USDOT Region V Regional University Transportation Center Final Report

NEXTRANS Project No. 090OY04

INVESTIGATING THE POTENTIAL OF EMPLOYER-BASED "REAL-TIME" RIDESHARING

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DISCLAIMER

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TECHNICAL SUMMARY

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Investigating The Potential of Employer-Based "Real-Time" Ridesharing

Introduction

The reemergence of ridesharing as a desirable means of travel is partly attributed to the role mobile phone and social networking technologies could play in enabling the "real-time" (or "dynamic") matching of passengers and drivers producing shared rides. In the past few years, several workshops and conference sessions have been dedicated to real-time ridesharing with a focus on the technological, behavioral, economic, social, and institutional aspects of this form of travel. Technologically, real-time ridesharing offers much greater flexibility than traditional ridesharing in establishing matches and making shared ride arrangements in the absence of a pre-arranged schedule. Economically, higher fuel and toll costs are increasing the incentives in favor of ridesharing. Institutionally, recent experiences with ad hoc ridesharing (e.g., 'casual carpools' in the San Francisco Bay area, and the 'slug-lines' in the Washington, DC area) are increasing the confidence in achieving successful applications.

Large employers concentrated in urban areas could greatly enhance the viability of real-time ridesharing. The common work destination increases the likelihood of a match and reduces the "stranger danger" problem. Large employers can also offer incentives (e.g., associating with parking and transit programs) and safety-nets (e.g., in cases where an emergency return-trip is needed by a ridesharing passenger). However, empirical-based evidence regarding the potential and challenges of employer-based real-time ridesharing is limited. The objective of this study is to investigate the viability and potential for real-time ridesharing to and from the OSU campus under a variety of incentive and travel behavior scenarios.

Findings

To understand the potential for a ridesharing program, the proximities of individuals with OSU affiliation to others in their neighborhoods with OSU affiliation were analyzed. The number of OSU neighbors an individual has within certain distance buffers and average distances to other OSU affiliates in certain neighborhoods are calculated. For example, across all individuals, on average individuals have 144.1 OSU neighbors residing within a 0.5 mile buffer and the average distance across individuals residing within this buffer is 494 meters (0.3 miles). In an effort to identify target areas for a ridesharing program, separate analyses were conducted for three suburban areas that are popular residential choices among the OSU community. Not surprisingly, the largest distances among neighbors and the lowest numbers of neighbors are reported for the lowest residential density among the three suburban areas.

To gauge the levels of the various variables that would realistically render ridesharing feasible and desirable among the OSU community, a web-based travel survey focused on ridesharing was designed and administered. The sample was drawn from the general OSU population with stratification for enrichment with travelers that are likely to be targeted as participants in a possible follow-on field demonstration study (based on their residential location and socio economic characteristics). The survey was conducted on a one-time basis during March through May of 2014 to collect data on socio-economic characteristics and capture revealed preference (RP) and stated preference (SP) information.

Recommendations

In the immediate term, one next step includes the analysis of the collected data from the application of the campus community survey. The propensity to participate in ridesharing programs using the data from the campus community survey will then be examined and implications of these propensities on the neighborhood structures for faculty, staff and students will be assessed. More specifically, based on the assessed levels of the various variables where travelers are likely to rideshare or not as drivers and passengers, the analysis based on the parking enrollment data will be refined to capture realistic conditions specific to the experiences, preferences, and attitudes of the campus community. In the longer term, if sufficient demand for ridesharing is assessed based on the integration of the parking enrollment data and survey response data noted above, an employer based ridesharing demonstration study will be designed and implemented. Such a study naturally requires the participation of multiple OSU and non-OSU entities and will entail a comprehensive data collection and assessment effort.

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1. INTRODUCTION AND MOTIVATION

The reemergence of ridesharing as a desirable means of travel is partly attributed to the role mobile phone and social networking technologies could play in enabling the “real-time” (or “dynamic”) matching of passengers and drivers producing shared rides. In the past few years, several workshops – for example, at MIT (2009) and TRB (2011) – and conference sessions have been dedicated to real-time ridesharing with a focus on the technological, behavioral, economic, social, and institutional aspects of this form of travel. Technologically, real-time ridesharing offers much greater flexibility than traditional ridesharing in establishing matches and making shared ride arrangements in the absence of a pre-arranged schedule. Economically, higher fuel and toll costs are increasing the incentives in favor of ridesharing. Institutionally, recent experiences with ad hoc ridesharing (e.g., ‘casual carpools’ in the San Francisco Bay area, and the ‘slug-lines’ in the Washington, DC area) are increasing the confidence in achieving successful applications. Amey et al. (2011) investigated the challenges facing ridesharing and pointed to the promise and possible challenges associated with real-time ridesharing, making the case for field demonstration studies that go beyond stated preferences survey results.

