBB) project to replace the Hurricane Deck Bridge over the Lake of the Ozarks in the form of the following equation:

"**BOLD** Approach = Industry + MoDOT = One Team = Best Value" (*7*)

Subsequently, MoDOT accepted several bold ATCs including two that proposed to the bridge's baseline alignment. The low bidder's ATC realignment resulted in a bid $8.0 million under the engineer's estimate for the baseline design. Two of the five bidders did not propose ATCs and their bids were roughly $10 million over the low bidder. MoDOT's Hurricane Deck Bridge proved that gaining early construction contractor input to a project's final design reaps benefits to both the agency and the taxpayer.

From the agency's perspective, ATCs are seen as "…a great partnering opportunity to involve our industry partners, and we can both benefit from the flexibility and upfront opportunity to ensure low bid" *(4).* On the other side, a paper by Papernik and Farkas (*8*) furnishes the following industry perspective understanding of ATC procurement policies:

> "Proposers are motivated to propose confidential ATCs which add value to the project owner because the ATCs can give them a competitive advantage over other proposers. Absent such a process, although the successful proposer could still share its ideas with the owner after it is selected; there is less incentive to do so once it has already won the job. Furthermore, under that approach the owner would only get the benefit of one proposer's ideas, instead of getting ideas from multiple proposers. Finally, any cost savings would not help drive down the initial pricing -- a significant consideration given that a high initial project cost may mean that the contract is never awarded." (8)

That quote makes two arguments for grounding ATC procurement policy on confidentiality that permits competing contractors the ability to gain a competitive edge from their innovative concepts before contract award. On one hand, the agency gains only one contractor's ideas to improve the project after award and on the other; the industry's low-bid culture makes pre-award competition of ATCs more effective by driving down the contract award cost rather than post-award value engineering adjustments of the contract price.

Taking the above perspectives in the context of selecting a project delivery method, the idea of using ATCs to leverage the potential benefits of alternative project delivery becomes

logical. Previous research (*9*) found that owners select DBB when the need to maximize price competition is present; DB when there is a "need for speed;" and CMGC when constructability is essential. Hence, DOTs can also use ATCs to lower the cost, accelerate the schedule, or design a constructable project on a project-by-project basis. ATCs provide a mechanism that allows the contractor to change the design. They also create an ability to manage an unacceptable risk by "removing it from the project" and replacing it with an acceptable risk (the ATC). Lastly, ATCs decrease the chance that cost will be increased by added risk-based contingencies.

However, to actually realize such benefits, the project's solicitation needs to be structured in a manner that both clearly communicates the owner's project goals (*10*) and provides a mechanism for the design and construction industry to achieve the owner's goals by developing approaches to project execution that enhance their competitive edge (*11*). Agencies must be careful in articulating the details of their evaluation system to avoid potential protests. Addressing this and ensuring equity and confidentiality led agencies to develop ATCs guidelines and procedures for ATC successful employment. *This paper details a comprehensive investigation of the submittal and evaluation/approval procedures and review process currently followed by state transportation agencies (STAs) to implement ATCs for transportation projects.* Such information is further used to identify successful practices to manage the ATC solicitation/evaluation/approval process in a fair, equitable, and transparent manner.

METHODOLOGY

The information contained in the paper springs from three autonomous sources: a comprehensive review of the literature, a survey of DOTs, and a formal content analysis. First, the literature review benchmarked both the current state-of-the-practice and historic information regarding ATCs. The output of the literature review was used to create a web-based survey questionnaire using Oppenheim's principles of questionnaire design (*12*). The questionnaire sought to identify submittal and evaluation procedures followed by STAs for delivering construction projects using ATCs. The survey consisted of four major sections. The first section recorded respondents' demographic information and ATC use. The second section focused on agency ATC procurement policies and procedures. The third section was devoted to ATC procurement selection. The last section collected ATC project contracting information. This paper will only discuss the submittal and evaluation procedures.

The targeted population was the state DOTs and the sample consisted of DOT employees involved in the procurement/innovative contract delivery process. The survey mode entailed three waves: (1) an email with an explanatory cover letter and a link to a web-survey, (2) one week later, a follow-up email was sent to non-respondents, emphasizing the importance of their participation and requesting their response and finally (3) Non-respondents were contacted by phone. Surveys were emailed to 50 DOTs, American Samoa, and D.C. Of these 52, 42 DOT responded (84% response rate). Additionally, responses were received from all three Federal Lands Highway Divisions.

