

**NCHRP 20-44(32)**

**GUIDELINES FOR SELECTING TRAVEL FORECASTING  
METHODS AND TECHNIQUES—IMPLEMENTATION**

**FINAL REPORT**

*Prepared for:*

National Cooperative Highway Research Program,  
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**SPECIAL NOTE:** This report **IS NOT** an official publication of the National Cooperative Highway Research Program, Transportation Research Board, National Research Council, or The National Academies.

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## **Disclaimer**

The opinions and conclusions expressed or implied are those of the research agency that performed the research and are not necessarily those of the Transportation Research Board or its sponsoring agencies. This report has not been reviewed or accepted by the Transportation Research Board Executive Committee or the Governing Board of the National Research Council.

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# CHAPTER 1. INTRODUCTION

The objective of NCHRP Project 20-44(32), Guidelines for Selecting Travel Forecasting Methods and Techniques—Implementation, was to build awareness of and an audience for a travel forecasting decision support tool (TFGuide) completed in 2017 under a separate NCHRP effort (Project 08-94) (see National Academies of Sciences, Engineering, and Medicine, 2017a and 2017b). TFGuide is intended to help inform selection for planning activities of the most appropriate travel forecasting method by transportation planners and policy practitioners. Until this project, TFGuide had not been in use by the community due to the lack of an administrator to host and maintain the software.

The original research developed TFGuide into a tool that enables practitioners to determine appropriate methods for travel demand forecasting needs and planning application use cases at regional and state transportation agencies across the U.S. TFGuide also provides information on budgets needed for planning analysis and suggests more cost-effective methods, which can be a significant benefit to practitioners who have limited time and resources to invest in new methods. TFGuide was designed with the understanding that the practice of travel forecasting is ever evolving, allowing an administrator to update much of the content through its user interface rather than requiring programming.

NCHRP Project 20-44(32) – through four multiagency workshops, peer exchange, and direct outreach – succeeded in raising awareness of TFGuide, accomplished usability and content enhancements, and transferred hosting of the tool to the American Association of State Highway and Transportation Officials (AASHTO). However, there remains a need to continue raising awareness of the tool and community interest in the long-term maintenance of the technical details that may change over time. Tool content will also require updating to remain current and relevant to the planning community. Only through long-term maintenance and content updates will TFGuide be able to remain current and useful.

This report documents the implementation project and suggests next steps. Chapter 2 discusses the design of the multiagency workshops and the software updates that were undertaken during the first months of the work program. Chapters 3, 4, 5, and 6 discuss each of the multiagency workshops. Chapter 7 discusses the peer exchange. Chapter 8 documents the interim and final panel meetings. Chapter 9 describes the technical support and additional public outreach provided. Chapter 10 summarizes conclusions from the implementation program and recommended next steps.

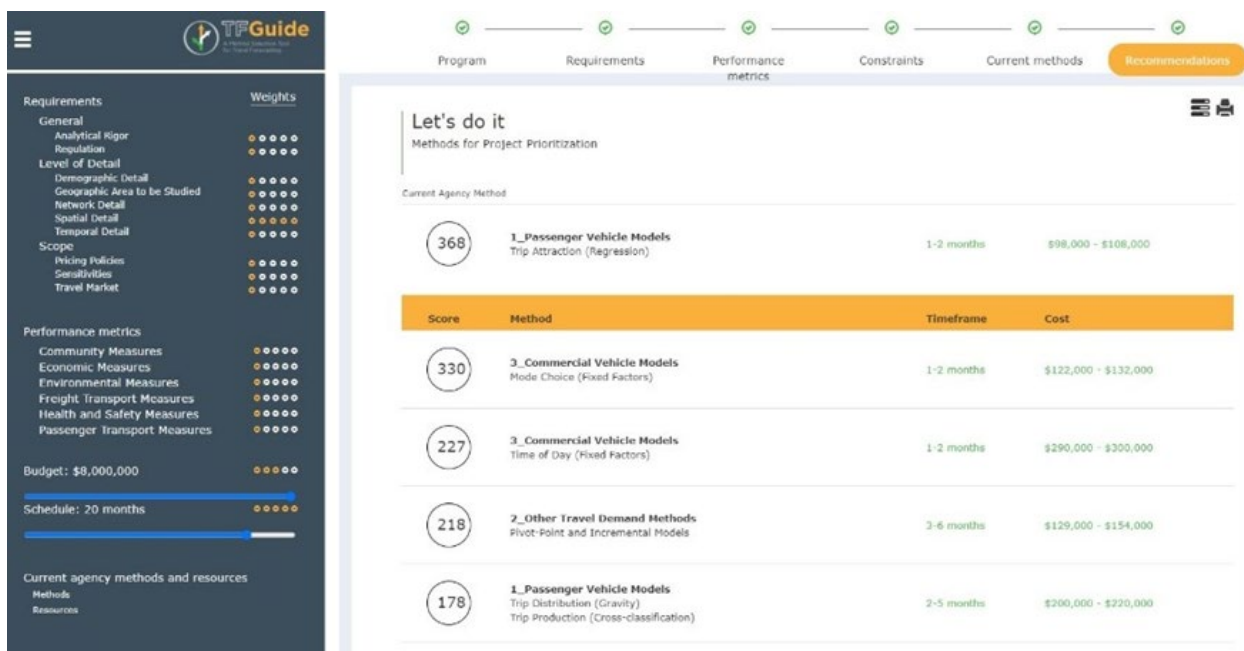
## CHAPTER 2. WORKSHOP DESIGN AND SOFTWARE UPDATES

This chapter discusses the design of the multiagency workshops and the software updates that were undertaken by the Project Team during the implementation work program.

### Workshop Design

#### Background Materials for Workshops

The prior project culminated in the TFGuide online tool and decision-support system around transportation forecasting methods to support planning (Figure 1). The previous research project also produced a research report and a user guide for the tool. For links to these products, see the TRB site: <http://www.trb.org/Main/Blurbs/176645.aspx>.



Source: TFGuide

**Figure 1. Screenshot of TFGuide webtool.**

Central to the implementation phase of the research (this project) was the research team's partnership with Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPO) to test and evaluate the tool in a robust and substantive way. The research team determined that half-day workshops would be the best way to spend time with people who would be applying the TFGuide in various ways to answer specific policy, planning, and investment decisions. This report documents all four workshops conducted as part of the implementation program.

The workshops included instruction on how to use and implement the results from TFGuide to prepare a scope, schedule, and budget for implementing new travel forecasting methods.

Due to the pandemic, these workshops were conducted remotely by the Project Team. This had the added benefit of providing more flexibility to participants that, in turn, allowed for greater workshop participation from a wider audience. The research team hosted the workshops on a platform that maximized participation and allowed for one-on-one technical assistance to be carried out in parallel with the larger workshop if needed.

