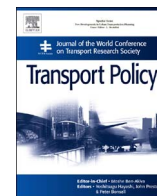




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Comparing data quality and cost from three modes of on-board transit surveys

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ABSTRACT

Many transit agencies invest substantial resources in surveying their passengers to generate data used for planning, marketing, and equity analyses. Within the industry, there is considerable interest in replacing traditional paper-based self-complete surveys with new approaches that might lower costs or generate better quality data. However, very limited research has been done to identify the relative performance of different transit passenger survey modes. This paper begins to fill that gap.

The research investigates the relative data quality for three different bus passenger survey methods distributed or administered on the transit vehicle: self-complete paper surveys, interviewer-assisted tablet-based surveys, and self-complete online surveys. The research used an experimental design, with the same survey questionnaire distributed via the three survey modes. All factors about the survey and distribution process were kept identical to the extent feasible, so that the only variation would be the survey mode itself.

The findings by survey mode are compared in terms of the overall response and completion rates, the completion rate for individual questions, respondent demographics, and labor costs per complete. The study results suggest that many agencies may still find the old-fashioned, low-tech paper survey to be the best option for bus passenger surveys. The paper mode required less labor per complete, and for many of the metrics discussed it generated data that was as good as—or better than—the tablet survey. In addition, the findings suggest that online survey invitations distributed on the transit vehicle are not a good option because they were labor intensive and had very low response rates.

1. Introduction

This research investigates the relative data quality and labor costs for three different modes of surveying bus passengers using survey methods distributed or administered on the transit vehicle: self-complete paper surveys, interviewer-assisted tablet-based surveys, and self-complete online surveys.

Many transit agencies invest substantial financial and time resources into surveying their customers, with costs easily running from \$500,000 to a \$1,000,000 for a large agency. For example, a 2006 survey of passengers on Chicago's Metra commuter rail system cost more than \$600,000. Expensive survey efforts are justified on the grounds that the data collected are fundamental inputs for a wide range of purposes that include travel modeling, system-wide or route-level planning, setting fare policy, and communicating with existing customers (Schaller, 2005; Members and Friends of the Transportation Research Board's Travel Survey Methods Committee, 2015).

Since the fall of 2012, the US Department of Transportation's

Federal Transit Administration (FTA) has directed larger transit agencies to conduct passenger surveys every five years and ensure participation from minority and low-income riders who have historically under-participated in such efforts (U.S. Department of Transportation, Federal Transit Administration, 2012). This FTA directive will require many U.S. transit agencies to survey more frequently than they have in the recent past. Thus, agencies have newly-strengthened interest in identifying survey methods that will reduce costs while still gathering high-quality data.

When planning a survey, transit agencies must choose among a variety of possible survey modes, with little guidance available to help them assess cost and quality tradeoffs. The growing availability of affordable information and communications technologies has led a number of agencies to experiment with new survey modes in hopes of either improving data quality or reducing costs. In recent years, agencies have tried a variety of survey modes, including:

1. On-board distribution of self-complete post-cards that collect phone

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- numbers and/or email addresses which are used for a follow-up computer-assisted telephone interview (CATI) or an online survey.
2. On-board interviewing, with surveyors recording responses on a tablet computer.
3. Distributing a postcard that contains a URL and/or QR code, with a request for passengers to self-complete an online survey.
4. Creating email lists of agency passengers, and emailing an invitation to complete an online survey.
5. Publicizing an online survey through media advertising and system announcements.

All of these survey modes have potential advantages and disadvantages when compared to traditional self-complete paper surveys. However, only two published studies have attempted to systematically compare the relative response rates, completion rates, or respondent demographics of different transit passenger survey modes (NuStats, 2009; Cummins et al., 2013). Thus, transit agencies seeking to employ innovative methods to meet their new surveying requirements have little guidance on how to proceed. For example, will switching from traditional paper-based self-complete surveys to internet-based ones save money without compromising data quality? Conversely, will more costly tablet-assisted personal-interview surveys provide better quality data than paper-based self-complete surveys?

This paper reports on a research project that begins to fill that gap in knowledge. A single set of surveyors administered the same survey questionnaire using three different survey modes to passengers on a sample of five bus lines operated by the San Francisco Municipal Transportation Agency (SFMTA), the major transit operator for the city of San Francisco (California, U.S.A.). All variables of the survey implementation process were kept as similar as possible across the three survey modes so that the one key variation would be the survey mode itself. The survey modes tested were variations on self-complete paper, self-complete online, and interviewer-assisted tablet surveys.

