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16. ABSTRACT

This report presents the findings from a research project investigating the relative data quality and administration costs for three different modes of surveying bus passengers that produce results generalizable to the full passenger population. The three modes, all of which used survey methods distributed or administered onboard the transit vehicle, were: self-complete paper surveys, self-complete online surveys, and interviewer-assisted tablet-based surveys. Results from this study indicate several implications for practitioners choosing a survey mode. First, and most importantly, the analysis reinforces the point that there is no single, best survey mode. The choice of mode must depend on an agency's priorities for what questions most need to be answered, what population groups are most important to represent, and exactly how that agency chooses to define concepts like a "complete" survey or a "usable" address. Findings suggest several general recommendations for current survey practice: (1) online surveys administered via an invitation distributed on the transit vehicle are not a good option; (2) old-fashioned, low-tech paper survey may still be the best option for many bus passenger surveys; (3) changes in survey results that accompany changes in survey methods should be interpreted with caution; and (4) using a new survey method, especially one relying on more complex technologies, may create unexpected glitches.

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RPMD Task ID Number: 2629 **Fed/State Funding: Fed%** **State%** 100 **Remaining Funding:** 0
Task Title: Comparing Modes of On-Board Transit Passenger Surveys
E-FIS ID Number: 14000189 **Contract/TPF Number:** 65A0499 **PSC :** Modal

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Signature: Fouad Za. **Date:** 07/12/16

Task Manager Supervisor: Sukhdeep Nagra **Phone: 9166549718**
Signature: [signature] **Date:** 07/12/16

Office Chief: Greg Larson **Phone: 9166574369**
Signature: [signature] for Greg Larson **Date:** 7/15/16

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Comparing Modes of On-Board Transit Passenger Surveys: Assessing Trade-Offs Between Data Quality and Cost

Date:
Program Steering Committee (PSC): **Modal**
Task Title: **Comparing Modes of On-Board Transit Passenger Surveys: Assessing Trade-Offs Between Data Quality and Cost**
Task Number: **2629**
Task Start Date: **October 28, 2013**
Task Completion Date: **June 15, 2015**

Principal Investigator:

- Name: **Hilary Nixon, Ph.D.**
- Title: **Assistant Professor**
- Research Center: **Mineta National Transit Research Consortium (MNTRC)**

Task Manager Contact:

- Name: **Fouad M. Ziaullah**
- Title: **Transportation Engineer (Electrical)**
- Email: **fouad.ziaullah@dot.ca.gov**

WHAT WAS THE NEED?

Transit agencies invest tremendous financial and time resources into surveying their customers. These efforts are justified as the data collected are fundamental inputs for a range of purposes including "travel modeling, long-range and areawide planning, route planning and scheduling, service design, marketing, and customer communications". In addition, these surveys are, as of Fall 2012, required by a new Federal Transit Agency circular to ensure participation from minority and low-income populations who have historically under-participated in such efforts.

Despite the critical value of transit surveys, they are also very costly to agencies, easily running $500,000 to a $1 million for a large agency. Thus, there was a need to identify the lowest cost survey mode options that can still produce quality results.

WHAT WAS THE GOAL?

The study results actively transmitted to both transportation professionals and academics. Presentations will be made at the annual meetings of the Transportation Research Board (TRB) and the Association of Collegiate Schools of Planning (ACSP). The results were of interest to other meetings on transit planning and survey methodologies, such as the National Transportation Applications Conference and the International Conference on Transport Survey Methods.

The National Transit Institute (NTI) was briefed on the findings to inform their course offerings for transit professionals. A seminar was given on the project to the Travel Survey Interest Group (TSIG), a working group of public sector transportation planners in Chicago, Illinois. Finally, an article was prepared for publication in a peer-reviewed journal such as

the *Journal of Public Transportation* (preferred, as it is open-access) or *Transportation Research A: Policy and Planning*.

WHAT DID WE DO?

This project investigated the relative costs, response rates, survey completion rates, and respondent demographics for several different modes of implementing transit rider surveys. The three modes compared were determined as part of the project, but were highly likely to be: (1) a paper-based, self-administered survey, (2) a paper-based self-administered short survey followed by a computer assisted telephone survey, and (3) a paper-based self-administered short survey on a postcard followed by an internet survey.

