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Project Title

Incorporating Tourism Data in Traffic Estimation on Wyoming Low-Volume Roads

University

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Research Needs

Tourism trips occupy a major part of traffic volume, especially in frequently visited areas. Historically, transportation planning has been led by urban and metropolitan planning. Much of this effort has been directed towards reducing traffic congestion and providing adequate capacity. More recently, there has been increased emphasis on estimating traffic on rural low-volume roads driven at least in part by safety and air quality concerns. So far, tourism traffic is barely recognized in travel demand model due to available data in this field (Hofer et al. 2016).

Recent advances in GIS software's analytical capabilities allow for more sophisticated analyses of transportation networks and the traffic they carry. Techniques that even a decade ago would not have been seriously considered may now be possible. Improved analytical capabilities may allow for more information to be extracted from the same data collections efforts. Additionally, with more sophisticated analytical methods, traffic counting, and other data collections efforts can be focused more efficiently (Goodchild 2000).

National Parks and State Parks and Historic Sites are popular destinations and stops for leisure travelers. According to a visitor survey in 2014, visiting a state or national park continues to be the most influential motivator for Wyoming travelers (Wyoming State Parks and Historic Sites 2014). As one of the least populated states in the U.S., Wyoming is famous for wilderness landscapes, historic towns, ranches, and cowboy cultures. Figure 1 shows some major points of

interest in Wyoming. Tourism-related activities in Wyoming include but not limited to outdoor adventure, recreation, and entertainment. The combination of low population density and natural scenery makes Wyoming a good place for epic road trips.

Fig. 1. Some major points of interest in Wyoming

The use of tourism-related travel data in travel demand model is one of the ways for transportation planners to incorporate tourism issues into their forecasting, planning, and designing processes. A variety of government agencies and private organizations have become involved in issues regarding tourism and recreation travel (Florida Department of Transportation-District Five, 2007). Most commonly, state and regional transportation planning agencies take the lead in identifying travel issues and needs for all travel segments for tourism and recreational development. Overall, 42% of the state Department of Transportation (DOT) and 54% of the other agencies reported that they regularly make use of tourism travel forecasts. Among the state DOTs that do make use of tourism forecasts, the dominant use is for transportation planning (NCHRP 2004). In tourism planning, evaluation in new and expanded transportation facilities can serve to support the operation and development of attractions (such as national parks) and identify needs for future maintenance. More focus has recently been given to the transportation systems in and near national parks because of the levels of visitor demand exceeding the transportation infrastructure within many parks (White 2007). As a result, various studies have assessed the cost-effectiveness and practicality of alternative transportation solutions, including roads, parking, bus service, trams, and other forms of transit facilities (NCHRP 2004).

In an effort to enable estimation of traffic for low-volume roads in Wyoming, the Wyoming Technology Transfer Center has developed traffic estimation models and generated person trips, agricultural crop production related freight trips, and oil production related freight trips for estimating traffic volumes (Apronti et al. 2016). According to the discussions done in above, an implementation of the traffic estimation models is required to be conducted utilizing tourism related data to investigate the effect of tourism on low-volume roads in Wyoming.

Research Objectives

(1) The tourism-related travel behavior parameters will be incorporated in the four-step modeling process to estimate traffic volumes.

(2) Calibrate the model using actual traffic volume data and implement the model for the whole State of Wyoming to evaluate how the model performs by incorporating the tourism-related parameters.

(3) Determine the seasonality in tourism travel demand and the impact of tourism travel on local transportation system.

By accomplishing these three goals, a more efficient travel demand model will be developed for the entire state; this will support a wide variety of design, planning, and management functions on both the state and county road networks. The modeling process includes: trip generation, trip distribution, mode choice, and trip assignment. Using improved models will make better traffic volume estimates possible with the same data, thereby lowering costs and improving the quality of traffic information. By taking advantage of better software and better models, more and higher quality information may be provided, leading to improvements in safety and other planning efforts.

Research Methods

The first step of the project will be done preparing a comprehensive literature review for the topic based on the previous efforts regarding tourism travel demand models. The literature review will include the review of the academic literature and relevant studies conducted by other state DOTs. In addition, different types of attractions and different purposes of the state's tourist travels (e.g. outdoor activities, recreation, and entertainment) will be analyzed.

