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USE OF THE ALTERNATIVE TECHNICAL CONCEPTS IN TRANSPORTATION PROJECTS

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The use of Alternative Technical Concepts (ATC) is becoming widespread in design-build transportation projects in the United States. According to Federal Highway Administration (FHWA) ATC is a request by a proposer (usually in design-build projects) to modify a contract requirement for gaining competitive advantage over competition. The owner, usually a state department of transportation, requires that the ATC provide a better or at least equal solution to the owner's design requirements. In Design-Build (DB) projects, the ATC is usually proposed by a proposer during the Request for Proposal (RFP) process and is considered in the evaluation and selection of the proposers in conjunction with the Best Value (BV) method of selection. In this paper, the authors have focused on two case studies involving ATC implementation and negotiations with the Massachusetts Department of Transportation (MassDOT) highlighting advantages and disadvantages of using ATC in DB contracts. In each case, the nature of ATC and the approval process is discussed. In the first case, the approved ATCs provided the proposer with a clear advantage in winning a contract with the agency despite not being the low bidder. In the second case, the proposed and approved ATCs did not result in winning a contract despite being the low bidder.

Keywords: Project delivery method, ATC, Design-Build, Design liability.

1 INTRODUCTION

Most Departments of Transportation in the United States allow the bidders in design-build projects to include Alternative Technical Concepts (ATCs) in their technical proposals in order to improve project characteristics reduce costs or accelerate the delivery. The ATCs are suggestions to the project baseline design also known as Base Technical Concept (BTC), which improves project without diminishing its quality or standards. The use of ATCs goes back at least to 2001 (Carpenter 2012). More recently, the introduction of the *Everyday Counts* (EDC) initiative by the U.S. DOT with the aim of shortening project delivery duration by the use of alternative delivery methods (such as DB and CM @ Risk) has been one reason that State DOTs are using the ATCs in their projects. Also, the passage of MAP-21 (*Moving Ahead for Progress in the 21st Century Act)* in 2012, reduced the state match for federal-aid funded projects as long as innovative methods such as ATCs are used (Gransberg *et al.* 2014). These have caused a surge in the use of ATCs especially in DB projects. Given the current interest in the use of ATC, it will be useful to provide an overview of the implementation process, points of strength, and cautions on pitfalls. We will then describe the use of ATCs on two transportation projects in the State of Massachusetts and highlight the lessons learned.

2 THE USE OF ATC IN DB PROJECTS

The use of ATCs in State Departments of Transportation in the United States is widespread. While CM @ Risk and even Design-Bid-Build (DBB) projects do not necessarily preclude the use of ATC, its use has been mainly in DB projects. Design-build contractor selection process provides an effective approach for incorporating the ATC solicitation and improving the integration of the project design and construction teams. According to the FHWA (2017) website, the following states have used ATC in their large DB or Public Private Partnership (PPP) highway projects: California, Colorado, Florida, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Nevada, Texas, Utah, Virginia, and Washington.

2.1 ATC Process

Figure 1 shows the overall process for ATC consideration and evaluation (Gransberg *et al.* 2014). Some states such as Massachusetts require submission of preliminary ATC (PATC). Each ATC must be evaluated and judged better or equal than the existing contract documents with respect to criteria, which is published by the owner agency. The following Figure assumes that the DB entities have already been shortlisted in a two-step process, the first step being Submittal of Qualification (SOQ). The Solicitation Issued is synonymous to issuance of Request for Proposal (RFP) documents.

