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16. Abstract

The Texas Department of Transportation (TxDOT) sought to update their project delivery method (PDM) selection methodology after gaining experience with the design-build method and updating their programmatic documents. This research study was performed by the Center for Transportation Research and The University of Texas at Austin through an interagency contract (IAC) and led to the development of the TxDOT Alternative Delivery System (ADS) Decision-Support Tool V2.0. This report documents the research methodology, the development process, and the tool's environment, as well as the benefits of the ADS V2.0. The quantification of risk impact on PDM selection and the expansion of innovation and complexity were two important advancements of the ADS V2.0 tool.

The key deliverable of this study was the TxDOT ADS V2.0 tool (Excel-based) and secondarily this report that provides all pertinent information around the tool and can guide its use.

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THE UNIVERSITY OF TEXAS AT AUSTIN
CENTER FOR TRANSPORTATION RESEARCH

The Texas Department of Transportation (TxDOT) Alternative Delivery System (ADS) Decision-Support Tool V2.0

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Disclaimers

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The authors would like to extend appreciation to the Texas Department of Transportation for providing the funding for this project. In particular, the authors would like to thank the Project Finance, Debt, and Strategic Contracts Division and Randall Grones for his many contributions to the progress of this work. In addition, the authors extend gratitude to the TxDOT, FHWA, and Industry experts that participated in the calibration and validation efforts of the ADS V2.0 Decision-Support Tool. Additional valuable guidance was provided by Bill Hale, TxDOT's Chief Engineer, Brian Barth, TxDOT's Director of Project Planning and Development, and Benjamin Asher, Director of TxDOT's Project Finance, Debt, and Strategic Contracts Division.

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Introduction

TxDOT has relied on the design-bid-build (DBB) method to deliver projects since its inception. The Texas Legislature approved TxDOT's use of the design-build (DB) method of project delivery based on best-value selection, starting with Fiscal Year 2012 letting cycle. In response, the TxDOT Alternate Delivery System (ADS) tool was developed to help guide decision-makers in selecting the most appropriate delivery method for projects. Version 1.0 (V1.0) of the TxDOT ADS tool was released in 2014 and used to support delivery method selection (Khwaja et al., 2018). However, since that time, both TxDOT and its affiliated design and construction industry partners have accumulated significant direct experience with DB and deepened their understanding of its relative risks and benefits. This experience has led to an evolution of TxDOT's programmatic approach to DB. These changes, coupled with TxDOT and its industry partners' collective experience, necessitated a review and update of the ADS V1.0 tool, leading to the creation of Version 2.0 (V2.0).

The principal changes in V2.0 are expansion of the assessment of innovation opportunities and risks relevant to execution, such as the presence of utilities and railroads. Right-of-way (ROW), while a potential significant risk, is not included in V2.0 as TxDOT's programmatic goal is to acquire all necessary parcels of ROW prior to the award of DB or DBB contracts. Also updated were the tool's expert weightings, to reflect changes in the set of project characteristics used.

Overall, V2.0 provides TxDOT with a tool that is contemporary in terms of current assessment of the benefits and challenges associated with DB and DBB, while continuing to provide a quantitative assessment of the relative benefits of each method with respect to relevant project characteristics and project goals. The ADS V2.0 tool has been developed specifically for use within the TxDOT institutional environment, which includes both the Texas legislative framework for execution of DB and DBB delivery methods as well as the experience and operating norms of TxDOT. Thus, while well-calibrated to score TxDOT projects, the tool is not recommended for use by other agencies without careful review and likely re-calibration for their institutional context.

This report outlines the methodology used to develop the ADS V2.0 tool, including updates to the characteristics, the description of the tool's mechanism, and the validation process. Further, the report presents the tool's environment and details the outputs provided by ADS V2.0. The quantification of the risk impact is an innovation of the ADS V2.0 tool and its benefits are captured in this study. Finally, this report presents recommendations for the tool's use and provides guidance for practitioners and experts developing such decision-making tools.

Methodology

The research team's goal when developing the ADS V2.0 tool was to create a quantitative, easy-to-use tool that captured the relative benefits of DB vs. DBB based on the enhanced experience

and institutional needs of TxDOT. As a result, the ADS V2.0 characteristics and goals were chosen to reflect the decision drivers that most impact the delivery method choice. The characteristics and goals were selected through an iterative and deliberative process with input from TxDOT's Administration, District, and Division staff with project delivery experience. In addition, the relative benefits of these characteristics in the selection were captured utilizing expert panel weightings and were used as part of the multi-attribute mechanism embedded in the tool. The tool's results were validated using 12 projects that were scored and evaluated through an expert panel. Figure 1 outlines the methodology employed for the development of ADS V2.0.

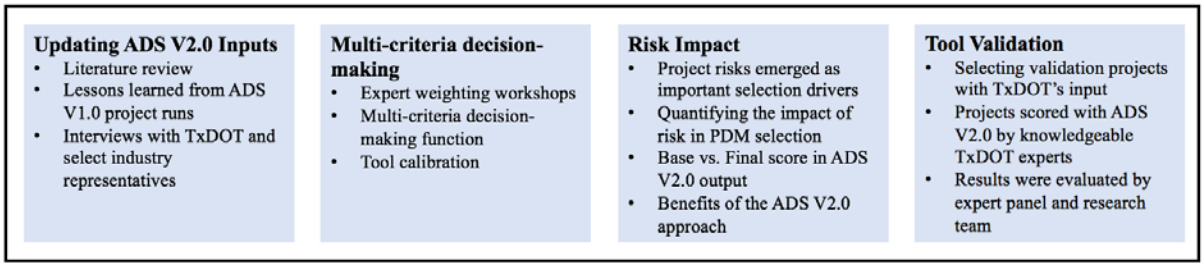


Figure 1 Methodology for developing ADS V2.0

ADS Tool's Inputs

The ADS V2.0 tool captures the evolution of DB in Texas and the accumulated experience of the agency and its industry partners. The updated characteristics reflect the most important selection drivers related to inherent project characteristics and project risks. In addition to a literature review, the research team conducted interviews with agency and industry experts, and investigated lessons learned from the use of the ADS V1.0 tool (Demetracopoulou et al. 2020) to finalize the project characteristics used for the selection methodology.

- *Lessons learned extracted from 57 projects run with ADS V1.0*. The team performed quantitative analysis of data from 57 projects that had been evaluated to date using ADS V1.0. The data was analyzed to explore the applicability levels of different characteristics as well as their variance on applicability. One of the main findings was around the 'Early completion' characteristic; in 47 out of 57 projects this characteristic was rated as 'Very Applicable'. Having no variability in scoring, this characteristic contributed little to the ADS V1.0 since it was almost a constant rather than a variable in the project evaluations. In addition, this analysis indicated that the 'Lower maintenance cost' goal was rarely assigned greater than 5% weight, and thus was not a major contributing factor to the overall decision. It was therefore not included in V2.0 to simplify the allocation of weights to the remaining three goals.
- *Interviews with TxDOT and select industry representatives*. These interviews addressed the various drivers of the delivery method decision-making process and the new characteristics took shape to reflect the accumulated experience and expert input. Experts consistently emphasized that finding innovative solutions to complex and challenging

projects is the main driver for preferring the DB method and therefore the characteristic was expanded with sub-categories to provide a common assessment protocol for Districts. Lessons learned from DB projects also shifted the understanding of risk allocation/transfer. Characteristics were added (e.g., railroads, contractor availability) or modified (e.g., utilities, permits) to capture the nuances around risk allocation. Finally, institutional changes resulted in eliminating some characteristics. For example, ROW acquisition was no longer considered a decision-making factor since TxDOT's stated goal is to acquire as much ROW before contract award as possible and any incidental ROW responsibility is transferred without the transfer of associated risk. The same approach is used for ROW regardless of delivery method.

Multi-criteria Decision-making

The calibration process began after finalizing the updated characteristics of ADS V2.0. A multi-criteria decision-making framework that uses value functions was employed to develop an objective and quantitative decision-making methodology. Therefore, relative weights among the tool's characteristics were collected through workshops with subject matter experts (SMEs). The experts were chosen from TxDOT's project delivery offices, TxDOT administration and the Alternative Delivery Program, and the Federal Highway Administration's regional staff; also included were experienced industry professionals that have collaborated with TxDOT. The research team organized three workshops, and 20 SMEs participated in total; Table 1 summarizes pertinent information on the weighting workshops. The workshops were facilitated to ensure the understanding of the characteristics, the objectives of the scoring exercise, and the consistency in scoring. The questionnaire used for the workshops is presented in Figures 2 and 3 (one for each method—DB and DBB).