The second step of the project will include identifying data sources and gathering data. The potential data sources include statistical data from the National Park Service (NPS) and planning documents and visitor surveys from the Wyoming State Parks and Historic Sites (SPHST). The NPS conducts visitor use and recreation research to examine how people physically move throughout a park, what they do while in a park, and how they perceive their experiences. The NPS Social Science Program is responsible for coordinating visitation statistics reporting to develop appropriate data collection procedures and provide quality control for public use data collection and reporting (National Park Service 2016). Figure 2 shows the entrances to Yellowstone and Grand Teton National Parks. This project will use traffic count data at northeast, east, and south entrances to Yellowstone National Park and all three entrances to Grand Teton National Park to estimate traffic volumes in Northwest Wyoming. Traffic count and

visitor data in other destinations will also be collected to estimate traffic volumes in other parts of the state. The Wyoming Division of SPHST obtains and analyzes the opinions of visitors to Wyoming's state parks and historic sites through an intercept visitor survey and provides quantitative and qualitative interpretation of the visitor experience based on intercept interviews (Wyoming State Parks and Historic Sites 2014). The Wyoming Division of SPHST also collects visitor use data at 28 parks and historic sites using 68 traffic counters. The traffic counters monitor lanes of traffic by counting vehicle traffic and they could be used to document traffic volumes at each SPHST.

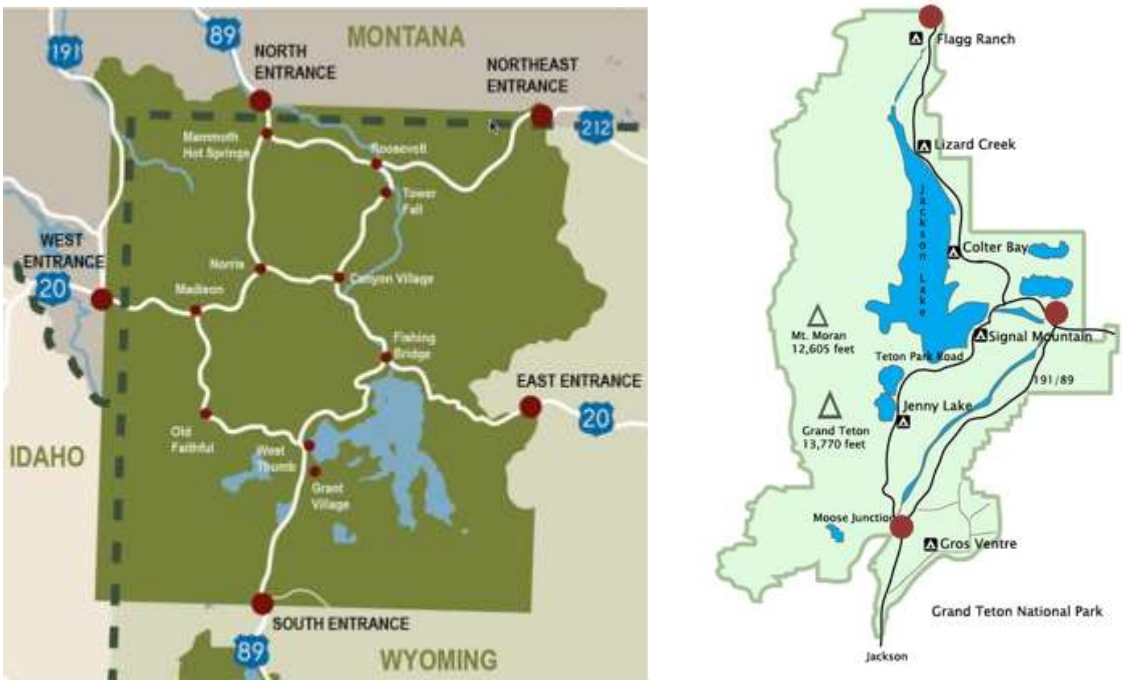

Fig. 2. Entrances to Yellowstone and Grand Teton National Parks

The third step of the project will input data into the model and run the model. Independent parameters will be identified and input into the model along with road network. Road network data obtained from the Tiger/Lines webpage of the US Census will be developed to represent the transportation system in each county. The developed shapefiles will contain data on speed limits, number of lanes, direction of travel, and functional class of the road. Next, trip rate equation will be assigned to each input parameter based on Trip Generation Handbook (Institute of Transportation Engineers 2017). The model will use the traffic analysis zones and network datasets of each county to generate traffic volumes for each road in the study area. Then the estimated traffic volume data will be assembled and stored in ArcGIS software and Excel database files for each county. The utility of the model will be calibrated and verified by comparing actual traffic volumes to predicted traffic volumes. Figure 3 shows the procedures of the enhanced four-step tour-based travel demand model.