For each survey mode, this project analysis:

1. Identified the cost per completed survey.
2. Derived response and completion rates.
3. Quantified any statistically significant demographic differences in participation.
4. Described associated logistical challenges and pitfalls.

WHAT WAS THE OUTCOME?

In terms of the return and completion rates, the survey modes' relative performance depends a great deal on whether one is interested in response rates or completion rates, as well as how one defines completion and return rates. The online survey is perhaps the simplest case. It generated by far the lowest return rates for all definitions, as well as very low completion rates. Comparing the paper and tablet modes, the paper survey had a much better return rate – 18 percentage points better – if the return rate is calculated as the percentage of passengers approached by a surveyor who returned a survey. Similarly, looking at *complete* surveys, paper performed at least 11 percentage points better than the tablet mode by all five definitions of completeness tested as a percentage of passengers approached. Both tablet and paper performed well in terms of complete responses as a percentage of returned surveys, with tablets marginally better at obtaining responses to all questions, or no more than one question skipped.

Next, the report analyzed the relative performance of the survey modes in terms of how often respondents answered particular questions or types of questions. Key findings are that:

- One key finding is that the tablet and online surveys performed better than paper for almost all questions, with the notable and important exception that the paper outperformed the tablet on the income question by 6 percentage points. However, the *magnitude* of the differences was minimal for most questions, with no difference greater than 11 percentage points and 5 percentage points or less in three-quarters of the comparisons across modes for any question.
- When questions were grouped into types, by either format or subject matter, the most striking finding was that the questions rating Muni service, which also uniquely appeared in a matrix format on the paper and online surveys, had the highest missing rates.
- An analysis of the usability of the geographic data that respondents provided found that all three survey modes generated similar percentages of geocodable trip origin address data (Q1B), but the online and tablet surveys generated modestly more usable home zip codes (a 5 percentage point improvement).

One survey question asked respondents to estimate their time on the travel vehicle. The online survey obtained a higher proportion of responses from short-trippers than did the paper surveys. (There was no statistically significant difference between the proportion of short-trippers from the tablet mode and either of the other two survey modes.)

An analysis of the four stated preference questions explored the variation in service quality ratings across the three survey modes. For every question, the mean service quality rating was higher for the tablet surveys than for either of the other survey modes, and these differences were statistically significant.

Turning to the socio-demographic characteristics of the people who responded to each survey type, the tablet and paper surveys performed within five percentage points of each other at representing all population groups. In a few cases these differences were statistically significant for population groups particularly important for equity analyses, with the paper survey capturing lower proportions of African-American and LEP passengers, but a higher proportion of very low-income and Asian passengers.

Finally, the report compares the cost of the three survey modes in terms of the on-board surveyor and data entry time required to generate each complete. The paper surveys required the fewest labor hours per complete by all definitions of completeness. The tablet surveys required from 50% to 100% more labor hours, depending on the definition of completeness, and the online surveys required considerably more labor.

WHAT IS THE BENEFIT?

The study results were of primary interest to transit agencies, which are now required to survey their passengers at least once every five years, and the transportation and market research consultants who carry out these surveys on behalf of the transit agencies. The results of this research directly informed the selection of survey mode by quantifying the cost and quality tradeoffs. Furthermore, this work assisted in the design of the chosen survey mode to ensure appropriate response rates and the inclusion of environmental justice populations.

This work was very useful to transportation planners at municipal and regional agencies, such as metropolitan planning organizations, which undertake travel surveys for the purposes of informing their travel demand models. This work provided tools for assisting these agencies to be critical consumers of surveys conducted by their partners as well as for informing their own travel survey methodologies. Since these agencies often provide the key funding for transit passenger surveys, it is essential that they are aware of survey mode tradeoffs.

More broadly, this work expanded the understanding of innovative surveying methods. This work specifically assisted in the design of mixed survey modes that incorporate intercept and follow up elements. In addition, this work was of particular use to those interested in surveying populations, which have historically demonstrated low participation rates in such efforts, including minorities and LEP populations.