Each workshop was designed around a specific set of plans and programs (Figure 2) that are commonly of interest to the DOTs and MPOs in attendance, which included four topics.

TRANSPORTATION	ENVIRONMENT
<ul style="list-style-type: none"> <li>• Bike/Pedestrian Capital Investments</li> <li>• Comprehensive Plans</li> <li>• Highway Detailed Design</li> <li>• Highway Preliminary Engineering</li> <li>• Intelligent Transportation Systems Plan</li> <li>• Travel Demand Management Program</li> <li>• Traffic Impact Study</li> <li>• Transit Operations Study</li> <li>• Transit-Oriented Development Study</li> <li>• Long-Range Transportation Plan</li> <li>• Transportation Improvement Program</li> <li>• Freight Plan</li> <li>• Major Highway Corridor Study</li> <li>• Major Transit Corridor Study</li> <li>• Bicycle and Pedestrian Plan</li> <li>• Freeway Operations and Management Study</li> <li>• Arterial Operations and Management Study</li> <li>• Congestion Management Plan</li> <li>• Pricing Study (Tolls, Fees, Fares, Gas, Parking)</li> <li>• Project Prioritization</li> </ul>	<ul style="list-style-type: none"> <li>• Air Quality Emissions Inventory for Conformity Analysis</li> <li>• Energy Use Study</li> <li>• Greenhouse Gas Mitigation Study</li> <li>• Sustainable Community Strategies</li> <li>• Environmental Clearance and Preliminary Design for Transportation Projects</li> </ul>
	ECONOMY
	<ul style="list-style-type: none"> <li>• Economic Development Plan</li> <li>• Economic Impact Analysis</li> </ul>
	SAFETY AND HEALTH
	<ul style="list-style-type: none"> <li>• Health and Physical Activity Plan</li> <li>• Emergency Evacuation Plan</li> <li>• Safety Program</li> </ul>
	EQUITY
	<ul style="list-style-type: none"> <li>• Environmental Justice Plan</li> </ul>

Source: RSG

**Figure 2. Plans and programs included in TFGuide.**

### Workshop Format

The workshops covered the development of scenarios, how to interactively adjust assumptions, and the interpretation of results. The outline for the four workshops covered the following:

- An introduction to TFGuide.
- Scenarios 1–4, discussed separately.
- Questions, feedback, and wrap-up.

The Kentucky workshop included four scenarios selected by the Kentucky Transportation Cabinet (KYTC) and the Ohio-Kentucky-Indiana (OKI) MPO:

1. Pricing Study.
2. Freeway Operations and Management Study.
3. Freight Plan.
4. Traffic Impact Study.

The Minnesota workshop included four scenarios selected by Minnesota DOT (MnDOT) and the Twin Cities Metropolitan Council (Met Council) MPO:

1. Freeway Operations and Management Study.



2. Major Highway Corridor Study.
3. Bicycle and Pedestrian Plan.
4. Environmental Justice Plan.

The Florida workshop included four scenarios selected by Florida DOT (FDOT) and the Sarasota/Manatee MPO:

1. Project Prioritization.
2. Congestion Management Plan.
3. Economic Development Plan.
4. Traffic Impact Study.

The Arizona workshop included four scenarios selected by Arizona DOT (ADOT), Maricopa Association of Governments (MAG) MPO located in the Phoenix region, and Pima Association of Governments (PAG) MPO in Tucson:

1. Major Highway Corridor Study.
2. Intelligent Transportation Systems Plan.
3. Long Range Transportation Plan.
4. Freight Plan.

## Feedback on the Workshops

The research team gathered feedback from the participants to inform subsequent workshops. This was also done to inform future project tasks involving further enhancements to the tool. The research team distributed a short survey to participants of each workshop to solicit additional feedback. This feedback is summarized in the workshop-specific Chapters of this report.

## Software Updates

This section discusses software updates that were made by the Project Team to TFGuide during the implementation project.

TFGuide was designed during the research project to be easy to use by sequentially advancing through a scenario wizard. Simple navigation allows users to return to previous steps, rename completed scenarios, and even copy scenario settings when they need to test a small change. The practical comparison for how inputs impact scenario options is a complex undertaking and it was recognized that new users would benefit from making some usability improvements.

Two such improvements were addressed prior to conducting the first workshop:

1. **Self-registration:** This permitted new users to create user accounts on their own without an administrator. Characteristics of this feature include filling out a form, being emailed a confirmation notice, and then gaining access to the site. A “forgot username” and “forgot password” buttons will allow accounts to be managed by the user alone, like most other websites.
2. **“Ask a Question” and “Provide Feedback” buttons:** The purpose of these buttons is to give users a way to get technical questions answered and leave feedback about the tool and technical content. These buttons allow information to be submitted to improve TFGuide and are of use to any TFGuide administrator.

The TFGuide workshops generated feedback from participants on the user interface and decision support mechanisms to also inform the software updates. One round of improvements was completed after the first two workshops to help users get more from TFGuide. Similarly, a second round of improvements was completed after the last two workshops. In summary, the improvements made during the implementation project included:

1. **Adding an introduction page:** A new intro page was added to TFGuide with additional context for users in response to feedback from the interim panel meeting.
2. **Updates to admin portal:** added the ability for users to sort items in lists through the admin portal,
3. **Refinements to methods database:** In preparing for project workshops, the Project Team tested the scenarios that workshop participants indicated were of interest. Part of this process entailed making adjustments to the methods associated with these scenarios to improve the resulting recommendations. This process involved both improving the quality of TFGuide’s recommendations as well as making the tool recommendations more consistent (something determined necessary after observing the recommendations for various scenarios developed in preparation for the workshops). These adjustments were made through TFGuide’s administrative portal.
4. **Updates to current methods page:** The method and resource categories used in the Current Methods step of TFGuide were updated to make completing this step of the tool setup less challenging for non-modelers.
5. **Question option improvements:** Selection options within the Requirements and Performance Metrics steps were refined. A few examples of improvements to options within the Requirements step include:
  - Adding a checkbox for “Race/Ethnicity Categories” to the question on demographic detail.
  - Separating checkboxes with “Pedestrian/Bike” into two distinct options.
  - Adding a checkbox for “Parking Supply or Pricing” to the question asking about which factors the analysis must consider.
6. **Improvements in score calculation:** Several enhancements were made to the scoring methodology
  - The scores for recommendations are unitless and users struggled to understand their relevance. The scoring was adjusted to be on a scale of 100, providing a more natural interpretation of the results.
  - A further update to the scoring algorithm entailed setting the max score based on the criteria that the user inputs. Prior to the update, scoring was normalized to 100, meaning the highest scoring method always received a score of 100 regardless of whether it met all the user inputs (i.e., selected Requirements and Performance Metrics). The updated scoring algorithm is calculated based on selected user inputs; for example, if a method meets 8/10 inputs, it receives a score of 80. The scoring update improves the ability to compare results across scenarios and more accurately reflects how well a given method meets users’ needs.
  - The cost and timeframe calculations provide higher scores for methods that are under budget or have shorter schedules but do not adequately reduce scores for methods that exceed budget or timeframe. The research team revised this algorithm to produce a more reasonable score for budget and timeframe constraints.
7. **Inclusion of less-complex methods in recommendations:** In response to feedback from the first two workshops, TFGuide logic was reconfigured to remove the exclusion of less-complex methods. Previously, if an agency selected having a complex model as a “current method,” the recommendations excluded any methods that were considered less complex (e.g., gravity models are considered a less complex method when compared to destination choice models). But feedback from users indicates that simpler methods can be better suited for some planning applications. This is true even when more complex methods are available. As a result, this distinction will not be used to eliminate

recommendations for simpler methods. All methods, except those identified as current methods, are eligible for the recommendations.