Table 1 Weighting workshops

Workshops	**Date**
Austin	12/19/19
Houston	1/21/20
Dallas	2/13/20
Participants	
14 TxDOT, 5 Industry, 1 FHWA	

Participant's Name: _____

Design-Build (DB) method

Rating key:
+3 = Strong Positive
+2 = Positive
+1 = Somewhat Positive
0 = No effect
-1 = Somewhat Negative
-2 = Negative
-3 = Strong Negative

Given each of the following characteristics are very applicable in a project, along with a Design-Build delivery method, how will they affect each of the project goals?

PROJECT CHARACTERISTICS	PROJECT GOALS			*Comments:*
1. This project requires the use of innovative methodologies.	**Lower capital cost**	**Higher cost predictability**	**Higher schedule predictability**	
INNOVATION OPPORTUNITIES				
TRAFFIC HANDLING				
Traffic control and management of traffic that minimizes the impact on the public				
CONSTRUCTOR'S RESOURCE AND SCHEDULE OPTIMIZATION				
Utility relocation avoidance/minimization **Optimization of work within constrained ROW** **Optimization of construction sequencing** **Optimization of fleet/equipment capabilities** **Optimization for constructability benefits**				
DESIGN AND CONSTRUCTION METHODS				
Opportunities for pre-fabrication **Innovative design (e.g., structural design, geometry)** **Opportunities to optimize design to minimize coordination with utilities and/or railroads** **Innovative materials** **Opportunities for accelerated construction methods**				
2. For this project, the incremental costs of alternative delivery are expected to be greater than the value added from innovation. *Expanded definition:* Incremental agency efforts and expenses include time spent preparing contracting documents and reviewing DB teams' qualifications statements, proposals, stipends to unsuccessful proposers, independent legal and financial experts, QA effort, etc.				
3. This project will significantly benefit from designer-contractor integration and the ability to transfer design errors and omissions risk.				
4. For this project, significant schedule savings can be achieved through design and construction overlap.				
5. For this project, the procurement duration of the alternate delivery method will negatively affect the overall project delivery duration.				

Figure 2 Workshop questionnaire for DB (part 1 of 2)

PROJECT CHARACTERISTICS	PROJECT GOALS			Comments:
	Lower capital cost	Higher cost predictability	Higher schedule predictability	
6. For this project, prescriptive project requirements limit contractor innovation in terms of alternatives. *Expanded definition:* Project-specific requirements include, but are not limited to, these features: Design elements, Methods, Materials, and Procedures.				
7. This project requires incorporating important public stakeholder approval of design and construction decisions and managing stakeholder expectations. *Expanded definition:* Public stakeholders can include, but are not limited to, cities and local governments. Projects with historical importance and restrictions on aesthetics imposed by stakeholders could require approval of design and construction decisions.				
8. This project requires significant interaction with railroads.				
Local (e.g. DART, MetroRail)				
Private (e.g. UP, BNSF)				
9. For this project, significant permits are expected to be outstanding at the time of letting/ award.				
10. For this project, the utility types listed below are expected to be outstanding at the time of letting/award.				
Long lead, reimbursable utilities (e.g., gas, transmission lines)				
Long lead, non - reimbursable utilities (e.g., gas, transmission lines)				
Public, reimbursable utilities				
Public, non - reimbursable utilities				
Private, reimbursable utilities				
Private, non - reimbursable utilities				
11. For this project, the location and/or market conditions are not likely to generate competitive bidding from well-qualified design-build contractors.				

Figure 3 Workshop questionnaire for DB (part 2 of 2)

For each characteristic, the experts were asked to assign a value from -3 (strong negative) to 3 (strong positive), considering the impact the characteristic would have on each goal had it been very applicable. Since there was no significant difference between the agency and industry sub-groups, simple averages for the scores provided by the 20 participants formed the entries of the two scoring matrices for DBB and DB. The expert panel weightings are embedded in the tool.

The participants' responses are captured in the weights and represent the value function v_{ijk} that captures the extent of the contribution of the characteristic i towards achieving the project goal j given the delivery method alternative k. The resulting value functions represent the final set of intra-attribute scores that are common across projects.

To calculate the final output of the tool for each project, the user needs to evaluate the inter-attribute scores that include the applicability of the project characteristics and the weights of the project goals. The applicability of project characteristics is scored from 0 to 100 using a sliding scale with a step of 10. The agency's goals are weighted to reflect the priorities in a specific project; a total of 100% is assigned among the three goals. Using the intra- and inter-attribute scores, a total score is calculated for each method. The final score (tool recommendation) is the absolute difference between the two methods' total scores (DB and DBB). The total score of each method is calculated as shown in the following equation:

$$\text{Total Score}_k = \sum_{j=1}^{3} W_j * \frac{\sum_{i=1}^{12} C_i V_{ijk}}{N_k}$$

W_j represents the relative weight of the goal j

C_i represents the applicability of the characteristic i (0–100, step of 10)

V_{ijk} represents the average contribution of characteristic i in meeting the project goal j given the delivery method k (range from -3 to +3)

The denominator N_k is calculated using a 'ramp' approach based on the project characteristics' level of applicability. As Figure 4 illustrates, if a characteristic is rated with scores higher than 20, then the denominator's value is 1. As the applicability of the characteristic decreases, its contribution to the final decision also decreases; when the applicability equals 10, the denominator value equals 0.75, and when the characteristic is not applicable (score = 0), then the value equals 0.5. The ADS V2.0 mechanism is summarized in Figure 5.

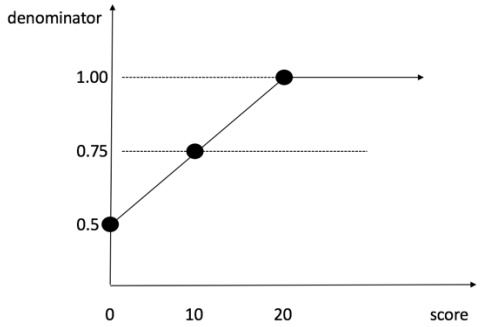


Figure 4 Denominator value vs. applicability score

In summary, the recommended method is the one with the higher score, as calculated using the following equation:

$$\text{Final Score Recommendation} = \text{Total Score}_{DB} - \text{Total Score}_{DBB}$$