Final Report Link: http://transweb.sjsu.edu/PDFs/research/1206-transit-passenger-surveys-quality-and-cost-comparison.pdf

MINETA TRANSPORTATION INSTITUTE

Comparing Data Quality and Cost from Three Modes of On-Board Transit Passenger Surveys

MTI Report 12-46

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The Mineta Transportation Institute (MTI) was established by Congress in 1991 as part of the Intermodal Surface Transportation Equity Act (ISTEA) and was reauthorized under the Transportation Equity Act for the 21st century (TEA-21). MTI then successfully competed to be named a Tier 1 Center in 2002 and 2006 in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). Most recently, MTI successfully competed in the Surface Transportation Extension Act of 2011 to be named a Tier 1 Transit-Focused University Transportation Center. The Institute is funded by Congress through the United States Department of Transportation's Office of the Assistant Secretary for Research and Technology (OST-R), University Transportation Centers Program, the California Department of Transportation (Caltrans), and by private grants and donations.

The Institute receives oversight from an internationally respected Board of Trustees whose members represent all major surface transportation modes. MTI's focus on policy and management resulted from a Board assessment of the industry's unmet needs and led directly to the choice of the San José State University College of Business as the Institute's home. The Board provides policy direction, assists with needs assessment, and connects the Institute and its programs with the international transportation community.

MTI's transportation policy work is centered on three primary responsibilities:

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MTI works to provide policy-oriented research for all levels of government and the private sector to foster the development of optimum surface transportation systems. Research areas include: transportation security; planning and policy development; interrelationships among transportation, land use, and the environment; transportation finance; and collaborative labor-management relations. Certified Research Associates conduct the research. Certification requires an advanced degree, generally a Ph.D., a record of academic publications, and professional references. Research projects culminate in a peer-reviewed publication, available both in hardcopy and on TransWeb, the MTI website (http://transweb.sjsu.edu).

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The educational goal of the Institute is to provide graduate-level education to students seeking a career in the development and operation of surface transportation programs. MTI, through San José State University, offers an AACSB-accredited Master of Science in Transportation Management and a graduate Certificate in Transportation Management that serve to prepare the nation's transportation managers for the 21st century. The master's degree is the highest conferred by the California State University system. With the active assistance of the California Department of Transportation, MTI delivers its classes over a state-of-the-art videoconference network throughout the state of California and via webcasting beyond, allowing working transportation professionals to pursue an advanced degree regardless of their location. To meet the needs of employers seeking a diverse workforce, MTI's education program promotes enrollment to under-represented groups.

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MTI promotes the availability of completed research to professional organizations and journals and works to integrate the research findings into the graduate education program. In addition to publishing the studies, the Institute also sponsors symposia to disseminate research results to transportation professionals and encourages Research Associates to present their findings at conferences. The World in Motion, MTI's quarterly newsletter, covers innovation in the Institute's research and education programs. MTI's extensive collection of transportation-related publications is integrated into San José State University's world-class Martin Luther King, Jr. Library.

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REPORT 12-46

COMPARING DATA QUALITY AND COST FROM THREE MODES OF ON-BOARD TRANSIT PASSENGER SURVEYS

Asha Weinstein Agrawal, Ph.D.
Stephen Granger-Bevan
Gregory Newmark, Ph.D.
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16. Abstract

This report presents the findings from a research project investigating the relative data quality and administration costs for three different modes of surveying bus passengers that produce results generalizable to the full passenger population. The three modes, all of which used survey methods distributed or administered onboard the transit vehicle, were: self-complete paper surveys, self-complete online surveys, and interviewer-assisted tablet-based surveys. Results from this study indicate several implications for practitioners choosing a survey mode. First, and most importantly, the analysis reinforces the point that there is no single, best survey mode. The choice of mode must depend on an agency's priorities for what questions most need to be answered, what population groups are most important to represent, and exactly how the agency chooses to define concepts like a "complete" survey or a "usable" address. Findings suggest several general recommendations for current survey practice: (1) online surveys administered via an invitation distributed on the transit vehicle are not a good option; (2) old-fashioned, low-tech paper survey may still be the best option for many bus passenger surveys; (3) changes in survey results that accompany changes in survey methods should be interpreted with caution; and (4) using a new survey method, especially one relying on more complex technologies, may create unexpected glitches.

