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2019 Kansas City Regional Household Travel Survey Final Report

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1. Introduction and Executive Summary

In spring 2018, the Mid-America Regional Council (MARC) issued a request for proposals seeking professional services for the Regional Household Travel Survey (HTS). Information collected as a part of the HTS will be incorporated into the MARC Travel Demand Model (TDM) update, used in support of advanced model development and analyzed to provide an assessment of current travel behavior in the Kansas City region.

MARC contracted with Westat to conduct the 2018 Regional HTS. The survey collected socio-demographic data and a one-day (24-hour) period of household travel behavior during weekdays (Monday through Friday). The survey called for data from 4,000 households across the MARC modeling domain, which includes the MARC Travel Demand Model (TDM) area (i.e., the Kansas City region, including Johnson, Leavenworth, Miami, and Wyandotte Counties in Kansas and Cass, Clay, Jackson, and Platte Counties in Missouri).

The survey also included the use of a smartphone app offered to all age eligible participants. The use of the app was an option to replace paper logs and help assess trip under-reporting from the self-reported component of the survey. In total, 558 households opted in to use the smartphone app, and 511 of those households completed retrieval.

The dataset was weighted and expanded to the American Community Survey 5-Year estimates and the results of the data match those control totals.

2. Survey Overview

2.1. Sample Design

2.1.1. Sample Frame and Selection

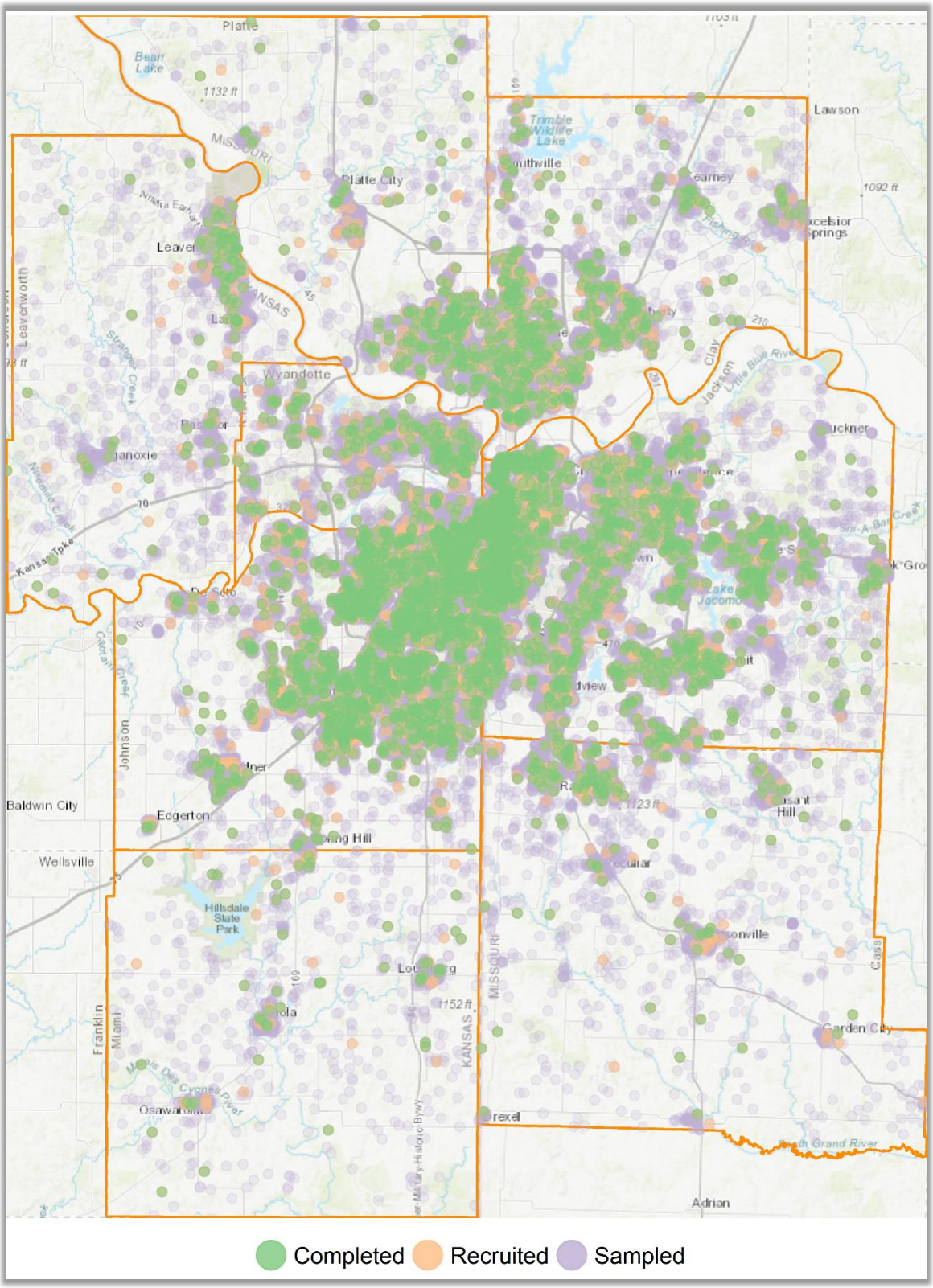
An address-based sample (ABS) frame was developed to identify all residential addresses in the study area and then a randomly selected sample of those addressed were invited to participate in the HTS. The ABS was selected from the United States Postal Service (USPS) Computerized Delivery Sequence File and included all street addresses in the geographic region of Johnson, Leavenworth, Miami, and Wyandotte Counties in Kansas, and Cass, Clay, Jackson, and Platte Counties in Missouri. All sampled addresses were eligible to participate in the study.

Based on pre-survey response rate assumptions, a sample of 50,000 residential addresses were selected for inclusion in the HTS to achieve the goal of 4,000 completed households. To adjust for lower than anticipated response rates, an additional wave of invitations were mailed out to 20,000 addresses in an effort to achieve the goal.

2.1.2. Sample Preparation

After the sample file was generated, Westat added additional variables to support specific HTS needs. All provided addresses were rerun through a geocoding process to assign latitudinal and longitudinal coordinates to each street address to improve accuracy and precision. Addresses that could not be geocoded to point or street level accuracy were flagged for additional verification from the participant. Figure 1 shows the locations of all sampled, recruited, and completed household locations

Figure 1. Sampled, Recruited, and Completed Household Locations



To achieve a balanced day-of-week distribution, the sample was also randomly assigned a specified weekday (Monday to Friday) travel day with 20 percent of the sample assigned to each of the five travel days. A calendar date was selected based on the day of week assignment, and then a specific travel date was assigned during the recruitment survey.

Sampled addresses were randomly assigned into specifically smaller groups, to control the timing and amount of sample released. Each release group was comprised of addresses that were representative of the entire modeling domain. Each release group contained 2,500 addresses, allowing the release of the sample to be managed effectively and efficiently as data collection proceeded.

The ABS sampling and release group strategy is designed to provide the best opportunity to achieve the sample objectives for geographic and socio-demographic distributions, day-of-week distributions, and to manage workflow.

2.2. Survey Methodology

The focus of the HTS was to collect travel behavior data from 4,000 households in the region during the spring of 2018. The study was designed as a mixed-mode survey providing web and telephone options for the recruitment survey and web, telephone, and smartphone app options for the retrieval or travel survey. This section of the report describes the survey instruments design and the data variables captured in the survey instruments.

2.2.1. Survey Recruitment and Retrieval Instruments

The HTS instrument was designed to collect key analytic data required to support the development of travel demand and forecasting models. The survey instrument collected specific data items for each person age 5 and older in the household, including the travel behavior data for one weekday (24-hour period, Monday through Friday).

While these data are important, it is critical that they be collected in a way that minimizes respondent burden. The recruitment and retrieval surveys were administered using an integrated survey software system that supported both computer-assisted self-interviews (CASI) and computer-assisted telephone interviewing (CATI). Surveys completed by web or telephone methods used the same underlying questions, branching, format, and logic checks. The web-based recruitment and retrieval instruments were accessible to participants via the project-specific public website. Each household was assigned a unique PIN during the initial outreach mailings allowing secure access to both questionnaires.

The recruitment questionnaire collected key TDM-focused demographic information about each household including income, household size, type of housing, and information about vehicle ownership. This questionnaire also asked for demographic characteristics about each member of the household such as age, gender, work, and student status, among others. At the conclusion of the recruitment survey, households were prompted for contact information, such as email and cellphone number, to encourage continued engagement through the survey process.

A travel date was assigned within the survey system once the recruitment survey was completed. Households were notified of their assigned travel date in the retrieval package sent out a few days after the completion of the recruitment survey.

Travel day details were collected through the customized TripBuilder™ component of the web survey software system, with an integrated online map that enabled real-time geocoding to collect accurate travel details. Travel details were captured in two steps. The first step was the creation of a sequential list of locations visited and basic attributes, including place name, arrival and departure times, and whether transit was used on the trip. If transit use was reported, access and egress details were captured within the TripBuilder™ interface.

The second step collected additional place details, such as mode of travel, place type, travel companions, primary activity at each place, and parking and transit fare information. Additional person-level characteristics and behavioral questions were collected once all household members age 5 and older completed reporting their travel details.

The following sections list the key information that was verified, collected, or derived about each completed household. A full detailed list of variables are provided in a separate data codebook for reference.

2.2.1.1. Household Data

Household-level details were collected for each household in the final dataset. Among the variables reported in the data are:

- Household size
- Household income
- Number of vehicles

2.2.1.2. Person Data

Specific questions were asked about each household member living in the home on the date the recruitment survey was completed. Key person-level variables collected about household members include:

- Age
- Gender
- Relationship of all household members to the recruit survey respondent
- Licensed driver status (age eligible)
- Employment status (age eligible)
- If employed, additional data items related to work
- Student status
- If a student, additional data items related to school
- Highest level of education earned
- Hispanic origin
- Race

2.2.1.3. Travel Day Trip Data

The travel day began at 3 a.m. on the assigned date of travel. Data were collected for each trip made by each household member (age 5 and older) throughout the day until 2:59 a.m. the following day. Key trip-related details collected include:

- Trip start and end locations
- Trip start and end times
- Mode of travel
- If household vehicle was used, additional data items related to the vehicle and passengers
- If transit was used, additional data items related to access and egress
- Travel Companions
- Primary activity at each location (trip purpose)

2.3. Branding and Public Outreach

A well-crafted public outreach effort is a key component to the success of a HTS. Westat, MARC and state DOTs worked together to develop three tools and strategies to help facilitate an effective public outreach effort.

First, a brand was developed to identify and convey the purpose of the survey. The logo depicted multiple modes of transportation across urban and rural landscapes to communicate that the survey was interested in all types of travel across all regions of the Kansas City area. The survey logo was displayed on all survey materials presented to the public including the public website, survey instruments, and respondent materials.

Figure 2. Study Logo

Second, a website was developed to serve primarily as a portal for prospective participants to learn more about and participate in the survey. The color scheme and design of the site were intentionally similar to the survey logo so that participants would see an immediate connection between the survey and invitation letter received in the mail. A short, descriptive web address, or uniform resource locator (URL) was used to allow for easy dictation to, and recall by participants (howwemovekc.com). In addition to access to the survey, the site also provided an informational video, frequently asked questions (FAQs), and press releases and links to external media coverage.

Finally, a press release was developed and distributed at key stages of the survey effort. The release was timed in conjunction with the commencement of survey data collection efforts to increase survey recognition by potential respondents, to provide legitimacy of the survey, and emphasize its importance to the region.

2.4. Data Collection

The data collection began with letters of invitation mailed in March 2018 to sampled addresses and ended with final travel data collection in early June 2018.

The survey data collection process included the recruitment of participants, various reminder contacts distributed across the field period, and the retrieval of the travel day data. The following sections describe this process in more detail.

2.4.1. Recruitment Process

Recruitment began by mailing a letter of invitation to participate in the survey to sampled addresses. The letter conveyed the purpose of the study, encouraged participants to self-recruit online, and provided a personal identification number (PIN) to access to the survey through the survey website URL. The letter also presented an incentive for completing the recruitment survey. (See Appendix 7.1.1 for the invitation letter.)

Invitation letters were mailed to 70,000 sampled addresses in the Kansas City region. The letter was addressed to "city" resident (e.g., Kansas City Resident), printed on project branded letterhead and signed by David Warm, MARC Executive Director. All mailed materials included a toll-free number to reach the study team if respondents had questions or preferred to participate by phone.

Invitation letters we mailed in a 9x12 envelope branded with the MARC logo noting support from the Kansas (KDOT) and Missouri Departments of Transportation (MoDOT) to increase legitimacy of the survey. A letter from the resident's state DOT (KDOT or MoDOT) was included to endorse the survey and encourage participation.

All mailed survey materials included a toll-free number to allow respondents to call the study team if they had questions or preferred to participate by phone. Recipients were given the option to self-recruit themselves or speak with one of Westat's survey team over the phone. Most households (95 percent) completed the recruitment process online. Table 1 shows the number of released sampled addresses and recruited households by state.

Table 1. Released Sample and Recruited Households

State	Sample	Recruited
Kansas	27,310	2,272
Missouri	42,690	2,937
Total	**70,000**	**5,209**

2.4.1.1. Recruitment Reminder Contacts (Postcards)

The study protocol included sending each sampled address up to two postcards to encourage participation. The first reminder postcard was mailed one week after the invitation letter and a second reminder postcard one week after the first postcard. Households that had completed the recruitment survey were purged from future reminder files (see Appendix 6.1 for examples of the reminder postcards).

2.4.1.2. Travel Date Assignment

Each address was randomly assigned to a day of the week (Monday through Friday) during the sampling process. Specific calendar dates were assigned at completion of the recruitment survey based on the day of week assigned. The goal was to have an even distribution of 20% of households to each of the five days of the week. Households were sent a retrieval package providing them with their recruitment completion incentive and detailing the second stage of the survey (retrieval) and their assigned travel date. Table 2 shows the distribution of recruited households by day of week.