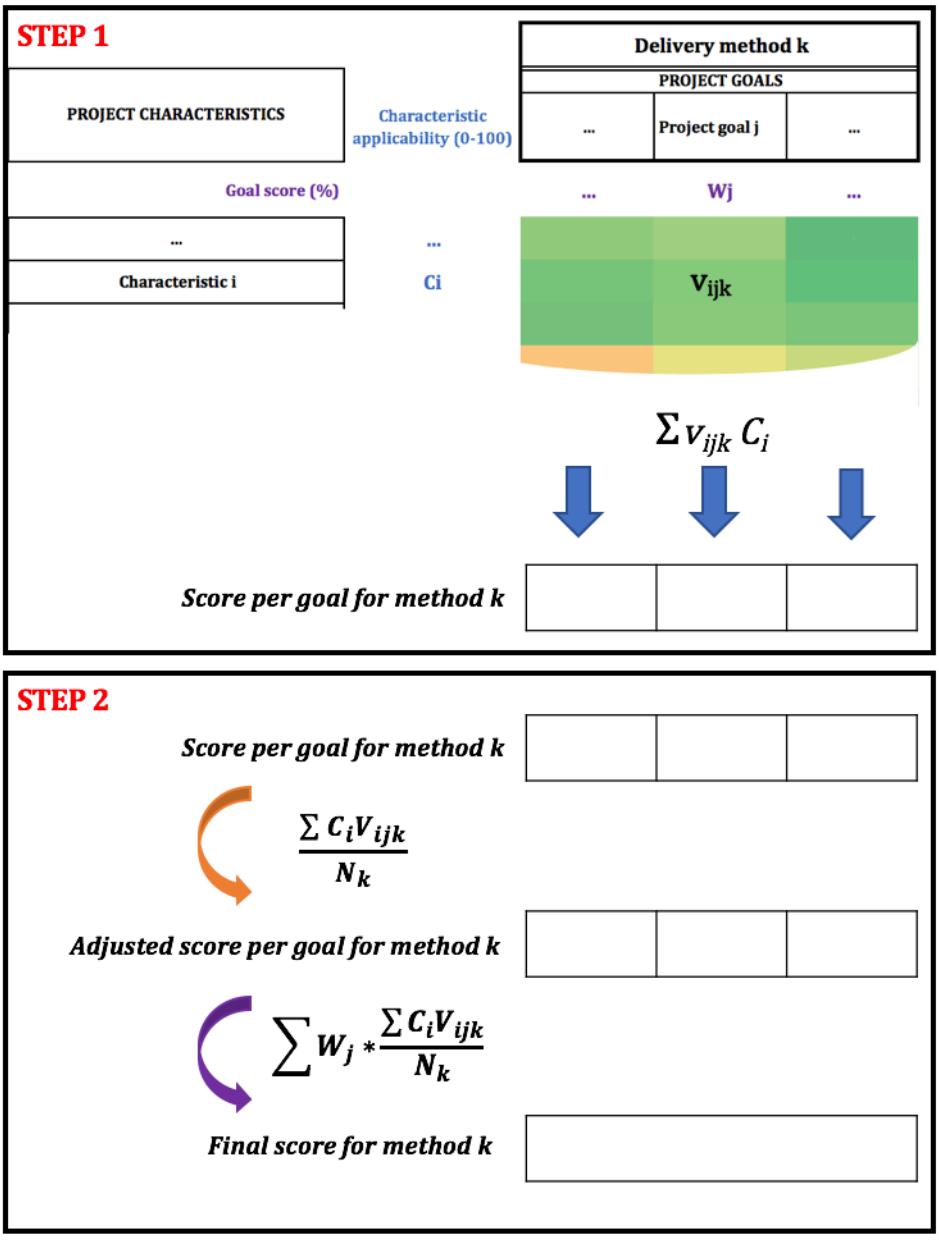


Figure 5 ADS tool mechanism function

Risk Impact

As presented above, the final score is calculated by summing the scores assigned the 12 characteristics of the ADS tool. However, to provide a comprehensive view of the process, the tool was designed so that these characteristics capture both **inherent project elements** and potential **project risks**. Tables 2 and 3 present the characteristics of the tool as they relate to these two categories.

Table 2 Inherent project elements (characteristics 1 through 7)

1.This project requires the use of innovative methodologies. Traffic Handling Constructor's Resource and Schedule Optimization Design and Construction Methods
2. For this project, the incremental costs of alternative delivery are expected to be greater than the value added from innovation.
3. This project will significantly benefit from designer-contractor integration and the ability to transfer design errors and omissions risk.
4. For this project, significant schedule savings can be achieved through design and construction overlap.
5. For this project, the procurement duration of the alternate delivery method will negatively affect the overall project delivery duration.
6. For this project, prescriptive project requirements limit contractor innovation in terms of alternatives.
7. This project requires incorporating important public stakeholder approval of design and construction decisions and managing stakeholder expectations.

Table 3 Project risks (characteristics 8 through 12)

8. This project requires significant interaction with railroads. Local (e.g., DART, Metro Rail) Private (e.g., UP, BNSF)
9. For this project, significant permits are expected to be outstanding at the time of letting/ award.
10. For this project, the utility types listed below are expected to be outstanding at the time of letting/award. Long lead, reimbursable utilities (e.g., gas, transmission lines) Long lead, non-reimbursable utilities (e.g., gas, transmission lines) Public, reimbursable utilities Public, non-reimbursable utilities Private, reimbursable utilities Private, non-reimbursable utilities
11. For this project, the location and/or market conditions are not likely to generate competitive bidding from well-qualified design-build contractors.
12. For this project, the location and/or market conditions are not likely to generate competitive bidding from well-qualified design-bid-build contractors.

The **final score** is calculated by totaling both the inherent elements and the project risks. However, using the same methodology described above, the **base score** is also calculated using only the inherent project elements, characteristics 1 through 7. The base score allows the evaluators to assess the project without the impact of risks. In addition, when comparing the base and final scores, the evaluators can have a clear understanding of the impacts of risk on project goals. The tool's output presents the most and least supportive characteristics for each method, thus informing the evaluators of the most significant sources of risk and assisting decision-makers in focusing their management and mitigation efforts on these risks.

Quantifying the impact of risk is an innovation of the ADS V2.0 and an advancement of the quantitative methodologies available for delivery method selection. The benefits of this approach are summarized below.

- It allows decision-makers to quantitatively assess the impact of project risks on project goals with each project delivery method.
- Decision-makers can identify the sources of risk and guide the agency's management and mitigation efforts.
- Decision-makers are able to quantitatively assess the impact of inherent project elements on the project delivery method selection.
- If risk mitigation can be performed or project conditions change (e.g., timing of letting), the project can be re-evaluated with the ADS tool.
- An accurate assessment of project risks can both modify the score and support management judgment. The ADS V2.0 is designed as a decision-support tool. By separating the base and final score, the decision-makers obtain quantitative information on the impact of inherent project elements and project risks. Therefore, the evaluators may re-run the tool in different project stages or make informed decisions according to the changes and mitigation efforts on project risks.
- It allows for more granularity and holistic evaluation for TxDOT's portfolio of projects. All pertinent project information needs to be considered before using the DB method, especially considering the legislative limitations placed on its use: six projects per biennium (Texas Transportation Code 2019).

The ADS V2.0 is a quantitative decision support tool for delivery method selection. The TCRP Report 131: *A Guidebook for the Evaluation of Project Delivery Methods* categorizes such decision approaches into three tiers (Touran et al. 2009). Tier 1 comprises a qualitative approach, while Tier 2 consists of a weighted matrix delivery decision approach that is quantitative with some level of subjectivity in prioritizing factors. Tier 3 is centered on risk-based cost-estimating methods and is employed if the Tier 2 approach doesn't yield a delivery method suggestion. The ADS V2.0 method quantitatively assesses decision factors and the impact of project risks. The approach

introduced through ADS V2.0 combines Tier 2 and 3 methods elements and allows quantification of the impacts of risks while maintaining the user-friendly decision process of a Tier 2 approach.

Validation

A validation process is a necessary requisite to ensure the output of the tool and the underlying mechanism supporting it, yields consistent, logical and understandable results. The research team selected twelve projects for the validation process with input from TxDOT's administration. The projects were chosen to cover a plethora of cases—different characteristics and challenges, different expected outcomes, and different Districts (Beaumont, Dallas, Fort Worth, Houston, Pharr, and San Antonio). Each project was scored by an expert who was knowledgeable on the project in 1-hour workshops run by the tool facilitator and the research team. Table 4 presents the results of the validation project runs.

One noteworthy requisite of these validation scoring workshops was that the team requested the responders to use the information that would have been available at the time prior to the delivery method selection and not the information that became clear or available during the construction phase.

Table 4 Validation project runs results

Projects	Suggested PDM	Final score
NTE 3A (FTW)	DB	**0.62**
Southern Gateway (DAL)	DB	**0.62**
IH 610 @ IH 69 Interchange (HOU)	DB	**0.42**
IH 10/ US 69 Interchange (BMT)	DB	**0.39**
IH 2/IH 69 Interchange (Pharr)	DB	**0.33**
LP 610 (IH 69 to IH 10) (HOU)	DB	**0.32**
SH 99 Seg H&I (HOU)	DB	0.19
Loop 1604 (FM 1957 to US 90) (SAT)	DBB	**0.42**
US 281 North (1604 to Stone Oak) (SAT)	DBB	**0.31**
Lowest Stemmons (DAL)	DBB	0.19
SH 360 South (FTW)	DBB	0.15
IH 10 (FM 359 to Brazos River) (HOU)	DBB - Tier 3	0.02

The final scores in bold in Table 4 are 'Strong Recommendations' since they are higher than the 0.3 thresholds. The IH-10 (FM 359 to Brazos River) project's score was lower than 0.15, which is the threshold for 'Tier 3' recommendations. 'Tier 3' recommendations indicate a close ranking between the D-B and D-B-B methods and additional evaluation is required to make a decision.

Overall, the project results align with the evaluators' expectations and validate the efficiency of the developed mechanism. As expected, complicated and large projects, like NTE 3A and Southern Gateway, that can benefit from the use of DB have strong DB recommendations with high final scores. On the other hand, in projects where alternative delivery would result in additional costs and higher procurement times, like Loop 1604 (FM 1957 to US 90), DBB was recommended as the most appropriate method with a high score.

Final scores capture the impact of inherent project characteristics and project risks. The base scores output by ADS V2.0 also aligned with the experts' expectations. For example, Southern Gateway is a highly complex project that can benefit from innovative methodologies and designer-contractor integration. On the other hand, significant interaction with private and public railroads and a high probability of outstanding utilities are important risks. Table 5 presents the input values

for that project's characteristics, and Figure 6 captures the input values for the project goals as provided by the expert evaluators.

