

Project No. 08-132

**ACCESSING AMERICA'S GREAT OUTDOORS:
FORECASTING RECREATIONAL TRAVEL DEMAND**

TECHNICAL MEMORANDUM

IMPLEMENTATION OF RESEARCH FINDINGS AND PRODUCTS

**Prepared for
NCHRP**

Transportation Research Board

of

The National Academies of Sciences, Engineering, and Medicine

**TRANSPORTATION RESEARCH BOARD OF
THE NATIONAL ACADEMIES OF SCIENCES,
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**RSG
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Introduction

Recreational travel is a major and growing activity in the United States and recreation trips to outdoor parklands tend to have different characteristics than trips for other types of recreation (entertainment, sporting events, regular exercise, etc.). Despite the significance of recreational travel to outdoor parklands and its impacts on the transportation system in many regions, regional and statewide travel demand models do not explicitly represent the factors that determine demand for this specific type of travel.

The purpose of this project was to build a set of models and open-source tools to predict recreational travel demand to “America’s Great Outdoors.” The demand models and tools created in this project will allow state and regional agencies and public land managers to predict visitor demand and vehicle travel to their recreational sites under a variety of future scenarios.

The models that were developed use passively collected “big data” in conjunction with data on recreational-site visitation and amenities, transportation service data, U.S. Census data, and data on climate and topography to replicate visitation patterns to various Federal and state parklands in the US. These models are appropriate for major recreational sites located in natural settings across the country which attract significant local and out-of-town visitation.

The large majority of currently collected recreational travel data and modeling efforts are both site- and time-specific, meaning that they were not intended to be generalized across various locations nor to be used in forecasting future demand. The models developed in this project, on the other hand, were created to be generalized to any major parkland site. This was a unique and challenging study, for a variety of reasons:

- It is the first attempt at creating predictive models of parkland visitation that can be used by various state and regional agencies in the US.
- The modeling uses passive “big data” as a primary data source, supplementing it with various types of data such as National Park Service data on visitation and amenities, Census data on socio-economics, land use data, road and air network data, and climate and topology data, each of which adds explanatory power to the models.
- The models are implemented into software tools and supporting data inputs that are available to be used by a wide variety of agencies—including state DOTs, regional MPOs, and parkland management agencies.

These unique and challenging features of the research lead to similarly unique challenges in ensuring that the research results are effectively put into practice. This memorandum describes work that has already been completed to move the results towards implementation in practice, the institutions that could further that progress, the issues that could affect implementation and recommendations for further actions to assist in future implementation.

Recommendations for Implementation

The recreational travel demand models that were developed as part of this research provide a new set of capabilities and tools that have not previously been incorporated into travel demand forecasting practice. Because these models are new, a prerequisite to any significant level of implementation in practice is effective dissemination of the research results. The project team began a significant dissemination effort concurrent with, and after, completion of Phase II of the research effort. This included presentations of the findings to researchers and practicing professionals at two conferences. A third presentation, occurring after completion of the research effort, is part of the 2023 TRB Innovations in Travel Analysis and Planning Conference in June 2023 in Indianapolis. This conference is widely attended by both travel demand

modeling researchers and practitioners of modeling at the regional, state, and federal levels. In addition, a summary of the research findings was prepared for publication in TRB's widely circulated Transportation Research News. Together, these efforts were designed to promote initial awareness of the research and of the modeling tools that have been developed.

The Phase II effort also produced a guidebook for using the new models and tools. This relatively technical document is designed for both researchers and travel demand modeling practitioners and, along with the project's final report, describes the model structure, the software code implementing the model and the process for using that code. This is intended to allow those professionals to understand the models well enough to implement them in existing or new travel demand forecasting model systems.

The dissemination and documentation efforts included in the Phase II project work are designed to promote awareness of the new tools and any initial implementations in practice. The project team has noted that the modeling effort was based on 2019 data and as, with all travel demand models, updates would be needed in the future. However, the future uses of these models and tools in practice would benefit from several types of updates related to the specific data that were used in their development. The project team recommends the following types of updates to support future implementations of the models and tools.