Twenty-eight DOT policy documents were found. Those policies along with 65 solicitation documents from 24 states were reviewed using Neuendorf's (*13*) structured content analysis protocol, whose purpose was to develop "valid inferences from a message, written or visual, using a set of procedures" (*12*). First, a set of standard categories, into which words that appear in the procurement or policy document can be placed, is developed. Then, the frequency of a given word's appearance is used to infer the content of the document (*13*).

RESULTS & DISCUSSION

This section reports the principles, and guidelines currently followed by STAs to implement ATCs classified in three areas (1) submittal procedures, (2) evaluation and approval guidelines and (3) review process.

ATC Submittal Procedures

Procedures for submitting ATCs vary between agencies and between project delivery methods. It was obvious from the content analysis of DOT policy documents that care needs be taken to ensure that competing contractors are not discouraged from pursuing ATCs due to onerous documentation requirements. For example, DOTs in Florida, Massachusetts, Missouri, North Carolina, Ohio, and South Carolina provide for a preliminary/informal contact with competitors where potential alternatives are suggested, vetted, and a determination is made whether or not the potential ATC is something that the agency could possibly approve if it is formally developed and submitted. The Alaska DOT's policy document (*14*) states: "Allowing the Proposers a forum in which to initially discuss potential solutions can help to ensure that the Proposal comes as close [as] possible to matching [the] DOT's desires."

The content analyses showed that ATC submittal procedures provide guidance in three basic areas. First, the conduct and character of meetings with competitors is covered to set the stage for ATC discussions. Next, the precise content of a responsive ATC submittal is specified so that the contractors can estimate the resource requirements and effort necessary to prepare a responsive ATC. Finally, procedures for addressing errors, omissions, and ambiguities found in the solicitation document are described to ensure that issues found in the baseline design do not become the competitive edge for the party that first identifies them.

Table 1 contains a summary of the information gleaned from the solicitation document content analysis regarding ATC procedures described for specific projects. It is seen that ATCs have been successful implemented in nearly all types of PDMs. It also shows that ATC implementation is not a function of project type with virtually even distribution between road and bridge projects. The one tunnel and seven "other" projects ranged in type from a traffic management system to an airport. Finally, the results show that ATCs can be implemented using IFB, RFQ, and RFP solicitation document types. Survey results regarding advertising and awarding contracts with ATCs also show that adding ATCs to DB projects does not typically change the 2-step RFQ/RFP process encouraged by FHWA (*15*). Since the national experience with DBB ATCs is limited to a single DOT, Missouri, the only information on this topic comes from that agency. That information is further constrained because MoDOT chose to retain full responsibility for advancing ATC design changes to a point where biddable quantities can be generated. As a result, it seems that awarding DBB contracts involving ATCs boils down to the agency making the following two decisions:

1. The permissible amount of variation from the baseline design.
2. Whether the agency or the contractor will furnish the post-award final design documents for approved ATCs.

While Missouri chose to retain design responsibility, there appears to be no technical reason why an agency could not assign that responsibility to the contractor. Legal issues requiring answers before deciding to place ATC design responsibility on the contractor will be very specific to the jurisdictions in which the approach is implemented. DBB ATCs require an early approval decision before design has advanced to a point where the cost of lost design effort exceeds the benefit brought by the ATCs. However, the magnitude of the savings recorded on MoDOT projects and the fact that DBB remains the predominant project delivery method in

transportation shows that there is a pressing need for research on the various legal and contractual issues surrounding the use of ATCs on DBB projects.