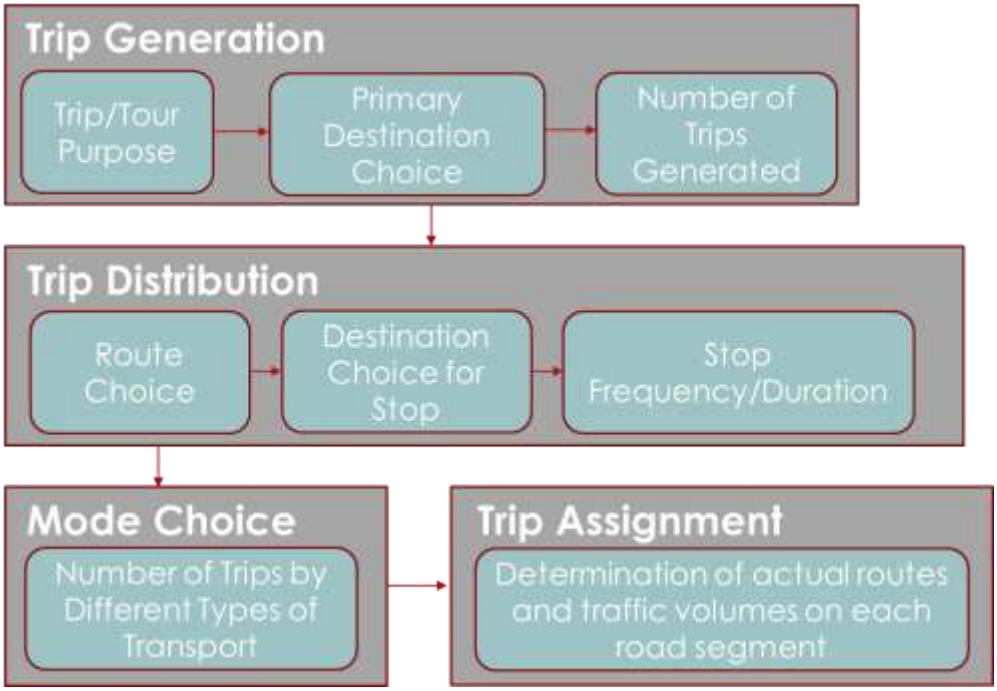

Fig. 3. Four-step tour-based travel demand model

The final step of the project will determine the seasonality in tourism travel and the impact of tourism travel on local transportation system in Wyoming. Based on the outputs of the model, the tourism travel seasonal patterns (e.g. peak season vs. non-peak season) will be determined and an analysis of how tourism travel impacting the local transportation system will be carried out.

Expected Outcomes

There is a growing need for integrating aspects of tourism–recreation travel into statewide and regional transportation planning. This study will make use of tourism data to address traffic on local and collector roads. A wide range of issues will be addressed at the intersection of tourism travel and the transportation system in this project. Based on ArcGIS and related software, maps of estimated traffic volumes on Wyoming low-volume roads will be created for more effective planning and management of the state's rural local road networks.

Relevance to Strategic Goals

The main contribution of the current study is to incorporate tourism related data into the travel demand model and develop methods to estimate traffic volume on low-volume roads near tourism destinations in Wyoming. As it was discussed in the section of Research Methods, all different aspects of the study focus on achieving this goal.

Educational Benefits

Since the project includes a large number of data collection and analysis as well as building travel demand models, at least two students should get involved in the project. The involved students will learn the project and modeling procedures in classroom, which will provide an

opportunity for students to get familiar with the usage of the travel demand modeling software and mapping techniques (e.g. Cube Citilabs and ArcGIS) and they will be able to use the packages for their future studies as well.

Technology Transfer

The results of this project will be presented in transportation-related conferences. The research team will target the high-level journals of transportation engineering for publishing the results. The technology transfer activities will also be reported in the Program Progress Performance Reports. Hopefully, the results will be considered by the WYDOT for future transportation planning on low-volume roads in Wyoming.

Work Plan

1. Literature Review
2. Data Collection
3. Model Simulation and Calibration
4. Model Output Analysis
5. Final Report Preparation and Results Delivery

The whole project will last one year. The literature review will need one months. The data collection and analysis will need two months. Before working on the models, it may take one month to train the involved students to get familiar with the software used in this project. The model simulation and calibration will need at least two months to adjust a variety of model parameters. The model output analysis will also need at least two months to compare model-predicted outcomes to real measurements. Final report preparation will need two months. During this procedure, the research team will move back and forth between data analysis and report writing. It may take another one or two months to deliver the project results, including journal manuscript preparation and presentation in local and national conferences.

Project Cost

Total Project Costs:	$183,377.27
MPC Funds Requested:	$95,162.00
Matching Funds:	$88,215.27
Source of Matching Funds:	Wyoming Department of Transportation

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