Table 2. Distribution of Recruited Households by Day of Week

Household Travel Day	Frequency	Percentage
Monday	999	19.18%
Tuesday	998	19.16%
Wednesday	1,071	20.56%
Thursday	1,082	20.77%
Friday	1,059	20.33%
Total	**5,209**	**100%**

2.4.1.3. Recruitment Confirmation

Households that provided an email address or contact number in the recruitment survey received a message a few days after completing the recruitment survey, thanking them for their participation and alerting them that their incentive had been mailed. The message reminded respondents that included with their incentive would be an opportunity to participate in another survey for an additional incentive. Respondents were also encouraged households to download the Westat DailyTravel App, if they so desired, to help track their travel on their assigned date.

2.4.2. Pre-Travel Date Contacts

Prior to the assigned travel date, steps were taken to enhance household participation and assist in the travel behavior data collection process. These efforts are presented in the following sections.

2.4.2.1 Travel Log Packet

After the recruitment survey was completed, households were sent a travel log packet that included their recruitment completion incentive, a letter detailing the second stage of the survey, and travel logs for each household member to use to record their travel. The letter informed households of their assigned travel date, provided instructions on how to complete the survey, and offered an additional incentive for completing the entire survey. The letter also included instructions on how to use the smartphone app to capture their travel information in real time instead of completing online or over the phone.

2.4.2.2. Pre-Travel Day Reminder Contacts

The day before the assigned travel day, households were sent messages (phone, email or text message) reminding them to record their travel on their assigned travel date. Email and text reminders allowed participants to respond with questions through the same medium; study team members responded to each participant in a timely manner.

2.4.3. Retrieval Process

In total, there were 3,821 completed households in the sampled region. Households were encouraged to self-report their data online; however, a telephone interview option was also available.

2.4.3.1. Post-Travel Day Reminder Contacts

A series of electronic reminders were delivered to recruited households in an attempt to improve response to the retrieval survey. Beginning the day after the travel date, up to five reminder prompts were sent as text messages or emails depending on the contact preference requested by the household. These reminders included the household's PIN and links to the public website.

2.4.3.2. Retrieval Details

Households were able to begin reporting their travel day trip and activity details by web or CATI beginning the day after the travel day. Households preferring to complete by telephone with an interviewer were called the first day after their assigned travel day. Those preferring to complete by web were also called if the household had not reported their travel by the third day after the travel day.

App users were able to record their travel details on their smartphone in real time on their travel day. Data was synchronized across all survey platforms allowing app users to review, edit, or finish reporting their travel details

online or over the phone if so desired. In addition, all shared trips captured in the app were ported to allow access for other household members who may have reported online or over the phone. App users were asked to record their travel for seven days, though only the first day (assigned travel date) was required for completion of the survey.

The retrieval questionnaire data was collected using Westat's TripBuilder Web™ (TBW) web-based software that enabled all participants regardless of response mode to provide travel and activity details while geocoding each reported location in real-time. TBW uses a built-in mapping interface developed with the Google Maps Application Program Interface (API).

2.4.3.3. Definition of a Complete Survey

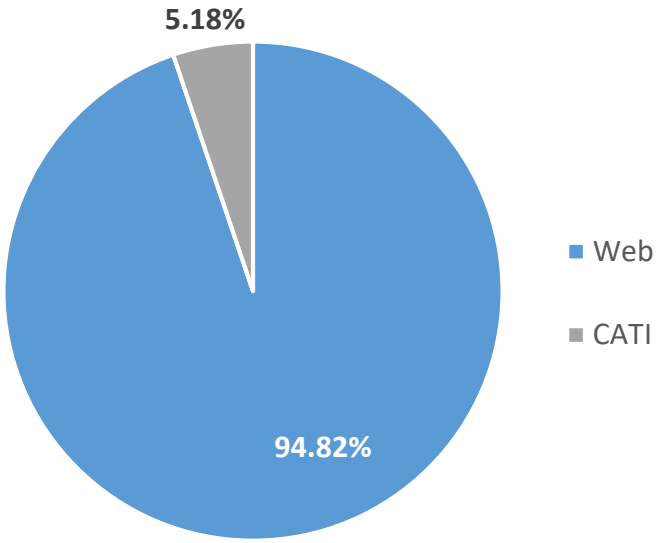
Households where all members reported travel details for the assigned travel day were considered complete and subsequently included in the final data deliverable file assuming that all edit checks and post processing errors were able to be cleared.

2.4.4. Sample Monitoring

Recruitment and retrieval results were monitored daily. Each sample mail group was monitored to assess sample yields.

Figure 3 shows the percentage of recruited households by recruitment mode. Although participants were encouraged to self-recruit online, providing multiple response modes provided each participant an option to choose the mode that best suited their household. Overall, 95 percent of all recruited households utilized the self-recruiting option.

Figure 3 Recruitment Response Mode (CATI and web)



Retrieval percentages by response mode are presented in Figure 4 which show online reporting was the dominant response mode for the retrieval survey supported by a measurable amount of CATI and app use.

Figure 4. Retrieval Response Mode (Web, CATI, and App)

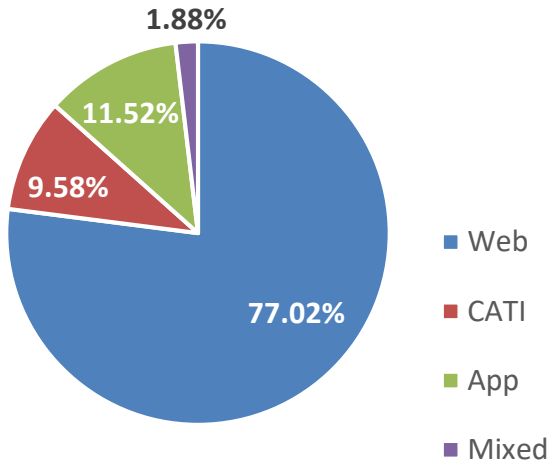


Table 3 presents the distribution of completed households by day of week. The percentages presented here are similar to the recruited results presented in Table 2 indicating the weighting process did not substantially change the

distribution of travel across the five days of the week. Close to 20% of the total count of households were assigned to travel on each of the five days. Note that in all tables containing weighted data, N represents the actual surveyed count, unwieghted represents the surveyed percentage, weighted, the weighted percentage, and MOE, the margin or error which is discussed in Section 4.4

Table 3. Distribution of Completed Households by Day of Week

Travel day - day of week	N	Unweighted	Weighted	MOE
Monday	710	18.58%	19.15%	1.47%
Tuesday	738	19.31%	18.78%	1.32%
Wednesday	783	20.49%	20.58%	1.38%
Thursday	796	20.83%	20.87%	1.36%
Friday	794	20.78%	20.63%	1.38%

Table 4 shows the distribution of completed households by state with slightly more households from Missouri mirroring the regional population distribution.

Table 4. Completed Households Summary by State

State	N	Unweighted	Weighted	MOE
KS	1,668	43.65%	43.51%	1.59%
MO	2,153	56.35%	56.49%	1.59%
Total	3,821	100.00%	100.00%	0.00%

Figure 5, Figure 6, and Figure 7 illustrate the spatial distributions of the work locations, school locations, and all other reported locations during the travel period, respectively.