As discussed in Amey et al. (2011), large employers concentrated in urban areas could greatly enhance the viability of real-time ridesharing. The common work destination increases the likelihood of a match and reduces the “stranger danger” problem. Large employers can also offer incentives (e.g., associating with parking and transit programs) and safety-nets (e.g., in cases where an emergency return-trip is needed by a ridesharing passenger). However, empirical-based evidence regarding the potential and challenges of employer-based real-time ridesharing is limited. The objective of this proposed study is to investigate the viability and potential for real-time ridesharing to and from the OSU campus under a variety of incentive and travel behavior scenarios.

2. PARKING DATA AND ANALYSIS

2.1 Parking Enrollment Data

The aim of the analysis in this section is to examine the spatial distribution of OSU students, faculty members, and staff members. Data on residential addresses of the campus population who enrolled for parking on campus were requested through CampusParc, a private company that provides parking services to the campus community. These data included residential address and status (student, faculty and staff member) information for individuals with campus parking permits. Of the 39,593 records received, approximately 27,000 were successfully geo-coded. The ones that were not geo-coded either had missing address information or reported residential addresses outside Ohio. Table 1 shows the percentages of faculty, staff, and students among the geo-coded records. Figure 1 depicts these data in map form.

TABLE 1: Descriptive statistics among the geo-coded records

Raw Data	Number of records	Percentage
Faculty	13,138	33.18%
Staff	3,347	8.45%
Student	14,031	35.44%
Med. Center	4,871	12.30%
All others	4,206	10.63%
Total	39,593	100.00%
Geo-coded data	Number of records	Percentage
Faculty	10,440	38.43%
Staff	2,563	9.43%
Student	8,617	31.72%
Med. Center	3,400	12.51%
All others	2,149	7.91%
Total	27,169	100.00%