Table 5 Southern Gateway input – ADS V2.0 project characteristics

Inherent Project Characteristics	
1. Innovative Methodologies	
Traffic handling	100
Constructor's resource and schedule optimization	100
Design and construction methods	100
2. Incremental Costs of Alternative Delivery	0
3. Designer - Contractor Integration	100
4. Design - Construction Overlap Schedule Savings	100
5. Procurement Duration	0
6. Project Requirements	60
7. Stakeholder Approval	60
Project Risks	
8. Railroads	
Local (e.g., DART, Metro Rail)	60
Private (e.g., UP, BNSF)	80
9. Permits	0
10. Utilities	60
Long lead, reimbursable utilities	60
Long lead, non-reimbursable utilities	60
Public, reimbursable utilities	60
Public, non-reimbursable utilities	60
Private, reimbursable utilities	60
Private, non-reimbursable utilities	60
11. Contractor Availability DB	0
12. Contractor Availability DBB	0

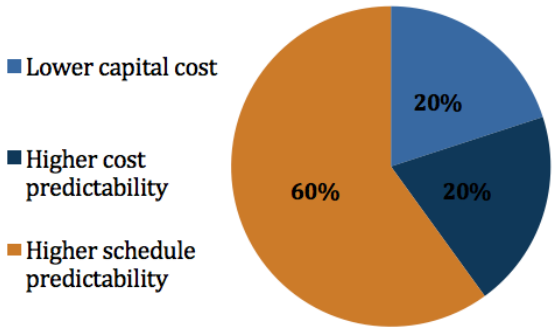


Figure 6 Southern Gateway input – project goals

For Southern Gateway, the interaction with railroads and outstanding utilities poses significant risks for DB and DBB delivery methods. Therefore, we expect the base score to be higher than the final, where the impact of risks is captured. For Southern Gateway, the base score was **1.04** with DB as the suggested delivery method, while the final was **0.62**. The difference between the base and final scores allows the decision-makers to assess the impact of risk on the project. Figure 7 presents the tool's output scores.

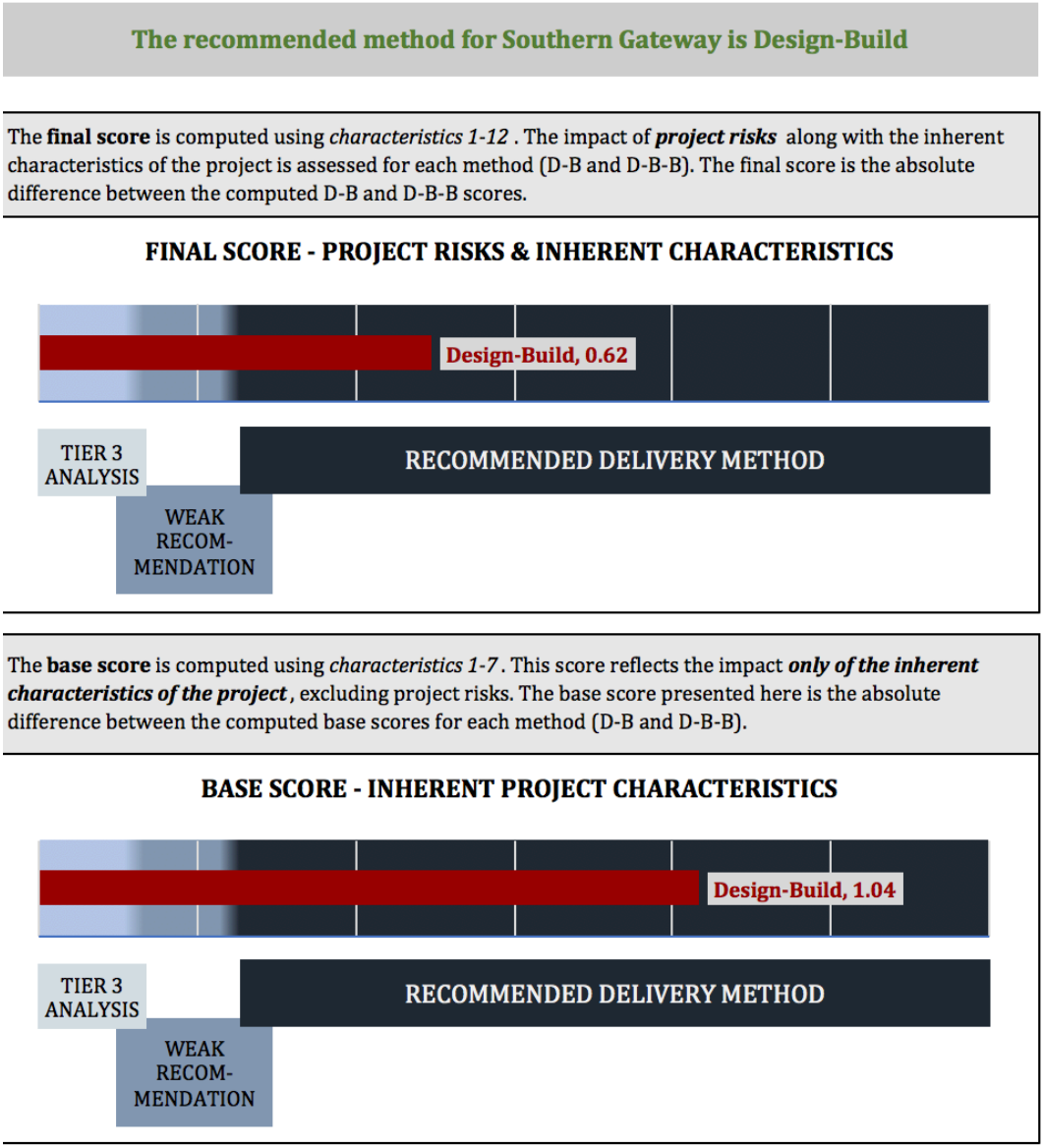


Figure 7 Southern Gateway output scores

ADS V2.0 Environment

The tool consists of five input and output sheets: **Yes-No Questions**, **Project Information**, **Project Characteristics**, **Project Goals**, and **Output**, which are **Step 1**, **Step 2**, **Step 3**, **Step 4**, and **Step 5**, respectively. Each section is indicated at the top of the sheet, as seen in Figure 8. Users can also move within the next and previous steps by using the buttons at the bottom of each sheet, as seen in Figure 9.

Figure 8 Step identifier provided at the top of each sheet (the Step 3 sheet is used here)

Figure 9 Buttons at the bottom of the sheet used to move between steps (the Step 4 sheet is used here)

Step 1 – Yes-No Questions

The **Yes-No Questions** sheet is the first step to be evaluated by the tool. This section aims at capturing the projects that do not fall within the calibrated limits for evaluation by the ADS V2.0. The questions in this section have Yes/No answers. If the answer to a question indicates that the tool is not calibrated for that project, the tool provides suitable messages/alerts to inform the user of the suitability of the ADS tool.

Figures 10 and 11 present the Yes-No Questions and the alerts that appear if the answer indicates unsuitability for evaluation through the ADS V2.0.