- **Update the model to augment or replace data from mobile device-based passive data with other data sources.** This project relied heavily on mobile-device based passive data from 2019 but the data sources used for those data are likely to continue to be diminished in quality and coverage while vehicle-based passive data will likely increase in coverage. In addition, it is possible that expansion of the NPS survey program and surveys at other outdoor recreation sites could at least in part replace the need for passive data. This would not be a simple swap of like data types as the vehicle-based datasets and NPS survey data have a distinct set of strengths and limitations that must be accounted for. But any future updates of model coefficients beyond the set estimated in this research using 2019 mobile device data will likely require transition to these new data sources.
- **Deal with mutual causality between visitor demand and the supply of park amenities.** Using cross-sectional data from just one or two years, it is not possible determine the direction of causality between the level of visitation and the provision of park amenities such as parking, lodging, camping, concessions, and trails. Future work should consider expanding the cross-sectional Park Visit Generation Model developed using only the 2019 NPS visitation data into a multi-year dynamic model. Such a model could also include trend effects and effects of external variables such as inflation rates, fuel prices, unemployment rates, demographic shifts, and even transient effects such as the COVID-19 pandemic. Such model enhancements may be of most interest to parkland management agencies, as they would allow the model to include a wider variety of actionable variables that could be used to influence visitation.
- **Update Census boundaries, Census data, and other data sources.** Since the model is based on 2019 demand data, the tract boundaries are the 2010-19 Census boundaries. The Census Bureau changed the block and tract boundaries in 2020, and gradually agencies will base the zones for their regional or statewide models on 2020 Census geography as well. PUMA boundaries will change in 2023 and many county boundaries have changed as well, so the National Long-Distance Model "NUMA" zone system used for this project should also be updated at some point. When the various types of data inputs that rely on Census boundaries have all been updated, create a set of inputs for the model to update to a new base year. For example, this work could be done in 2025 or 2026 to update the base year to 2024. This change could be made at the same time as one or more of the other updates or enhancements recommended above.
- **Represent the multi-destination aspect of outdoor recreation travel.** The model outputs generated as part of this study use the simplifying assumption that trips to a parkland destination area travel directly from the direction of the home location or an intervening airport, and that trips leaving

the area return in that same direction. In reality, many visitors come from or go to other non-home destinations on a multi-destination tour. As we have learned in practice, developing tour-based models that predict the entire itinerary for multi-destination tours is much more complex than developing simpler models that do not attempt to predict multi-step itineraries. Such models require more complex estimation methods and software implementation, and also more complete, high-quality data. It would be more feasible to attempt modeling multi-destination park visit tours at the level of a single state, rather than attempting to tackle the entire US in the first attempt at such a model. When this type of model is completed successfully for one state, it would be more feasible to replicate it for other states and/or expand it to cover multiple states.

- **Customize the model specification and calibration more closely to local conditions.** One of the several challenging aspects of this project is how to translate the results of model that uses a coarse national-level zone system and road network into results that can be assigned to the local zone system and network for any MPO or statewide model. A first step would be to identify one or two agencies with adequate high-quality multi-day travel data and/or connected vehicle data to estimate models of local trips that parkland visitors make while staying in the park and the surrounding area. As part of the project, they could apply the model system from this NCHRP project to that same parkland and use the outputs from this model as inputs to the estimation of models of the local trip pattern of park visitors. This would be the most rigorous way of translating the results of the auxiliary models to use in local models and may even provide new models to replace some or all of the auxiliary models with new models based on more complete and detailed data.
- **Apply the models for other types of outdoor recreational sites.** Most of the models in the model system were estimated only on data for visitors to national parks and monuments, while some included data for visitors to selected state parks in two states. We hypothesize that the models are transferable to similar types of parks, such as national recreation areas and national seashores, and to major state parks in other states. There are also other types of outdoor recreation sites for which these models are less likely to be transferable. One such type is scenic byways. Travel data is usually analyzed in terms of trips. Both travel survey data and passive data typically require a stop of at least a minimum threshold duration to be made to register a trip being made to a particular destination. Scenic byways have many through-travelers who do not stop, so modeling use of these facilities would require a much different approach to data process and analysis. Another type of site for which the models may not be transferable are large national forests which have little in the way of amenities except for limited campsites. If there is interest in modeling demand and related traffic effects for other types of outdoor recreation sites, such as National Forests, National Wildlife Refuges, US Army Core of Engineers (USACE) sites, Bureau of Reclamation Sites, and Bureau of Land Management (BLM) lands, that likely would involve different data collection and model design strategies than the ones used for this project. The methods would be sensitive to considerations such as the how spatially concentrated the visitation is, the number of entrances and roads traversing the site, the types of recreation activities available at the site, and the relative attractiveness to local versus non-local visitors. In some cases, there may be a good deal of commonality with the sites used as the basis for this research. For instance, many USACE sites provide concentrated camping, boating and watersport activities that are similar to some national and state parks.