TABLE 1 Solicitation Document Content Analysis Summary

Information Item	**Number of Observations (65 total)**				
Project Delivery Method	**DBB**	**CMGC**	**DB**	**P3**	**Other**
	1	6	50	6	2
Solicitation Type	**IFB**		**RFQ**		**RFP**
	1		4		59
Project Type	**Bridge**	**Road**	**Tunnel**		**Other**
	29	28	1		7
Information Item	**Number of Observations (65 total)**				
	Yes		**No**		**Unclear**
ATCs permitted	65		0		-
Confidential one-on-one meetings authorized	43		22		-
Agency reserves right to amend solicitation to correct errors, omissions, and ambiguities found during ATC process	18		25		22
Competitors are allowed to request confidential clarifications of solicitation document without submitting an ATC	13		20		32
Base proposal in addition to ATC required	12		12		41
Total number of ATCs is restricted	6		49		10
Approved ATCs required to be included in proposal	8		39		18
Agency ATC response time specified	19		46		-

The remainder of this section will report the findings of the content analyses and the survey with respect to ATC submittals mainly handling errors, omissions, and ambiguities, and the content of ATC submittals.

Solicitation Document Errors, Omissions, and Ambiguities

One advantage of the ATC process is the ability to identify issues with the solicitations such as errors, omissions, and ambiguities before the contract is awarded and these become potential compensable changes. Most of the solicitation documents reviewed in the content analysis contained a clause reserving the right to correct errors found in the confidential one-on-one process or submittals prior to award. A passage from the Alaska DOT's DB manual is typical:

> "These meetings may be kept confidential when discussing solution-specific issues. Allowing the Proposers a forum in which to initially discuss potential solutions can help to ensure that the Proposal comes as close to possible to matching DOT&PF's desires. If errors or inconsistencies in the proposal are noted then this information should be made available to all Proposers" (*14*).

The FHWA's understanding of the ATC process also acknowledges the need to make corrections to the solicitation found in confidential meetings if appropriate (*16*). The Florida DOT "reserves the right to disclose to all Design/Build Firms any issues raised during the ATC meetings, except to the extent that FDOT determines, in its sole discretion, such disclosure would reveal confidential or proprietary information of the ATC" (*17*).

ATC Submittal Content

The best source of information for ATC content was the solicitation document content analysis since each document contained instructions to proposers on how to assemble the necessary information to permit an agency to review an ATC. TABLE 2 details that analysis and shows that nearly all the solicitation documents required some form of narrative explanation of the proposed ATC, as well as most also required drawings or sketches of the ATC and how it relates to the current project design. Next, 51 of 65 documents asked that explicit requests for the necessary design deviations needed to implement a given ATC to be specified in the ATC proposal. Lastly, the majority of the solicitations also asked the contractor to detail the impact of the proposed ATC on the project schedule, right-of-way (ROW), and permits.

TABLE 2 ATC Submittal Content from Solicitation Document Content Analysis

Submittal content	# of Documents		
	Yes	No	Unclear
Preliminary Concept	8	30	27
Narrative Explanation	63	0	2
Drawings	55	6	4
Cost data	31	26	8
Identify Deviations	51	4	10
Schedule Impact	47	7	11
ROW Impact	45	8	12
Permit Impact	51	3	11
Approved ATC Required in Proposal	8	39	18

Roughly, half the solicitation documents asked for cost data to be submitted with the ATC. This shows that there are two approaches to the issue of providing cost impact data with a formal ATC proposal:

1. Cost data is required to prove that the given ATC will accrue actual savings or to prove that it fulfills the minimum cost savings constraint contained in the solicitation.
2. Cost data is excluded to provide a purely technical appraisal of the ATC and then the subsequent bid price will contain the ATC if approved.

There are several advantages and disadvantages of both approaches. The main advantage to requiring cost data is that it furnishes the agency with order of magnitude information, which may aid in its review and decision process and ensure that the agency is not overwhelmed with too many small ATCs to review and approve, or in the case of a DBB ATC project, too many small details that require incorporating into the final project design. The primary disadvantage is that when evaluators know the cost of a new concept it may influence their decision in some manner. The American Consulting Engineers Council (*18*) opines: “When price is on the table it trumps other considerations, even quality and innovation.”

The primary advantages to not having cost data is that the evaluation is purely technical in nature and if any given ATC is approved, there is no expectation of specific cost savings since the ATC becomes part of the specific contractors bid price. The disadvantage is that there is no easily measured limitation on the number of ATCs if the solicitation document does not explicitly set a limit on the total number from each competitor. The above analysis leads to the inference that if cost data is not needed in the ATC evaluation process, then establishing a limit

on how many ATCs can be submitted would be an effective practice to protect the agency from being "nickel and dimed to death" with a multitude of minor ATCs.