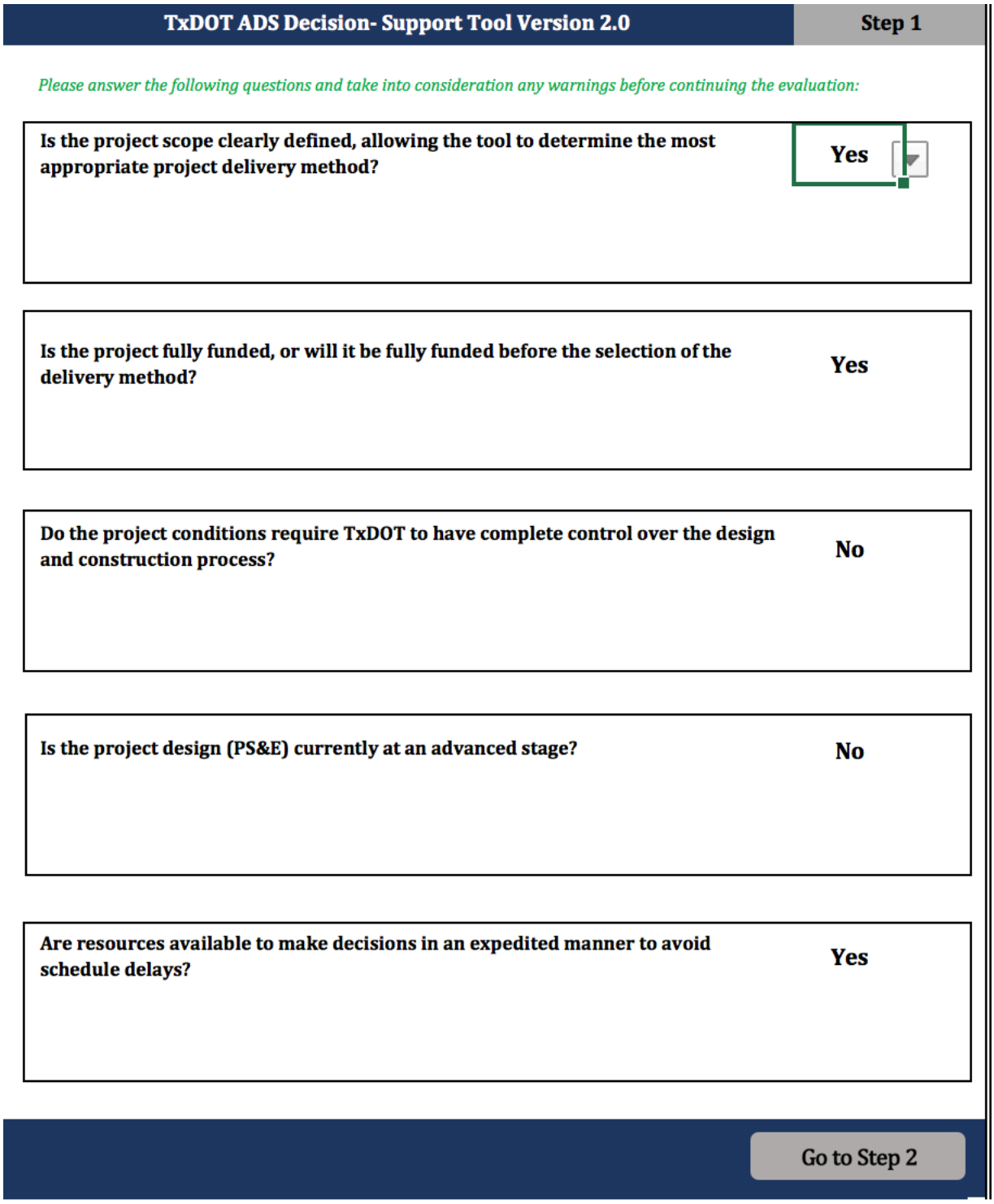


Figure 10 Yes-No Questions, Step 1

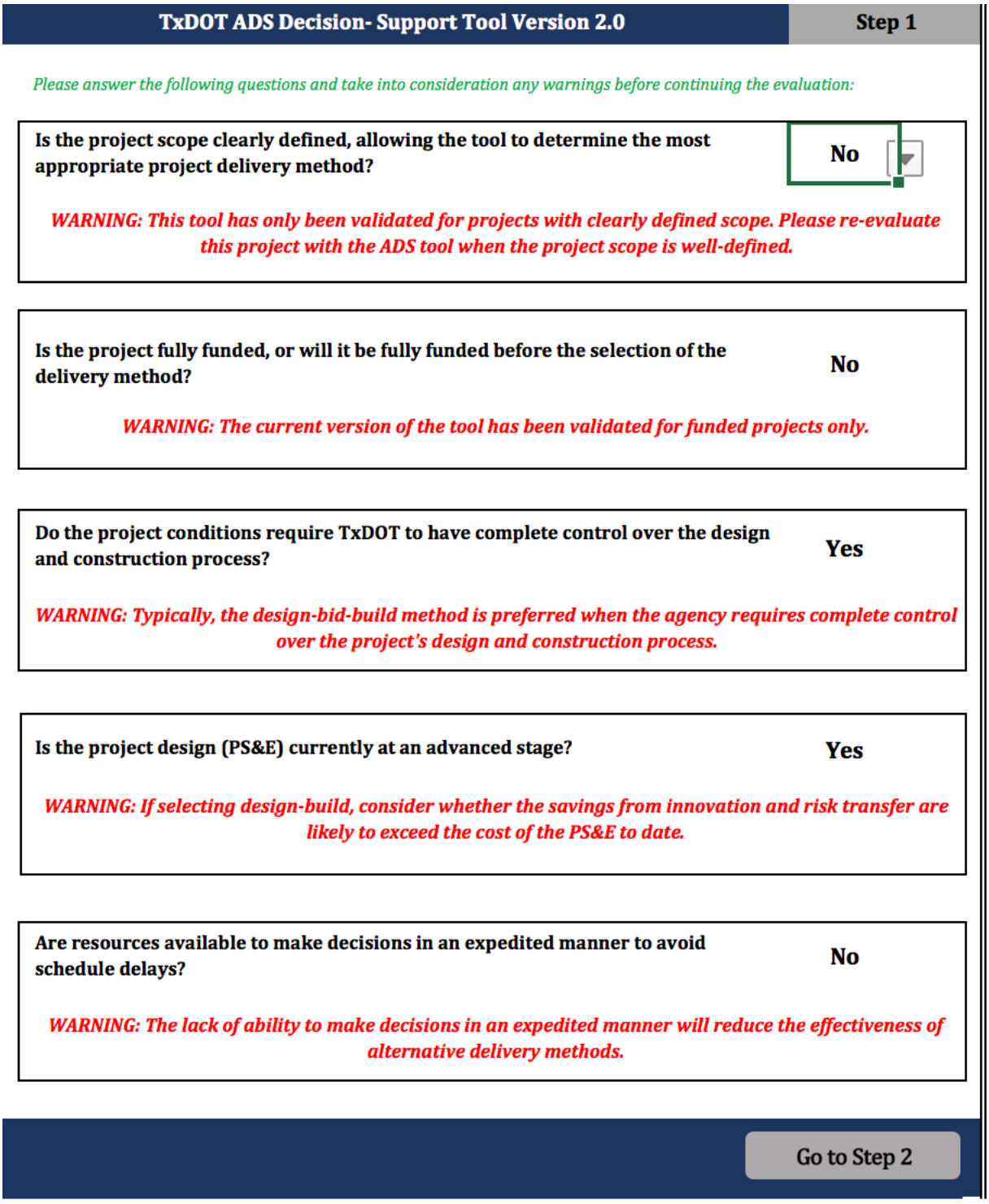


Figure 11 Messages/alerts for projects not suitable for evaluation with ADS V2.0

Step 2 – Project Information

The **Project Information** sheet is used to capture necessary project data, as shown in Figure 12. In addition, it provides space for identifying the project's risks and challenges (Figure 13). Documenting this information is helpful for anyone reviewing the results later. This section also facilitates brainstorming among the project evaluators before getting into the **input** sections of the tool. In addition, in this section, space is provided for listing the participants' names and the date of evaluation for archival purposes (Figure 14).

PROJECT INFORMATION

Project name:	**TEST**
Project limits:	
Brief description:	
Estimated total project cost:	
Sources of funding:	
Target letting/award date: ☐ **Firm**	
Target completion date:	
Main stakeholders:	

Figure 12 Basic project information; part of Step 2

Project's special characteristics, main risks and challenges:
-
-
-
-
-
-
-
-
-
-

Figure 13 Project's special characteristics, main risks, and challenges; part of Step 2

Evaluating Team:		
Number of participants:		
List of participants:	-	-
	-	-
	-	-
	-	-
	-	-
	-	-
	-	-
	-	-
	-	-
	-	-
	-	-
	-	-
Date of evaluation:		

Figure 14 Evaluating team; part of Step 2

Step 3 – Project Characteristics

The **Project Characteristics** section represents one of the two primary input screens to describe the project according to its specific characteristics. The screen lists all 12 project characteristics incorporated in this decision-support model. Assessing the applicability of each characteristic to a project is the most critical input required for determining the project delivery method. Expanded definitions are added to some characteristics to explain their scope better or illustrate examples. Each characteristic is presented as a statement. The user should thoughtfully review the contents of each characteristic's detailed explanation and determine its applicability to the project under consideration. The evaluators rate each characteristic's applicability on a 0-to-100 scale, in increments of 10. A description on the scale provides explanation and guidance for the evaluators. Figure 15 presents an example of the explanations on the sliding scale.