8. **Improved layout and controls on recommendations page:** The recommendations page was improved to fit the detailed recommendation columns on one page rather than requiring the user to scroll across the columns to see totals. In addition, the readability of the detailed recommendations table for each method was improved.

A final set of TFGuide software update activities were engaged in as the project looked forward to transitioning to a long-term hosting solution. These final activities included:

1. **Bug fixes:** Corrected an issue that caused the Current Agency Method to disappear from the Recommendations step.
2. **Migrating to new hosting:** The Project Team worked with AASHTO representatives to transfer the tool hosting to a server controlled by AASHTO representatives. The AASHTO server was set up with all of the dependencies for TFGuide. The Project Team uploaded the TFGuide software to the AASHTO servers and made available via an easy to reference URL: <https://tf-guide.org/welcome>

At the conclusion of the implementation project, TFGuide was hosted and operational on a server controlled by AASHTO.

## CHAPTER 3. WORKSHOP #1

### Description

Workshop 1 was hosted with the Kentucky Transportation Cabinet (KYTC) and a partner MPO, the Ohio-Kentucky-Indiana Regional Council of Governments (OKI). Scott Thomson from KYTC and Bob Koehler from OKI were the primary points of contact. Through discussion and input prior to the workshop, KYTC and OKI identified the following four topics of interest: pricing, freeway operations, freight plans, and traffic impact studies.

In preparation for the workshop, the research team created a scenario for each topic within TFGuide. Each scenario was tested to review the tool's resulting recommendations. In some cases, the Project Team adjusted methods through TFGuide's administrative portal to refine results.

The workshop was hosted virtually on Microsoft Teams from 1:00 to 4:30 PM (EST) on February 4th. Fourteen DOT and MPO staff participated, along with four presenters and support staff from the Project Team:

- Workshop participants:
  - Brandon Rudd (OKI)
  - Connor Schurman – (KYTC)
  - David Souleyrette (KYTC)
  - Elizabeth Niemann (KYTC)
  - Hui Xie (OKI)
  - Jayalakshmi Balaji (KYTC)
  - Liren Zhou (OKI)
  - Mikael Pelfrey (KYTC)
  - Nathan Ziegler (OKI)
  - Robert Koehler (OKI)
  - Scott Thompson (KYTC)
  - Stephen De Witte (KYTC)
  - Ting Zuo (OKI)
- Project team participants:
  - Maren Outwater (presenter)
  - Jay Evans (presenter)
  - Florian Fessel (support staff)
  - Gabby Freeman (support staff)

Following an introduction on the project and TFGuide, the research team presented each of the four scenarios by stepping through the selections in the tool while receiving input from participants. The scenarios were broken up midway with a 10-minute break and followed by a half-hour of discussion and feedback on TFGuide.

The workshop agenda followed the following format:

- [1:00] Introductions
- [1:10] Purpose and overview of the workshop (Jay)
- [1:20] Introduction to TFGuide (Maren)
- [1:50] Scenario 1 Pricing: run scenario, review (Maren)
- [2:30] Scenario 2 Freeway Operations: run scenario, review (Jay)
- [3:00] Break
- [3:10] Scenario 3 Freight Plan: run scenario, review (Maren)

- [3:40] Scenario 4 Traffic Impact Study: run scenario, review (Jay)
- [3:55] Questions, feedback, and wrap up (Jay and Maren)
- [4:30] Adjourn

The first few scenarios followed specific examples. For the pricing scenario, the example project was tolling on the bridge over the Ohio River connecting Ohio and Kentucky. This project has already been designed, but it needs funding. For the freeway operations scenario, the project example was a study to improve the operations of several interstate highways and freeways in northern Kentucky. The last two scenarios were generic and did not align with specific project examples.

## Findings

Participants agreed that TFGuide is useful as a screening tool, particularly to search for available travel forecasting methods or to verify suggestions from consultants. Participants noted that they currently defer to experience or consultants when deciding on travel forecasting methods for a particular project, but recognized that both practices have limitations, such as individual bias or lack of knowledge of newer methods.

One recommendation for improvement concerned TFGuide’s scoring method. Participants found the scoring for recommendations to be unintuitive and confusing, noting that the numbers seemed “random,” and it was not clear what constituted a “good” score. It was suggested that the scoring be scaled to 100 or at least to have some more guidance included in TFGuide on the Recommendations page to explain how scores are produced.

Another recommendation concerned the Current Methods step of TFGuide. Participants, especially those without a modeling background, found the various options difficult to interpret. One participant who identified as a planner mentioned that they would need the help of a modeler to accurately complete the step. Another participant suggested categorizing options by model type or having TFGuide automatically select options based on user input of available software packages at their agency.

Other recommendations mentioned included acknowledging nonmodel methods and approaches in TFGuide, such as sketch methods, and developing presentations or guidance on how to interpret results and explain them in nonmodeling terms to decision makers.

## Feedback and Lessons Learned

Following the workshop, participants received a four-question survey soliciting feedback. The questions posed and submitted answers are as follows:

1. How could TFGuide be improved to help your agency select methods for travel forecasting?
  - a. Continue focus on nontechnical users of TFGuide.
  - b. A bit more explanation/description/definition of terms and/processes for the non-modeler.
2. How would you recommend TFGuide best be brought into the conversation to inform decision-making around the methods to use in tackling planning analysis needs at your agency or your partners?
  - a. Think about how Highway Design Project Managers can benefit from the tool.
  - b. The guide could be on-boarded by the leadership in KYTC and then presented to the District Planning staff, MPOs, and Kentucky Area Development Districts (ADDs).
3. How can we best follow-up to support implementing TFGuide in your agency or by your partners?

