

Transit Origin-Destination Surveys

DESCRIPTION

Transit origin-destination (OD) surveys are important strategic planning tools for transit agencies. Agencies collect OD data to provide insights into transit markets and to understand the demographics and travel behavior of riders on a system. In short, an OD study examines the following:

1. **Who** uses the transit system (demographics).
2. **Why** they use it (choice riders and captive riders).
3. **When, where, how, and for what** they use it (trip profile).

OD surveys are also used to acquire Federal Transit Administration (FTA) funding for capital investments. In addition to providing the “before” snapshot for federal funding, ODs are also used to develop an “after” comparison to assess project efficacy. Demographic data from ODs can also help agencies fulfill Title VI reporting requirements.

While OD surveys intended to fulfill FTA requirements may be done on an ad-hoc basis, it is a best practice to conduct these onboard surveys at a regular interval. Doing so ensures agencies are always positioned with current data.

Effective sampling and ensuing weighting/expansion requires an initial systemwide on-to-off count, either by intercept or from other reliable data sources. A 10% onboard sample of daily system ridership is generally considered representative. Ideally, onboard sampling should be conducted by personal interview using a tablet. Agencies should aim to match these best practice approaches established by FTA and, where not possible, efforts should be made to ensure any alterations do not adversely affect the efficacy and accuracy of the survey.



HOW WILL THIS SURVEY HELP ME?

- > **Spot trends:** If repeated, these surveys can help spot trends in the who, what, when, where, why for transit.
- > **Acquire funding:** These surveys are a fundamental input into acquiring federal funding for major transit investments.
- > **Track progress:** If repeated, these surveys can help practitioners examine the impact of major capital investments or policies implemented.
- > **Engage the public:** These surveys allow the public to feel heard and can be effective tools for fostering community dialogue.



SUCCESS STORIES

JTA Onboard Rider Demographic Survey (2016)

Administration Method: On-board tablet-based survey

Recruitment: On-board buses and Skyway

Sampling: Representative 10% sample of daily ridership

The study team collected over 5,000 completed surveys from Jacksonville Transportation Authority (JTA) riders on both bus and the Skyway, a people mover. The study, which included initial on-to-off counts for Skyway, allowed JTA to analyze the effect of recent changes made to their service plan and continue planning for BRT corridors, a commuter rail, and Skyway improvements.

COST

Med-Med/High

TIME

Medium

METHODS

On-Board Tablet Paper

CHALLENGES

Representative Sample Weighting

EXPERTISE

Sampling Design Data Wrangling

Sample size, labor costs, and survey method are important drivers of cost for this type of research. Larger sample sizes require more surveyors working more hours. With a significant share of the budget going to field labor, the local cost of surveyor labor is a key consideration. Survey method also has cost trade-offs. Paper surveys can be less expensive than tablet-based efforts, but these methods are less accurate and lack many features of online instruments.

> The Benefits of Digital

Why Tablets?

Interview-based tablet surveying allows for customized survey branching and language, complex question design (e.g., geocoded location), surveyor support to ensure accurate reporting, and real-time tracking and validation of progress and results. Tablets result in higher response and completion rates with fewer invalid records which means better and more representative data.

Why Not Paper?

Paper remains a viable option when the questionnaire is simple, or when the project budget precludes using the more effective tablet method but lack the main benefits of using tablets.

STUDY ROADMAP

1 QUESTIONNAIRE DESIGN/ADMINISTRATION

A well-designed survey includes questions that facilitate effective sampling, weighting, and analysis of key study objectives. Asking the FTA or transit agencies for example questionnaires is recommended.

2 SAMPLING/RECRUITMENT

Sampling and recruitment strategies should seek to accurately represent daily ridership on a system.

On-to-off: Before fielding the OD survey, conduct an on-to-off survey to capture boarding/alighting pair data for routes with over 3,000 average weekday riders. This will inform weighting for the OD study.

Origin-Destination Survey: Surveyors should be distributed according to a detailed sampling plan based on daily ridership data. Aim for a sample size of at least 10% of daily ridership by route/line, direction, and time period.

