Project Title:
Impacts of Ridesourcing on VMT, Parking Demand, Transportation Equity, and Travel Behavior

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University of Colorado Denver

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Research Needs:
The transportation sector is currently experiencing a monumental disruption with the introduction and evolution of transportation services such as bikesharing, carsharing, ridesharing, and on-demand ridesourcing (e.g. Lyft, Uber). Many factors – including social networks, real-time information, and mobile technology – allow passengers and drivers to connect through mobile smartphone applications (i.e. apps). In turn, this led to the creation and popularization of ridesourcing companies offering an app-based on-demand platform. As these new layers of technology-based transportation options begin to flourish, it is important to understand how they compete and interact with more traditional modes. Beyond travel behavior, these evolving transportation services can also significantly impact our transportation systems, society, and the environment. Yet, these outcomes have yet to be adequately studied in the academic literature. Accordingly, this research will investigate the travel modes replaced by these evolving services and why people shifted from a previous mode. More specifically, we will investigate new trips that may not have occurred before (i.e. induced travel) as well as multimodality (i.e. availability of several modes) and intermodality (i.e. combination of various modes for a single trip or mixed-modes) in order to analyze the impact of these services on the overall transportation system in terms of vehicle miles traveled (VMT), parking demand, transportation equity, and travel behavior.

In theory, providing a more diverse array of travel options may reduce car dependence and lower parking demand; in practice, however, there are still unresolved questions about what cities actually gain (or lose) with ridesourcing in terms of sustainability-related outcomes such as mode choice, VMT, carbon emissions, as well as transportation equity issues. For instance when replacing

single occupancy vehicle (SOV) trips, there is a potential for negative effects. If a person shifts from driving to ridesourcing, the ride-source driver may travel additional mileage – to pick them up or after dropping them off – than what would have been driven with the initial trip. There is also a theoretical saturation point where higher ridesourcing supply than demand leaves many drivers circulating without riders, which can cause unnecessary VMT, congestion, environmental issues, and other problems that are not yet documented with respect to these new technology-based modal options.

While there is robust information online regarding companies such as Uber and Lyft, the academic literature on ridesourcing is extremely limited due to the lack of open data on these services. This research will employ a combination of revealed-behavior data and stated-response data structures collected via travel data records, travel diaries, and individual surveys using an innovative approach that combines information gathered from the Lyft/Uber driver and passenger interviews. We will assess the travel modes replaced by ridesourcing including new trips, multimodal trips, and intermodal trips in order to gather insights from individuals on the process of why a specific mode was selected over the alternatives. For example, what is the role of travel time, travel cost, and parking ease in the decision making process? Other measurements will include VMT impacts and equity issues with the introduction of ridesourcing in our transportation systems. We will then be able to provide insights into the different impact levels of ridesourcing based on the characteristics of a region or a city. We hypothesize that the effects on VMT, parking demand, and equity issues vary among different geographical areas (e.g. urban vs. suburban vs. rural, city size, density) and mode share distribution (e.g. the higher the driving mode share for a city the more positive effects the city will experience with ridesourcing). As a result, this research will be relevant for the region and beyond. Also, current transportation travel models focus on traditional modes of transportation (i.e. car, transit, walk, and bike), but few models appropriating take into account the impacts of ridesourcing (e.g. Lyft, Uber) (DuPuis et al., 2015). Thus, this research will also fill a gap in the literature by studying the effects of evolving services on travel behavior, which will help cities and regional transportation organizations better account for the impact of technology and evolving transportation services in their transportation planning processes.

Research Objectives:
The objectives and key contributions of this research are that we will build upon the existing literature on evolving transportation services by:
1. Developing surveys for ridesourcing passengers and drivers and seeking IRB approval;
2. Collecting a unique dataset via a survey of ridesourcing passengers and drivers;
3. Assessing what travel modes are replaced by these evolving transportation services;
4. Measuring the VMT and parking demand impacts of ridesourcing services;
5. Investigating transportation equity variation across different geographical areas;
6. Evaluating the factors associated with why people shifted from their previous travel modes; and
7. Developing a framework for a mode choice model that would allow for integrating ridesourcing services into regional travel models.

Research Methods:

This research will initiate with a thorough literature review of research related to ridesourcing services such as Lyft and Uber as well as other current transportation options including carsharing services that could impact VMT, parking demand, and travel behavior in general. While there is robust information online regarding companies such as Uber and Lyft, the academic literature on ridesourcing remains relatively limited due to the lack of open data on these services.

We first plan to collect a minimum of 500 surveys focused on current and previous travel behavior from ridesource drivers and their passengers. For instance, the proposed survey will ask passengers questions regarding current travel behaviors, available modal options, modality resources (e.g. car ownership, transit pass, etc.) for both typical transportation patterns and for specific trip characteristics to the ridesourcing service. The survey will cover regular travel behaviors prior to ridesourcing options becoming available as well as socio-demographic/socio-economic status. We will then collect data from the ridesourcing drivers such as times, locations, and total VMT broken down by "cruising for a ride", "driving to passenger", and "ride distance". This data collection effort will facilitate a travel behavior comparison that will allow us to quantify the VMT and parking demand impacts of these evolving transportation services.