ATC Evaluation and Approval

The process for evaluating and approving ATCs is best detailed in the project solicitation's instructions to proposers. The fundamental information necessary in these instructions has four components:

1. Guidance on Baseline Design and Proposals, if necessary

Given the definition of an ATC, the proposed concept requires a change to the solicitation to qualify. Thus, there will need to be a tangible benchmark against which this test can be measured. The Federal statute 23CFR§ 636.209(b) says agencies "may allow proposers to submit ATCs in their proposals as long as these alternative concepts do not conflict with criteria agreed upon in the environmental decision making process. ATC proposals may supplement, but not substitute for base proposals that respond to the RFP requirements." Thus, ATCs are measured against a baseline design scope of work, and to be compliant with the statute, proposers will submit a proposal for the baseline design as well as the design as modified by approved ATCs.

A number of states have requested programmatic waivers through the FHWA's Special Experimental Program 14 (SEP-14). Washington State is one and cited the need to "avoid unnecessary costs and diversion of resources required for proposers to advance a base design that will ultimately not be used" (*2*) as justification. Maryland is another state that sought and received an SEP-14 waiver from requiring two proposals. It designed its ATC approval process in the following manner to ensure it met the requirements of the waiver.

> "The waiver of FHWA's requirement to furnish a base proposal provided each proposer the opportunity to submit ATCs for pre-approval and then to submit a proposal with or without ATCs. The SHA's procurement process was carefully crafted to avoid any potential unfairness. Pre-approval of deviations, from design requirements that otherwise would be deferred until after the contract is awarded, was required as part of this process. The proposed ATC process gave the SHA the ability to factor the proposers' technical solutions into the selection process, allowing a true "best value" selection; and gave the SHA access to solutions from all proposers. It also gave the successful proposer a head start on implementation of its ATCs, and avoided unnecessary costs for proposers to advance a base design that was not used" (*19*).

The solicitation document content analysis found that 12 of 65 documents required the statutory baseline proposal. Those 12 were DB RFPs. The baseline design is a different issue in DBB project ATCs. MoDOT recommends that "[c]aution must be used to make sure baseline designs are finalized prior to any ATC submittal on that design element… Any significant alterations could affect the savings on the ATC design… Any changes could possibly be construed as co-opting the contractor's proposal" (*5*).

2. ATC Evaluation Process Description

The content analysis found that some agencies ask competing contractors to submit preliminary ATCs, which are then given a cursory review resulting in a recommendation to the submitter as to whether the concept was worth pursuing and the effort needed to submit a formal ATC proposal was warranted (*20*). The solicitation document content analysis found eight documents (Massachusetts, Missouri, North Carolina, Ohio, and South Carolina) specifically cited the need

to submit preliminary ATCs as part of the evaluation process and the survey did not address that question. Figure 1 is a generalized ATC evaluation and review process based on a synthesis of the processes described in the literature. Figure 1 assumes that ATCs are received before the one-on-one meetings. There are cases where the preliminary and formal ATCs are actually received for the first time at the meeting. Regardless of the case, it is important for the proposers to know exactly when and where the proposed alternatives will be presented. It is also critical that the criteria for evaluating the ATCs be known when the solicitation is first published (*2*, *20*).