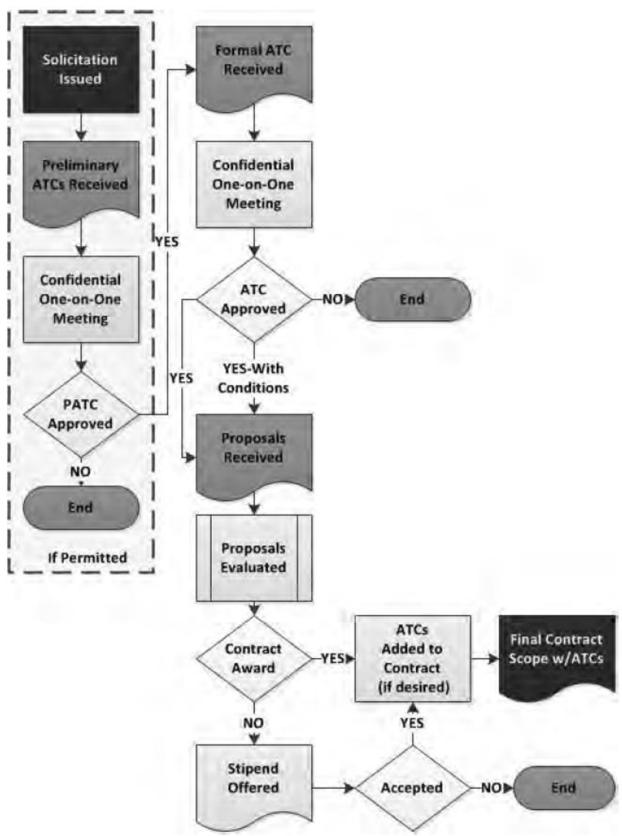

Figure 1. ATC evaluation and review process (Gransberg *et al.* 2014).

2.2 Some Legal and Contractual Aspects of ATC Usage

The DB team develops preliminary ATCs during the proposal development phase of the procurement process. One concern is the confidentiality of the ideas. The contractor would be reluctant to share his ideas if he thinks it could be used by the competition. All safeguards must be in place to ensure that the proposed ATC will remain confidential. It is important that the owner publishes the evaluation process and makes the process as transparent as possible. This will reduce the bidders' uncertainties and the possibility of them protesting and challenging the outcome later on (Gransberg *et al.* 2014). Another legal issue is the ownership of the idea. Many owners provide a stipend to bidders to partially cover the cost of DB proposal preparation. In such cases, the owner believes that the ATC rightly belongs to the agency and they can use it even if the proposer is not eventually selected (Missouri DOT n.d.). Design liability, in case the ATC does not work as intended, would depend on the type of delivery method. In DB procurement, as the DB team provides large parts of design, the ATC design liability usually resides with the DB team. Many of these issues have not been tested in the courts though. The number of ATCs allowed varies from state to state or even various agencies within a state. There is an understanding that allowing too many ATCs will lengthen the review process and can lead to procurement delays. To expedite the process, many owners provide a list precluding certain types of ATCs for instance the use of certain material or certain methods of maintaining traffic during the construction; conversely, they may provide a list of potentially acceptable ATCs. Because of such concerns some states impose a limit on the number of ATCs allowed. Limiting the number of ATCs may have the effect of constraining the level of innovation in the project.

2.3 The Effect of Preliminary Design Completion Level on Potential ATCs

The level of completion of preliminary design has an impact on potential ATCs. Where the design is less prescriptive and at a lower level of completion, there would be more opportunities for the DB team to introduce creative and effective ATCs and both the owner and DB teams would benefit from such a process. In addition to performance requirements and specifications, owners or their consultant typically secure certain minimum documents such as environmental permitting, agreement with the surrounding communities and stake holders, initial coordination with the utility companies, and initial geotechnical investigation data prior to issuing DB solicitation. Beyond that owners can choose the level of completion of the BTC documents. In recent years, more sophisticated owners are leaning towards a risk based method in determination of degree of completion of the BTC documents. High-risk items may be advanced to a higher level of design completion while low risk items may remain at the conceptual levels. For instance, high risk utility line may be designed to 50% or more completion level, while structural type and configuration of a low risk bridge may remain at 5% level allowing the DB team to determine the most suitable and innovative and yet cost-effective solution for the project.