The next sections of this paper review additional matters related to the challenges of choosing a survey mode for on-board passenger surveys and the existing literature, and then describe the study methodology. The following section describes the detailed research findings, and a final section presents summary findings, study limitations, and implications for practice.

2. The challenges associated with on-board passenger surveys

As noted above, agencies conduct on-board passenger surveys to generate data used for a wide variety of purposes. Internally, the agency may use the data for planning, performance measurement, and customer outreach purposes. In addition, the data may be used by other agencies, such as metropolitan planning organizations that develop travel demand models. To meet these diverse needs, transit surveys traditionally seek to gather one or more of three types of information: passenger demographics, travel behaviors, and customer satisfaction (Schaller, 2005; Baltes, 2002). Some more recent surveys also pursue a fourth type of knowledge: how users might react to proposed policy changes (stated preference).

Some of the most important measures used to assess the quality of a survey are response and completion rates. Response rates are used to assess whether the survey sample is likely to reflect the characteristics of the riding population, with low response rates raising concern. Completion rates consider not only the number of responses but also whether respondents answer enough questions to make that survey record useful for analysis.

The recent availability of new mapping and surveying technologies raises additional concerns about survey quality. Specifically, can new surveying technologies yield data that are more easily geocoded and might new surveying technologies yield different pictures of the rider

demographics if people in a particular demographic group are more likely to respond to one survey mode than another? For example, older people might be more reluctant to respond to online surveys than would younger people, so the results of a survey completed with that mode might underrepresent older riders and overrepresent younger ones.

Surveying bus passengers poses many practical challenges, since the surveyors typically interact with passengers on moving transit vehicles. The surveying conditions are often crowded and noisy, with many people standing, and with neither passengers nor the surveyors having convenient places to fill out a survey. A further complication is that many passengers remain on the bus for less time than it takes to receive, complete, and return a lengthy survey instrument. Capturing responses from these so-called “short-trippers” is a key challenge. Finally, many agencies need to survey passengers who do not speak, read, and write in the dominant local language, and some passengers may not be literate in any language. Collecting data from such passengers is critical for equity analyses.

3. Literature review: new survey modes

In the last two decades, surveying practices in general have been evolving significantly in response to cultural and technological developments (Groves, 2011; Spitz et al., 2006). Traditional household survey approaches such as random-digit-dialing telephone surveys and mail-back surveys are becoming less reliable, with falling response rates (Kohut et al., 2012). In addition, the advent of cell phones and portable numbers makes it increasingly difficult to obtain a random sample of telephone numbers for residents within any geographic area smaller than the full nation (Mokrzycki, 2009). Meanwhile, the penetration of fixed and mobile internet access has opened up a new and highly economical mode of surveying – internet-based inquiry – but this is of very questionable efficacy, since some groups like elderly or low-income passengers are less likely to have internet access or are unwilling to take a survey online (Anderson, 2015; Pew Research Center, 2015; Zickuhr and Smith, 2012).

While there is a great deal of research comparing new and traditional survey modes in general (Couper, 2011; Greenlaw and Brown-Welty, 2009; Lin and Van Ryzin, 2012; and references therein), few researchers have focused on the unique needs of transit surveys, a gap that this study contributes to filling.

Specific to transit, we identified two studies that investigate important questions related to *how* a particular survey mode is administered, such as the impact of questionnaire length or use of incentives (NuStats, 2009; Memarian, 2008). In addition, we found only two studies that compare data quality across two survey modes. Work done by NuStats (2009) for the Los Angeles County Metropolitan Transportation Authority (in California, U.S.A.) examined the data quality for demographic and travel behavior questions using two modes. The first mode was paper-based self-complete surveys with a telephone interview follow-up for missing questions. In the second mode, respondents completed a short paper-based postcard survey on the bus that was coded to track each respondent’s boarding and alighting stop, and respondents answered more questions in a follow-up telephone interview. The study found that the postcard survey mode achieved a higher response rate, but that the two survey modes produced similar rider profiles for the three socio-demographic questions asked. More recently, Cummins et al. (2013) compared responses to customer satisfaction question responses from paper surveys distributed on the transit vehicle with surveys emailed out to a list of agency passengers. The study found that responses across the two survey modes were statistically equivalent for one of the two agencies studied but not for the other.

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