- a. Workshops for non-modelers/forecasters so that they can experience the benefits of the TFGuide.
  - b. I believe you have already involved our Forecasting/Modeling Branch as well as our Director of Planning. They would be the contacts to get this moving.
4. Is there any other feedback you would like to provide relating to TFGuide or the workshop?
- a. Very productive. Understanding the kinds of projects currently being considered creates the opportunity to make the tool useful immediately.
  - b. The whole topic is perhaps too broad. I think I was expecting more "how to" on topics rather than provision of the potential tools.

Overall, the findings from the workshop and feedback collected via the survey stressed that more work is needed to make TFGuide accessible to a nonmodeling audience. This was particularly true for the Current Methods step in the tool, which contains many technical terms and groups options into broader categories without distinguishing by model type or software. As noted, in Chapter 2, this step was subsequently updated as part of the implementation work program.

## CHAPTER 4. WORKSHOP #2

### Description

The Project Team followed a similar format to prepare for and host the second workshop, which was hosted with Minnesota DOT (MnDOT) and partner MPO Metropolitan (Met) Council. Jim Henricksen (MnDOT) and Jonathan Ehrlich (Met Council) served as the primary points of contact.

The Minnesota workshop was hosted from 1:00 to 4:30 PM (CDT) with 17 participants and three members of the Project Team:

- Workshop participants:
  - Ashely Asmus (Met Council)
  - Cole Hiniker (MnDOT)
  - David Burns (Met Council)
  - Dennis Farmer (Met Council)
  - Gene Hicks (MnDOT)
  - Heidi Schallberg (Met Council)
  - Jim Henricksen (MnDOT)
  - John Tompkins (MnDOT)
  - Jon Solberg (MnDOT)
  - Jonathan Ehrlich (Met Council)
  - Joseph Barbeau (Met Council)
  - Kary Brian (MnDOT)
  - Liz Roten (Met Council)
  - Paul Czech (MnDOT)
  - Rachel Wiken (Met Council)
  - Steve Elmer (Met Council)
  - Steven Peterson (Met Council)
- Project Team participants:
  - Maren Outwater (presenter)
  - Jay Evans (presenter)
  - Gabby Freeman (support staff)

The four scenarios covered during the workshop included freeway operations, a major highway corridor study, a bicycle and pedestrian plan, and an environmental justice plan. The timing and agenda were as follows:

- [1:00] Introductions
- [1:10] Purpose and overview of the workshop (Jay)
- [1:25] Introduction to TFGuide: purpose and function (Maren)
- [1:55] Scenario 1 Freeway Operations: run scenario, review (Maren)
- [2:35] Scenario 2 Highway Corridor Study: run scenario, review (Jay)
- [3:00] Break
- [3:10] Scenario 3 Bicycle and Pedestrian Plan: run scenario, review (Maren)
- [3:35] Scenario 4: Environmental Justice Plan: run scenario, review (Jay)
- [4:00] Questions, feedback, and wrap up (Jay and Maren)
- [4:30] Adjourn

Participants submitted valuable feedback during the half-hour of discussion and were sent the same follow-up survey as participants of the first workshop.

## Findings

An interesting outcome of this workshop was all scenarios resulting in the “Current Agency Method” having the highest score out of all recommendations. These results are due to the fact that Met Council and MnDOT both have a large selection of sophisticated modeling tools already available. As a result, TFGuide always recommended the Current Agency Method and only produced a few recommendations for each scenario. Participants agreed that TFGuide might be more useful for smaller MPOs or agencies who have fewer tools available and need to know what additional tools they should be investing in with limited resources.

Participants noticed that TFGuide only recommended higher-class model methods and stressed that sometimes the most sophisticated modeling solution is not the best suited to a particular project. For example, even if an agency has an activity-based model (ABM), it might not be the best tool to apply to every project. An ABM could require more investment to develop data that may have a larger range of error than other, simpler tools. The Project Team noted that currently TFGuide does not recommend lower-class models if an agency identifies having a higher-class model selected as a current method, but in some instances, lower-class tools present viable simpler and nimbler alternatives and should be included in the recommendation results.

Other comments highlighted that TFGuide needed to better address trends and questions that are topical and current. For example, participants found that the tool did not adequately address topics like race and active transportation, both of which are currently the focus of many agencies. Although it was conceded that many modeling tools do not presently have strong capabilities related to these topics, TFGuide needs to be forward-looking and anticipate future modeling needs and questions. Significant investment will be needed to keep TFGuide up to date; otherwise, it will become irrelevant.

Another topic was the extensibility of TFGuide to address multiple projects. For example, one participant suggested having the ability to use TFGuide to flag multiple projects to see where different models could be applied for several projects or applications of interest.

Similar to the KYTC workshop, participants found the “Current Methods” step difficult to navigate. One participant referred to it as the goldilocks dilemma, where one needs a certain level of expertise to use TFGuide, but those who do not have the expertise are the ones who need it most.

Another participant mentioned that while the tool could be a useful resource for explaining travel forecasting to decision makers and executives, it is currently geared towards users who already have a lot of forecasting knowledge and would need to be either reformatted or significantly unpacked for those who are not in the forecasting world.

## Feedback and Lessons Learned

Participants were sent the same four-question survey soliciting feedback:

1. How could TFGuide be improved to help your agency select methods for travel forecasting?
  - a. Identifying alternatives to our default models (e.g., identifying options other than activity-based models for some questions).
2. How would you recommend TFGuide best be brought into the conversation to inform decision-making around the methods to use in tackling planning analysis needs at your agency or your partners?
  - a. Go through the exercise of using the tool for projects or studies.



3. How can we best follow up to support implementing TFGuide in your agency or by your partners?
  - a. I think it might be useful for someone to build a list of agencies that have used each of the tools listed in TFGuide so that agencies know who they might go to for guidance.
4. Is there any other feedback you would like to provide relating to TFGuide or the workshop?
  - a. None.

Participant feedback during the workshop reinforced the need to revisit the Current Methods step of TFGuide to make it more intuitive and accessible to non-modelers. The research team has decided to reformat this portion of the tool before the next set of workshops.

In addition, in response to feedback from the Minnesota workshop, a few improvements have been made to some of the selection options in TFGuide, specifically within the Requirements and Performance Metrics steps. A few examples of improvements to options within the Requirements step include the following:

- Adding a checkbox for “Race/Ethnicity Categories” to the question on demographic detail.
- Separating checkboxes with “Pedestrian/Bike” into two distinct options.
- Adding a checkbox for “Parking Supply or Pricing” to the question asking about which factors the analysis must consider.

## CHAPTER 5. WORKSHOP #3

### Description

The third workshop was hosted with the Florida Department of Transportation (FDOT) Central Office, District 1, and partner metropolitan planning organization (MPO) Sarasota/Manatee.

Thomas Hill from FDOT Central Office and Christopher Simpron from FDOT District 1 were the primary points of contact. Through discussion and input prior to the workshop, FDOT District 1 and Sarasota/Manatee identified the following four topics of interest:

- Project Prioritization.
- Congestion Management Plan.
- Economic Development Plan.
- Traffic Impact Study.