3 CASE STUDIES

Two case studies, based on personal experience of one of the authors working for a major design firm, which served as the lead design firm for both cases, are presented here:

- Case 1: Interstate 495 Lowell Bridge Bundle
- Case 2: Fall River Route 76/I-195, Interchange Reconstruction

The selection process for both was a 2-step process. The first step was Submittal of Qualification (SOQ) where 3 teams where shortlisted. The second step was Request for Proposal

(RFP) where both the technical and cost proposals were submitted. The selection was based on the (BV) criteria, where the owner ranked the DB teams based on their technical score and bid price. The team with the highest BV score was selected. For both of these projects, the DB teams submitted a number of ATCs during the RFP phase; some were accepted and other denied.

In the following paragraphs, the ATCs proposed for each of these contracts along with their impact on the overall outcome of the bid results are briefly discussed.

3.1 Case 1: Interstate 495 Lowell Bridge Bundle

This project was among the first DB projects by MassDOT and was advertised in 2009, part of the Accelerated Bridge Program; the project value was approximately $40 million. The plans provided were at nearly 70% completion since it was initially envisioned to utilize DBB method of delivery for this project. This project included replacement of six bridges, two bridges over Concord River, two bridges over the B&M Railroad and two over Woburn Street. The two bridges over Concord River were shown to be 2-span continuous bridges with a center pier in the river, and the remaining four bridges where shown as 3-span continuous bridges, each with two abutments and also two piers placed adjacent to B&M Railroad or Woburn Street.

The DB team identified that all six bridges can be converted into simple single span bridges resulting in significant benefits to the owner and the public including cost and schedule benefits by avoiding construction of piers in the river, adjacent to an active railroad, and a busy street. It proposed several ATCs of which two were accepted and discussed herein. To convert Concord River bridges from two 90’ spans into a single span of 180’, the designer increased steel plate girder depth, yet ensured that sufficient vertical clearance above 100 year flood water level would be maintained, See Figure 2 for ATC #1.

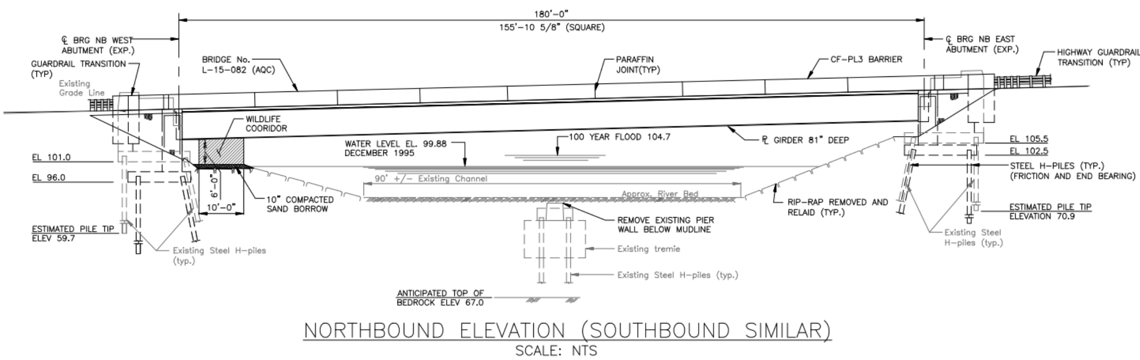

Figure 2. ATC #1, as proposed by the DB team.

ATC #2, was to convert the remaining four 3-span bridges into single span bridges. The designer did not have the option of increasing girder depths due to the limited available vertical clearance above the railroad tracks and the local street. Instead it was decided to fill the first and third spans in each bridge by utilizing MSE (Mechanically Stabilized Earth) walls and relocating the abutments forward and placing them behind the front face of the MSE walls to where the proposed BTC piers would have been located (See Figure 3).

Figure 3. ATC #2, as constructed.

Bid Results: The DB team proposing the above ATCs received the second highest technical score among the three teams competing. It also was the second low bidder. Overall however, it was ranked number 1 in BV, thus winning the contract.

3.2 Case II: Fall River Route 79/I-195 Interchange Reconstruction

MassDOT advertised this project in 2013 as part of Accelerated Bridge Program. The engineer's estimate was approximately $230 million. The plans were in general at 25% completion level. The project included design and construction of improvements to the Route 79/I-195 interchange in Fall River. The full scope of this project is extensive and beyond the intent of this paper. However, the focus here will be on two components of this project. The author's design firm proposed a number of ATCs on behalf of their DB team; two ATCs were accepted and are discussed below.