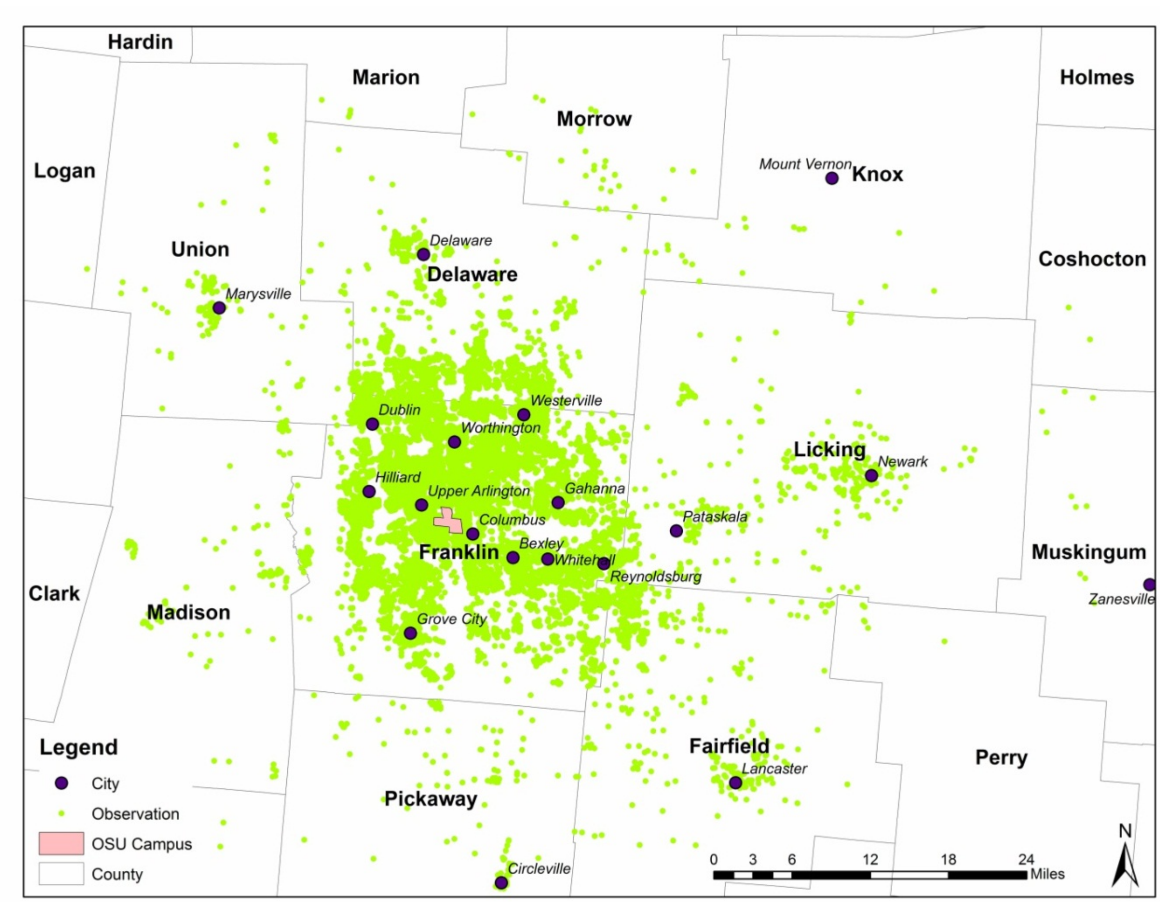

FIGURE 1: Spatial distribution of geo-coded records

2.2 Analysis

To understand the potential for a ridesharing program, the proximities of individuals to others in their neighborhoods with OSU association were analyzed. The number of OSU neighbors an individual has within certain distance buffers and average distances to other OSU affiliates in certain neighborhoods are calculated. One challenge in this process was the high computer processing times necessary for the calculations using the street network and ArcGIS, the Geographic Information System software used in this study. Although following the street network yields more accurate results, because of the running time constraints, some of the calculations (particularly the ones involving the entire sample) were completed using Euclidian distances (using the software *R*). Table 2 shows the descriptive statistics regarding the number of neighbors and distances among neighbors using a 0.5 mile buffer around each individual using the whole sample as well as exclusively for different affiliation groups. For example, across all individuals, on average individuals have 144.1 OSU neighbors residing within a 0.5 mile buffer and the average distance across individuals residing within this buffer is 494 meters (0.3 miles).

TABLE 2: Travel distances (in meters) and number of OSU neighbors using a 0.5 mile buffer

	All	Faculty Members	Staff Members	Medical Center Employees	Students
Number of neighbors					
Mean	144.1	63.1	8.6	11.6	103.3
Min	0	0	0	0	0
Max	648	293	39	69	455
Distances (in meters)					
Mean	494	509.2	497	492.6	460
Min	0	0	0	0	0
Max	805	805	805	805	805
N	27,169	11,270	2,563	3,400	8,690

In an effort to identify target areas for a ridesharing program, separate analyses were conducted for three suburban areas that are popular residential choices among the OSU community: Dublin, Upper Arlington and Worthington. Tables 3 and 4 show the descriptive statistics regarding travel distances and number of neighbors, respectively. Of these three suburban areas, Upper Arlington and Worthington are in closer proximity to OSU campus. Both tables report the results considering street network, Euclidian, and Manhattan distances. While in general the Euclidian and Manhattan distance based results are expected to bracket the street network based ones, such bracketing is not reflected in the results. Further debugging along with investigation and interpretation of the nature of the results is, therefore, necessary. Nevertheless, not surprisingly, the number of neighbors values are the lowest for Dublin, the area with smallest residential density among the three suburban areas considered, and the highest for Upper Arlington, the area with largest density.

TABLE 3: Travel distances (in meters) among OSU neighbors for three suburban areas using a 1.0 mile buffer

	Street Network	Euclidean Distances	Manhattan Distances
Dublin Sample (N = 1,009)			
Mean	1030.69	1005.41	1005.71
Std. dev.	425.83	403.83	405.93
Min	0.00	0.00	0.00
Max	1600.0	1600.0	1600.0
Upper Arlington Sample (N = 2,058)			
Mean	1047.77	998.80	1008.11
Std. dev.	384.07	398.25	398.22
Min	0.00	0.00	0.00
Max	1600.0	1600.0	1600.0
Worthington sample (N = 611)			
Mean	998.51	966.23	968.59
Std. dev.	405.91	415.01	412.86
Min	0.00	0.00	0.00
Max	1600.0	1600.0	1600.0

