

**American Association of State Highway and Transportation Officials
Special Committee on Research and Innovation**

FY2024 NCHRP PROBLEM STATEMENT

Problem Number: 2024-B-01

Problem Title

Understanding Travel Behavior Impacts of Transportation Systems Management and Operations (TSMO)

Background Information and Need for Research

TSMO strategies and approaches are playing an increasing role in meeting transportation agencies' strategic goals of improved equity, mobility, reliability, and safety. Many evaluations of the effectiveness of TSMO deployments have been performed over the last few decades, but most have focused on the system performance outcomes, namely the impacts on performance metrics such as travel speed, travel time, delay reduction, and crash rates. Hence, the impacts of TSMO strategies on critical impacts in the traveler behavior realm, such as mode choice, departure time, route choice, and other traveler decisions are not well known. In addition, the impact of traveler behavior (due to TSMO deployments) on the overall transportation network performance is not well established. By better understanding how deployed TSMO strategies affect both the tactical and strategic behavior of travelers, more effective combinations of TSMO approaches can be designed to help agencies meet their goals.

This project will evaluate the impacts of TSMO deployment on traveler behavior and corresponding network performance using data from active TSMO deployments. Specifically, traveler behavior within this context refers to how travelers plan their journey and in-journey decisions made based on the choice sets available to them. There are typically five (5) stages in an immediate trip chain in which travelers make choices. These include destination choice, time of day choice, mode choice, route choice, and lane/facility choice. When comprehensively applied, TSMO strategies can influence many stages of the trip chain and, thus influence both the supply and demand sides of transportation management. Different TSMO strategies can influence different parts of the trip chain, so the focus is more on the influence of TSMO in making short-term, real-time changes to traveler behavior based on prevailing conditions than it is on long-term, habitual, and static changes to traveler behavior. Understanding how deployed TSMO strategies affect the dynamic decisions travelers make in terms of

destination choice, time of day choice, mode choice, route choice, and lane/facility choice is the primary objective. Additionally, network performance changes because of the choices travelers make due to TSMO strategies is also of interest.

Literature Search Summary

Based on a list of research developed for this statement, much of the documented research and information available relates to approaches, guidelines, and mechanisms for influencing traveler behavior along with simulation scenarios for evaluating outcomes. However, none of the research focuses on understanding the impacts of TSMO strategies on critical impacts in the traveler behavior realm, such as mode choice, departure time, route choice, and other traveler decisions. Potential resources to review under this task include several FHWA publications and Transportation Research Record sources. A list of literature available for review has been prepared to support this statement.

Research Objective

To date, the effectiveness and impacts of various TSMO strategies has largely been measured by the response to the system, such as travel time or delay. However, the behavior of motorists is a critical component to add into the understanding of TSMO, as motorists make dynamic decisions based on the situations they expect and incur during their travel. In turn, these decisions affect the overall network performance beyond the local setting of any given strategy. Understanding, cataloging, and communication these impacts are critical to the continued and successful application of TSMO strategies. The objective of this research is to identify how various TSMO activities affect traveler behavior whether pre-trip, en-route, or from a holistic perspective and how these behavior changes affect system performance. This research would be executed in two phases.

Phase 1

- Task 1: Literature Review - Conduct a comprehensive review of published literature, ongoing projects, and other documents related to the TSMO and its impacts on the transportation network. The review will provide insights on industry best practices as well as what agencies may consider when developing TSMO strategies.
- Task 2: Investigate Traveler Behavior Preferences - The purpose of this task is to investigate how travelers change their travel behavior in both tactical and strategic ways based on TSMO operational strategies and related information.
- Task 3: Assess Agency Approaches to Measuring Traveler Behavior - The purpose of this task is to assess how infrastructure owner operators who deploy, operate, and maintain TSMO strategies gather information from the traveling

- public, such as via agency data collection equipment, third-party data sources, public outreach and feedback mechanisms, travel surveys, etc., and how they might use that information to modify existing TSMO strategies, develop and deploy new strategies, and modify or enhance information provided to the traveling public related to TSMO operations.
- Task 4: Investigate Connectivity Between TSMO and Transportation Planning - The purpose of this task is to identify to what extent regional TSMO programs are integrated or connected to regional transportation planning programs and regional travel demand management programs to address the intersection of travel options, equity, and quality of life for the traveling public.
- Task 5: Develop Interim Report and Draft Work Plan for Phase 2 - Based on the results of Tasks 1-4, this task will develop an interim report describing the research conducted to date and the need for Phase 2 research if appropriate. The interim report will also include a draft work plan to conduct Phase 2 of the project.
- Task 6: NCHRP Stakeholder Panel Meeting - Organize a meeting to review and obtain feedbacks on the Phase 1 results and determine approach toward progressing with Phase 2 of the project.