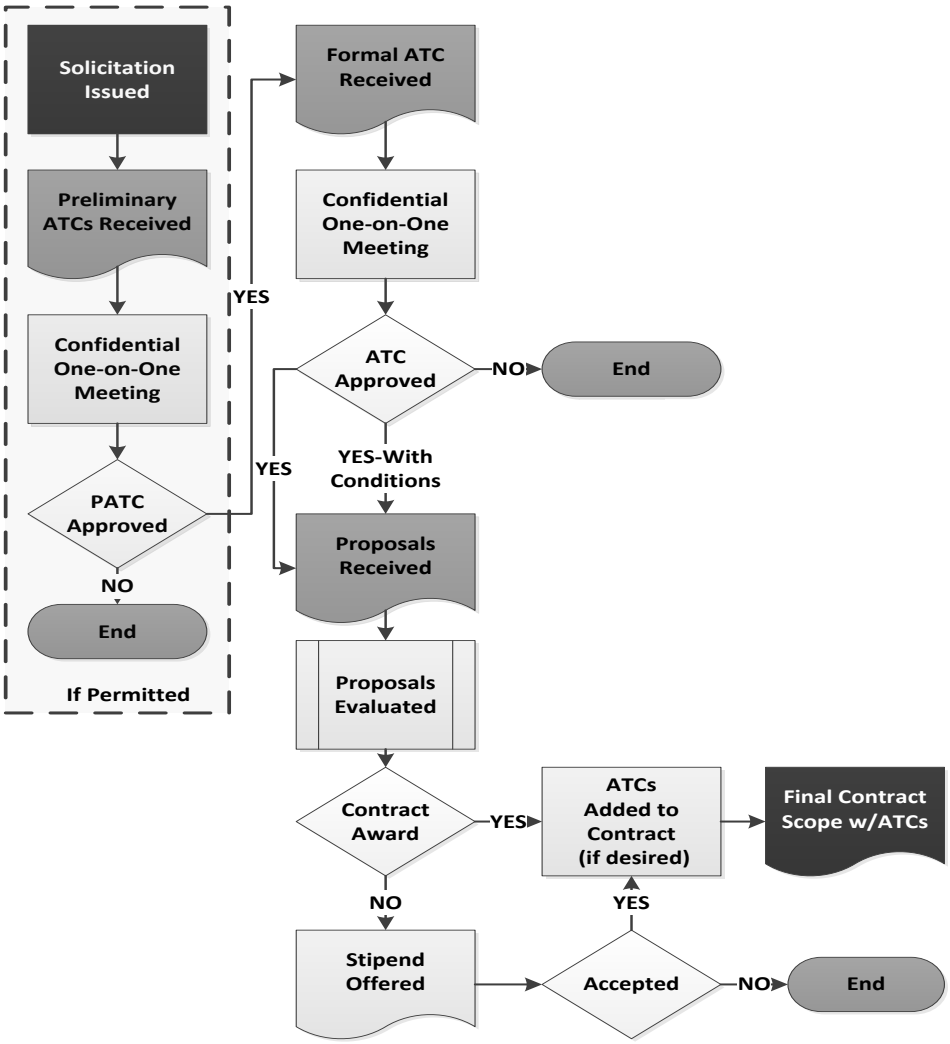

FIGURE 1 Generic ATC Evaluation and Review Process

3. ATC Evaluation Factors

The primary factor cited in the solicitation document content analysis is that "ATCs must be 'equal to or better than' the original requirements of the contract documents included in the procurement package" (*8*). Many agencies qualify that statement by setting the standard as purely the agency's sole discretion (*21*). The next most common factor dealt with the issue of deviations for cited design criteria and other documents. There were two approaches found in the analyses. The first approach merely specified that deviations from published criteria were not

authorized. The second approach was to spell out the process for getting approval for a deviation from project design criteria as in MoDOT (*22*):

> "ATC's requiring new Design Exceptions must receive both MoDOT and FHWA approval. Any new design exceptions must be offset by elimination or reduction of existing design exceptions elsewhere in the project. Any combination of existing and new design exceptions must be equal to or better than the existing design as determined by MoDOT" (*22*).

The Maryland SHA expanded its definition to permit consideration of ATCs that not only deviated from design criteria but also project requirements using the following verbiage:

> "The Administration did not approve any ATC that entailed a deviation from the requirements of the RFP, unless the Administration determined, in its sole discretion, that *the proposed end product based on the deviation was equal to or better than the end product absent the deviation*" (*19 italics added*).

More commonly, agencies described those elements of the baseline design that could not be changed as in the MoDOT's Missouri River Bridge I-70 Interchange project in St. Louis:

> "The following geometric design components are off limits to change due to an ATC:
>
> a. The grade and alignment of the tie-in of the eastbound/westbound ramps (parkways) at Cass Avenue shall not change from as shown on contract documents.
>
> b. The grade and alignment of the tie-in of the eastbound and westbound ramps at the Missouri Approach to the MRB shall not change as shown on the contract documents.
>
> c. Unless it is a weekend closure due to a bridge demolition, at least two lanes of traffic in each direction on Interstate 70, 55 and 44 throughout the project area shall be maintained at all times.
>
> d. Any change shall be compatible with the Phase II full-build interchange." (*22*)

Lastly, the system for evaluation and the range of possible outcomes for evaluated ATCs was included in most of the solicitation documents.