3.2.1 ATC #1: Davol street bridge

The BTC consisted of two units and six spans for a total bridge length of 628'. ATC #1 proposed to maintain the profile, alignment, and the total length of the bridge but change the bridge to a 4-span haunched composite continuous plate girder bridge with span arrangement of: 153'-172.5'-172.5'-130' (see Figure 4). By utilizing variable depth girders thru the use of parabolic curves, the ATC maintained the required vertical clearances above the railroad tracks. The ATC had a number of advantages: it reduced the number of foundations and piers from 16 to 6, reduced cost, and improved the schedule.

3.2.2 ATC #2: Ramps A, C, and E

The BTC specified a 9-span continuous bridge for Ramps A, C, and E. Recognizing that parts of these bridges were not high above the ground, the DB team envisioned filling in some of these spans using MSE walls. This method allowed modification of a long bridge into three separate short bridges (see Figure 5).

Bid Results: The DB team proposing the above ATCs received the second highest technical score among the three teams competing. Despite being the low bidder, it was ranked number 2 in BV, thus losing the contract.

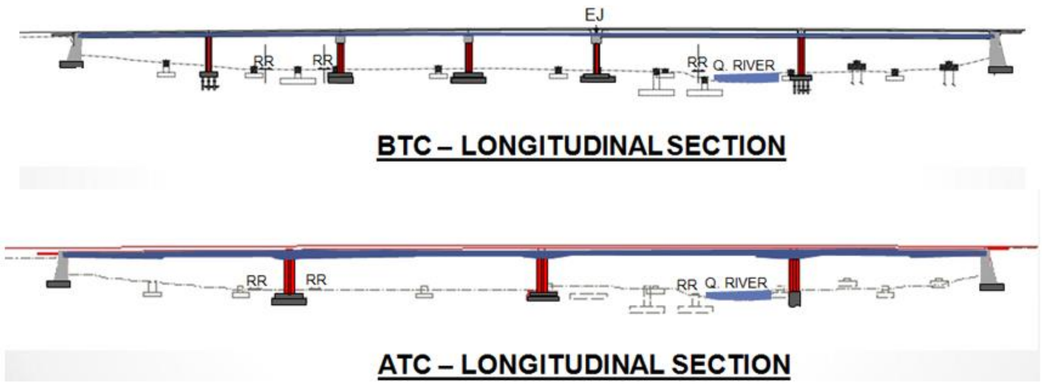

Figure 4. ATC #1, as proposed by the DB team.

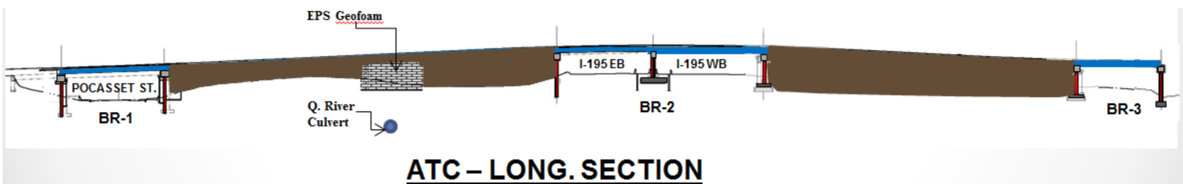

Figure 5. ATC #2, as proposed by the DB team.

4 CONCLUSION

The DB method of delivery and the ATCs process provide a significant opportunity for the owners to save on construction cost and reduce construction schedule without sacrificing project objectives and quality. The competition between DB teams allows for innovation by both engineers and contractors brining their best expertise to bear on a project and to create value for the owners. Owners can benefit the most from the ATC process by being less prescriptive and more open to new ideas and methods. Based on authors' experience it is best to keep preliminary design package at no more than 15% level, although for high-risk items the owner may choose to advance the preliminary design to a higher level. The above two cases demonstrate that having innovative and bold ideas and ATCs are necessary to win a project although may not be sufficient.

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