National Center for Transit Research
Center for Urban Transportation Research
College of Engineering
University of South Florida

For more information,
contact: Robert L. Bertini, Ph.D.
NICR Director
Email: rbertini@usf.edu

Project: Improving the Quality and Cost Effectiveness of Multimodal Travel Behavior Data Collection

Authors: Sean Barbeau, Ph.D.

Summary

In order to build safe and effective multimodal transportation infrastructure, Departments of Transportation (DOTs), Metropolitan Planning Organizations (MPOs), and transit agencies need quality data about how the public is currently traveling in various modes. The primary methods of data capture, like on-board surveys, miss travelers that opted for other modes. In addition, on board survey do not capture longitudinal behaviors. Practitioners and researchers have yet to understand the precise relationship between transit and Transit Network Companies (TNCs) (Uber, Lyft, etc.). Finally, a USDOT-UTC workshop determined a lack of data on when and where bicyclists travel, as well as their interactions with vehicles, is one of the greatest limitations in understanding Florida's high bicyclists and pedestrian fatality rates.

Some efforts to collect bicycle data through apps like Cycle Tracks, Cycle Atlanta, and Strava have their limitations. These apps collect bike bath data from smartphones, but do not collect data on transit or other transportation. Specifically, Strava does not provide trip origin destination at an individual user level.

In this project, the research team designed, developed, and deployed a proof-of-concept system to collect multimodal travel behavior data over extended periods. The system would collect data directly from users from a popular open-source mobile app, OneBusAway (OBA) for multi-modal information. The non-profit Open Transit Software Foundations is currently deployed in 10 cities around the world with over 350,000 users.

A more specific goal of this project was to overcome some of the past battery life challenges cited by other travel behavior data collection apps. Users often expressed that the app would use too much battery life and thus they would stop using the application. To do this, the research time would prioritize energy-efficient data collection by using Google's Android Activity Transition Application Programming Interface (API) that was launched in March 2019. The interface uses a sensor co-processor to help conserve energy by "waking-up" the main application only when it detects new motion. A limitation is that it only detects when a user is in a vehicle, bicycling, running, walking, or is still. This means that the app cannot detect when the user is on transit; however, the application does save data on interactions with the app. If a person used the app to track a bus and then gets in a vehicle, it can be determined that they user took transit.

The process and visualize the collected data, the research team created a methodology to convert from an activity transition model, where each data record consist of a transition from one mode to another at

a single location, to a more tradition origin destination model, where each record consists of both an origin and destination location with the mode used to travel between them.

The data collection software developed in this project was released as an update to the OneBusAway app to a beta testing group of 676 users on July 11, 2019. No users withdrew and no users reported any negative consequences. In the end, data collected from 74 users from the beta testing group over about 10 weeks was examined for this project. There were 65,582 trips, with 73% walking trips. This was likely because the Activity Transition APO can detect very short walking trips within a building which means that many of the trips were likely very short trips from an office to a conference room, for example. After filtering out trips less than 5 minutes, or origin-destination of less than 50 meters, 13,698 trips remained. This changed walking trips from 73% to 43% and vehicle trips from 21$ to 48%. 86% of all origin-destination trips were collected and the remaining 14% of location could not be determined likely because of user setting that restrict location permissions.

In summary, the proof-of-concept travel behavior data collection software deployed in this project is a promising technology with a fundamental tradeoff of reduced data density (i.e., collecting origin and destination locations instead of a breadcrumb travel bath) for a reduced impact on battery life and the ability to collect data from a large number of users for longitudinal studies with few incentives required. It should be noted that additional location data collection could be selectively added to the app, but it comes at a cost to device battery life and therefore should only be added if vital to the study.

Further studies could more precisely identify which bus arrival times were viewed and which were not, which may be important for route-choice studies. In addition, explicitly asking users to identify their home and work locations would help in analyzing the data. Further studies could also create various incentive mechanisms to further boost participation and provide very brief, targeted surveys to collect qualitative data.

VIEW FULL REPORT: scholarcommons.usf.edu/cutr_nctr/13