In preparation for the workshop, the Project Team created a scenario for each topic within TFGuide. Each scenario was tested to review the tool's resulting recommendations. In some cases, the Project Team adjusted methods through TFGuide's administrative portal to refine results.

The workshop was hosted virtually on Microsoft Teams from 1:00 to 4:30 PM (EDT) on June 10th. Seven FDOT and MPO staff participated, along with three presenters and support staff from the Project Team:

- Workshop Participants:
  - Alvimarie Corales-Cuadrado (Sarasota/Manatee MPO)
  - Christopher Simpron (FDOT District 1)
  - Daniel Macmurphy (Traf-O-Data/FDOT District 1)
  - Dave Hutchinson (Sarasota/Manatee MPO)
  - Jerry Graham (Traf-O-Data/FDOT District 1)
  - Kyle Purvis (FDOT District 1)
  - Thomas Hill (FDOT Central Office)
- Project Team Participants:
  - Maren Outwater (Presenter)
  - Jay Evans (Presenter)
  - Gabby Freeman (Support staff)

Following an introduction on the project and TFGuide, the Project Team presented each of the four scenarios by stepping through the selections in the tool with input from participants. The scenarios were broken up midway with a 10-minute break and followed by a half-hour of discussion and feedback on TFGuide. The timing and agenda were as follows:

- [1:00] Introductions
- [1:10] Purpose and overview of the workshop (Jay)
- [1:20] Introduction to TFGuide (Maren)
- [1:50] Scenario 1 Project Prioritization: run scenario, review (Maren)
- [2:30] Scenario 2 Congestion Management Plan: run scenario, review (Jay)
- [3:00] Break
- [3:10] Scenario 3 Economic Development Plan: run scenario, review (Maren)
- [3:40] Scenario 4 Traffic Impact Study: run scenario, review (Jay)
- [3:55] Questions, feedback, and wrap up (Jay and Maren)
- [4:30] Adjourn

This workshop was the first workshop with the new format for the Current Methods step. Whereas participants in prior workshops had commented on the inaccessibility of the Current Methods step in its old format, the absence of such feedback during the FDOT workshop suggested that the update successfully improved the usability of the tool.

Participants were sent the same four-question survey as the previous workshops, asking the following:

1. How could TFGuide be improved to help your agency select methods for travel forecasting?
  - a. Possibly include Complete Streets option
2. How would you recommend TFGuide best be brought into the conversation to inform decision-making around the methods to use in tackling planning analysis needs at your agency or your partners?
  - a. I appreciate the organized format and sequence of instructions that TFGuide provides. This is a useful and purposeful tool.
3. How can we best follow up to support implementing TFGuide in your agency or by your partners?
  - a. Presentation to the Florida Model Task Force at a future meeting would be highly useful for Florida practitioners.
4. Is there any other feedback you would like to provide relating to TFGuide or the workshop?
  - a. The research group did an excellent job of presenting, instructing and answering questions.

## CHAPTER 6. WORKSHOP #4

The Project Team followed the same format for the fourth and final workshop, which was hosted with Arizona Department of Transportation (ADOT) and two partner MPOs: Maricopa Association of Governments (MAG) located in the Phoenix region, and Pima Association of Governments (PAG) in Tucson. The points of contact for the Arizona workshop included Baloka Belezamo (ADOT), Arup Dutta (MAG), and Hyunsoo Noh (PAG).

The Arizona workshop was hosted from 2:00 to 5:30 PM (AST) on June 29th with 21 participants and three members of the Project Team, as follows:

- Workshop participants:
  - Arup Dutta (MAG)
  - Asad Karim (ADOT)
  - Baloka Belezamo (ADOT)
  - Bernadette Phelan (ADOT)
  - Carlos Lopez (ADOT)
  - Charla Glendening (ADOT)
  - Daehyun You (MAG)
  - Hyunsoo Noh (PAG)
  - James Tokishi (PAG)
  - Jason James (ADOT)
  - Jeanette DeRenne (PAG)
  - Jingwei Lian (MAG)
  - Josh Pope (PAG)
  - Lavanya Vallabhaneni (MAG)
  - Paul Casertano (PAG)
  - Sam Patton (ADOT)
  - Saroja Devarakonda (ADOT)
  - Sreevatsa Nippani (MAG)
  - Tazeen Dwan (ADOT)
  - Tracy Clark (ADOT)
  - Xiao Li (PAG)
- Project Team participants:
  - Maren Outwater (presenter)
  - Jay Evans (presenter)
  - Gabby Freeman (support staff)

The four scenarios covered during the workshop were:

- Major Highway Corridor Study.
- Intelligent Transportation Systems Plan.
- Long Range Transportation Plan.
- Freight Plan.

As with the other workshops, the Project Team created a scenario for each topic within TFGuide. Each scenario was tested to review the tool's resulting recommendations. In some cases, the Project Team adjusted methods through TFGuide's administrative portal to refine results.

The workshop agenda was as follows:

- [2:00] Introductions
- [2:10] Purpose and overview of the workshop (Jay)

- [2:25] Introduction to TFGuide: purpose and function (Maren)
- [2:55] Scenario 1 Major Highway Corridor Study: run scenario, review (Maren)
- [3:35] Scenario 2 Intelligent Transportation Systems Plan: run scenario, review (Jay)
- [4:00] Break
- [4:10] Scenario 3 Long Range Transportation Plan: run scenario, review (Jay)
- [4:35] Scenario 4 Freight Plan: run scenario, review (Maren)
- [5:00] Questions, feedback, and wrap up (Jay and Maren)
- [5:30] Adjourn

Participants submitted valuable feedback during the half-hour of discussion and were sent the same follow-up survey as participants of the previous workshops. Feedback was recorded as follows:

Participants were sent the same four-question survey as the previous workshops, asking the following:

1. How could TFGuide be improved to help your agency select methods for travel forecasting?
  - a. The more details in the documentation the better for primary users. For people presenting to management for changes suggested by the software visual aids are better.
  - b. Communication is the key. Few meetings might help to understand the needs.
  - c. It is a good tool to estimate an overall estimation especially for developing an OWP. But it would be great if you could consider.
    - i. Include land-use and air-quality component
    - ii. Consider a given-base option in "Requirements" based on "Program" instead of selecting individual item in "Requirements"
    - iii. In "Resources Breakdown" of "Recommendations", it would be great if you could give a detailed information of each item. For example, what does mean "Standard Hardware"?
  - d. Right now, TFGuide appears to show the gap analysis between tools needed to accomplish a policy level intervention, versus tools currently employed by the Agency. However, with each passing year, there are new metrics and terms that are introduced by TRB (Vertical Equity, Horizontal Equity, etc.). Hence, the tool has to be expanded annually as well. Agencies need to expand their modeling capability each year, given the changing landscape in advanced modeling.
2. How would you recommend TFGuide best be brought into the conversation to inform decision-making around the methods to use in tackling planning analysis needs at your agency or your partners?
  - a. For technical people the opportunity to see the results of scenarios should motivate use. For management I think a focus on increasing capabilities or reducing costs is the motivating factor.
  - b. Understanding the needs and methods available and the recommendation from TFGuide can help in the decision-making process.
  - c. Especially for OWP, it would give a good estimation with clear high-level understanding of the current resources.
  - d. The best way to engage analysts and decision makers would be to host more workshops or to develop smart flow charts to explain the gap between what the agency has versus what the agency needs to accomplish policy level goals.