Onboard recruitment: Respondents should be recruited aboard the vehicle, using a tablet-based questionnaire. Interviewers should approach riders at random to limit sample biases.

Incentives and representation: Incentives, like cash or a drawing entry, can be effective options to support recruitment. When incentives are not an option, supplemental techniques, e.g. follow-up emails, calls, or use of paper surveys, may prove useful to encourage general participation, as well as to ensure accurate representation of riders with disabilities, non-English speakers, or those making short trips.

3 ANALYSIS

Data Cleaning

Data cleaning and trip validation (ensuring trips make logical and logistical sense) are important processing steps. Paper surveys will require significant cleaning and validation, while tablet-based surveys will generally require less. Each trip's origin and destination should be plotted on a map to ensure it makes sense.

Survey Weighting

Initial weighting: The survey data should be weighted and expanded to match daily ridership on the system (often weekday only). Weighting should be conducted at the most disaggregate level possible. Iterative proportional fit (IPF) weighting based on boarding and alighting station/stop/segment pairs, direction, and time of day is often useful for weighting responses. Compromises may occur where data collected was too low to utilize this approach (e.g., small survey sample size or on-to-off counts).

Linked trip weights: The initial weighting, or unlinked trip weight, does not account for rider transfers. Linked trip weights adjust weights based on the number of transfers.

Analysis

Cross-tabulated analysis may be useful by transit mode (where multiple modes exist, e.g. bus and rail) or by some market segmentation criteria. Additional geographic analysis should occur by zone (origin and destination or, ideally, production and attraction). Heat maps and other static or dynamic visualizations can also be effective mechanisms for analyzing trip data.



TYPICAL CHALLENGES

Sampling and Administration: Collecting a large, representative sample usually requires surveying many routes over many days. This requires a detailed, thoughtful sampling plan and a strong field management team to safeguard progress and troubleshoot challenges as they inevitably arise. Organizational prowess and a knack for logistics are necessary for success!

Capturing Short Trips: With limited time to approach and interview riders making short trips, efforts should be made to ensure short trips are sufficiently represented in the survey sample. Recruitment techniques such as collecting contact information for later completion may help. Effective initial on-to-off counts and ensuing IPF weighting will help mitigate bias.

Survey Accessibility: American Disabilities Act (ADA) compliance and accommodation for Limited English Proficient (LEP) populations should be considered. Multilingual interviewers and ancillary survey completion options (e.g. paper, phone-based interview, or online) may be necessary to ensure accessibility.



Important Considerations!

Consider the analysis being conducted when choosing the correct weight to apply to the data:

- 1) For route-specific analysis, unlinked trip weights may be used to understand how the sample reflects route *riders*.
- 2) For all other analysis, linked trip weights should be used to understand how the sample reflects system *trips*.

> Iterative Proportional What??

Iterative Proportional Fitting (IPF) is a procedure to weight collected data so that aggregate totals across selected variables are matched to a target population. IPF utilizes a multidimensional “seed” distribution (e.g., boarding/alighting with automatic passenger counts) to develop rider weights. The “seed” cells are proportionally adjusted (i.e., weighted) iteratively to equal the “marginal” totals established with on/off count data. R is a common tool for conducting IPF.

Marginal Totals	X	X	X	X	
Y	Z	Z	Y	ZZ	ZZ
Y	Z	Z	Y	ZZ	ZZ
			Seed Cells		Fitted Cells (Weights)

ADDITIONAL RESOURCES

TCRP Synthesis 138: Public Transit Rider Origin Destination Survey Methods and Technologies
<http://www.trb.org/Publications/Blurbs/179008.aspx>

Understanding Traditional Origin-Destination Data: A Survey

https://www.fhwa.dot.gov/planning/tmip/publications/other_reports/understanding_o-d_data/fhwahep19046.pdf

For more information visit the Statewide Survey Colloquium:
<https://bit.ly/SurveyColloq>