2017-2018 REGIONAL TRAVEL SURVEY 7-DAY PANEL EVALUATION

Kenneth Joh, Ph.D., AICP, CPM
Principal Statistical Survey Analyst

TPB Technical Committee
January 6, 2023

National Capital Region
Transportation Planning Board

Background

In 2019, COG/TPB conducted a follow-on survey to the Regional Travel Survey (RTS) based on a smartphone app-based methodology:

- The RTS Follow-On Smartphone Panel Survey (SPS) sampled a panel of respondents from the RTS
- The primary objectives were to evaluate the effectiveness of the smartphone-app based survey and to determine the feasibility of smartphone surveys for future survey efforts by COG/TPB
- The SPS collected demographic and travel diary information with a survey instrument based on a smartphone app developed by Resource Systems Group, Inc. (RSG), called ***rMove***

Comparison of RTS and SPS

Type of Survey	RTS	SPS
Who Participated	Every member of household required to complete the travel diary	One person in household
Period Recorded	1 Weekday	Up to 7-Days
Completed Responses	15,976 (households)*	1,039 (persons)
Period Conducted	October 2017 to December 2018	October and November 2019
Geographic Area	TPB Modeled Region	Activity Centers in TPB Region
Status of Internal QA/QC	Complete and extensive	Complete

*Through collaboration with the Baltimore Metropolitan Council (BMC), TPB staff added information collected by the 2018/2019 Maryland Travel Survey for Anne Arundel, Carroll, and Howard Counties. There was also an oversample conducted for Arlington County. These two efforts added another 2,039 households and brought the total number of households reported in the final RTS data files to 18,015.

Overview of the Project

The evaluation includes the following key objectives:

1. Conduct a comprehensive review of the SPS data files and all of the data items contained in those files
2. Perform data editing and imputation of the household, person, trip, and vehicle files based on the review of the SPS data files
3. Conduct logic and consistency checks of the SPS trip file which include speed checks, loop trip checks, missing/incomplete trip checks, and activity purpose checks
4. Conduct an evaluation of the efficacy of the smartphone app-based survey by reviewing user feedback and comments on the smartphone app survey (*rMove*)

Data Editing and Imputation

- TPB staff reviewed the data files and code provided by RSG to
  - Evaluate the quality and consistency of the data files
  - Identify data items that required data editing, including variable recoding and imputation
- TPB staff focused on recoding open-ended ("other, please specify") responses which included several questions in the household, person, trip, and vehicle files
- Some variables in the data files had missing data or cells, but based on TPB staff's review, these missing values appeared to be reasonable and consistent

Erroneous Trips

- Open responses for trip origin purpose and trip destination purpose did not always reflect actual trips. TPB staff coded these cases as “erroneous trips” because they did not include an actual stop at a destination, reasons included:
  - Unintended stops on the way to a destination (due to traffic incidents, waiting at a long traffic light, or a train holding)
  - Movement within the confines of a home such as taking out the trash
  - Interruption due to a lack of Wi-Fi coverage
- The share of trips that were identified by TPB staff as erroneous was relatively small; only 19 out of 390 open response records (4.9 percent) for trip origin purpose and 19 out of 393 open response records

Consistency Check – Approach

- After data cleaning and imputation, TPB staff reviewed the SPS trip file for trip logic and consistency:
  - Speed and distance checks by travel mode
  - Trip logic and consistency checks for subway and commuter rail trips (including missing/incomplete trip checks)
  - Trip purpose checks for loop trips (home to home trips and work to work trips)
- In addition to speed and distance checks by travel mode and trip logic and consistency checks for subway and commuter rail trips, TPB staff performed trip purpose checks for loop trips:
  - Home to home loop trip
  - Work to work loop trip

Speed and Distance Checks by Travel Mode (1)

- For all travel modes, the top five common issues identified are:
  - Short trip distance over extremely long duration (n = 263)
  - Speed is too high for this mode (n = 70)
  - Extremely long trip distance over a short duration (n = 49)
  - Extremely short trip distance (n = 33)
  - Extremely long trip duration (n = 29)
- Ranked by number of flagged issues by travel mode:
  - Household vehicle trips (n = 227)
  - Walk trips (n = 112)
  - Rail (n = 78)
  - Other vehicle (n = 19)
  - Bus (n = 18)