Figure 5. Completed Households - Work Locations

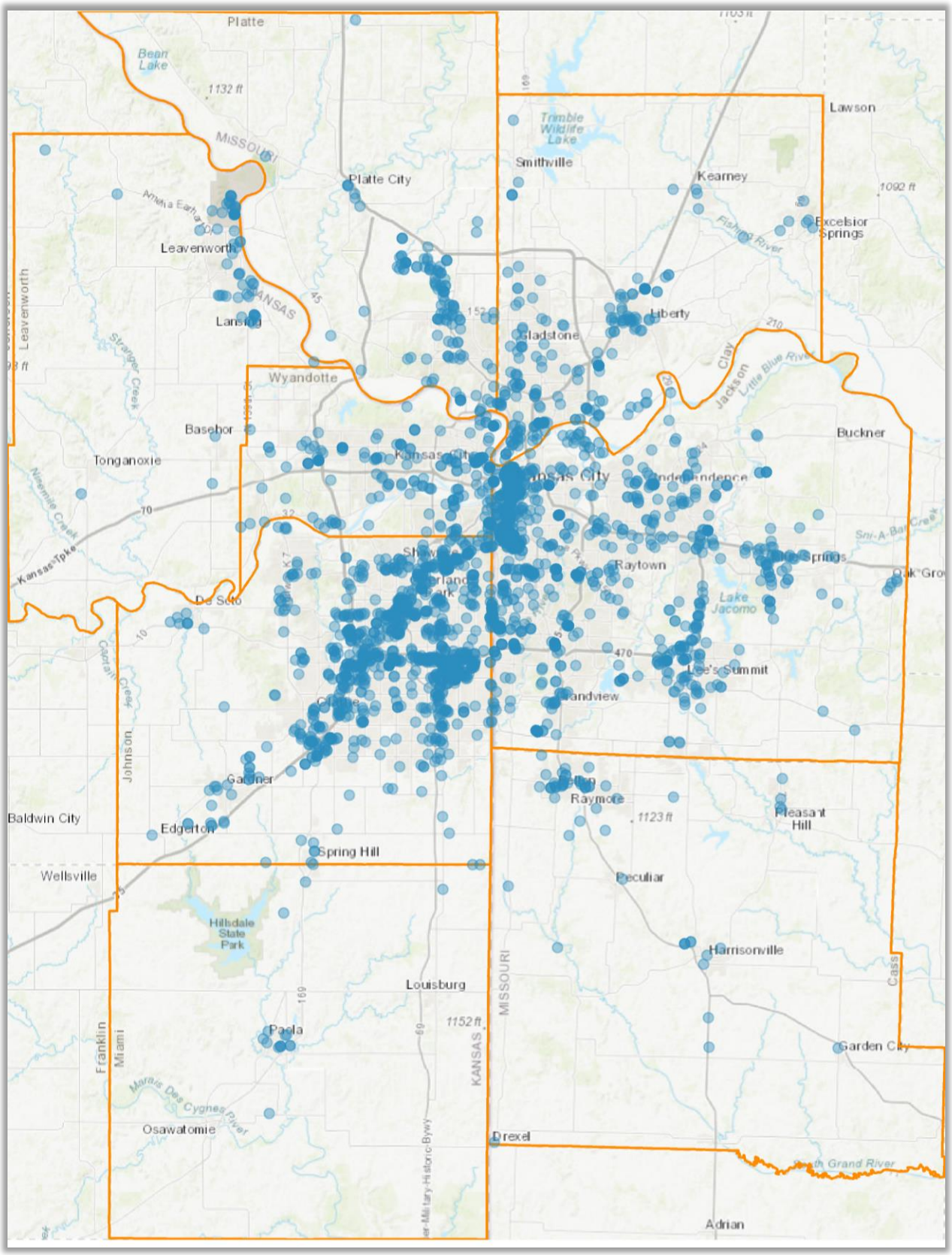


Figure 6 Completed Households - School Locations

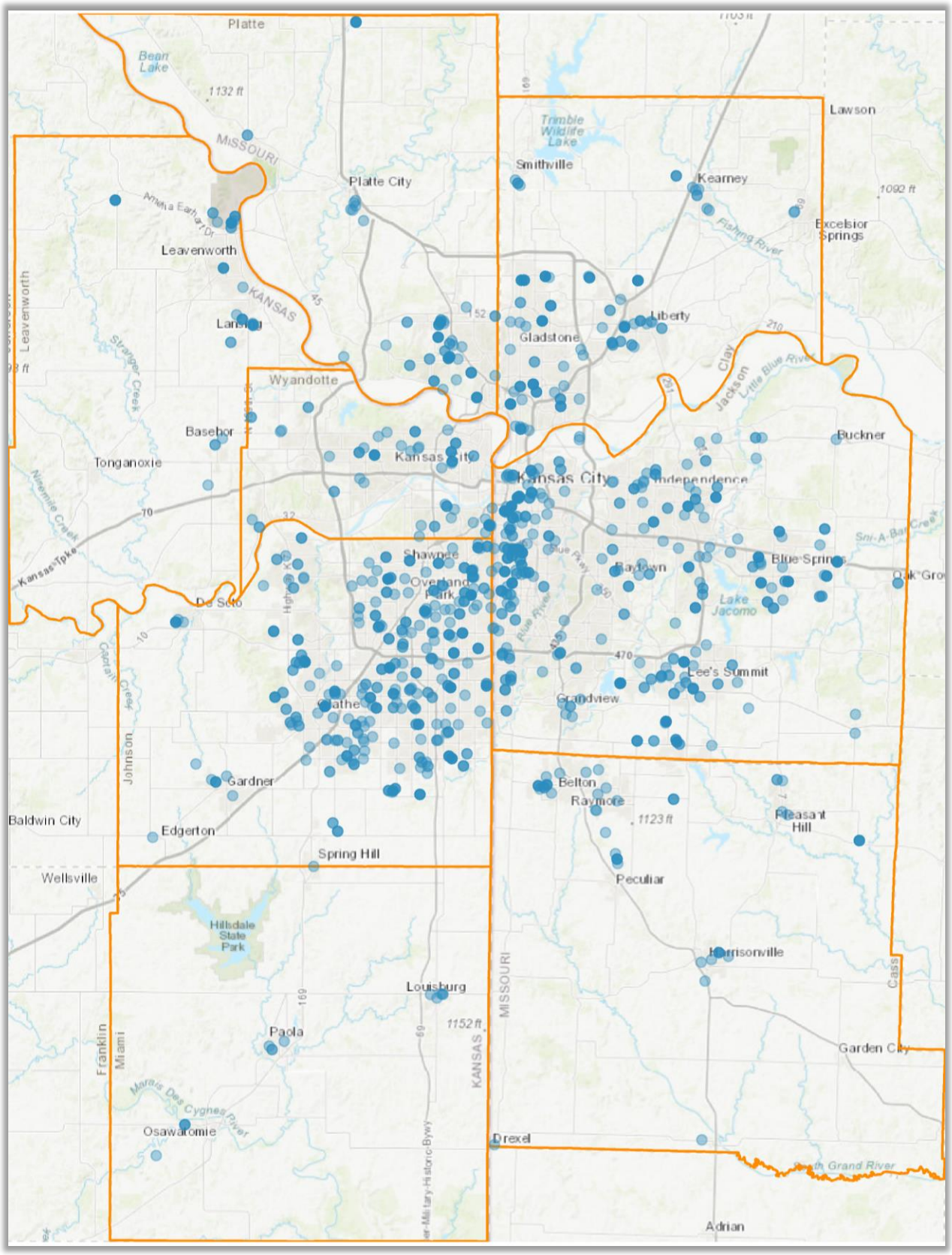
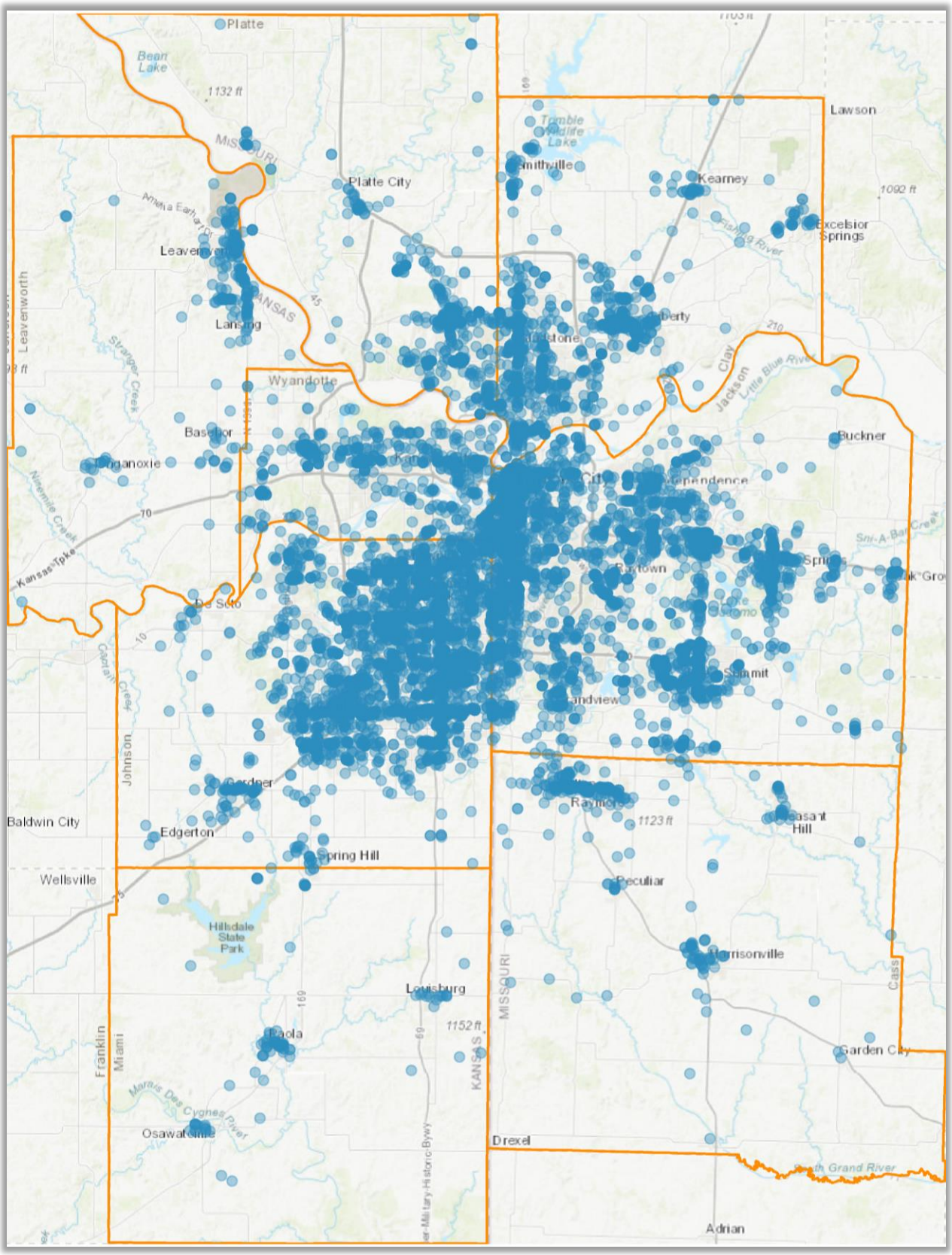


Figure 7 Completed Households - All Other Locations



2.5. Survey Response Rates

The recent decline in survey response rates has been well documented in all areas of research, but especially in household travel surveys. The shift from random digit dialing (RDD) to address-based sampling (ABS) frames provides many benefits to targeted sampling and coverage bias, but only adds to the diminishing response rate issue. In general, approximately 40 to 50 percent of all sampled addresses are matched to a telephone number, and about 15 percent of those matches generally prove to be bad matches (e.g., not associated with the sampled address). Because more than half of the sampled households are only reachable by mail in the ABS sample design, passive refusals happen at a high rate. Response rates achieved from ABS frames are largely dependent on the salience of the study, the presentation of the recruitment materials, and public outreach campaigns.

Response rates were calculated for both the recruitment and retrieval stages of the survey.

The recruitment rate ($R_{Recruit}$) in surveys using an ABS is calculated by dividing responding households by eligible addresses.

$$R_{Recruit} = \frac{Recruited\ Households}{Sampled\ Addresses}$$

The retrieval rate ($R_{Retrieve}$) is the percentage of households that completed the study after agreeing to participate.

$$R_{Retrieve} = \frac{Retrieved\ Households}{Recruited\ Households}$$

The final response rate (R_{Final}) is the product of the recruitment and retrieval rates.

$$R_{Final} = R_{Recruit} \times R_{Retrieve} = \frac{Retrieved\ Households}{Sampled\ Addresses}$$

Table 5 shows the recruitment, retrieval and overall response rates by State.

Table 5. Response Rates by State

State	Sampled	Recruitment	Recruitment Rate	Retrieved	Retrieval Rate	Response Rate
KS	27,310	2,272	8.3%	1,671	73.5%	6.1%
MO	42,690	2,937	6.9%	2,156	73.4%	5.1%
Total	**70,000**	**5,209**	**7.4%**	**3,827**	**73.5%**	**5.5%**

As expected in all voluntary surveys, there is some level of item non-response. Survey logic did not allow participants to skip questions; however, participants could provide a "don't know" or "prefer not to answer" response to most survey questions. To mitigate non-response, the "don't know" and "prefer not to answer" options were not initially shown to participants. However, if a participant tried to advance a page without providing a response to a question, a pop-up would appear prompting whether they meant to answer the question, did not know the answer, or would prefer not to answer. If the participant reported that they meant to answer the question, the pop-up was cleared allowing them an opportunity to provide a response. Westat has successfully utilized this non-response strategy in other HTS to combat non-response.

Table 6 presents variables with the highest level of non-response. For households that refused income in the initial, recruitment stage, a follow-up with broader categories was presented in retrieval. This resulted in a reduction of income non-response from 87 to 43 households for a final non-response rate of 1.1%.

Table 6. Item Non-Response

Non-response Variable	Frequency	Total Queried	Percentage
Household Income	43	3,821	1.12%
Race	48	8,361	0.57%
Reason for not traveling	3	959	0.31%
Number of Jobs	11	4,208	0.26%
Work Industry	9	3,999	0.23%
Hispanic/Ethnicity	14	8,361	0.17%
Student Status	9	8,361	0.11%

2.6. Daily Travel Smartphone Application

This section of the report describes the Daily Travel Smartphone app used, the methods employed to distribute and collect the survey data from the smartphone, and presents the results of the deployment effort

2.6.1. DailyTravel App Data Deployment

2.6.1.1. DailyTravel App Application

The travel log letter presented households with the option to record travel using Westat's smartphone application for household travel survey data collection. Use of the smartphone app to record travel day information was offered to all households. All households members 13 years or older were eligible to use the smartphone app.

Households were provided a link to the DailyTravel app website with links to the Apple App Store and the Android Google Play Store. They were given instructions to install the app and log in using the household PIN, provided in the invitation letter and all reminders. Once logged in, household members selected themselves on their respective smartphone thereby linking device and data collected on it to the appropriate household member. Reminders were used to encourage participants to opt into using the smartphone app for data collection.

Household members using the smartphone app were asked to use the app to capture GPS locations and confirm place details on the assigned travel date and to continue collecting data for another 6 days, for a total of 7 days of GPS-based travel data. Once the app was installed and authenticated using the PIN, the GPS data was collected regardless of user interaction with the application. However, many participants continued to confirm places and place details throughout the full 7 days.

2.6.1.2. Smartphone Usage

In total, 625 participants across 558 households downloaded and initialized the app, and 576 of these participants completed retrieval of their travel using the app. Table 7 shows the total number of households where at least one member installed the app, and the percentage of those households that completed the survey.

Table 7. Smartphone Application Usage and Recruitment and Completion Results

Travel Reporting Mode	Installed App	Completed Retrieval	% Complete
Smartphone App	558	511	91.57%

2.6.2. DailyTravel App Data Collection and Processing

2.6.2.1 Smartphone App data location and process

App users were able to record up to 7 days of travel including the main travel day. The participants were encouraged but not required to report details about app-captured places on the additional 6 days. During this time, the app may have automatically collected places that were not valid stops. Consequently, the data needed to be

processed to remove invalid places and impute important travel details. The steps were as follows: First, we identified duplicate locations and combined them into one location record. Next, we attempted to remove two types of invalid trips. Instances where the app captured a stop but the participant was still traveling (common at traffic lights) and instances where the app added a trip but the participant had not left (common for movement on large sites). Finally, we used GPS and Accelerometer data to impute travel mode and trip purpose

2.6.2.2 Combine Duplicate Locations

To combine duplicate locations, we used a density-based clustering algorithm, DBSCAN, to cluster all locations within a household that were close in proximity. If a cluster was identified, we would choose a location within that cluster based on the following priority: Habitual (home, work, or school), whether it had location details, and its horizontal accuracy if it was a GPS collected place.

2.6.2.3 Identify and Collapse False Stops

False stops are instances where the participant was actually still traveling, but the app recorded a stop. The most common scenario is heavy traffic or a long stop light. We developed a heuristic, an imputation solution leveraging confirmed travel data attributes, to detect these instances by looking at stop duration and gap speed. Gap speed was computed by grabbing the last GPS point before the stop and the first point after the stop and computing the speed. High gap speeds indicated that the participant may not have actually stopped. It was also useful to address whether the stop was "on the way" to the next location as well as looking at the GPS trace upon arrival.

2.6.2.3 Identify and Collapse Noise Stops

Noise stops are instances where the app records a trip, but the participant had not left their existing location. This is common at locations like parks, campuses, or large offices where the participant may move around without actually leaving. These were identified using a heuristic-based algorithm as well. Short origin-destination distances with low speeds tended to indicate noise stops. Very compact, circuitous GPS traces were also a common indicator.

2.6.2.4 Impute Travel Mode

For travel mode imputation of smartphone trips collected beyond the travel day, we moved from the heuristic-based approach to a modeling approach. The smartphone trip imputation model was trained on trips collected from the app on confirmed travel days (confirmed every trip on the day). Trips with user-edited start/arrival times were not used. For each trip, we merged GPS and Accelerometer sensor data at 1 Hz and aggregated the data over a 1 minute rolling window every 30 seconds. For each window, we calculated the following variables:

- GPS Point Count
- Connected Point Distance
- Circuity (Connected Point Distance / Straight Line Distance)

- Compactness (Connected Point Distance / Diagonal Distance)
- Accelerometer Count
- Speed (Average, Median, 25th & 75th Percentile, Standard Deviation, Kurtosis, Skew)
- Magnitude of Acceleration (Average, Median, 25th & 75th Percentile, Standard Deviation, Kurtosis, Skew)
- Average Change in Heading
- Range of Altitude
- Person Type

We then collapsed the categories in the mode list so the model could make more discrete/unambiguous predictions. A Random Forest algorithm using 100 trees was trained on the confirmed data and then applied to the unconfirmed travel days.

2.6.2.5 Impute Trip Purpose

We elected to use a heuristic to determine trip purpose using a combination of person and location-based information. These included whether the participant was a student or worker and whether the origin/destinations were habitual home, school, or work locations. Like travel mode, the trip purpose categories were collapsed to reduce ambiguity.

3. Survey Processing, Data Cleaning, and Data Quality Checks

3.1. Overview of Survey Processing and Data Cleaning

Data processing and data cleaning were conducted on an ongoing basis throughout the study. Updates were made to key operational variables during the administration of survey (e.g., the addition of a car that was not originally reported). Variables that did not impact the flow of the survey were updated at the conclusion of data collection (e.g., recoding race based on "Other, specify" responses).

A series of automated edits, range checks, and consistency checks were performed within the survey instrument, and data preparation staff performed frequency reviews and problem resolution to monitor, correct, and update the data. Automated checks were run to evaluate the validity of reported trip data. The following sections provide more details for each of the data quality checks used.

3.1.1. Logic Checks

Logic checks were programmed into the recruit and retrieval instruments to ensure that questions were answered as accurately as possible. These included requiring that certain questions be answered (e.g., requiring a response even if "don't know" or "prefer not to answer") and forcing the data type (e.g., requiring a number for the question AGE). Data range checks were employed to ensure that the data fell within the expected range for a given question (e.g., 0-112 for AGE). Consistency checks were conducted to confirm data consistency in common variables across data files (e.g., household size or participant age).

3.1.2. Real-Time Geocoding

Westat's TBW survey software was used to collect the travel day details in the retrieval portion of the household travel survey. All trip ends were geocoded reporting in real-time using a Google interface during the completion of the trip. Respondents could enter the location's address or were able to use the Google search engine to locate a specific place (e.g., the CVS drugstore at a specific intersection) when they did not know the address of the location. TBW captured full address information and the matching X/Y coordinate of the location.