* Unit: meter

TABLE 4: Number of OSU neighbors for three suburban areas using 0.25, 0.50, and 1.0 mile buffers

	Street Network			Euclidean Distances			Manhattan Distances		
Buffer dist. (mile)	0.25	0.50	1.0	0.25	0.50	1.0	0.25	0.50	1.0
Dublin									
Mean	7.2	19.5	67.4	16.7	52.0	171.0	11.8	35.2	116.8
Min	0	0	0	0	0	1	0	0	0
Max	24	52	170	38	110	327	31	75	228
Std. dev.	4.5	11.6	40.4	7.8	24.6	81.4	5.9	15.8	54.6
Upper Arlington									
Mean	21.7	81.1	307.8	46.7	156.1	498.8	31.9	105.0	346.2
Min	0	3	14	1	10	27	0	8	14
Max	61	158	564	92	261	755	70	167	539
Std. dev.	11.8	34.1	117.5	15.3	45.0	141.1	11.9	29.9	98.9
Worthington									
Mean	13.1	42.4	134.4	30.5	89.0	254.3	20.9	63.0	181.6
Min	0	1	20	1	17	62	1	8	52
Max	44	88	264	66	163	433	52	119	293
Std. dev.	7.1	19.0	53.4	12.4	30.1	83.8	9.2	22.1	58.6

3. CAMPUS COMMUNITY SURVEY

3.1 Motivation and Sample

To gauge the levels of the various variables that would realistically render ridesharing feasible and desirable among the OSU community, a web-based travel survey focused on ridesharing was designed and administered. The sample of anonymous OSU students, faculty members, and staff members is drawn from the OSU affiliated population with stratification for enrichment with travelers that are likely to be targeted as participants in a possible follow-on field demonstration study (based on their residential location and socio-economic characteristics). Based on prior experience with response rates to campus surveys, a total of 21,900 university-affiliated individuals (7,500 undergraduate students, 4,800 graduate students, 4,800 staff members, and 4,800 faculty members) were invited to respond to the survey.

3.2 Survey Design and Administration

The survey was conducted on a one-time basis during March through May of 2014 to collect data on socio-economic characteristics and capture revealed preference (RP) and stated preference (SP) information. The socio-economic characteristics included variables such as university affiliation, duration of affiliation, household composition, and age. The RP part of the survey elicited responses on current travel behavior including attitudes towards various transportation options, travel frequency, modes including car and motorbike sharing, departure and arrival times, intra-week schedule variability, and possible trip chaining relating to both travel to and from campus. The existence of linked trips has implications on ridesharing convenience. Intra-week schedule variability is important in determining the flexibility many members of the university community (notably the students and faculty) have in determining the timing and location of work and study. The absence of both elements has been recognized in Amey (2011) as an important limitation in certain surveys.

The SP part of the survey elicited responses to various hypothetical scenarios, including changes to the existing transportation alternatives and introduction of various incentives for ridesharing. First, respondents are asked to assess their likelihoods of engaging in the ridesharing as drivers and passengers. Based on their responses, respondents are randomly presented with one of several scenarios, feasible to their situations, aimed at either gauging what levels of variables would render ridesharing more attractive to them (e.g., parking discounts, parking space locations, discounts on day-to-day purchases, and cash payments) and what levels of variables would render ridesharing less attractive to them (e.g., pick-up time, travel diversion time, and time to travel from the drop-off location to the final destination) as either drivers or passengers.

4. NEXT STEPS

In the immediate term, one next step includes the analysis of the collected data from the application of the campus community survey. The propensity to participate in ridesharing programs using the data from the campus community survey will then be examined and implications of these propensities on the neighborhood structures for faculty, staff and students will be assessed. More specifically, based on the assessed levels of the various variables where travelers are likely to rideshare or not as drivers and passengers, the analysis based on the parking enrollment data will be refined to capture realistic conditions specific to the experiences, preferences, and attitudes of the campus community.

In the longer term, if sufficient demand for ridesharing is determined based on the integration of the parking enrollment data and survey response data noted above, an employer-based ridesharing demonstration study will be designed and implemented. Such a study naturally requires the participation of multiple OSU and non-OSU entities and will entail a comprehensive data collection and assessment effort.

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