Speed and Distance Checks by Travel Mode (2)

Ranked by percentage share of flagged issues by travel mode (travel modes with under 100 trip records and "other" are excluded):

- **Rail (2.4 percent of rail trip records flagged)**
- Ridehailing (1.6 percent of ridehailing trip records flagged)
- Bus (1.3 percent of bus trip records flagged)
- Household vehicle (1.2 percent of household vehicle trip records flagged)
- Bike (1.1 percent of bike trip records flagged)
- Walk (1.1 percent of walk trip records flagged)
- Other vehicle (1.0 percent of other trips flagged)
- Bikeshare (0.6 percent of bikeshare trip records flagged)

Trip Purpose Checks for Loop Trips

- There was a total of 1,934 trip records in the home-to-home loop trip file, and a total of 1,881 trip records in the work-to-work loop trip file. Due to the large number of trip records, only the first 400 trip records from each file were checked for consistency.
- A total of 111 home-to-home loop trips were flagged, and a total of 91 work-to-work loop trips were flagged.

Trip Purpose Check Findings for Loop Trips

- For the 111 home-to-home loop trips, the top issues identified include:
  - **Destination purpose wrong (53.2 percent of 111 trip records flagged)**
  - **Origin purpose wrong (19.8 percent of 111 trip records flagged)**
  - Too short to be a trip (12.6 percent of 111 trip records flagged)
  - Origin and destination purpose wrong (11.7 percent of 111 trip records flagged)
- For the 91 work-to-work loop trips, the top issues identified include:
  - **Destination purpose wrong (46.2 percent of 91 trip records flagged)**
  - **Origin purpose wrong (25.3 percent of 91 trip records flagged)**
  - Too short to be a trip (6.6 percent of 91 trip records flagged)
  - Dual work trip (i.e., trip from one workplace to another workplace) (6.6 percent of 91 trip records flagged)

User Comments – Approach (1)

- The SPS provided an opportunity for survey participants to provide feedback on the survey experience. This was an open response question that was asked at the conclusion of the survey. Nearly one-half of all survey respondents (46.8 percent) provided feedback on the user experience (486 out of 1,039 respondents), which provided valuable information for evaluating the SPS data from the users' perspective.
- TPB staff conducted a detailed analysis of user feedback and comments on the smartphone app survey summarizing the comments into broad topic categories and key words/themes, based on topics and attitudes (positive, neutral/constructive, negative).

User Comments – Approach (2)

TPB staff reviewed all user feedback and comments from the SPS, and placed them into the following broad topic categories:

- **App Interface/Functionality.** These comments focused on the interface and functionality of the *rMove* app.
- **General Experience.** These comments focused on general experience with the survey.
- **Survey Questionnaire.** These comments focused on the survey questionnaire, instructions, and question options.
- **Tech/Accuracy.** These comments focused on technical issues pertaining to accurate recording of trips such as GPS.
- **Tech/Battery.** These comments focused on technical issues pertaining to battery usage.
- **Other.** These comments did not fall into the categories listed above.

The comments were also placed into attitudinal categories (positive, neutral/constructive, and negative).

User Comments – Key Findings

From a total of 486 comments, the number of user comments by broad topic categories are listed below in descending order:

- **General Experience** (200 comments)
- **App Interface/Functionality** (111 comments)
- **Other** (79 comments)
- **Tech/Accuracy** (49 comments)
- **Survey Questionnaire** (36 comments)
- **Tech/Battery** (11 comments)

For attitudinal categories (positive, neutral/constructive, and negative) of all user comments, the breakdown by attitude is as follows:

- **Positive** - 277 comments
- **Neutral/Constructive** - 102 comments
- **Negative** - 107 comments

Summary of User Comments by Attitude and Topic

	Negative	Neutral/Constructive	Positive	Total
General Experience	2 comments	8 comments	190 comments	200 comments
App Interface/Functionality	38 comments	15 comments	58 comments	111 comments
Other	1 comment	59 comments	19 comments	79 comments
Tech/Accuracy	26 comments	17 comments	6 comments	49 comments
Survey Questionnaire	30 comments	2 comments	4 comments	36 comments
Tech/Battery	10 comments	1 comment	0 comments	11 comments

Note: Darker shade indicates more user comments.