3.1.3. Frequency Reviews

Frequency reviews were conducted in the beginning, middle and end of data collection to ensure that all data were being properly captured in the survey database. A report displaying a frequency table for each survey variable was generated including branching logic, question text and responses. Through the review of these frequency reports, analysts would identify and correct issues with the data as appropriate.

3.1.4. Edit Checks

Upon completion of retrieval, a series of edit check queries were run on the data to identify potential reporting inconsistencies. If an edit check failed, the data from the household was manually reviewed by an analyst. Edit checks were completed on trip data and non-trip data. Non-trip data checks were executed as part of the frequency review process described above and included checks of each survey variable at each survey stage (recruit and retrieval).

Trip data was processed through Westat's trip processing system (TPS). TPS includes a series of consistency checks on reported trip data. When a TPS edit failed, an analyst reviewed the data to determine whether adjustments to the data could be made based on information provided by another household member or if the household needed to be re-contacted to resolve the inconsistency in the data. Whether the data was updated by an analyst or an interviewer as a result of a re-contact with the household, the entire household record was reprocessed through the TPS checks. Cases were continually run through this process until it cleared TPS without any failures. Only households that successfully passed these edits were included in the final dataset.

See Appendix B for a list of data edit checks.

3.1.5. Upcoding and Cleaning

At the conclusion of data collection period, open-ended and "other, specify" responses were reviewed and upcoded or aggregated as a new response category as appropriate. Upcoding is the activity of recoding an open-ended response into a categorical response option (e.g., recoding Caucasian to white). The process includes removing the "other, specify" (open-ended) text response.

In addition to coding open-end text into categorical responses, Westat also combined or collapsed other responses that were similar to each other (e.g., misspelling of the response, different letter spacing in the response or capitalization issues). These responses appear in the original dataset as independent, unique responses but have been corrected and combined in the final dataset for more efficient analysis.

3.1.6. Derived Variables

Several variables in the data deliverable were derived using counts from participant responses. Derived variables provide the sum of an attribute across a household. For example, the derived number of household students (HHSTUD) is the count of all household members that answered "Yes" to the question "Are you/he/she currently enrolled in any type of school, including daycare, technical school, or a university?" The result is an actual count of the number of students in a household, full-time or part-time. The survey question about student status (STUDE) is

available in the data deliverable, so analysis can be conducted at the person level using the reported, rather than the derived household level data.

In survey research, some data elements are captured in more than one question or format causing discrepancies in the data. For example, asking how many people live in a household and a derived household size based on the number of rostered household members can lead to discrepancies between the two. Limiting the number of people that may be rostered based on the response to another question may also affect the accuracy of the reported data in the more specific roster format. In this example, the derived variable is more accurate than the single question format.

Another type of derived variable provided in this dataset is the conversion of data collected in multiple units (e.g., hours and minutes) into a single unit of analysis (e.g., minutes). Calculations can also be used to determine quantitative values such as number of non-household members on a trip. This number was derived by subtracting the number of household members (HHPARTY) reported on a trip from the total number (PARTY) reported on the trip. A list of all of the derived variables included in the data deliverable can be found in Appendix 7.4.

4. Weighting and Expansion Methodology

4.1. Household Base Weights

The household base weight reflects the probability of selection for a sampled household and is calculated simply as the reciprocal of its probability of selection.

4.1.1. Adjustment for Non-Response at the Household Level

After the assignment of the household level base weight, an adjustment for non-response was made to reflect those for which a retrieval interview was not obtained. Household non-response adjustments were made to Census target cells at the State level, sampling stratum (high density of key sample characteristics[1]/remaining households), and whether telephone number was available for the household. A non-response adjustment factor was calculated for each cell as the ratio of the sum of household weights for all eligible households to the sum of the household weights for all recruited households. The non-response adjustment factor was applied to the household base weight of each responding household. In this way, the weights of the responding households were "weighted up" to represent the full set of responding and non-responding households in the adjustment cell.

[1] Within each area, the first stratum consisted of addresses in Census tracts with a high density of hard-to-reach households which are defined as low income households, large households (4 or more persons), and linguistically isolated Spanish households (households where no one speaks English very well).

4.1.2. Raking at the Household Level

Raking adjustment procedures are used to improve the reliability of survey estimates and, to some extent, correct for the bias due to under-coverage and/or non-response. Raking is a post-stratification adjustment procedure where survey weights are iteratively adjusted to independent control totals for various demographic categories. The process has the effect of differentially adjusting the weights of the sampled households within groups of demographically similar households, so that the total sum of weights for the sampled households equals the corresponding independent control totals for all households.

The raking process used with the Kansas City data had four "dimensions." The weights were adjusted to equal the totals within the cells for each dimension in an iterative process, until the process converged, and every dimension's cell totals equaled the independent control totals. The dimensions at the household weighting level included the following:

- Household size by number of workers per household
- Household size by number of vehicles per household
- Household income
- Households by State

All the control total data came from the 2013–2017 5-year American Community Survey (ACS). In Table 8 through Table 10, the weighted estimates for several key household-level demographic variables (e.g., household size, number of workers, etc.) are presented by state alongside the ACS estimate for the same variables in the study region.

Table 8. Household Size by State

State	HH Size	MARC	MARC MOE (90%)	ACS	ACS MOE (90%)
KS	*1 person*	27.29%	1.47%	26.79%	0.88%
	2 person	34.10%	1.43%	33.59%	0.87%
	3 person	15.12%	1.11%	15.47%	0.89%
	4+ person	23.50%	1.58%	24.16%	0.89%
MO	*1 person*	30.68%	1.21%	30.96%	0.78%
	2 person	33.09%	1.11%	33.49%	0.78%
	3 person	15.16%	0.87%	14.90%	0.79%
	4+ person	21.07%	1.20%	20.65%	0.79%

Table 9. Household Number of Vehicles by State

State	HH Size	HH Vehicles	MARC	MARC MOE (90%)	ACS	ACS MOE (90%)
KS	*1 person*	*0 vehicles*	3.05%	0.72%	3.40%	1.03%
		1 vehicles	19.59%	1.30%	19.35%	1.02%
		2 vehicles	3.79%	0.57%	3.36%	1.03%
		3 vehicles	0.48%	0.20%	0.46%	1.03%
		4+ vehicles	0.37%	0.09%	0.23%	1.03%
	2 person	*0 vehicles*	0.73%	0.47%	0.73%	1.03%
		1 vehicles	5.08%	0.84%	5.76%	1.03%
		2 vehicles	21.42%	1.09%	21.04%	1.02%
		3 vehicles	5.33%	0.52%	4.69%	1.03%
		4+ vehicles	1.54%	0.26%	1.37%	1.03%
	3 person	*0 vehicles*	0.08%	0.13%	0.24%	1.03%
		1 vehicles	2.83%	0.68%	2.50%	1.03%
		2 vehicles	6.28%	0.73%	6.68%	1.03%
		3 vehicles	4.46%	0.64%	4.64%	1.03%
		4+ vehicles	1.46%	0.36%	1.40%	1.03%
	4+ person	*0 vehicles*	0.00%	0.00%	0.40%	1.03%
		1 vehicles	1.97%	0.77%	2.29%	1.03%
		2 vehicles	11.83%	1.22%	11.95%	1.03%
		3 vehicles	5.49%	0.98%	5.77%	1.03%
		4+ vehicles	4.21%	0.86%	3.75%	1.03%
MO	*1 person*	*0 vehicles*	5.08%	0.58%	4.78%	0.93%
		1 vehicles	21.66%	1.03%	21.79%	0.92%
		2 vehicles	3.28%	0.44%	3.61%	0.93%
		3 vehicles	0.56%	0.15%	0.58%	0.93%
		4+ vehicles	0.09%	0.07%	0.20%	0.93%

State	HH Size	HH Vehicles	MARC	MARC MOE (90%)	ACS	ACS MOE (90%)
	2 person	*0 vehicles*	1.33%	0.35%	1.32%	0.93%
		1 vehicles	7.86%	0.64%	7.30%	0.93%
		2 vehicles	18.57%	0.83%	18.92%	0.92%
		3 vehicles	4.25%	0.40%	4.74%	0.93%
		4+ vehicles	1.07%	0.20%	1.21%	0.93%
	3 person	*0 vehicles*	0.54%	0.26%	0.54%	0.93%
		1 vehicles	3.07%	0.52%	3.17%	0.93%
		2 vehicles	6.28%	0.56%	5.99%	0.93%
		3 vehicles	4.00%	0.49%	3.88%	0.93%
		4+ vehicles	1.27%	0.28%	1.32%	0.93%
	4+ person	*0 vehicles*	0.33%	0.27%	0.52%	0.93%
		1 vehicles	3.39%	0.66%	3.08%	0.93%
		2 vehicles	9.73%	1.00%	9.26%	0.93%
		3 vehicles	4.87%	0.76%	4.68%	0.93%
		4+ vehicles	2.75%	0.66%	3.12%	0.93%

Table 10. Household Income by State

State	HH Income	MARC	MARC MOE (90%)	ACS	ACS MOE (90%)
KS	*Less than $10,000*	4.22%	1.17%	4.51%	1.10%
	$10,000 to $14,999	2.20%	0.72%	3.17%	1.10%
	$15,000 to $19,999	3.07%	0.82%	3.13%	1.10%
	$20,000 to $24,999	3.47%	0.83%	3.73%	1.10%
	$25,000 to $29,999	3.22%	0.90%	4.06%	1.10%
	$30,000 to $34,999	4.03%	0.74%	4.36%	1.10%
	$35,000 to $39,999	4.78%	0.90%	4.07%	1.10%
	$40,000 to $44,999	4.83%	0.84%	4.34%	1.10%
	$45,000 to $49,999	2.37%	0.67%	4.01%	1.10%
	$50,000 to $59,999	7.35%	1.02%	7.38%	1.10%
	$60,000 to $74,999	11.59%	1.25%	10.15%	1.10%
	$75,000 to $99,999	16.02%	1.08%	13.61%	1.10%
	$100,000 to $149,999	17.21%	0.98%	17.70%	1.10%
	$150,000 to $199,999	8.16%	0.97%	7.64%	1.10%
	$200,000 or more	7.47%	0.96%	8.16%	1.10%
MO	*Less than $10,000*	7.32%	0.92%	6.12%	0.93%
	$10,000 to $14,999	4.63%	0.75%	4.70%	0.93%
	$15,000 to $19,999	4.78%	0.81%	4.66%	0.93%
	$20,000 to $24,999	5.36%	0.86%	5.04%	0.93%
	$25,000 to $29,999	5.06%	0.90%	4.61%	0.93%
	$30,000 to $34,999	5.67%	0.89%	5.11%	0.93%
	$35,000 to $39,999	6.76%	1.06%	4.88%	0.93%
	$40,000 to $44,999	4.66%	0.83%	4.99%	0.93%
	$45,000 to $49,999	2.75%	0.72%	4.13%	0.93%
	$50,000 to $59,999	7.89%	0.76%	8.11%	0.93%
	$60,000 to $74,999	9.83%	0.85%	10.82%	0.93%
	$75,000 to $99,999	11.67%	0.81%	13.57%	0.93%
	$100,000 to $149,999	14.41%	0.74%	14.06%	0.93%
	$150,000 to $199,999	6.04%	0.79%	5.09%	0.93%
	$200,000 or more	3.17%	0.55%	4.11%	0.93%

4.2. Person-Level Weights

4.2.1. Adjustment of Initial Person-Level Weights

The final household weight was assigned to each person in responding household in the sample. This weight represents the initial person-level weight.

4.2.2. Raking at the Person Level

For the same reasons raking was used at the household level (improved reliability, reduction of potential bias, and to achieve consistency with known population counts), a simple raking/post-stratification procedure was also used at the person level. Survey weights of responding persons were adjusted so that the sum of the weights of the responding persons equaled the corresponding independent control total for the study area population. The dimensions at the person-weighting level included the following:

- Sex by age
- Race/Ethnicity
- Population by State

The independent control totals came from 5-Year ACS data. Table 11 and Table 12 present the weighted frequencies for the person-level variables age range and sex alongside the comparable ACS estimates from the regional population. The majority of respondents identified as white (over 75 percent) with all estimates falling within the margins of error between the MARC results and the ACS.