It is normally expected that any set of travel demand models used in practice should be updated regularly to reflect current behavior, to incorporate new and improved methods and to use new sources of data. This certainly applies to these outdoor recreation travel demand models and, since these are entirely new types of models, the above recommendations reflect the opportunities for further evolution of these particular models as they are incorporated into practice.

Institutions that Could Provide Leadership

In addition to TRB's Cooperative research Programs, there are several organizations that have supported the development and improvement of travel demand models and that could support efforts to implement the models developed in this research. The most obvious are federal, state, and regional agencies that currently support and maintain travel forecasting models, institutions responsible for outdoor recreation sites and academic institutions that teach travel demand forecasting methods and conduct related research.

Agencies that Support Travel Demand Models

- **U.S. DOT** The U.S. DOT for many decades has supported the development and improvement of travel demand models. FHWA's TMIP program and TF Resource continue that tradition and would be a logical lead in promoting implementation of the new models developed in this research.
- **State DOTs** Many State DOTs maintain statewide travel demand models that include outdoor recreation sites that generate significant visitor traffic. One or more of these states could support implementation of these new models as part of an update of their statewide model.
- **MPOs** As with state DOTs, any MPOs with significant outdoor recreation sites within or adjacent to their regions could support implementation of these new models as part of an update of their regional model.

Institutions Responsible for Recreation Sites

Federal and state agencies that conduct transportation plans for outdoor recreation sites could provide leadership by promoting the use of these models in any major transportation planning studies. The NPS, USFS and USFWS have all provided leadership in the development and use of visitor surveys to support planning and development of the outdoor recreation sites and could similarly support the application of the models that were developed through this research.

Academic Institutions

There are many U.S. university programs that teach travel demand modeling courses and that conduct research designed to improve travel demand modeling methods and applications. The Bipartisan Infrastructure Law (BIL) supports five National University Transportation Consortium Centers at a level of \$4 million each. One of these is the Center for Understanding Future Travel Behavior and Demand (led by the University of Texas at Austin) which could provide leadership by promoting applications of outdoor recreation travel modeling in regions served by its member universities (e.g., Arizona State University).

Issues Affecting Implementation

The outdoor recreation travel demand models developed in this research represent an additional category of trips, a novel approach to modeling these trips and new types of data in the context of current travel demand forecasting models. Each of these departures from current modeling practice present challenges to travel demand modeling practitioners.

As noted above, the project team has already initiated efforts to make the modeling community aware of the products of this research through publications and presentations at professional conferences. In addition, the guidebook, the supporting national data, and the code implementing the models should reduce the effort required to implement the models. Supporting initial implementation of the models in one or more regions would further promote awareness of these models and provide an example for others who are motivated to model outdoor recreation trips.

Measuring Impacts of Implementation

As detailed in the literature search conducted for this project, there are no existing models of outdoor recreation travel demand comparable in scope to those developed for this research. It should be relatively easy to identify and track any initial implementations of these models because the network of travel demand modelers is relatively well connected through the Travel Model Improvement Program (TMIP) Listserv. An evaluation component could also be included in an initial implementation to identify ways in which the models were used, and the benefits of the models compared to previous approaches.