Deep Dive Analysis Using Key Words/Themes – General Experience (1)

Comments focusing on general experience were grouped into the following types based on key words/themes, with selected verbatim comments.

Positive Comments about General Experience:

- Simple and easy (84 comments)
  - "This was a very easy, intelligent survey. The company behind the app is amazing!"
  - "Survey was easy to do. I enjoyed it."
  - "It was very simple and straightforward."
- Fun and great (53 comments)
  - "It was a fun and interesting experience. I'd do it again, anytime!"
  - "It was fun!"
  - "Everything was great!"
- Good experience (35 comments)
  - "Great user experience!"
  - "It was great to be a part of this!"

Note: A comment may include multiple themes/key words so the tabulation of key words/themes was not mutually exclusive.

Deep Dive Analysis Using Key Words/Themes – General Experience (2)

Positive Comments about General Experience (continued):

- Worked well (16 comments)
  - "Everything worked very well."
  - "It worked well. Straightforward."
- Thank you (13 comments)
  - "Thank you for the great effort and planning that went into launching the survey and tool. It was a pleasure to participate."
  - "Thanks for asking. Keep me in mind for other surveys."

Deep Dive Analysis Using Key Words/Themes – App Interface/Functionality

Positive Comments about App Interface/Functionality:

- Simple and easy (31 comments)
  - "It was really easy with the technology tracking each trip automatically and guessing the commuting trip details."
  - "It was very easy to fill out the forms during my day to day."
- Auto-fill/smart (14 comments)
  - "The surveys are very easy to follow and the auto-fill feature for repeated trips is useful."
- Fun/love it (10 comments)
  - "I love it! Was totally clear on how to handle trip chaining."
- Well designed (10 comments)
  - "Well designed and easy interface with smart features."

Negative Comments about App Interface/Functionality:

- Difficult to modify/delete trip (11 comments)
  - "Hard to edit or add trips"

Deep Dive Analysis Using Key Words/Themes – Survey Questionnaire and Tech/Accuracy

Negative Comments about Survey Questionnaire

- Too many questions/choices (16 comments)
  - "Too many questions and improve the auto-fill feature."
  - "The survey is way too long."
- Confusing/need more instructions (10 comments)
  - "More specific instructions on how best to fill out the survey would have been helpful."
  - "Purpose of trip categories could have been clearer."

Negative Comments about Tech/Accuracy

- Wrong GPS captured (14 comments)
  - "Issues with false trips need to be fixed for future surveys"
  - "This app doesn't collect trips properly."
- Missing or loss of GPS signal (11 comments)
  - "Sometimes the survey would lose reception in certain areas."
  - "App seemed to miss the beginning of several trips."

Consultant Comments (1)

RSG noted that the following enhancements were made to *rMove* since the seven-day panel:

- *rMove* provides more accurate departure times through a speed and distance-based algorithm that corrects for lag in location collection.
- *rMove* allows users to edit departure and arrival times for all trips, which supplements raw trip times and algorithm-adjusted times.
- *rMove* utilizes an algorithm to analyze trip paths and identify where a user may have made a brief stop that was not initially recognized. The potential missed stops are displayed to the user who can keep or reject them. This functionality is particularly useful in splitting a single loop trip into two constituent trips when a brief activity was conducted along the way (e.g., dropping someone at school or picking up food).
- *rMove* uses a two-step authentication process for accessing the application to improve data security.

Consultant Comments (2)

RSG noted that the following enhancements were made to *rMove* since the seven-day panel:

- *rMove* includes a re-designed interface that includes a dashboard and a trip roster. The dashboard itemizes all tasks required of the user, including daily summary survey and surveys collecting general travel behavior of household children. A separate trip roster allows all trip collection and modification to occur in a standalone interface.
- *rMove* requires users to verify each trip they make, where they can add or remove stops, and edit trip times.
- *rMove* has an improved survey flow, particularly for trip verification.
- *rMove* assigns travel dates dynamically to shorten the between recruit and survey start.
- *rMove* reviews previous trips and previous trip survey responses to prepopulate survey answers and reduce user burden.