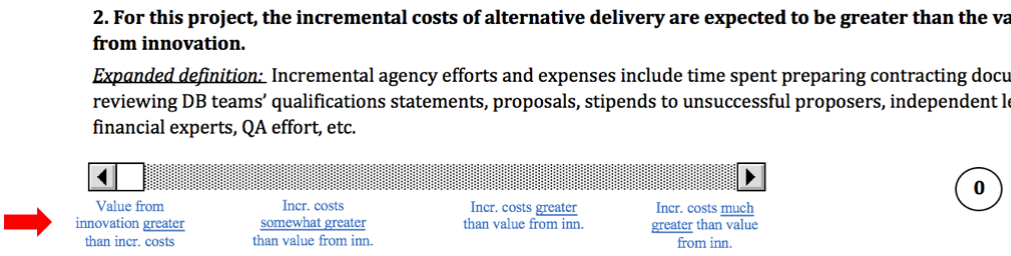


Figure 15 Example of sliding scale explanation for characteristic #2

Determining each characteristic's applicability requires knowledge of the project conditions, issues, challenges, funding, and cost issues related to design and construction, and experience and familiarity with the use of delivery methods available to TxDOT.

- **Characteristic #1**

This characteristic aims at capturing the innovation opportunities for each project. It is the only characteristic that is evaluated in two parts. First, the users can select the project attributes that are relevant from the checklist provided. This step doesn't contribute to the final output; it motivates discussion and brainstorming around the elements that necessitate innovation in a project.

1. This project requires the use of innovative methodologies.

Check the Project Characteristics that apply:

TRAFFIC CHALLENGES
☐ High traffic volumes on existing roadways
☐ Multiple highways with convergent routes

DESIGN ELEMENTS
☐ Complex horizontal/ vertical alignments
☐ Multi-level intersections/ interchanges
☐ Major intersections
☐ Multiple cross streets
☐ Retaining walls/ tall vertical elevations

PROJECT CONSTRAINTS
☐ Reconstruction of existing facilities
☐ Constrained site conditions (e.g., constrained ROW, limited staging areas, high-rise buildings)
☐ Accommodation for proximity to periodic high traffic generators
☐ Numerous railroad crossings, dense utilities

Select the level of the Innovation Opportunities that apply:

TRAFFIC HANDLING

Traffic control and management of traffic that minimizes the impact on the public

0

No innovation opportunities | Some innovation opportunities | Many innovation opportunities | Significant innovation opportunities

CONSTRUCTOR'S RESOURCE AND SCHEDULE OPTIMIZATION

Utility relocation avoidance/ minimization
Optimization of work within constrained ROW
Optimization of construction sequencing
Optimization of fleet/ equipment capabilities
Optimization for constructability benefits

0

No innovation opportunities | Some innovation opportunities | Many innovation opportunities | Significant innovation opportunities

DESIGN AND CONSTRUCTION METHODS

Innovative design (e.g., structural design, geometry)
Opportunities to optimize design to minimize coordination with utilities and/or railroads
Innovative materials
Opportunities for accelerated construction methods
Opportunities for pre-fabrication

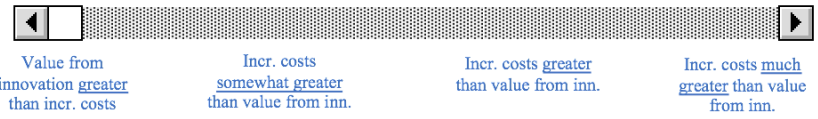
0

No innovation opportunities | Some innovation opportunities | Many innovation opportunities | Significant innovation opportunities

➢ Characteristic #2

2. For this project, the incremental costs of alternative delivery are expected to be greater than the value added from innovation.

Expanded definition: Incremental agency efforts and expenses include time spent preparing contracting documents and reviewing DB teams' qualifications statements, proposals, stipends to unsuccessful proposers, independent legal and financial experts, QA effort, etc.



➢ Characteristic #3

3. This project will significantly benefit from designer-contractor integration and the ability to transfer design errors and omissions risk.

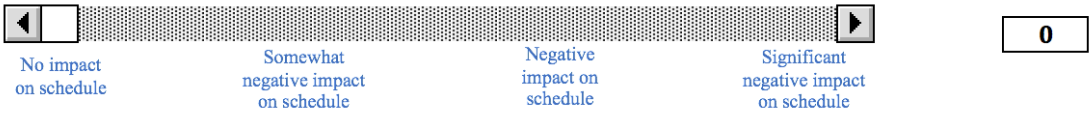
Expanded definition: The design-build method accomplishes the transfer of design errors and omissions risk to the contractor as well as facilitates improved integration between design and construction means and methods.

➢ Characteristic #4

4. For this project, significant schedule savings can be achieved through design and construction overlap.

➢ Characteristic #5

5. For this project, the procurement duration of the alternate delivery method will negatively affect the overall project delivery duration.



➢ Characteristic #6

6. For this project, prescriptive project requirements limit contractor innovation in terms of alternatives.

Expanded definition: Project-specific prescriptive requirements include, but are not limited to, these features: Design elements, Methods, Materials, and Procedures.

➢ Characteristic #7

7. This project requires incorporating important public stakeholder approval of design and construction decisions and managing stakeholder expectations.

Expanded definition: Public stakeholders can include, but are not limited to, cities and local governments. Projects with historical importance and restrictions on aesthetics imposed by stakeholders could require approval of design and construction decisions.

➢ Characteristic #8

8. This project requires significant interaction with railroads.

Local (e.g. DART, Metro Rail)

Private (e.g. UP, BNSF)

➢ Characteristic #9

9. For this project, significant permits are expected to be outstanding at the time of letting/ award.

Expanded definition: Outstanding permits at the time of letting/award will result in uncertainty on cost and schedule and impact project performance. If the evaluation team is unable to estimate whether significant permits may be outstanding at the time of letting/ award, please revisit the evaluation when information on outstanding permits is available. Significant permits include, but are not limited to permits from Corps of Engineers and/or other regulatory agencies.

0

Not applicable | Somewhat applicable | Applicable | Very applicable

➢ Characteristic #10

10. For this project, the utility types listed below are expected to be outstanding at the time of letting/award.

Expanded definition: Outstanding utilities at the time of letting/award will result in uncertainty on cost and schedule and impact project performance. If the evaluation team is unable to estimate whether utilities may be outstanding at the time of letting/ award, please revisit the evaluation when information on outstanding utilities is available.

Long lead, reimbursable utilities (e.g., gas, transmission lines)

Not applicable | Somewhat applicable | Applicable | Very applicable

0

Long lead, non - reimbursable utilities (e.g., gas, transmission lines)

Not applicable | Somewhat applicable | Applicable | Very applicable

0

Public, reimbursable utilities

Not applicable | Somewhat applicable | Applicable | Very applicable

0

Public, non - reimbursable utilities

Not applicable | Somewhat applicable | Applicable | Very applicable

0

Private, reimbursable utilities

Not applicable | Somewhat | Applicable | Very applicable

0

Private, non - reimbursable utilities

Not applicable | Somewhat | Applicable | Very applicable

0

➢ Characteristic #11

11. For this project, the location and/or market conditions are not likely to generate competitive bidding from well-qualified design-build contractors.

Highly competitive bidding | Competitive bidding | Somewhat competitive bidding | No competitive bidding

0

➢ **Characteristic #12**

12. For this project, the location and/or market conditions are not likely to generate competitive bidding from well-qualified design-bid-build contractors.

Step 4 – Project Goals

The **Project Goals** section is the second input tab of the ADS tool. In this section, the users distribute 100% between the three given goals, reflecting each goal's relative importance for the project. Figure 16 presents the three goals included in the ADS V2.0. In addition, warning text in red may appear if the sum of distributed weights does not equal 100% (Figure 17).