4. Solicitation Amendment for Approved ATCs

The survey found that very few DOTs reported the need to amend their solicitation after an approved ATC. One of the reasons cited by the FHWA for confidential one-on-one meetings is that the dialog helps the agency to better understand "what RFP change is being requested and this helps the Agency understand if any RFP amendments would be appropriate" (*16*). Thus, the decision on whether or not information brought to the agency's attention warrants an amendment to the solicitation is really a determination of whether the ATC originates from an error, omission, or ambiguity in the solicitation or if it is indeed a change to the scope of work. The Florida DOT confirms this assertion in its DB manual when it states: "The Department reserves the right to *disclose* to all Design/Build Firms *any issues raised during the ATC meetings*, *except* to the extent that FDOT determines, in its sole discretion, such disclosure would reveal *confidential or proprietary information* of the ATC" (*17 italics added*).

The literature indicated that contractor design input contributes to an effective design and reduces errors and omissions through the input of construction knowledge (*23*). Furthermore, West (*24*) argues that "contractor design input is [a] benefit… because it enhances constructability and innovation and creates potential for cost savings through effective design solutions." One reason that the Massachusetts DOT (*25*) chose to implement ATCs was "to

avoid delays and potential conflicts in the design." Thus, it seems that implementing ATCs with confidential one-on-one meetings 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 (*24*) words, the practice creates a "form of price clarification, eliminating confusion and potential misunderstanding by mandating information-rich communications."

ATC Review Process

The process for evaluating ATC has three major components:

1. *ATC Review Team:* Pulling a team together to review ATCs is not as simple as it sounds. Not only are members that are technically qualified to determine the viability of proposed concepts required but there also is a need for members who can evaluate the impact of each ATC on environmental permits, ROW, third-party impacts, as well as the legal requirements to properly incorporate the ATC into the construction contract. First critical aspect is to separate the proposal evaluation panel and the ATC review panel to avoid the appearance of impropriety. Another aspect that may be considered is the presence of observers from outside the agency. Minnesota and Utah are two states whose enabling legislation for CMGC and DB require outside membership on selection panels. Additionally, the potential exists that ATC evaluation panels might have representatives from the FHWA, state resource agencies, and local government. To cover this eventuality, the Texas DOT includes the following clause in their solicitation:

> "…[competitors] are advised that observers from federal or other agencies, including representatives of local agencies and municipalities, may observe the… evaluation process … FHWA has agreed to take reasonable steps to prevent this information from becoming a public record. Outside observers, including any advisors to FHWA, will be required to sign TxDOT's standard confidentiality agreement" (*26*).

As cited in the TxDOT clause, the issue of confidentiality will need to be addressed for any outside observers. The strength of TxDOT's approach to this issue is that by stating the possibility that individuals that are external to TxDOT may be present, the agency effectively puts all proposers on notice that it cannot guarantee complete confidentiality except through its nondisclosure agreement. In doing so, it puts the competitors in a position of needing to vet every potential ATC to ensure that proprietary information is not accidently leaked outside the ATC evaluation panel, and on the downside, this might cause some to opt to not propose certain ATCs because of the external observers presence.

2. *Preconstruction Milestone Development:* When an agency decides to implement ATCs on a specific project, it will need to verify the procurement schedule and ensure sufficient time for the development of ATCs by industry and the subsequent review by the agency. Understanding that the time frames are highly dependent on both the scale and type of project as well as project delivery method and individual agency capabilities. For example, since CMGC projects do not require the contractor to commit to a price until after the design is fundamentally complete (*27*), there is no need to technically evaluate ATCs before awarding the CMGC preconstruction services contract. The solicitation document content analysis found that the average period between CMGC RFP release and proposal due date ranged between 21 and 55 days (3 to 8 weeks) with an average of 40 days (6 weeks). The solicitation document content analysis found that the average period to prepare and submit ATCs for DB projects after RFP

release was 47 days (7 weeks) within an overall proposal period of 90 days (13 weeks). Some states extended the time for proposers to consider potential ATCs to 168 days (24 weeks) by releasing a draft DB RFP prior to the final RFP release.