Table 11. Person Age Range by State

State	Age Range	MARC	MARC MOE (90%)	ACS	ACS MOE (90%)
KS	*Under 5 years*	7.23%	0.89%	6.90%	0.38%
	5 to 9 years	6.45%	0.71%	7.28%	0.38%
	10 to 14 years	6.84%	0.85%	7.22%	0.38%
	15 to 19 years	5.79%	0.75%	6.45%	0.38%
	20 to 24 years	4.25%	0.78%	5.79%	0.38%
	25 to 29 years	6.80%	1.06%	6.58%	0.38%
	30 to 34 years	7.72%	0.96%	7.28%	0.38%
	35 to 39 years	8.41%	0.88%	7.05%	0.38%
	40 to 44 years	7.11%	0.85%	6.68%	0.38%
	45 to 49 years	5.68%	0.84%	6.55%	0.38%
	50 to 54 years	7.01%	0.97%	6.89%	0.38%
	55 to 59 years	7.69%	0.80%	6.57%	0.38%
	60 to 64 years	6.03%	0.62%	5.80%	0.38%
	65 to 69 years	5.56%	0.57%	4.45%	0.38%
	70 to 74 years	3.54%	0.48%	3.14%	0.38%
	75 to 79 years	1.95%	0.36%	2.09%	0.38%
	80 to 84 years	1.23%	0.32%	1.53%	0.38%
	85 years and over	0.73%	0.25%	1.75%	0.38%
MO	*Under 5 years*	7.79%	0.86%	6.64%	0.33%
	5 to 9 years	6.52%	0.67%	6.74%	0.33%
	10 to 14 years	6.62%	0.76%	6.82%	0.33%
	15 to 19 years	6.11%	0.84%	6.21%	0.33%
	20 to 24 years	5.02%	0.90%	6.19%	0.33%
	25 to 29 years	7.26%	0.87%	7.36%	0.33%
	30 to 34 years	8.13%	0.89%	7.19%	0.33%
	35 to 39 years	7.23%	0.79%	6.57%	0.33%
	40 to 44 years	6.76%	0.91%	6.32%	0.33%
	45 to 49 years	6.18%	0.75%	6.39%	0.33%
	50 to 54 years	5.91%	0.69%	6.97%	0.33%
	55 to 59 years	6.99%	0.65%	6.82%	0.33%
	60 to 64 years	6.71%	0.65%	5.87%	0.33%
	65 to 69 years	5.10%	0.56%	4.69%	0.33%
	70 to 74 years	3.92%	0.46%	3.35%	0.33%
	75 to 79 years	1.91%	0.31%	2.34%	0.33%
	80 to 84 years	0.97%	0.20%	1.75%	0.33%
	85 years and over	0.88%	0.25%	1.77%	0.33%

Table 12. Person Race by State

State	Race	MARC	MARC MOE (90%)	ACS	ACS MOE (90%)
KS	*White*	80.33%	2.25%	81.54%	0.31%
	Black or African American	6.61%	1.84%	8.42%	0.35%
	American Indian, Alaskan Native	0.71%	0.39%	0.36%	0.35%
	Asian	4.50%	1.27%	4.12%	0.35%
	Native Hawaiian or Pacific Islander	0.12%	0.11%	0.05%	0.35%
	Some other race	2.64%	1.25%	2.25%	0.35%
	Multiracial	5.08%	1.37%	3.26%	0.35%
MO	*White*	72.87%	1.48%	74.65%	0.34%
	Black or African American	15.85%	1.75%	16.59%	0.36%
	American Indian, Alaskan Native	0.79%	0.32%	0.45%	0.37%
	Asian	1.92%	0.84%	1.92%	0.37%
	Native Hawaiian or Pacific Islander	0.68%	0.82%	0.21%	0.37%
	Some other race	1.29%	0.62%	3.05%	0.37%
	Multiracial	6.60%	1.34%	3.12%	0.37%

4.3. Trip Weights and Rates

Trip weights were generated by simply multiplying the final person weight by 260 to represent the number of trips on any given weekday within a year. These weights should be used to expand the data to the population.

Trip rates in Table 13 through Table 20 were calculated by dividing the sum of trips by the sum of households or persons in the survey. As an example, to estimate the number of daily trips per household, calculate:

- The weighted count of households = Sum of the household weights, and
- The weighted count of trips = Sum of the trip weights.

The estimate of daily trips per household for the region is then simply its weighted trip count divided by its weighted household count. The previous calculation needs to be performed over each replicate weight to be able to calculate standard error, which is explained further below

Consistent with findings from other household travel surveys, the How We Move KC survey data show that larger households made more trips per household than smaller households (Table 15). Households with more workers also made more trips than those with fewer workers (Table 17). Higher income households made more trips than households in the lower income brackets (Table 18).

Table 13. Household Trip Rates by State

State	Trips	Unweighted	Weighted	MOE
KS	13,984	8.38	9.32	0.35
MO	16,437	7.63	8.48	0.32
Total	30,421	7.96	8.85	0.22

Table 14. Person Trip Rates by State

State	Trips	Unweighted	Weighted	MOE
KS	13,984	3.72	3.57	0.14
MO	16,437	3.57	3.35	0.12
Total	30,421	3.64	3.45	0.09

Table 15. Household Trip Rates by Household Size by State

State	HH Size	Trips	Unweighted	Weighted	MOE
KS	*1*	1,908	4.35	4.40	0.28
	2	5,998	7.94	7.86	0.37
	3	2,265	10.25	10.83	0.81
	4+	3,813	15.07	16.16	1.21
MO	*1*	2,958	4.34	4.44	0.24
	2	7,170	7.77	7.86	0.36
	3	2,510	9.16	10.17	0.76
	4+	3,799	13.86	14.13	1.00
Total	*1*	4,866	4.34	4.42	0.20
	2	13,168	7.85	7.86	0.24
	3	4,775	9.65	10.46	0.54
	4+	7,612	14.44	15.07	0.76

Table 16. Person Trip Rates by Age by State

State	Age Range	Trips	Unweighted	Weighted	MOE
KS	*I prefer not to answer*	12	3	3.09	0.52
	5 - 12	972	3.22	3.22	0.37
	13 - 15	403	2.99	2.91	0.30
	16 - 17	255	3.59	3.24	0.58
	18 - 44	4,155	3.89	3.94	0.25
	45 - 64	4,677	4.17	4.10	0.20
	65 - 84	3,427	4.28	4.17	0.21
	85 or older	83	2.18	1.88	0.76
MO	*I prefer not to answer*	14	7.00	7.00	0.00
	5 - 12	1,105	2.93	2.86	0.23
	13 - 15	357	2.98	2.80	0.26
	16 - 17	286	3.14	2.84	0.48
	18 - 44	5,604	3.92	3.81	0.18
	45 - 64	5,145	3.87	3.76	0.19
	65 - 84	3,774	4.08	3.98	0.20
	85 or older	152	2.81	2.65	0.68
Total	*I prefer not to answer*	26	4.33	3.62	1.07
	5 - 12	2,077	3.06	3.02	0.20
	13 - 15	760	2.98	2.86	0.19
	16 - 17	541	3.34	3.00	0.37
	18 - 44	9,759	3.91	3.87	0.16
	45 - 64	9,822	4.00	3.91	0.13
	65 - 84	7,201	4.17	4.07	0.15
	85 or older	235	2.55	2.35	0.50

Table 17. Household Trip Rates by Number of Household Workers by State

State	Count of Household Workers	Trips	Unweighted	Weighted	MOE
KS	*0*	3,031	6.69	6.50	0.86
	1	4,480	7.53	8.14	0.68
	2	5,414	10.03	11.06	0.61
	3	904	12.91	14.85	1.71
	4	155	15.50	16.74	2.82
MO	*0*	3,710	6.01	5.67	0.42
	1	5,770	6.81	7.59	0.51
	2	6,076	9.86	11.10	0.67
	3	760	11.52	12.60	1.52
	4	121	17.29	17.39	5.86
Total	*0*	6,741	6.30	6.01	0.48
	1	10,250	7.11	7.82	0.36
	2	11,490	9.94	11.08	0.45
	3	1,664	12.24	13.70	1.26
	4	276	16.24	16.97	2.86

Table 18. Household Trip Rates by Household Income by State

State	HH Income	Trips	Unweighted	Weighted	MOE
KS	*I don't know*	0	0.00	0.00	0.00
	I prefer not to answer	175	7.61	7.70	3.24
	Less than $15,000	345	5.15	6.70	1.64
	$15,000 to $24,999	482	6.18	8.49	3.86
	$25,000 to $34,999	468	5.57	5.66	0.86
	$35,000 to $49,999	1,139	7.07	8.33	1.14
	$50,000 to $59,999	878	6.91	8.14	1.03
	$60,000 to $74,999	1,528	7.64	8.35	0.71
	$75,000 to $99,999	2,570	8.83	10.08	0.79
	$100,000 to $149,999	3,474	9.62	10.88	0.79
	$150,000 to $199,999	1,450	10.51	12.12	1.44
	$200,000 or more	1,475	10.69	12.03	1.38
MO	*I don't know*	15	7.50	10.04	6.00
	I prefer not to answer	96	5.33	5.75	2.65
	Less than $15,000	798	4.27	4.94	0.69
	$15,000 to $24,999	915	6.58	8.96	1.39
	$25,000 to $34,999	971	5.85	6.68	1.05
	$35,000 to $49,999	1,809	6.80	7.84	0.86
	$50,000 to $59,999	1,422	6.84	7.54	0.85
	$60,000 to $74,999	1,834	8.15	9.09	0.85
	$75,000 to $99,999	2,470	7.94	9.33	0.94
	$100,000 to $149,999	3,851	9.56	10.94	0.90
	$150,000 to $199,999	1,406	9.63	10.79	1.14
	$200,000 or more	850	10.37	11.48	1.80
Total	*I don't know*	15	7.50	10.04	6.00
	I prefer not to answer	271	6.61	6.94	2.21
	Less than $15,000	1,143	4.50	5.46	0.76
	$15,000 to $24,999	1,397	6.44	8.81	1.51
	$25,000 to $34,999	1,439	5.76	6.33	0.76
	$35,000 to $49,999	2,948	6.90	8.03	0.77
	$50,000 to $59,999	2,300	6.87	7.79	0.64
	$60,000 to $74,999	3,362	7.91	8.74	0.52
	$75,000 to $99,999	5,040	8.37	9.72	0.62
	$100,000 to $149,999	7,325	9.59	10.91	0.64
	$150,000 to $199,999	2,856	10.06	11.47	0.88
	$200,000 or more	2,325	10.57	11.83	1.10

Table 19. Household Trip Rates by Retrieval Mode

Survey mode at retrieval completion	Trips	Unweighted	Weighted	MOE
Web	23,188	7.88	8.68	0.26
CATI	2,061	5.63	5.97	0.61
Both (Web & CATI)	770	10.69	11.87	1.55
Smartphone	4,402	10.00	10.97	0.74

Table 20. Person Trip Rates by Retrieval Mode

Survey mode at retrieval completion	Trips	Unweighted	Weighted	MOE
PHONE APP	4,402	4.99	4.67	0.71
WEB	27,351	3.91	3.76	0.09
CATI	2,556	3.32	3.23	0.29

In Table 21 through Table 25 , weighted and unweighted frequencies for trip purpose and mode are shown. The most prevalent trip purposes were related to home and work, with the 3rd and 4th most prevalent purposes being social / recreational, and maintenance / errands as illustrated in Table 21. It is important to recognize that the travel day for most participants in the study began at home. This contributed to the high percentage of home-based trip purposes reported. Trips in the 'Other' category, had destinations outside of the study region, and had higher proportions of social/recreational trips. For example, an "Other" trip would be a business trip to Topeka and any trips in Topeka before the respondent returned to the KC region.

Table 21. Primary Trip Purpose by State

State	Trip Purpose	Trips	Unweighted	Weighted	MOE
KS	*I don't know*	1	0.01%	0.00%	0.01%
	I prefer not to answer	0	0.00%	0.00%	0.00%
	Home	4,861	34.86%	35.26%	1.02%
	Work	1,943	13.93%	15.06%	0.83%
	School	583	4.18%	5.49%	0.45%
	Volunteer	68	0.49%	0.38%	0.12%
	Social / Recreational	2,471	17.72%	16.06%	0.74%
	Maintenance / Errands	2,915	20.90%	18.10%	0.88%
	Escorting / Mode change	1,047	7.51%	9.22%	0.93%
	Something Else	57	0.41%	0.42%	0.18%
MO	*I don't know*	0	0.00%	0.00%	0.00%
	I prefer not to answer	2	0.01%	0.02%	0.04%
	Home	5,606	34.42%	34.56%	0.75%
	Work	2,326	14.28%	14.95%	0.89%
	School	642	3.94%	5.49%	0.50%
	Volunteer	132	0.81%	0.57%	0.13%
	Social / Recreational	2,920	17.93%	16.06%	0.83%
	Maintenance / Errands	3,431	21.06%	19.44%	1.01%
	Escorting / Mode change	1,184	7.27%	8.64%	0.92%
	Something Else	45	0.28%	0.27%	0.09%

Table 22. Primary Trip Purpose by External and for All Trips

State	Trip Purpose	Trips	Unweighted	Weighted	MOE
Other	*I don't know*	0	0.00%	0.00%	0.00%
	I prefer not to answer	0	0.00%	0.00%	0.00%
	Home	19	10.16%	10.35%	4.85%
	Work	35	18.72%	22.24%	10.25%
	School	1	0.53%	0.33%	0.65%
	Volunteer	0	0.00%	0.00%	0.00%
	Social / Recreational	81	43.32%	39.86%	9.30%
	Maintenance / Errands	16	8.56%	9.08%	6.45%
	Escorting / Mode change	35	18.72%	18.14%	6.72%
	Something Else	0	0.00%	0.00%	0.00%
Total	*I don't know*	1	0.00%	0.00%	0.00%
	I prefer not to answer	2	0.01%	0.01%	0.02%
	Home	10,486	34.47%	34.76%	0.54%
	Work	4,304	14.15%	15.04%	0.58%
	School	1,226	4.03%	5.46%	0.28%
	Volunteer	200	0.66%	0.48%	0.09%
	Social / Recreational	5,472	17.99%	16.18%	0.57%
	Maintenance / Errands	6,362	20.91%	18.78%	0.72%
	Escorting / Mode change	2,266	7.45%	8.95%	0.69%
	Something Else	102	0.34%	0.34%	0.10%

Data presented in Table 23 through Table 25 show that privately owned vehicles (POV), as the driver or a passenger, was the most frequent mode choice for all trips, including on trips to work and school. Table 24 shows that the mode choice for auto travel decreases for school-related trips with walk and school bus modes increasing for these types of trips.