3. How can we best follow up to support implementing TFGuide in your agency or by your partners?
  - a. I think you mentioned a user community in the presentation and this is going to be critical not only for sharing between agencies but also letting those in charge of the tool target further training in problem areas. Follow up to motivate feedback is best by email.
  - b. Frequent communication.
  - c. It would be great to have any update for this project through email.
  - d. The best way to engage analysts and decision makers would be to host more workshops or to develop smart flow charts to explain the gap between what the agency has versus what the agency needs to accomplish policy level goals.
4. Is there any other feedback you would like to provide relating to TFGuide or the workshop?
  - a. The one area people seem to ignore until very far into the process is data requirements both in economic forecasts and other data needs to support the methods. There is a tendency to use the data we have even if that data is not what is truly needed.
  - b. No, I don't have any. Thank you for your effort!
  - c. Again, the best way to engage analysts and decision makers would be to host more workshops or to develop smart flow charts to explain the gap between what the agency has versus what the agency needs to accomplish policy level goals.

# CHAPTER 7. PEER EXCHANGE

## Subsection 1. Overview of the Peer Exchange

### Purpose

In addition to the initial four workshops, the NCHRP 20-44(32) project sponsored a peer exchange in Boise, Idaho, on August 31st, 2022, in conjunction with the 17<sup>th</sup> National Tools of the Trade Conference. The peer exchange was focused on sharing experiences and considering future directions of the TFGuide, the online tool designed to guide public agencies in selecting appropriate forecasting methods and techniques depending on the application. This chapter summarizes the peer exchange.

The peer exchange was intended to:

- Share experiences to date with the tool.
- Consider how best to maintain the tool long-term and how best to leverage the original and implementation investment.
- Provide insight into a future research agenda.

### Peer Exchange Overview

The peer exchange was held as a 5-hour session attended by nine representatives of regional, state, or national organizations and three facilitators from RSG. This report summarizes the discussions that took place at the peer exchange, including key takeaways and directions for next steps.

A variety of TFGuide stakeholders participated in the peer exchange (Table 1).

**Table 1. Peer exchange participants.**

Attendee	Representation
Jeff Von Brown	Iowa Department of Transportation
Hannah Cockburn	City of Greensboro, North Carolina
Mike Ulrich	Spokane Regional Transportation Commission
Greg Giaimo	Ohio Department of Transportation
Natalia Brown	Utah Department of Transportation
Mitch Skiles	Community Planning Association of Southwest Idaho
Christeen Pusch	Texas Department of Transportation
Bhupendra Patel	Association of Monterey Bay Area Governments
Penelope Weinberger	AASHTO
Jay Evans	RSG
Maren Outwater	RSG
Reid Haefer	RSG

## Subsection 2. Peer Exchange

As previously described, the peer exchange was attended by participants from across the country and focused on eliciting feedback on the tool to identify any potential modifications and a future course of action. The format of the peer exchange was a combination of technical presentations and facilitated group discussions. The agenda included a detailed presentation of the TFGuide software, case-study presentations

from two peer exchange participants, and two breakout sessions on specific topics related to the application and long-term maintenance of TFGuide.

## Decision-Making for Analysis Tools

The introductory session of the peer exchange asked participants to briefly describe how their agencies decide on the type of tools and analyses they use for policy and planning applications. Participants described a variety of frameworks that their agencies use to determine the appropriate tools for travel modeling and transportation analysis. The frameworks described vary amongst the agencies and include a variety of decision-making processes that involve individual agency staff, collaboration amongst agencies, formal peer review, and stakeholder involvement. A common theme of all the frameworks described is that the decision-making is often spread amongst agency staff and other entities such as peer agencies, stakeholders, board members, and industry experts. Table 2 below shows a summary of the high-level frameworks that participants described their agencies using.

**Table 2. Existing agency frameworks for analysis tools decision-making.**

Framework Type	Description	Entities Involved
Informal staff process	Agency staff members conduct independent research, potentially with assistance from consultants and peer agency's staff and make independent decisions on modeling tools and methodologies.	Agency Staff
Collaborative effort amongst multiple agencies	Agencies collaborate with other agencies to determine coordinated modeling framework. For example, state agencies may utilize models for all MPOs or smaller MPOs may borrow modeling frameworks from larger MPOs.	States, MPOs, Counties, Cities
Travel Model Improvement Program (TMIP) Peer Review Process	Formal process through the Federal Highway Administration (FHWA) TMIP where a panel of experts make recommendations to agency staff, which guide decisions on modeling tools and methodologies.	Expert Panel, Agency Staff
Political-based process	Informal process that is influenced by top-down priorities established by agency governing boards or political constituents. Modeling decisions are strongly influenced by agency's boards, committees, or stakeholders.	Agency board members, other influential stakeholders

## TFGuide in Action

Prior to the peer exchange, two participants were selected to try out the TFGuide software and report back during the peer exchange about their experience. During this session, the two participants gave presentations that summarized their initial feedback on TFGuide. The presentations included substantive insights that positively confirmed the utility of the tool to their agency and included feedback about how the tool could be improved in several ways. Each of these participants were representatives of a state DOT.

Participant #1, from Texas DOT, described how they see lots of potential use for the tool within their agency. This participant said they shared the tool with modelers within their agency, who expressed excitement about the tool. Yet, as a non-modeler, this participant found the tool somewhat difficult to follow and described it as complex. The participant recommended that there be additional information provided in the tool guidebook and also more guiding information provided directly in the tool. This participant was also surprised at the complexity and cost of the techniques recommended through the tool.



Participant #2, from Iowa DOT, described how their agency has less complex modeling applications and how the high level of detail included in the tool may be more advanced than necessary for their agency. This agency typically hands off more complex modeling projects to consultants. When reviewing the tool results, this participant was overwhelmed by the level of detail. This participant was impressed by the robustness of the tool and conveyed that the tool could be useful for new MPOs or for agencies that have not yet done much modeling.

## Leveraging TFGuide

In the first roundtable discussion, the peer exchange participants had a comprehensive group discussion on the TFGuide tool. Discussion topics included the type of methods that are recommended in the tool, whether the tool will achieve widespread use, other information that could be included in the tool, and tool user interface feedback.