Reflections and Next Steps

- The 7-day panel evaluation provided insights in evaluating the effectiveness of the smartphone-app based survey and to determine the feasibility of smartphone surveys for future survey efforts by COG/TPB
- Smartphone surveys will likely be the primary data collection method for future travel surveys but should be supplemented with other data collection methods
- As smartphone app technology continues to evolve, the quality of travel diary data will likely improve
- Due to declining response rates, respondent burden should be explicitly considered when designing survey apps

Kenneth Joh, Ph.D., AICP, CPM

Principal Statistical Survey Analyst
Department of Transportation Planning
202.962.3276
kjoh@mwcog.org

mwcog.org/tpb

Metropolitan Washington Council of Governments
777 North Capitol Street NE, Suite 300
Washington, DC 20002

Summary of Key Findings - Data Editing and Imputation

- Several data items required data editing and imputation, including the recoding of open response variables.
- There were many variables with missing data or cells, but most of these missing values were reasonable and consistent.
- Open responses for trip origin and trip destination purposes in the trip file required recording and were recoded into origin purpose and destination categories.
- There were a few cases where open responses for trip origin purpose and trip destination purpose did not reflect actual trips; these were coded as “erroneous trips”.

Summary of Key Findings – Consistency Checks (1)

- Consistency checks were performed to determine the accuracy and validity of trips captured by the smartphone app: 1) speed and distance checks by travel mode; 2) trip logic and consistency checks for subway and commuter rail trips; 3) trip purpose checks for loop trips (home-to-home and work-to-work trips.

- The most common issues identified include: 1) short trip distance over extremely long duration; 2) speed is too high for this mode; 3) extremely long trip distance over a short duration; 4) extremely short trip distance; 5) extremely long trip duration.

- Further consistency checks were performed on subway and commuter rail trips, which found that trip start or end times were incorrect in about one-third of all flagged trip records. Other common issues included wrong travel mode, wrong trip duration, and wrong trip purpose.

Summary of Key Findings – Consistency Checks (2)

- Trip purpose checks for loop trips were performed for the first 400 daily trip records containing a home-to-home loop trip and the first 400 daily trip records containing a work-to-work loop trip.

- Based on this review, 111 home-to-home loop trips and 91 work-to-work loop trips were flagged.

- For home-to-home loop trips, over one-half of 111 trip records flagged had the wrong destination purpose; for work-to-work loop trips, nearly half of 91 trip records flagged had the wrong destination purpose. This was verified by confirming the XY coordinates for the home and work locations.

Summary of Key Findings – User Comments (1)

- User feedback and comments offered insight on users' perspective on the smartphone app survey.
- The largest number of comments focused on general experience, followed by app interface and functionality. Many user comments were positive or neutral/constructive, suggesting that the app worked well and that the user experience was positive for the majority of SPS participants.
- Comments that focused on the survey questionnaire and technical issues such as accuracy and battery were more negative than positive, but the overall share of respondents who reported an issue on the survey questionnaire and technical issues was small compared with the total number of survey participants or total number of commenters.

Summary of Key Findings – User Comments (2)

- Deep dive analysis using key words and themes revealed that many respondents had similar comments and feedback about their experience taking the smartphone app survey.
- Many positive comments about the general experience described the survey as “simple and easy” and “fun and great. Positive comments about the app interface and functionality noted that it was easy to complete, well-designed, and had smart features such as auto-fill which made the survey easier to complete.
- Comments about the survey questionnaire tended to be more negative, with some respondents complaining about the length of the survey and the large number of questions, while others desired more specific instructions and improved question choices.
- Comments about tech/accuracy and tech/battery were generally negative with some respondents reporting issues with false and inaccurate trips, loss of GPS signal and reception, and issues with battery drain using the app.