Table 23. All Trip Modes by State

State	Mode	Trips	Unweighted	Weighted	MOE
KS	*Walk*	752	5.39%	5.26%	0.83%
	Bike	72	0.52%	0.53%	0.30%
	Privately Owned Vehicle	12,704	91.09%	90.12%	1.40%
	Public Transit	125	0.90%	1.16%	0.34%
	Other	293	2.10%	2.93%	0.71%
MO	*Walk*	1,130	6.94%	6.82%	0.86%
	Bike	49	0.30%	0.27%	0.14%
	Privately Owned Vehicle	14,133	86.77%	85.43%	1.20%
	Public Transit	353	2.17%	2.54%	0.51%
	Other	623	3.82%	4.94%	0.65%
Other	*Walk*	15	8.02%	8.30%	7.50%
	Bike	0	0.00%	0.00%	0.00%
	Privately Owned Vehicle	117	62.57%	65.97%	13.78%
	Public Transit	15	8.02%	6.26%	4.65%
	Other	40	21.39%	19.47%	8.69%
Total	*Walk*	1,897	6.24%	6.12%	0.63%
	Bike	121	0.40%	0.38%	0.15%
	Privately Owned Vehicle	26,954	88.60%	87.47%	0.97%
	Public Transit	493	1.62%	1.93%	0.35%
	Other	956	3.14%	4.10%	0.49%

Table 24. Mode to School by State

State	Mode to School	N	Unweighted	Weighted	MOE
KS	*Walk*	45	7.08%	6.28%	1.69%
	Bike	12	1.89%	1.56%	1.25%
	Privately Owned Vehicle	464	72.96%	72.86%	5.00%
	School Bus	62	9.75%	10.84%	3.42%
	Public Transit	35	5.50%	5.34%	2.31%
	Other	18	2.83%	3.12%	1.78%
MO	*Walk*	44	5.95%	7.47%	3.25%
	Bike	1	0.14%	0.13%	0.25%
	Privately Owned Vehicle	442	59.73%	54.80%	4.41%
	School Bus	166	22.43%	25.00%	4.35%
	Public Transit	67	9.05%	10.05%	3.01%
	Other	20	2.70%	2.56%	1.37%
Total	*Walk*	89	6.47%	6.94%	1.98%
	Bike	13	0.94%	0.77%	0.57%
	Privately Owned Vehicle	906	65.84%	62.81%	3.70%
	School Bus	228	16.57%	18.72%	2.93%
	Public Transit	102	7.41%	7.96%	2.18%
	Other	38	2.76%	2.81%	1.06%

Table 25. Mode to Work by State

State	Mode To Work	N	Unweighted	Weighted	MOE
KS	*Walk*	6	0.42%	0.41%	0.36%
	Bike	11	0.77%	0.92%	0.73%
	Privately Owned Vehicle	1,387	97.33%	97.15%	1.26%
	Public Transit	9	0.63%	0.57%	0.43%
	Other	12	0.84%	0.95%	0.73%
MO	*Walk*	52	2.96%	3.60%	1.73%
	Bike	10	0.57%	0.52%	0.35%
	Privately Owned Vehicle	1,632	93.04%	92.20%	2.03%
	Public Transit	40	2.28%	2.38%	0.76%
	Other	20	1.14%	1.30%	0.66%
Total	*Walk*	58	1.82%	2.17%	0.97%
	Bike	21	0.66%	0.70%	0.36%
	Privately Owned Vehicle	3,019	94.97%	94.42%	1.29%
	Public Transit	49	1.54%	1.57%	0.45%
	Other	32	1.01%	1.14%	0.49%

Table 26 presents the frequency of trips by day of week. The results show travel across the region is well balanced by day of week with a slight to moderate variations across days.

Table 26. Number of Trips by Day of Week by State

State	Travel day - day of week	Trips	Unweighted	Weighted	MOE
KS	*Monday*	2,475	17.75%	18.23%	2.46%
	Tuesday	2,485	17.82%	17.78%	2.99%
	Wednesday	2,714	19.46%	20.19%	2.71%
	Thursday	3,188	22.86%	21.88%	2.73%
	Friday	3,084	22.11%	21.91%	2.98%
MO	*Monday*	2,888	17.73%	17.79%	2.25%
	Tuesday	3,187	19.57%	20.07%	2.69%
	Wednesday	3,537	21.72%	21.03%	2.37%
	Thursday	3,291	20.21%	20.25%	2.52%
	Friday	3,385	20.78%	20.86%	2.27%
Other	*Monday*	26	13.90%	14.53%	9.29%
	Tuesday	21	11.23%	14.45%	10.36%
	Wednesday	14	7.49%	5.52%	4.70%
	Thursday	57	30.48%	26.55%	13.82%
	Friday	69	36.90%	38.95%	15.65%
Total	*Monday*	5,389	17.71%	17.97%	1.74%
	Tuesday	5,693	18.71%	19.00%	1.83%
	Wednesday	6,265	20.59%	20.57%	1.86%
	Thursday	6,536	21.49%	21.03%	1.90%
	Friday	6,538	21.49%	21.43%	1.92%

4.4. Replicate Weights

In addition to the survey weight, a set of 100 replicate weights was calculated for each analytic sample unit (household, person, vehicle and trip). The paired jackknife repeated replication method was used to calculate the sampling variance of estimates obtained from the data. The Jackknife method involves repeatedly removing one record from the sample and calculating estimates. The estimates of all models are then aggregated into a single estimate of the parameter. The method of deriving these weights was aimed at reflecting the features of the sample design appropriately for each sample, so that when the jackknife variance estimation procedure was implemented, approximate unbiased estimates of sampling variance were obtained. In addition, the various weighting procedures were repeated on each set of replicate weights to appropriately reflect the impact of the weighting adjustments on the sampling variance of a survey estimate. The replicate weights are used to develop calculate the standard error

and margins of error for a given estimate. The margin of error is a measure of the possible variation of the estimate around the population value. The tables in the report include the margin of error for the estimate represented in the table.

Many software packages for personal computers exist for replication variance estimation methods. For example, WesVar, later versions of SAS, and STATA all have the capability of producing replication estimates. These software packages produce both the appropriate estimates and corresponding variance estimates for the estimates. WesVar, developed and distributed by Westat, is available for free.

5. Survey Results

5.1. Travel Characteristics and Demographic Results

The following section includes observations about travel characteristics as well as demographic characteristics like race, gender, and income. Table 27 through Table 31 shows the average travel time for each of these categories. Table 32 shows mode share by household size for each state.

Table 33 shows that travel durations tend to be longer in Missouri than Kansas. Additionally, school trips have shorter durations than both work and "other" commutes.

Table 27. Time (in minutes) to Work, School, and "Other" by State

State	Location Type	Trips	Unweighted	Weighted	MOE
KS	*Work*	1,421	19.86	19.79	0.94
	School	983	12.31	12.38	0.89
	Other	11,580	18.32	18.13	0.71
MO	*Work*	1,782	21.39	22.08	0.87
	School	963	14.90	15.18	1.69
	Other	13,692	18.83	18.92	0.95
Total	*Work*	3,203	20.71	21.04	0.56
	School	1,946	13.59	13.81	0.99
	Other	25,272	18.60	18.56	0.65

Table 28 shows that there are only minor differences between average travel times among the most commonly identified demographics, with perhaps the most significant difference being average time to school between White and African American demographics.

Table 28. Time to Work, School, and "Other" by Race

Location Type	Race	Trips	Unweighted	Weighted	MOE
Work	*I don't know*	3	20.67	20.67	0.00
	I prefer not to answer	6	23.83	20.80	17.25
	White	2,803	20.73	21.03	0.63
	African American, Black	188	19.16	19.76	2.31
	Asian	76	21.79	20.72	3.69
	American Indian, Alaskan Native	13	20.77	20.51	8.17
	Native Hawaiian or Pacific Islander	6	26.00	27.12	11.52
	Multiracial	79	20.97	22.96	4.98
	Some other race	29	23.69	24.35	6.09
School	*I don't know*	2	3.00	3.00	0.00
	I prefer not to answer	2	18.00	18.00	0.00
	White	1,547	13.16	13.14	0.82
	African American, Black	177	15.75	14.64	3.05
	Asian	55	13.95	13.63	3.81
	American Indian, Alaskan Native	17	14.41	14.28	4.25
	Native Hawaiian or Pacific Islander	2	12.50	11.21	17.94
	Multiracial	118	15.91	18.48	4.12
	Some other race	26	13.35	13.97	3.09
Other	*I don't know*	29	17.38	13.99	23.05
	I prefer not to answer	112	14.54	12.96	2.36
	White	22,185	18.53	18.58	0.71
	African American, Black	1,590	19.72	18.52	1.68
	Asian	379	19.59	19.78	5.41
	American Indian, Alaskan Native	118	15.20	14.85	2.14
	Native Hawaiian or Pacific Islander	24	22.21	22.09	2.19
	Multiracial	646	18.02	17.78	1.78
	Some other race	189	21.17	21.83	5.69

Table 29 and Table 30 show that difference in income correlates with only slight variations in travel time to work and school locations with higher income households having slightly longer commutes to work, and slightly shorter commutes to school.

Table 29. Time to Work, School, and "Other" by Income

Location Type	Household Income Range	Trips	Unweighted	Weighted	MOE
Work	*I don't know*	1	16.00	16.00	0.00
	I prefer not to answer	13	22.85	23.91	6.89
	Less than $30,000	193	18.96	19.66	2.83
	$30,000 to $59,999	599	19.77	20.71	1.38
	$60,000 or more	2,397	21.08	21.35	0.68
School	*I don't know*	0	0.00	0.00	0.00
	I prefer not to answer	0	0.00	0.00	0.00
	Less than $30,000	188	15.03	14.08	2.38
	$30,000 to $59,999	272	15.17	15.70	3.81
	$60,000 or more	1,486	13.12	13.20	0.77
Other	*I don't know*	14	14.71	13.88	1.69
	I prefer not to answer	258	20.64	19.55	5.32
	Less than $30,000	2,897	18.25	17.70	1.29
	$30,000 to $59,999	5,078	17.64	18.17	1.25
	$60,000 or more	17,025	18.91	18.98	0.92

Table 30 and Table 31show average time to work, school, and other by gender and age with only slight differences in commute times for gender.

Table 30. Time (in minutes) to Work, School, and "Other" by Gender

Location Type	Gender	Trips	Unweighted	Weighted	MOE
Work	*I prefer not to answer*	0	0	0	0
	Male	1,657	21.31	21.55	0.76
	Female	1,546	20.07	20.43	0.84
School	*I prefer not to answer*	1	1	1	0
	Male	815	14.46	14.61	1.23
	Female	1,130	12.97	13.21	1.03
Other	*I prefer not to answer*	17	11.88	13.39	4.06
	Male	11,836	19.64	19.60	0.87
	Female	13,419	17.69	17.63	0.85

Table 31. Time (in minutes) to Work, School, and "Other" by Age

Location Type	Age Range	Trips	Unweighted	Weighted	MOE
Work	*I prefer not to answer*	0	0.00	0.00	0.00
	5 - 12	15	13.60	17.81	7.66
	13 - 15	6	12.17	10.98	4.98
	16 - 17	20	14.05	14.35	1.94
	18 - 44	1,583	20.44	20.81	0.75
	45 - 64	1,340	21.55	21.83	0.94
	65 - 84	238	19.11	19.63	1.96
	85 or older	1	5.00	5.00	0.00
School	*I prefer not to answer*	0	0.00	0.00	0.00
	5 - 12	637	12.87	13.34	1.29
	13 - 15	220	15.92	16.07	1.57
	16 - 17	149	15.01	16.34	2.56
	18 - 44	750	13.57	13.47	1.34
	45 - 64	183	12.11	11.80	1.79
	65 - 84	7	15.71	17.91	16.34
	85 or older	0	0.00	0.00	0.00
Other	*I prefer not to answer*	26	14.15	14.92	6.87
	5 - 12	1,425	15.46	15.31	1.72
	13 - 15	534	17.71	18.88	4.45
	16 - 17	372	15.24	15.30	1.61
	18 - 44	7,426	18.94	18.70	0.87
	45 - 64	8,299	19.95	19.96	1.16
	65 - 84	6,956	17.50	17.53	0.75
	85 or older	234	19.27	19.20	2.86

Table 32 shows the percentages of trips by mode and household size, for each state. Over 87% of all trips came from privately owned vehicles, with nearly one third of those trips being undertaken by households with four or more members.

Table 32. Mode by Household Size by State

State	Mode	Household Size	Trips	Unweighted	Weighted	MOE
KS	*Walk*	*1*	130	0.93%	0.99%	0.29%
		2	308	2.21%	1.60%	0.40%
		3	88	0.63%	0.67%	0.36%
		4+	226	1.62%	2.00%	0.59%
	Bike	*1*	13	0.09%	0.06%	0.07%
		2	14	0.10%	0.07%	0.06%
		3	19	0.14%	0.12%	0.13%
		4+	26	0.19%	0.28%	0.27%
	Privately Owned Vehicle	*1*	1,724	12.36%	11.31%	1.23%
		2	5,579	40.00%	26.67%	1.97%
		3	2,089	14.98%	16.35%	1.73%
		4+	3,312	23.75%	35.79%	3.03%
	Public Transit	*1*	29	0.21%	0.29%	0.18%
		2	21	0.15%	0.19%	0.13%
		3	13	0.09%	0.10%	0.06%
		4+	62	0.44%	0.57%	0.26%
	Other	*1*	35	0.25%	0.25%	0.19%
		2	44	0.32%	0.24%	0.14%
		3	53	0.38%	0.43%	0.22%
		4+	161	1.15%	2.00%	0.65%
MO	*Walk*	*1*	311	1.91%	1.73%	0.41%
		2	505	3.10%	2.17%	0.39%
		3	132	0.81%	1.03%	0.40%
		4+	182	1.12%	1.89%	0.59%
	Bike	*1*	15	0.09%	0.07%	0.07%
		2	18	0.11%	0.07%	0.05%
		3	6	0.04%	0.05%	0.06%
		4+	10	0.06%	0.08%	0.08%
	Privately Owned Vehicle	*1*	2,390	14.67%	13.04%	1.06%
		2	6,339	38.92%	26.91%	1.71%
		3	2,189	13.44%	15.88%	1.54%
		4+	3,215	19.74%	29.60%	2.36%
	Public Transit	*1*	132	0.81%	0.83%	0.25%
		2	87	0.53%	0.54%	0.31%
		3	29	0.18%	0.22%	0.12%
		4+	105	0.64%	0.96%	0.31%
	Other	*1*	56	0.34%	0.35%	0.16%
		2	154	0.95%	0.91%	0.29%
		3	119	0.73%	0.82%	0.23%
		4+	294	1.81%	2.86%	0.63%