3. *ATC Design Information Management:* The management of the ATC design review process can be likened to traditional value analysis conducted during the design phase of a DBB project. Lee et al. (*28*) define value analysis as: "a systematic analysis of a project, product, or process aimed at improving quality and performance and reducing operation, maintenance, and life-cycle costs and environmental impacts." Essentially, the goal for the agency ATC reviewers is to determine if the concept under review will furnish the required technical functionality while accruing a benefit to the overall project in terms of cost, schedule, or life cycle savings. Neither the survey nor the content analyses furnished detailed information of the procedures currently in use on the topic of managing design information flow during ATC review. Therefore, the remaining discussion is drawn from the literature and placed in the context of the greater picture painted by the previously discussed output from the other research instruments.

ATC Value Analysis

Value analysis is one of the two major concepts found in the literature that apply directly to ATC reviews. The other is termed "integrated design" (*29*). ATCs are indeed an integration tool because, even in a DBB project, they become a mechanism where the owner, designer, and contractor come together before setting the project's price to investigate potential ideas to improve overall project technical, cost, and schedule performance (30). While the typical ATC does not involve the complete redesign of a given project, taking the fundamentals of value analysis and integrated design together and focusing them on the specific alternative concept under evaluation provides a framework for the management of ATC design reviews to be conducted.

The California Department of Transportation (Caltrans) uses performance attribute matrices as the central focus of its value analysis methodology (*28*). Caltrans employs this technique during its design process to "provide a standardized means of identifying, defining, evaluating, and measuring performance… [through] a systematic analysis of a project, product, or process aimed at improving quality and performance and reducing operation, maintenance, and life-cycle costs and environmental impacts" (*28*). The concept of measuring potential performance of an alternative concept fits nicely with the objective of ATCs, to improve project performance. Figure 2 is derived from consolidating the Caltrans performance attribute matrix process with the integrated design process proposed by Larsson (*29*). It's essential characteristics are employing a multi-disciplinary design review team composed of the owner's personnel to provide the "strong leadership" described by Forgues and Koskela (*31*) in "establishing clear goals and objectives," and the designer-of-record's technical experts "to address all design issues flowing from the objectives" with the alternative concepts proposed by the contractor. In DBB projects, the designer-of-record would be either the owner's internal designers or the owner's design consultant. In DB, the designer-of-record would be working with the contractor to present and explain ATCs to the owner's multi-disciplinary review team.