Phase 2

- Task 7: Evaluate the Influence of TSMO Strategies on Traveler Behavior - The purpose of this task is to determine the manner in which travelers modify their tactical and/or strategic travel behavior based on the deployment and information related to one or more TSMO strategies.
- Task 8: Analyze TSMO Traveler Behavior Choices on System Performance - The purpose of this task is to determine how tactical and strategic behavior choices made by travelers directly impacts network performance, including but not limited to, equity, mobility, reliability, safety, and the environment.
- Task 9: Prepare Technical Report - Develop a draft technical report that reflects the results of research tasks.
- Task 10: Prepare Outreach Materials - The purpose of this task is to prepare the final outreach materials

Urgency and Potential Benefits

This project was identified by the AASHTO CTSO in 2022 as a high priority research topic to be addressed. DOTs and other IOOs don't have a holistic understanding of how TSMO strategies effect travel behavior and therefore they cannot successfully align their efforts with their mobility and societal goals. Some of the key traveler behavior finding could include:

- How TSMO strategies affect tactical traveler behavior such as lane/facility use, route diversions, etc.
- How TSMO strategies affect strategic traveler behavior such time of departure, destination choices, mode choice, decision to trip chain.
- How the combination of TSMO strategies within and across different TSMO approaches affect traveler behavior such as mode choice, destination choice, etc.
- How TSMO-induced traveler choices (e.g., time of departure) affect network and quality of life decisions for travelers, which might have a broader impact on the network.

Link to 2021-2026 AASHTO Strategic Plan

This research need broadly supports the goals of safety, mobility and access to everyone. By understand travel behavior, we can better align with needs for aligning transportation interests across regions, under the impacts to the advancement of equity and social justice and being about to provide a reliable transportation system that connects communities.

Implementation Considerations

The state DOT TSMO practitioners (Traffic Management Center managers, ITS Engineers, Systems Engineers, Transportation Engineers, Traffic Signal Engineers, etc.) can use the results to help them plan, program, design, operate, and maintain TSMO deployments to more effectively meet their agency goals and objectives. Each state can implement the findings into their TSMO plans and strategy toolboxes. Implementation will include an outreach component at the conclusion of the research. The purpose of the outreach is to educate national practitioners regarding the findings and how it could alter strategies for TSMO deployment. Materials can be developed for sharing with the National Operations Center of Excellence for reference for practitioners and also webinar training can be developed based on the findings to increase awareness.

The following have provided support for this research need:

- Beverly Kuhn, ACP20 Freeway Ops Committee Chair, Texas A&M Transp. Institute, b-kuhn@tti.tamu.edu.
- Mohammed Hadi, ACP80 Committee Cochair, Florida International University, hadim@fiu.edu

Recommended Research Funding and Research Period

\$400,000 - \$500,000

1-2 years

Problem Statement Author(s): For each author, provide their name, affiliation, email address and phone.

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Potential Panel Members: For each panel member, provide their name, affiliation, email address and phone.

Select members from the TRB Freeway Operations Committee (ACP20) and TRB Traffic Simulation Committee (ACP80) would be available to serve on the panel for this project.

Person Submitting the Problem Statement: Name, affiliation, email address and phone.

Texas Department of Transportation

NCHRP Review of B-01

Revised by:

Trey Joseph Wadsworth
twadsworth@nas.edu

Comments:

This research could be valuable to a majority of state DOTs and the research objectives are clear. The time needed to complete the research would be no less than two years.

Review Date:

November 17, 2022

FHWA Evaluation of B-01

Revised by:

Karen White, Tracy Scriba, Valentin Vulov, Danny Jenkins

Comments:

The study is relevant. Research into TSMO activities and traveler behavior using a behavioral psychology approach could yield useful research and improvements in the field. This research will support smarter decision making by considering the demand side of the equation, and not just capacity/supply side. The research would be improved with a narrower focus TSMO areas for research. The research needs to acknowledge the interplay of TSMO and commercially available traffic information systems such as Waze and Google. The literature review needs to include available data sources, data collection methods, and a narrowing to the research approach. The literature review should be tailored towards the travel behavior and interaction with TSMO strategies and information, i.e. "nudging" theory and practice. Task 4 may benefit focusing on disaggregating travel behavior and responses of different socio-economic groups to TSMO strategies and information. also applicable to Task 7. Some of the good questions in the "Urgency and Potential Benefits" section should be considered for inclusion in the scope of the study. A longer time period for the research would be more realistic to accommodate data collection/procurement. Consider merging with NCHSP Work Statement G-05 Guidelines for Developing a Cost-effective transportation behavior change program to promote sustainability and safety goals.

Review Date:

December 23, 2022

AASHTO Committee Evaluation for B-01

Submitted By:

Robert T White

Transportation System Operations

Comments:

Priority.

Submitter Response for B-01

Comments:

Response to Wadsworth: We concur that the duration should be extended

Response to FHWA: The authors agreed with the reviewers on the comments.

Additional Comments from the Authors:

- There are no specific questions listed in the “Urgence and Potential Benefits” section in the version being used by the Authors. The questions listed in the Research Problem Statement could be included in the Research Objective section or elsewhere as appropriate.
- The authors do not have access to Work Statement G-05. However, the combination of this research with the aforementioned one might prove to be unwieldy and stray beyond the focus of this statement which is related to TSMO. One could assume that there are a variety of traveler behaviors that can impact sustainability and safety goals that are beyond the TSMO arena, which directly relates to managing the existing network.

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