GOAL	DESCRIPTION	POINTS ASSIGNED
Lower **capital cost**	The contractual cost of the project must be the lowest reasonable; the budget available is tight.	20%
Higher **cost predictability**	The project must be completed within the budget. The agency wants to avoid cost growth.	20%
Higher **schedule predictability**	The project must be completed within the target schedule. The agency wants to avoid schedule growth.	60%
	TOTAL	**100%**

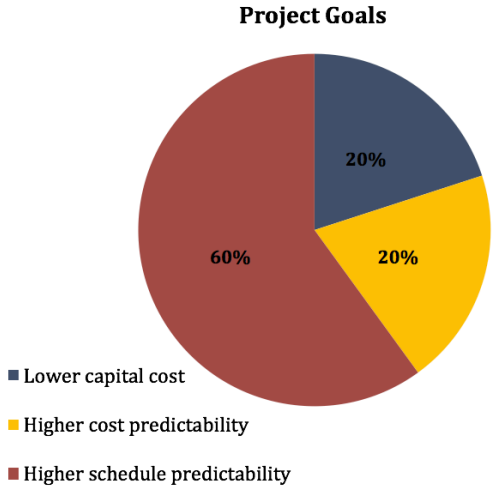


Figure 16 The three goals evaluated in the tool & example of assigned weights

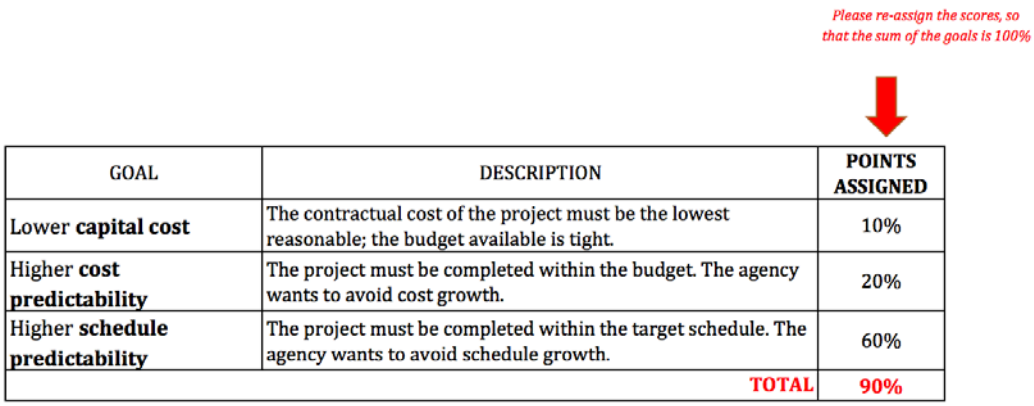


Figure 17 Warning message if the sum of the assigned weights is different from 100%

Step 5 – Output

After completing the **Project Characteristics** and the **Project Goals** input sections, the tool's recommendation is displayed in the **Output** section. The primary tool output is the project delivery method recommendation. The strength of recommendation varies as a function of the tool's final score (Table 6).

Table 6 Recommendation as a function of score

Score thresholds	Recommendation	
<0.15	**Tier 3 analysis**	A recommended Delivery Method for **[Project]** cannot be given, due to the small difference in the alternatives' scores. To select a Delivery Method, perform a detailed Tier 3 risks and opportunities analysis for each alternative.
0.15 to 0.30	**Weak Recommendation**	**[DBB/DB]** is a WEAK recommended Delivery Method for **[Project]**. A Tier 3 analysis to detect risks and opportunities is strongly recommended.
> 0.3	**Strong Recommendation**	**[DBB/DB]** is the recommended Delivery Method for **[Project]**. However, Tier 3 analysis is recommended to analyze mitigation strategies for the method's least supportive characteristics, which are listed below.

The tool provides a **final** and a **base score**. The base score reflects the impact of only the ***inherent project characteristics*** (characteristics 1 through 7), while the final score also incorporates the impact of ***project risks*** (characteristics 8 through 12) into the decision-making process. Project risks often have a negative impact on both delivery methods; the delta between the two scores can highlight the severity of risks in the project under consideration.

Figure 18 presents the two scores of the ADS V2.0, along with a brief description of each as part of the output section. The scores are delivered on a graded bar divided into three areas. The recommendation given is based on the final score value, according to Table 6.

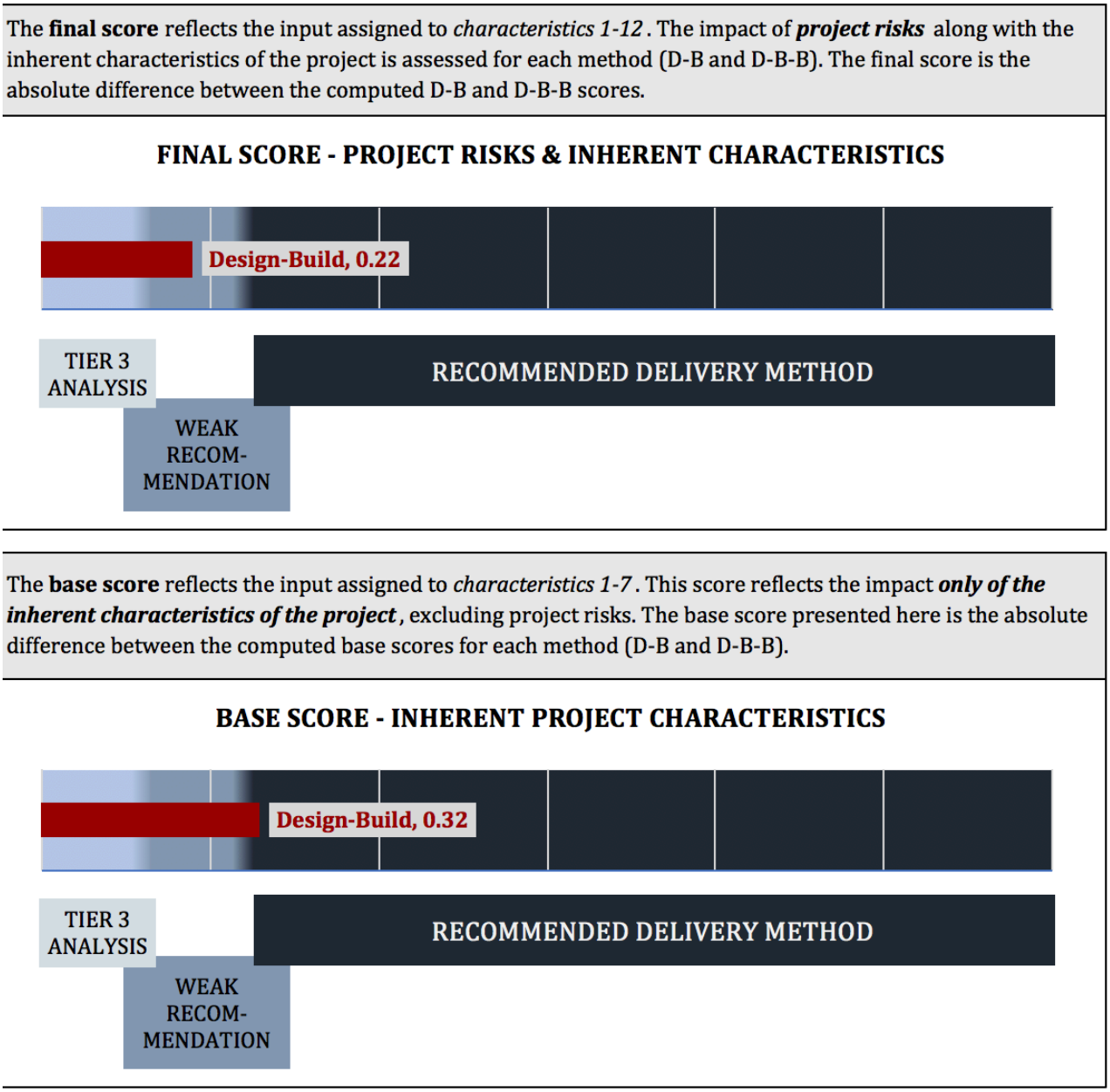


Figure 18 Final & base score in the Output section of the tool

The tool provides additional information to complement the recommendation. Additional output includes bar charts combined with a heat map, showing the score for each delivery alternative for the base and the final score, and bar charts presenting each delivery method's impact in achieving the project goals. Finally, the most and least supportive characteristics for each delivery method, determined by the weight that each characteristic represents in the total score of the delivery

method, are also presented in the output. The two attributes with higher positive scores are listed as the most supportive ones. The two characteristics with the lowest negative scores are provided as those least supporting the delivery method. This feature is intended to help the decision-makers understand the tool's selection of the recommended method and highlight characteristics that could signify a project risk. Figures 19 and 20 present the results provided in the output section, in addition to the base and final scores.