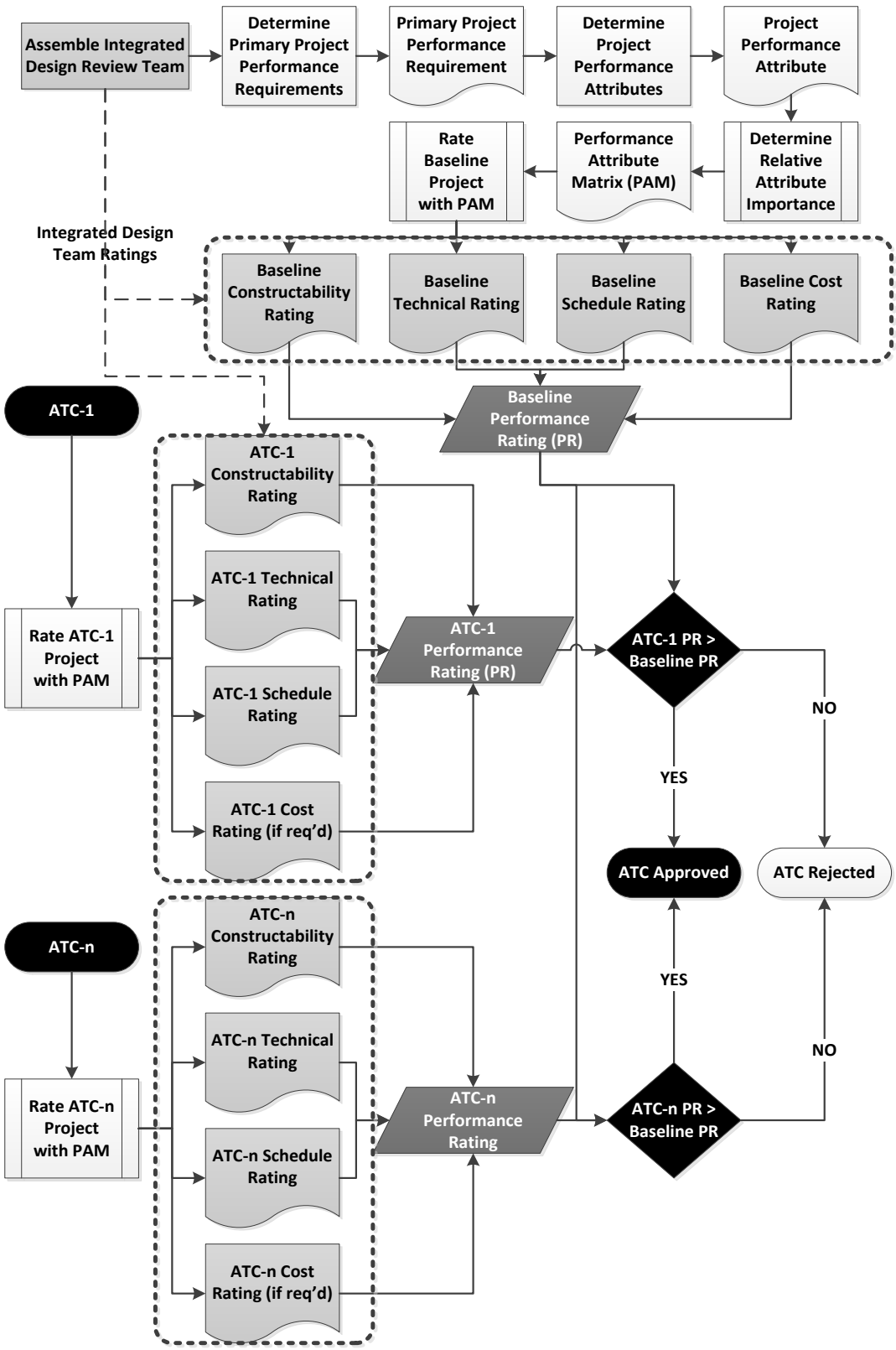

Figure 2 Hypothetical Integrated Design and Performance Attributes Based ATC Review Process

The process shown in Figure 2 involves first establishing the performance attribute matrix for the baseline design and then using that output as the foundation upon which all ATCs are evaluated. The process utilizes the assumption that for an ATC to be approved, it will exceed the performance rating of the baseline case.

CONCLUSIONS

The aim of this paper was to investigate the submittal procedures, evaluation and approval guidelines, and review processes that are followed by DOTs to employ ATCs for transportation projects. To collect information on the ATC practices employed, the study relied on three sources of information: literature review, survey of DOTs, and content analysis of RFP and policy documents. The following conclusions are drawn based on the analyses discussed in this paper:

1. Care needs be taken to ensure that competing contractors are not discouraged from pursuing ATCs due to onerous documentation requirements in the solicitation documents,
2. ATC submittal procedures was seen to provide guidance in three primary areas: the conduct and character of meetings with competitors that set the stage for ATC discussions, the precise content of a responsive ATC submittal, and the procedures for rectifying errors, omissions, and ambiguities found in the solicitation.
3. One major advantage of the ATC process is the ability to identify issues with the solicitations such as errors, omissions, and ambiguities before the contract is awarded and before they become potential compensable changes.
4. The following three fundamental instructions should be included in the solicitation document evaluation and approval section:

- Since ATCs are measured against a baseline design scope of work, the document needs to clarify whether a proposal for the baseline design needs to be submitted in addition to the proposal for the approved ATCs.
- The ATC evaluation process description should list to the proposers when and where the proposed alternatives will be presented in addition to the ATCs' evaluation criteria that should be known when the solicitation is first published.
- Definition of what constitutes an ATC evaluation factor ('equal to or better than' the original requirements) in addition to detailing how issues of deviations for cited design criteria and other documents should be included.

Future research is needed on the various legal and contractual issues surrounding the use of ATCs on DBB projects. In addition, research is needed to develop guidance on how to incorporate ATCs into the agency's procurement and technical culture and how to build flexibility into the environmental/NEPA/permitting process so that innovative design approaches contained in ATCs are not automatically squelched because they conflict with existing commitments.

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