State	Mode	Household Size	Trips	Unweighted	Weighted	MOE
Other	*Walk*	*1*	*2*	1.07%	0.50%	0.99%
		2	4	2.14%	1.11%	2.21%
		3	5	2.67%	3.55%	4.63%
		4+	4	2.14%	3.14%	5.95%
	Bike	*1*	0	0.00%	0.00%	0.00%
		2	0	0.00%	0.00%	0.00%
		3	0	0.00%	0.00%	0.00%
		4+	0	0.00%	0.00%	0.00%
	Privately Owned Vehicle	*1*	23	12.30%	12.83%	9.79%
		2	61	32.62%	24.51%	13.08%
		3	23	12.30%	18.02%	12.75%
		4+	10	5.35%	10.61%	9.03%
	Public Transit	*1*	0	0.00%	0.00%	0.00%
		2	12	6.42%	3.55%	3.23%
		3	*2*	1.07%	1.26%	1.65%
		4+	*1*	0.53%	1.44%	2.71%
	Other	*1*	6	3.21%	2.19%	2.79%
		2	22	11.76%	8.82%	5.35%
		3	8	4.28%	5.00%	5.01%
		4+	4	2.14%	3.47%	3.32%
Total	*Walk*	*1*	443	1.46%	1.39%	0.24%
		2	817	2.69%	1.91%	0.27%
		3	225	0.74%	0.88%	0.28%
		4+	412	1.35%	1.95%	0.45%
	Bike	*1*	28	0.09%	0.06%	0.05%
		2	32	0.11%	0.07%	0.04%
		3	25	0.08%	0.08%	0.07%
		4+	36	0.12%	0.17%	0.13%
	Privately Owned Vehicle	*1*	4,137	13.60%	12.25%	0.63%
		2	11,979	39.38%	26.79%	1.00%
		3	4,301	14.14%	16.10%	0.75%
		4+	6,537	21.49%	32.32%	1.27%
	Public Transit	*1*	161	0.53%	0.58%	0.16%
		2	120	0.39%	0.40%	0.19%
		3	44	0.14%	0.17%	0.07%
		4+	168	0.55%	0.78%	0.20%
	Other	*1*	97	0.32%	0.32%	0.12%
		2	220	0.72%	0.65%	0.17%
		3	180	0.59%	0.66%	0.15%
		4+	459	1.51%	2.47%	0.48%

Table 33 shows the average trip distance (in miles), by mode. Auto modes had the longest average trips with 8.41 miles, while walking had the shortest average trips of only .42 miles. The "Other" category includes airplane modes of which there are few trips, but cover far greater distance than an average trip by any other mode in the region.

Table 33. Avg. Trip Distance (miles) by Mode

State	Mode	Trips	Unweighted	Weighted	MOE
KS	*Walk*	762	0.38	0.39	0.05
	Bike	70	1.66	1.52	0.81
	Privately Owned Vehicle	12,691	8.27	8.20	0.73
	Public Transit	140	4.56	3.79	1.36
	Other	321	93.80	56.47	41.02
MO	*Walk*	1,135	0.45	0.48	0.10
	Bike	51	3.10	2.48	1.19
	Privately Owned Vehicle	14,263	8.54	8.47	0.63
	Public Transit	353	6.49	8.79	9.71
	Other	635	38.08	23.92	11.53
Total	*Walk*	1,897	0.42	0.44	0.06
	Bike	121	2.27	1.89	0.70
	Privately Owned Vehicle	26,954	8.41	8.34	0.42
	Public Transit	493	5.94	7.31	6.84
	Other	956	56.79	35.11	16.09

Table 34 shows the average trip distance (in miles) by trip purpose. Distances to work and school were comparable between states. Escorting / Mode change had the longest average distance 25.51 followed by Work with 12.40. The Escorting/Mode change distance may be skewed due to respondents providing this purpose for trips with airplane mode as well, i.e. a place is reported at a connecting airport with a purpose of Mode Change, all the miles in between are assigned to that purpose.

Table 34. Avg. Trip Distance (miles) by Trip Purpose

State	Primary Trip Purpose	Trips	Unweighted	Weighted	MOE
KS	*I don't know*	1	3.38	3.38	0.00
	I prefer not to answer	0	0.00	0.00	0.00
	Home	4,855	7.14	7.16	0.58
	Work	1,950	12.69	12.74	2.29
	School	588	4.30	3.89	0.59
	Volunteer	76	7.22	6.96	2.47
	Social / Recreational	2,504	8.14	7.41	1.31
	Maintenance / Errands	2,874	6.37	6.38	1.62
	Escorting / Mode change	1,082	31.80	22.46	10.91
	Something Else	54	8.58	8.98	6.54
MO	*I don't know*	0	0.00	0.00	0.00
	I prefer not to answer	2	0.55	0.55	0.00
	Home	5,631	7.77	7.67	0.73
	Work	2,354	12.16	12.34	1.12
	School	638	3.70	3.56	0.43
	Volunteer	124	6.03	6.93	1.99
	Social / Recreational	2,968	9.03	8.79	2.01
	Maintenance / Errands	3,488	6.51	6.95	1.89
	Escorting / Mode change	1,184	19.77	13.65	4.60
	Something Else	48	10.37	6.91	4.63
Total	*I don't know*	1	3.38	3.38	0.00
	I prefer not to answer	2	0.55	0.55	0.00
	Home	10,486	7.48	7.44	0.53
	Work	4,304	12.40	12.53	1.20
	School	1,226	3.99	3.71	0.36
	Volunteer	200	6.48	6.94	1.59
	Social / Recreational	5,472	8.62	8.15	1.27
	Maintenance / Errands	6,362	6.45	6.70	1.26
	Escorting / Mode change	2,266	25.51	17.90	5.70
	Something Else	102	9.42	8.06	4.07

Table 35 displays the proportions of trips by mode and area type. Sixty four percent of all trips occurred in urban locations and significantly more walk and bike trips occurred in urban areas than in other area types.

Table 35. Mode by Area Type

Mode	Area Type	Trips	Unweighted	Weighted	MOE
Walk	*Urban (CBD, Urban, Fringe)*	1,437	4.72%	4.49%	0.56%
	Suburban	364	1.20%	1.36%	0.31%
	Rural	69	0.23%	0.19%	0.09%
	Out of Area	27	0.09%	0.07%	0.05%
Bike	*Urban (CBD, Urban, Fringe)*	99	0.33%	0.32%	0.15%
	Suburban	13	0.04%	0.03%	0.03%
	Rural	9	0.03%	0.03%	0.02%
	Out of Area	0	0.00%	0.00%	0.00%
Privately Owned Vehicle	*Urban (CBD, Urban, Fringe)*	17,132	56.32%	54.40%	1.51%
	Suburban	7,106	23.36%	24.26%	1.38%
	Rural	2,148	7.06%	7.19%	0.82%
	Out of Area	568	1.87%	1.62%	0.29%
Public Transit	*Urban (CBD, Urban, Fringe)*	340	1.12%	1.27%	0.34%
	Suburban	92	0.30%	0.43%	0.13%
	Rural	44	0.14%	0.20%	0.10%
	Out of Area	17	0.06%	0.03%	0.02%
Other	*Urban (CBD, Urban, Fringe)*	493	1.62%	2.16%	0.40%
	Suburban	294	0.97%	1.36%	0.27%
	Rural	105	0.35%	0.41%	0.15%
	Out of Area	64	0.21%	0.16%	0.07%

Table 36 shows the distribution of trip departure times. As expected, there are peaks during morning commute hours between 7am to 9am, and a slightly larger spike between 3pm and 6pm.

Table 36. Distribution of Trip Departure Time

Departure Hour	Trips	Unweighted	Weighted	MOE
00:00	66	0.22%	0.26%	0.09%
01:00	14	0.05%	0.09%	0.07%
02:00	15	0.05%	0.06%	0.03%
03:00	33	0.11%	0.14%	0.06%
04:00	89	0.29%	0.27%	0.07%
05:00	358	1.18%	1.27%	0.16%
06:00	1,043	3.43%	3.86%	0.46%
07:00	2,618	8.61%	9.74%	0.56%
08:00	2,086	6.86%	7.34%	0.51%
09:00	1,479	4.86%	4.26%	0.29%
10:00	1,612	5.30%	4.69%	0.42%
11:00	1,866	6.13%	5.31%	0.34%
12:00	1,940	6.38%	5.70%	0.31%
13:00	1,759	5.78%	5.05%	0.33%
14:00	1,956	6.43%	6.33%	0.42%
15:00	2,670	8.78%	9.30%	0.50%
16:00	2,668	8.77%	9.01%	0.52%
17:00	2,681	8.81%	8.97%	0.50%
18:00	2,064	6.78%	6.63%	0.41%
19:00	1,327	4.36%	4.34%	0.31%
20:00	1,042	3.43%	3.56%	0.31%
21:00	596	1.96%	2.19%	0.46%
22:00	296	0.97%	1.13%	0.19%
23:00	143	0.47%	0.52%	0.11%

Table 37 shows the most frequent trip purposes by mode. Trip purposes of Home and Social / Recreational accounted for the largest share of walk modes. Work trips using public transit modes only accounted for just over a quarter of one percent of all trips.

Table 37. Most Frequent Trip Purposes by Mode

Trip Purpose	Mode	Trips	Unweighted	Weighted	MOE
Home	*Walk*	692	3.22%	3.22%	0.40%
	Bike	55	0.26%	0.26%	0.13%
	Privately Owned Vehicle	9,198	42.81%	41.89%	0.62%
	Public Transit	191	0.89%	1.04%	0.22%
	Other	350	1.63%	2.24%	0.32%
Work	*Walk*	170	0.79%	0.76%	0.17%
	Bike	15	0.07%	0.08%	0.05%
	Privately Owned Vehicle	3,987	18.55%	19.57%	0.71%
	Public Transit	56	0.26%	0.28%	0.09%
	Other	76	0.35%	0.36%	0.12%
School	*Walk*	87	0.40%	0.56%	0.17%
	Bike	8	0.04%	0.05%	0.04%
	Privately Owned Vehicle	768	3.57%	4.57%	0.35%
	Public Transit	100	0.47%	0.61%	0.14%
	Other	263	1.22%	1.86%	0.32%
Social / Recreational	*Walk*	644	3.00%	2.49%	0.32%
	Bike	29	0.13%	0.10%	0.05%
	Privately Owned Vehicle	4,647	21.63%	19.34%	0.78%
	Public Transit	52	0.24%	0.24%	0.13%
	Other	100	0.47%	0.47%	0.15%

It is expected that some portion of the regional population makes no trips on any given weekday. Table 38 shows the reasons that persons provided for why they did not travel on their travel day. The most frequent responses were that no trips were made due to personal illness, working around home (not for pay), and not scheduled to work on the travel day.

Table 38. Reason for No Trip on Travel Day

State	Reason	Trips	Unweighted	Weighted	MOE
KS	*I prefer not to answer*	2	0.51%	0.48%	0.68%
	Personally sick	58	14.65%	18.04%	8.66%
	Vacation or personal day	34	8.59%	8.68%	3.56%
	Caretaking	14	3.54%	3.12%	1.90%
	Home-bound elderly or disabled	41	10.35%	9.52%	3.53%
	Worked at home (for pay)	48	12.12%	10.66%	3.47%
	Not scheduled to work	36	9.09%	12.31%	4.45%
	Worked around home (not for pay)	90	22.73%	20.23%	5.70%
	Out of area	21	5.30%	4.91%	3.05%
	No transportation available	5	1.26%	1.35%	1.20%
	Bad Weather	7	1.77%	1.35%	1.20%
	Something else	40	10.10%	9.35%	4.18%
MO	*I prefer not to answer*	1	0.18%	0.14%	0.27%
	Personally sick	102	18.12%	19.53%	4.10%
	Vacation or personal day	50	8.88%	8.01%	3.14%
	Caretaking	29	5.15%	7.22%	2.92%
	Home-bound elderly or disabled	60	10.66%	10.34%	3.14%
	Worked at home (for pay)	49	8.70%	8.92%	3.31%
	Not scheduled to work	49	8.70%	11.16%	3.98%
	Worked around home (not for pay)	115	20.43%	16.79%	3.74%
	Out of area	26	4.62%	3.78%	1.97%
	No transportation available	17	3.02%	4.03%	2.26%
	Bad Weather	14	2.49%	1.77%	1.15%
	Something else	51	9.06%	8.31%	2.26%
Total	*I prefer not to answer*	3	0.31%	0.27%	0.32%
	Personally sick	160	16.68%	18.93%	4.04%
	Vacation or personal day	84	8.76%	8.28%	2.16%
	Caretaking	43	4.48%	5.57%	1.85%
	Home-bound elderly or disabled	101	10.53%	10.01%	2.50%
	Worked at home (for pay)	97	10.11%	9.62%	2.56%
	Not scheduled to work	85	8.86%	11.62%	3.13%
	Worked around home (not for pay)	205	21.38%	18.18%	3.22%
	Out of area	47	4.90%	4.24%	1.79%
	No transportation available	22	2.29%	2.95%	1.40%
	Bad Weather	21	2.19%	1.60%	0.85%
	Something else	91	9.49%	8.73%	2.31%