A substantive topic was the type of information and methods that are currently in the tool compared to other content that the participants suggested could be included. Additional information and methods suggested by participants included equity analysis, strategic models, model post processing, reporting, and data visualization. It was suggested that less quantifiable, ‘soft science’ methods should be included, which include methods related to equity analysis. Participants also suggested the inclusion of strategic models which are not currently included in TFGuide. Most notably, this includes VisionEval, which is a set of strategic models used by state and regional governments for scenario planning (VisionEval, 2022). Other suggestions included the incorporation of land use models, such as UrbanSIM and CommunityViz, project prioritization tools, and specific bike/ped models. Lastly, the participants suggested that TFGuide include suggestions for post-processing, data visualization, and reporting methods that complement the core modeling methods that the tool currently recommends. It was also suggested that the tool needs to show the costs of tool maintenance over time, not just the cost for implementing the tool.

Another topic discussed was the tool user interface. There were a handful of suggestions for making improvements to how users input information and view the recommended results. Many of the participant comments revolved around the idea that the amount of information in the tool was slightly overwhelming and that it may be preferable to pare down the amount of content presented. But it should also be noted that the participants previously suggested that additional content be included in the tool (see above paragraph). A recurring comment was to integrate the standalone (outside-of-tool) guidance document into the tool so that users have all the guidance they need in a single location. The inclusion of that guidance document in the tool could be paired with ‘tooltip’ popup boxes that explain certain parts of the tool that may be unclear to users. It was also noted that for the ranked recommendations, for some users, the rankings of the recommendations were not always presented in the correct top-to-bottom order. This was noted and will be subsequently discussed with the software developers.

Lastly, the participants discussed whether the tool will achieve widespread use by agencies across the country over time. One of the barriers brought up was the inertia of agencies being settled in the current methods they use and not having any incentive to explore other options. Participants emphasized that agencies need an incentive to use the tool, which could include cost-savings and a demonstration of effectiveness by peer agencies. Other barriers to adoption include a lack of awareness or publicity for the tool and whether the tool will have a long-term maintenance strategy that makes it sustainable (see section below for more info).

## TFGuide Long-Term Maintenance

The second roundtable peer exchange session pertained to the long-term ownership and maintenance of the TFGuide tool. This session explored the different potential options for long-term maintenance of TFGuide, which included:

- **Crowd-sourced approach by committee or volunteers.** One example of this option is the Travel Forecasting Resource (<https://tfresource.org>) which is a collection of the best practices for travel demand forecasting and travel survey methods. TRB managed this work and the volunteers through a subcommittee of the Transportation Demand Forecasting (AEP50) Committee (Travel Forecasting Resource, 2022).
- **Consortium approach.** One example of this option is the ActivitySim (<https://github.com/ActivitySim/activitysim.github.io>) project, where agency partners create and maintain advanced, open-source, activity-based travel behavior modeling software. There are currently 10 consortium partners, and the funding is managed by the Association of Metropolitan Planning Organizations (AMPO) Research Foundation, a Federal 501(c)(3) organization (AMPO, 2022).
- **Federal pooled fund approach.** One example of this approach is VisionEval (<https://visioneval.org/project>), a collaborative project to build a family of strategic modeling tools for scenario planning (VisionEval, 2022). These tools were originally developed by the Oregon Department of Transportation and then updated by the Federal Highway Administration, working with ODOT. The current updates are funded through an FHWA-pooled fund, with seven state DOT partners.
- **Federal research or organization approach.** One example of this is the AASHTOWare project (<https://www.aashtowareproject.org/#>), a software developed for the transportation construction community (AASHTO, 2022a).

After discussing a variety of different approaches, the group came to a general conclusion that a hybrid model would be most appropriate. The recommended hybrid model would consist of a committee of volunteers (including MPOs) to steer and update the tool and paid support for technical expertise or feature changes. The AASHTO Technical Service Program (AASHTO, 2022b) requires DOT member support and could provide funding for software hosting and maintenance as well as technical support for new features. The group discussed the need to consider the likely costs to support the tool long-term.

## Next Steps

The final session of the peer exchange discussed the next steps for the TFGuide project. The facilitators outlined next steps which include synthesizing the peer exchange in written documentation (this chapter), continuing to promote the tool amongst public agencies, providing technical support until the end of the contract, and delivering the final report.

## CHAPTER 8. PANEL MEETINGS

There were three project panel meetings held during the course of the implementation project: an initial panel meeting, an interim panel meeting, and a final panel meeting. This chapter describes the meetings and key outcomes.

### **Initial Panel Meeting**

The initial panel meeting was held on November 9, 2020. The amplified work plan, which had been circulated in advance, was the primary discussion topic. The meeting allowed a discussion of key comments and a finalization of the amplified work plan.

### **Interim Panel Meeting**

The interim panel meeting was held on May 6, 2021. The meeting provided an opportunity to discuss the first two workshops and to ratify the plan for moving forward with the final two workshops and the peer exchange. The panel also agreed to the research team continuing its approach of investing in making software improvements in TFGuide as budget allows, and to begin the process of securing a long-term host.

### **Final Panel Meeting**

The final panel meeting was held on November 15, 2022. The focus of the meeting was on findings and next steps generated by the peer exchange, which occurred in August 2022. The panel was also briefed on the outcomes and completion of other tasks, including the two workshops held since the Interim Panel Meeting, and the migration of the TFGuide software hosting to AASHTO. The panel discussed additional outreach activities to be accomplished before the end of the contract, including production of a conference abstract, presentation, and an easy-to-reference handout. Project team attendance and presentation will continue at several upcoming conferences through the end of the implementation project contract.