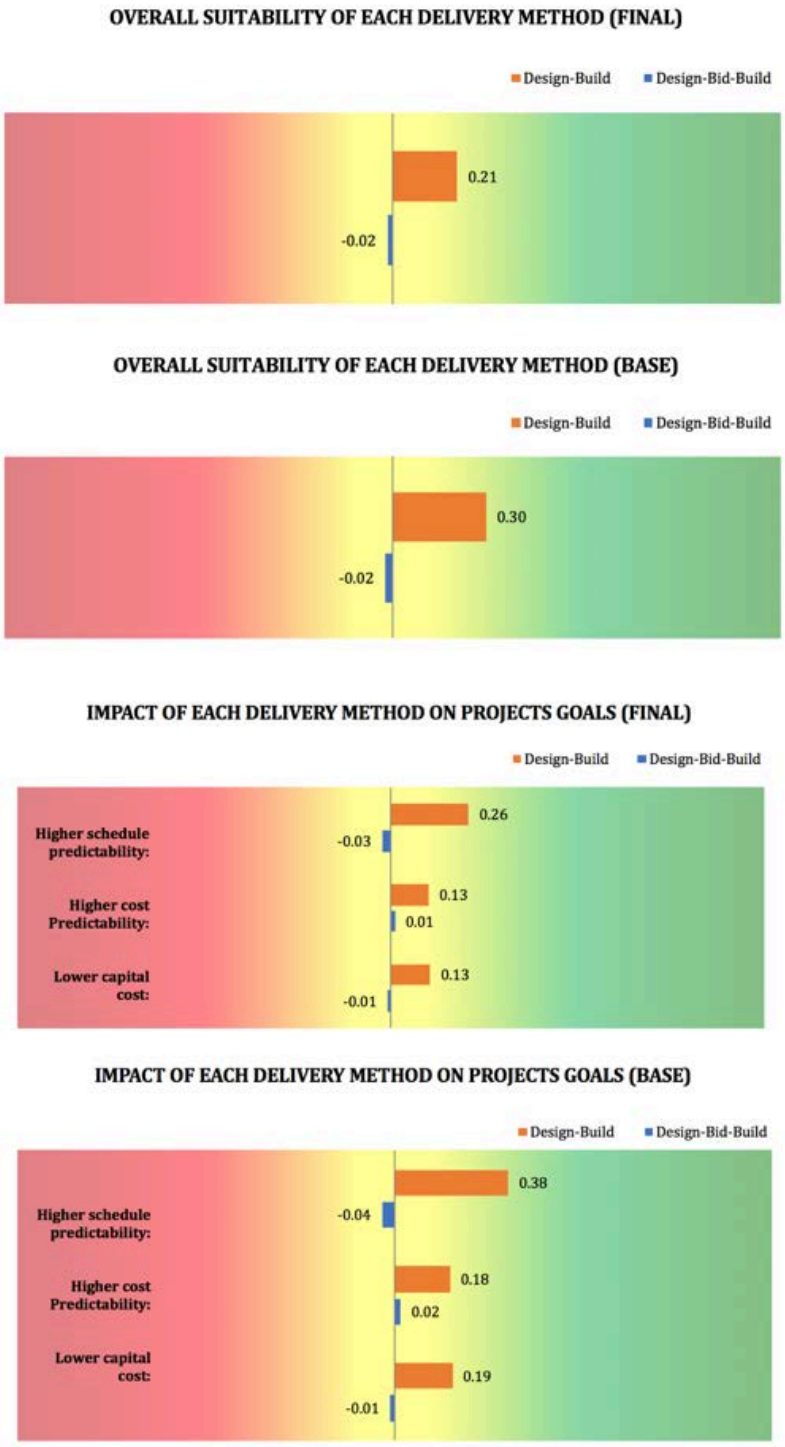


Figure 19 Overall suitability of each delivery method (base & final) and the impact of each delivery method on project goals (base & final)

Design - Build	
Most supportive characteristics	**Least supportive characteristics**
This project requires the use of innovative methodologies.	For this project, significant permits are expected to be outstanding at the time of letting/ award.
This project will significantly benefit from designer-contractor integration and the ability to transfer design errors and omissions risk.	For this project, the utility types listed below are expected to be outstanding at the time of letting/award.
Design -Bid - Build	
Most supportive characteristics	**Least supportive characteristics**
For this project, the incremental costs of alternative delivery are expected to be greater than the value added from innovation.	This project will significantly benefit from designer-contractor integration and the ability to transfer design errors and omissions risk.
For this project, the procurement duration of the alternate delivery method will negatively affect the overall project delivery duration.	For this project, significant schedule savings can be achieved through design and construction overlap.

Figure 20 Most & least supportive characteristics for each method

In a separate tab, the tool also outputs the final score in the form of a gauge dial, as seen in Figure 21. The dial was developed as an attachment to the ADS tool by a separate team working under the direction of TxDOT. The dial needle points to the direction based on the suggested method (DB or DBB) and presents the final tool score. The grey areas capture the scores for which the tool doesn't provide a strong recommendation for either method (<0.3).

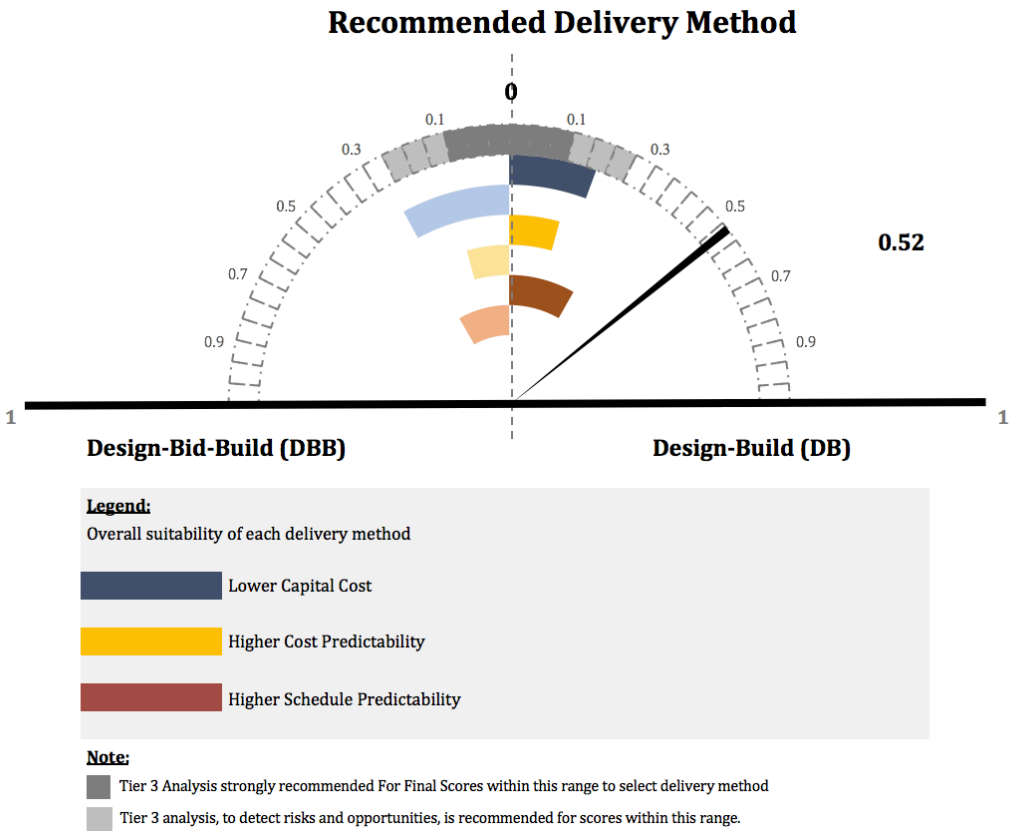


Figure 21 Output in the form of a dial

Conclusions

This report summarizes the development of the ADS V2.0 tool and provides guidance for its use. The calibration and validation efforts described in this report were made to ensure the updated ADS tool captures the benefits and trade-offs between DB and DBB within TxDOT's institutional framework. To ensure efficiency in the tool's use and consistency in the evaluations' results:

- The ADS V2.0 tool should be used through a facilitated process. Facilitation can help evaluators avoid misinterpretation of characteristics or the scoring scale. In addition, a facilitator, having acquired experience in evaluating different projects, can guide scoring, especially for experts who don't have prior experience with the ADS tool. The ADS V2.0 evaluation workshops can typically be completed in about an hour or less.
- The project to be evaluated should have a clear scope definition. While the ADS V2.0 can be utilized at an early stage in the project planning, well-defined project scope description is necessary to evaluate the characteristics and goals accurately. Project risks (e.g., outstanding permits or utilities) are often scored by estimating the situation at the time of letting/award; if there are changes on any characteristic, the team suggests that the tool is re-run. A scope-related question is included in the Yes-No Questions (the first

tab of ADS tool) to capture projects with evolving scopes and present appropriate messages to the evaluators.

- Evaluators should be knowledgeable about the project, including its inherent risks and challenges as well as opportunities. Experience with the ADS tool can also help during the evaluation; however, it is the facilitator's role to assist and guide the teams with less or no experience.

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