For our research objective focusing on evaluating transportation equity variation, we plan to combine the data collected from the ridesource drivers (e.g. passenger waiting time and passenger/trip characteristics) with spatially located socio-economic and socio-demographic data. This will allow us to conduct a transportation equity analysis across different populations and geographic areas to see where these services are more or less accessible and by whom. This step will also let us revisit outcomes such as VMT and parking demand from a spatial perspective, which could facilitate, for instance, a better understanding regarding how the findings shift across the rural to urban spectrum.

Our last research objective focuses on better understanding the mode choice decision process related to ridesourcing services. This involves building a statistical model of travel mode choice for ridesourcing based on the survey data collected combined with transportation and land use data. The model will implement an econometric analysis that accounts for the influence of latent modal preference and logit mixture models on travel mode choice behavior (Atasoy et al., 2011; Vij et al., 2013; Vij and Walker, 2014). For example, Vij et al. (2013) introduced the concept of modality style, which can be defined as "a certain travel mode or set of travel modes that an individual habitually uses". This idea counters the conventional assumption that people choose a mode independently for every trip and instead investigates short- and long-term decisions as a function of higher-level behavior orientations. We will also explore how one's modality style might shift with the introduction of ridesourcing options. The proposed models will require us to collect the following data:

- Characteristics of the individual and household;
- Land use characteristics (for both origin and destination locations);
- Modality style (e.g. car-oriented, multimodal with car, non-car, or bi-style);
- Modality resources (e.g. car ownership, transit pass, carsharing membership, etc.); and
- Travel attributes (e.g. travel time, travel cost, parking, etc.).

The intent is to better understand the actual motivations why a ridesourcing user chooses this mode over the alternatives and use this knowledge to create the framework for a statistical mode choice with ridesourcing services that can be integrated into regional travel models. For example, the Denver Regional Council of Governments (DRCOG) conducts a travel survey every decade to feed into their activity-based travel model. With this research, we are hoping to guide and provide input into what survey questions and data from ridesourcing need to be incorporated into the models to account for new and evolving transportation services.

Expected Outcomes:
This work will employ a combination of revealed-behavior data and stated-response data structures to fill a needed gap in the literature regarding the evolving transportation services. The expected outcomes of this research include:

1. A better understanding regarding the role of evolving transportation services in the overall transportation system;
2. An assessment of the impact of ridesourcing on VMT and parking demand;
3. An evaluation of transportation equity variations across different socio-economic and socio-demographic populations as well as different geographies due to ridesourcing;
4. A framework for mode choice models that better accounts for the presence of ridesourcing and evolving transportation services;
5. Manuscripts for presentation/publication at TRB and other peer-reviewed journals; and
6. Presentations to academic and policy audiences.

Relevance to Strategic Goals:
This research falls mainly under the strategic goal of environmental sustainability, but it also relates to livable communities and economic competitiveness. An assessment of VMT and parking demand, as well as the transportation equity variations, defines the environmental sustainability impacts of ridesourcing into our cities and transportation systems. A better understanding regarding the role of evolving transportation services will help guide policies with respect to the acceptance and applications of new services, which in turn, will allow cities to be more environmental sustainable, livable, and equitable. The results will offer a better understanding of the situations where negative effects may occur and help more cities adapt to the new spectrum of transportation options available to the population.

Educational Benefits:
This study will be integrated into Dr. Marshall's "Sustainable Transportation Systems" graduate course through a case study approach that will present research materials to the students and provide the opportunity for students to get involved in data collection and analysis as part of their term projects. The course is based in the Civil Engineering Department but cross-listed in Urban and Regional Planning as well as Public Administration. The GIS data will also be made available to students in the Master's of Engineering GIS program for use in term projects or master's reports.
As a result, this project will influence students from a variety of disciplines that comprise our future transportation professionals.

Work Plan:

The proposed scope of work is scheduled for a one year timeframe, beginning with notice to proceed from the Mountain Plains Consortium. The main steps for this research include:

Action Item	2016								
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Literature Review	██	██				██			
Develop driver data collection and	██	██							
IRB Process	██	██							
Data Collection		██	██	██					
Preliminary Data analysis		██	██						
Final Methodology Selection				██	██				
Organize and Geocode Data				██	██	██			
Data Analysis and generalize findings					██	██	██		
Write-up				██	██	██	██	██	
Disseminate key findings and publish							██	██	██

Findings will be published in peer-reviewed journals and/or peer-reviewed conference proceedings as well as presented at various conferences.

Project Cost:

Total Project Cost: $154,422

MPC Funds Requested: $77,000

Matching Funds: $77,422

Source of Matching Funds: University of Colorado Denver

TRB Keywords:

Ridesourcing, Lyft, Uber, VMT, parking demand, transportation modality styles equity, travel behavior, mode choice,

References:

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