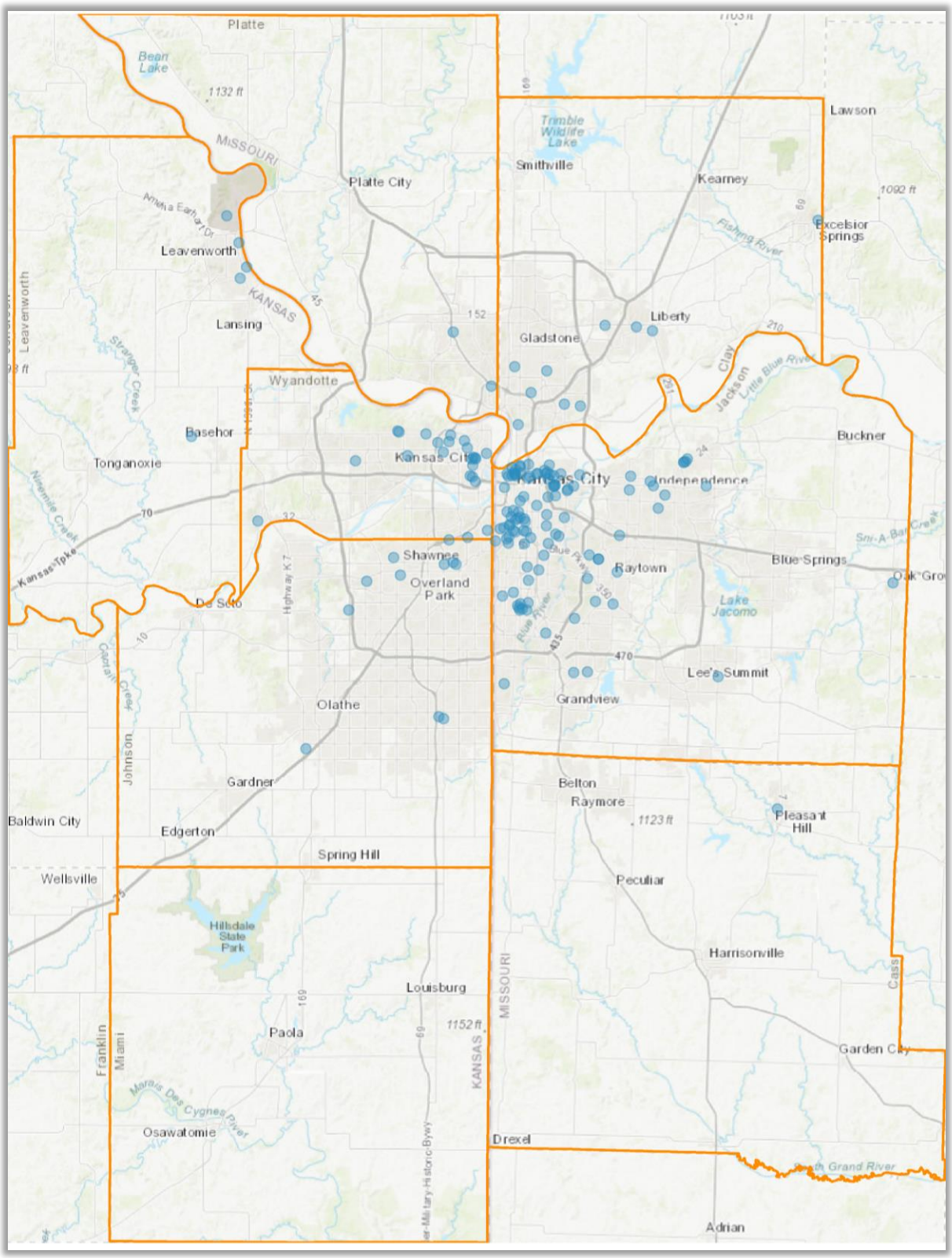
5.2 Vehicle / Fleet

The following section includes three tables relating to privately owned vehicles. Table 39 shows the proportions of vehicles by body type, Table 40 shows the age of vehicles by year, or range of years that the vehicle was made, and Table 32 shows mode by household vehicle ownership. shows the geographic distribution of zero vehicle households.

Table 39. Vehicle Body Type

Body Type	N	Unweighted	Weighted	MOE
I prefer not to answer	3	0.04%	0.05%	0.09%
Automobile/Car/Station Wagon	3,691	50.13%	50.98%	1.43%
Van (Mini/Cargo/Passenger)	422	5.73%	6.73%	0.57%
SUV (Santa Fe, Tahoe, Jeep, etc.)	2,027	27.53%	26.65%	1.10%
Pickup Truck	934	12.69%	12.38%	0.79%
Other Truck	27	0.37%	0.38%	0.21%
RV (Recreational Vehicle)	24	0.33%	0.23%	0.10%
Motorcycle/Motorbike	235	3.19%	2.61%	0.39%

Figure 8. Map of Zero Vehicle Households



Twenty seven percent of vehicles were produced in the last 5 years (2015 - 2019), and 28.5 were produced between 2010 and 2014. Seventy-seven percent of privately owned vehicles were among those model years from 2004 to 2019. The remaining 22.52% of vehicles were manufactured before 2004.

Table 40. Fleet age

Model Year	N	Unweighted	Weighted	MOE
I don't know	13	0.18%	0.22%	0.18%
I prefer not to answer	13	0.18%	0.20%	0.17%
Before 2000	670	9.10%	8.63%	0.72%
2000 - 2004	939	12.75%	13.47%	0.95%
2005 - 2009	1,600	21.73%	23.08%	1.16%
2010 - 2014	2,104	28.58%	28.47%	1.21%
2015	543	7.37%	7.30%	0.76%
2016	486	6.60%	6.28%	0.61%
2017	475	6.45%	5.92%	0.56%
2018	387	5.26%	4.82%	0.57%
2019	133	1.81%	1.60%	0.29%

Table 41 illustrates trips by travel mode and vehicle ownership. There were far more trips (86.5%) from households with 1+ privately owned vehicles (3,662 households reported owning at least one vehicle) than there were trips from households that did not own any vehicles (593 trips from 159 households with zero vehicles).

Table 41. Mode by Household Vehicle Ownership

Travel mode	Vehicles	N	Unweighted	Weighted	MOE
Walk	*0*	203	0.67%	0.99%	0.30%
	1+	1,694	5.57%	5.13%	0.56%
My own bike	*0*	12	0.04%	0.03%	0.04%
	1+	108	0.36%	0.35%	0.15%
Kansas City BCycle	*0*	1	0.00%	0.00%	0.00%
	1+	0	0.00%	0.00%	0.00%
Scooter (Bird, Lime)	*0*	4	0.01%	0.01%	0.02%
	1+	1	0.00%	0.00%	0.00%
Motorcycle/moped	*0*	0	0.00%	0.00%	0.00%
	1+	38	0.12%	0.12%	0.05%
Car/van/truck (as the driver)	*0*	44	0.14%	0.29%	0.21%
	1+	21,783	71.61%	68.97%	1.10%
Car/van/truck (as the passenger)	*0*	103	0.34%	0.53%	0.21%
	1+	4,986	16.39%	17.56%	1.11%
Carpool/vanpool	*0*	42	0.14%	0.22%	0.13%
	1+	257	0.84%	0.88%	0.28%
School bus	*0*	13	0.04%	0.10%	0.11%
	1+	460	1.51%	2.30%	0.41%
Bus	*0*	140	0.46%	0.61%	0.18%
	1+	286	0.94%	1.13%	0.23%
Dial-a-Ride	*0*	2	0.01%	0.02%	0.04%
	1+	2	0.01%	0.00%	0.01%
Paratransit	*0*	4	0.01%	0.01%	0.02%
	1+	4	0.01%	0.01%	0.02%
Streetcar	*0*	7	0.02%	0.02%	0.02%
	1+	48	0.16%	0.12%	0.09%
Private shuttle bus	*0*	8	0.03%	0.03%	0.03%
	1+	38	0.12%	0.10%	0.05%
Taxi	*0*	7	0.02%	0.05%	0.07%
	1+	7	0.02%	0.02%	0.01%
Private limo	*0*	0	0.00%	0.00%	0.00%
	1+	4	0.01%	0.01%	0.01%
Uber/Lyft	*0*	3	0.01%	0.01%	0.02%
	1+	54	0.18%	0.21%	0.17%
Airplane	*0*	0	0.00%	0.00%	0.00%
	1+	49	0.16%	0.13%	0.05%
Other	*0*	0	0.00%	0.00%	0.00%
	1+	9	0.03%	0.02%	0.03%

5.3 Attitudinal / Behavioral Survey Topics

The following section includes three sub-sections about automated vehicles, Transportation Network companies, (TNCs) use, and public transit use.

Automated Vehicles

Table 42 and Table 43 present results on attitudinal questions related to automated vehicles and Table 44 displays the reported fuel type preference for future vehicle purchases. In Table 42, 82% of respondents said they pay some level of attention to advancements in automated vehicles, compared with 18% who said they never pay attention.

Table 42. Level of Attention Paid to Automated Vehicles

Level of Attention	N	Unweighted	Weighted	MOE
I don't know	3	0.08%	0.12%	0.14%
I prefer not to answer	4	0.11%	0.13%	0.13%
Very often	295	7.97%	7.83%	1.05%
Often	578	15.61%	14.58%	1.34%
Sometimes	1,205	32.55%	31.85%	1.69%
Seldom	950	25.66%	24.90%	1.59%
Never	667	18.02%	20.60%	1.32%

In Table 43, 52% of persons surveyed indicated some willingness to purchase an automated vehicle, whereas 48% said they had no interest at all in purchasing an automated vehicle.

Table 43. Willingness to Purchase Automated Vehicle

Willingness to purchase	N	Unweighted	Weighted	MOE
I don't know	3	0.08%	0.06%	0.07%
I prefer not to answer	6	0.16%	0.23%	0.20%
Extremely	167	4.51%	4.69%	0.78%
Very	248	6.70%	7.09%	0.90%
Moderately	585	15.80%	15.95%	1.35%
Slightly	937	25.31%	24.44%	1.55%
Not at all	1,756	47.43%	47.55%	2.03%

Table 44 illustrates a majority of responses to the question indicated likelihood to purchase either a hybrid or electric vehicle in the future. Respondents were able to select more than one option, therefore estimates could not be produced, however, gas/diesel is the single fuel type with the most responses. The unweighted percentage reflects the percent of responses by category, not by person.

Table 44. Fuel Type of Future Vehicle Purchase

Fuel Type	N	Unweighted
I don't know	1	0.02%
I prefer not to answer	3	0.78%
Electric	1,083	20.32%
Hybrid	1,760	33.03%
Gas/Diesel	2,098	39.37%
None of the above	384	7.21%

TNC Use

This section includes three tables that focus on TNC use. Table 45 shows that the majority of respondents (93%) did not use a TNC in the week leading up to the assigned travel date.

Table 45. TNC use in the last week

TNC Use	N	Unweighted	Weighted	MOE
At least once in the past week	443	6.83%	6.37%	0.74%
Didn't use	6,043	93.17%	93.63%	0.74%

Table 46 shows that the highest share of TNC use was for 'Personal outside of business hours' purposes at 36.13%, followed by 20.45% of TNC trips undertaken for errand running (personal and business) during work hours, and 19.28% undertaken for the entire, or part of the daily work commute.

Table 46. Purpose of TNC Use

TNC Trip Purpose	N	Unweighted	Weighted	MOE
I don't know	223	13.49%	14.46%	2.93%
I prefer not to answer	142	8.59%	9.68%	2.21%
Entire work commute	200	12.10%	14.99%	3.29%
Partial work commute	63	3.81%	4.29%	1.27%
Work-related during business hours	91	5.51%	5.81%	1.54%
Non-work/personal during business hours	262	15.85%	14.64%	2.69%
Personal outside of business hours	672	40.65%	36.13%	3.21%

Table 47 shows that the majority of participants (74%), reported TNC usage in the last week was 'typical'.

Table 47. TNC Use in a Typical Week

TNC Use in a Typical Week	N	Unweighted	Weighted	MOE
I don't know	78	1.20%	1.05%	0.32%
I prefer not to answer	64	0.99%	0.97%	0.34%
Low	1,284	19.81%	23.80%	1.72%
Typical	4,798	74.02%	70.50%	1.74%
High	258	3.98%	3.68%	0.61%

Public Transit Use

Table 48 shows the reasons participants reported for not using public transit. The question asked for the "primary" reason. There could be additional reasons that were not collected that could shed more light on why transit is not used more often. As it stands, the two most frequent responses were related to transit access locations and service convenience.

Table 48. Reasons for Not Using Transit

Reason for not using transit on travel day	N	Unweighted	Weighted	MOE
I don't know	6	0.11%	0.10%	0.09%
I prefer not to answer	8	0.14%	0.16%	0.14%
Fares are too expensive	17	0.30%	0.48%	0.25%
Transit stops are too far away	694	12.44%	13.02%	1.31%
Streetcar/buses do not run often enough	168	3.01%	3.50%	0.72%
Not enough parking at transit stations	5	0.09%	0.07%	0.06%
Transit not convenient for that day's activities	2,001	35.85%	33.03%	1.72%
I prefer to drive	2,682	48.06%	49.63%	1.85%

6. Conclusion

The results of the How We Move KC travel survey illustrate that there have not been major shifts in travel behavior in the region since the previous study conducted in 2004. Despite the introduction and high visibility or several emerging modes (e-scooters, bikeshare), the overall mode share in the region has not moved significantly, other than for more personally owned vehicle trips to be undertaken alone rather than with multiple travelers. TNC use has not taken much of the auto mode share but has offset the traditional taxi mode share. The point estimate for transit mode suggests an increase in transit use since 2004. However, considering the margin of error and unknown error from 2004, the change could be possibly uncertain.

Overall, trip rates in the region have gone down since 2004. This is in line with the 2017 National Household Travel Survey and other regional surveys comparable to How We Move KC. There is some evidence of trip replacement through increased instances of teleworking and higher frequency of e-commerce. The degree of increase is difficult to establish due to unidentified error in the 2004 survey, but based on the 2019 data and margins of error, an increase is likely. Trip duration and distance for common trip purposes have increased in the region since the 2004 survey.

The weighted and expanded results of the random sample of 3,821 completed households is closely matched to the American Community Survey. Most variables that were used for weighting are within the margin of error of the regional population per ACS. The results of the How We Move KC survey can be used to generate estimates for the regional population according to any of the one hundred plus available data items collected in the survey, although care should be taken when sample sizes are below 30.

7. Appendices

The following section contains appendices with examples of survey materials used during the project. Appendix A – 1.1 through A – 1.3 are examples of the invitation letter and two reminder postcards that were mailed to all selected samples. Appendix A – 1.4 and A – 1.4 contain the survey packet cover letter and example log.

Appendix B – 1 and Appendix C – 1 contain tables of data edits checks run on the data for all completed households, and derived variable, respectively.

Appendix D - 1 through F - 1 provide frequencies for a selection of demographic results for household, person, and trip level characteristics.

Appendix G – 1 contains the full text of the Household Travel Survey and Replica Data Comparison Final Memo as written by Cambridge Systematics and approved by the Mid America Regional Council.

Appendices H – 1 and I – 1 contain the final survey instrument scripts, recruitment and retrieval respectively