## CHAPTER 9. TECHNICAL SUPPORT

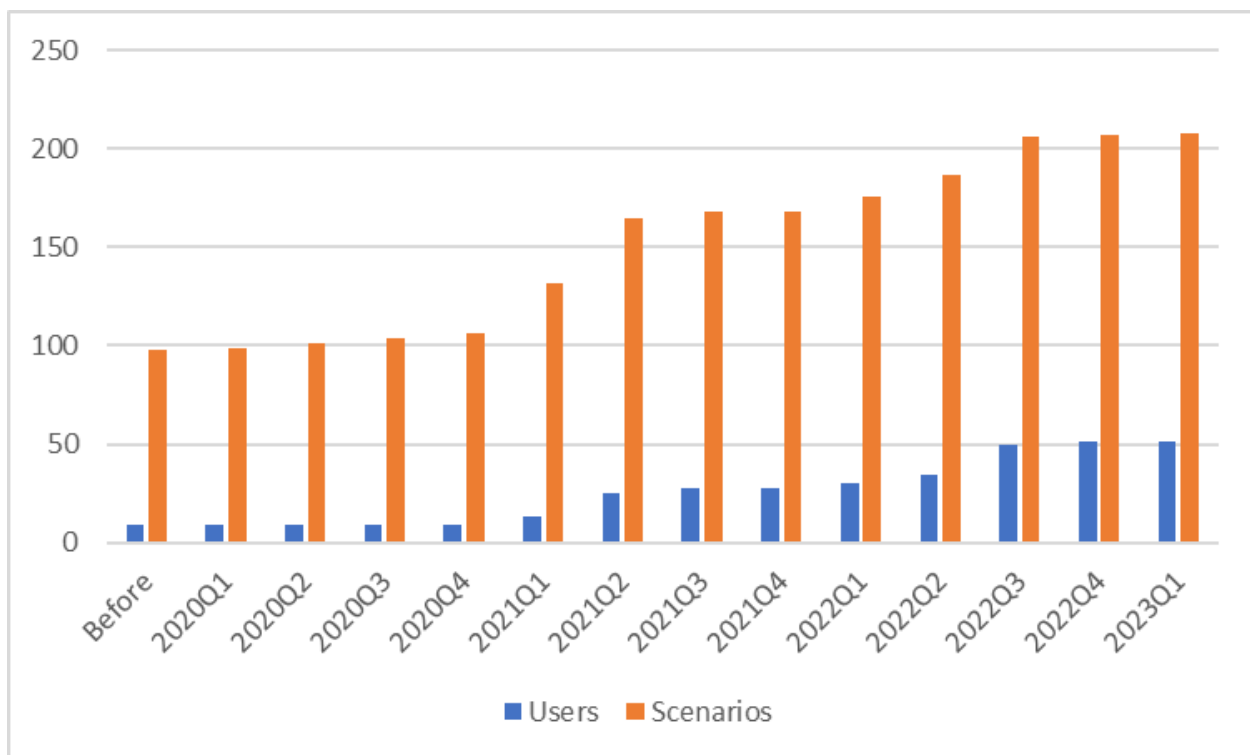
Since the development of TFGuide, technical support has been available to ensure that users are able to navigate the tool effectively and receive assistance with any technical issues that arise, as well as guidance on use cases.

From the commissioning of this implementation program, the success of the tool and implementation plan were to be partially measured by the following metrics:

1. Number of overall users.
2. Number of scenarios developed by users.
3. Feedback from users on the quality of the recommendations.
4. Feedback from users on the usefulness of the tool.

As shown in Figure 3, the first two measures have been quantified by the TFGuide administrator to enable reporting on a quarterly basis.

Although TFGuide provides a feedback option within the tool, no actionable feedback from users was obtained. However, feedback through the workshops and the peer exchange was acted on or documented for future potential action herein.



**Figure 3. Number of users and scenarios developed by quarter.**

Figure 3 displays the number of users and scenarios developed by quarter. The number of TFGuide users increased with each activity conducted during the implementation project, indicating effective outreach to the workshop groups and training them in the use of the tool. It is also reflective of the technical support that helped evolve the usability of the tool during the implementation project.

Along with the increase in users, there has also been an increase in the number of scenarios developed using TFGuide. This shows that the transportation planners and engineers introduced to the tool made an effort to try the tool. However, the figures also suggest that when there was no outreach activity, there were lulls in TFGuide usage. Users introduced to the tool through the workshops usually did not return to use the tool during the period of the implementation project.

During the implementation project, the project team transferred hosting of TFGuide to AASHTO and it is currently reachable via <https://tf-guide.org/welcome/>. This involved transferring the libraries, code, and configurations necessary for hosting TFGuide in the AASHTO-supplied environment.

Technical support was provided by the project team for a one-year period within the overall project framework. This represented the anticipated time to answer questions and update the content as needed to advance the tool's utility during the project period. Technical support was available to the transportation planning community to address questions, bug-fixes, and adjustments to the tool's technical content. Additionally, technical support was available to the workshop and peer exchange participants to address questions as they moved forward after the initiation workshops. With the conclusion of the support period included within the project, AASHTO has taken over the provision of technical support.

## CHAPTER 10. CONCLUSIONS AND NEXT STEPS

In summary, the implementation of the TFGuide decision support tool has led to several important findings and considerations for its long-term usage and maintenance.

First, AASHTO is now providing hosting for TFGuide as a service of its Planning Committee. However, for the tool to find sustained usage, a community of caretakers must organize around providing technical support for the tool. AASHTO can solicit volunteers to help steer this process, and TRB can provide opportunities for volunteer engagement as well. A pooled fund or AASHTO-supported fund may provide the best options for longer-term technical support. The participants of the funding can set priorities, and technical support could be contracted out.

Second, the implementation program found that direct outreach is required to bring users to the tool. While users ultimately made numerous suggestions for expanding the use cases, expanding the content, and refining the recommendations, additional investment would be required to implement these suggestions. To ensure that the content is current and relevant, ongoing updates to TFGuide are needed. A technical support team could direct updates to TFGuide, and the community of practitioners could set priorities for new methods and metrics. Given past challenges with volunteer content development and curation, a funding stream and contractor mechanism for accomplishing these updates would be preferred.

During the final panel meeting, the importance of balancing the simplicity wanted by planners with the complexity wanted by modelers was emphasized. Indeed, the peer exchange provided contradictory recommendations, suggesting that more things should be added to the tool while also making it simpler.

For example, to keep TFGuide relevant and up-to-date, the peer exchange participants called for a continuing need to include reference to emerging methods. That is, TFGuide should incorporate new methods and models as they emerge in the transportation planning field. For example, TFGuide currently does not explicitly address land use models, strategic models, bike and pedestrian models, or equity analysis. At the same time, the peer exchange participants called for continuing to work on simplifying the user interface of TFGuide to improve its usability and build user understanding. For example, suggestions included adding features such as popup boxes to enhance the user's knowledge of terms or creating more accessibility to the underlying knowledgebase.

The peer exchange participants noted that there remain barriers to seeing wider usage of TFGuide, including inertia around the current ways of determining forecasting approaches with no incentive to explore other options, remaining lack of awareness, and concerns about sustainability for long-term use. Despite this, panel members expressed satisfaction with the work done, and expressed hope that the AASHTO Planning Committee could find ways to approach the issues long term.

In conclusion, the TFGuide decision support tool is fully operational and has the potential to be a valuable resource for transportation planners and modelers alike, but sustained usage and maintenance will require a community of practitioners to provide technical support and regular updates. AASHTO has agreed to provide long-term hosting for the tool, and a pooled fund or AASHTO-supported fund appear to provide the best options for technical support. A funded technical support team and community of practitioners could work together to ensure that the content is current and relevant. Hopefully, AASHTO will be able to continue to work to address these barriers and encourage wider adoption and usage, thereby helping to ensure the long-term success of the tool.

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