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The authors also thank Mineta Transportation Institute staff, including MTI Executive Director Karen Philbrick, Ph.D.; Director of Communications and Technology Transfer Donna Maurillo, who also provided additional editorial and publication support; Research Coordinator Joseph Mercado; and Webmaster Frances Cherman.

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EXECUTIVE SUMMARY

This report presents the findings from a research project investigating the relative data quality and administration costs for three different modes of surveying bus passengers that produce results generalizable to the full passenger population. The three modes, all of which used survey methods distributed or administered onboard the transit vehicle, were: self-complete paper surveys, self-complete online surveys, and interviewer-assisted tablet-based surveys. While there is a great deal of research comparing new and traditional survey modes in general, almost none of it has focused on the unique needs of transit surveys, a gap that this study contributes to filling.

STUDY METHODS

The research was set up with an experimental design, so the same survey questionnaire was distributed via three different survey modes. All factors about the survey and distribution process were kept identical to the extent feasible, so the only variation would be the survey mode itself. The firm of Corey, Canapary & Galanis Research (CC&G) administered the survey on a subset of San Francisco Municipal Transportation Agency (SFMTA) bus routes chosen to represent a heterogeneous set of SFMTA passengers.

The questionnaire was designed to include a variety of the types of questions asked of transit passengers, yet not to be longer than is typically used for passenger surveys (and not so long as to deter respondents from completing the survey). In addition, the questionnaire was designed to collect the passenger information that the Federal Transit Administration (FTA) Circular VI[1] requires transit agencies to collect by survey for equity analyses, including income, race/ethnicity, and fare payment method.

The three different survey modes, all administered to passengers on a bus, were:

- Paper: Self-administered paper surveys with a mail-back option
- Online: Self-administered online surveys, with the invitation on a postcard printed with a URL and QR code
- Tablet: Interviewer-administered surveys recorded on tablet computers, with a paper mail-back option for respondents making short trips and for non-English-speaking Spanish speakers

The analysis focused on several key questions:

- Did return and completion rates vary by survey mode?
- Did the percentage of respondents skipping or providing unusable information for particular questions or question types vary by survey mode?
- Did responses vary across socio-demographic characteristics by survey mode?

- Did responses vary depending on passenger travel behavior by survey mode?
- Did customer satisfaction levels vary by survey mode?
- What was the cost per complete survey by mode?

SUMMARY OF FINDINGS

In terms of the return and completion rates, the survey modes' relative performance depends a great deal on whether one is interested in response rates or completion rates, as well as how one defines completion and return rates.

The online survey is perhaps the simplest case. It generated by far the lowest return rates for all definitions, as well as very low completion rates.

Comparing the paper and tablet modes, the paper survey had a much better return rate – 18 percentage points better – if the return rate is calculated as the percentage of passengers approached by a surveyor who returned a survey. This performance difference between the modes reflects the fact that many more passengers who were approached by surveyors refused to take the tablet survey than refused to take the paper survey. These relative refusal and return rates suggest that the paper survey was the mode that better reflected the underlying bus passenger population. Similarly, looking at *complete* surveys, paper performed at least 11 percentage points better than the tablet mode by all five definitions of completeness tested as a percentage of passengers approached. Both tablet and paper performed well in terms of complete responses as a percentage of returned surveys, with tablets marginally better at obtaining responses to all questions, or no more than one question skipped.

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- The tablet and online surveys performed better than paper for almost all questions, with the notable and important exception that the paper outperformed the tablet on the income question by 6 percentage points. However, the *magnitude* of the differences was minimal for most questions, with no difference greater than 11 percentage points and 5 percentage points or fewer in three-quarters of the comparisons across modes for any question.

- When questions were grouped into types, by either format or subject matter, the most striking finding was that the questions rating Muni service, which also uniquely appeared in a matrix format on the paper and online surveys, had the highest missing rates.

- An analysis of the usability of the geographic data that respondents provided found that all three survey modes generated similar percentages of geocodable trip origin address data (Q1B), but the online and tablet surveys generated modestly more usable home zip codes (a 5 percentage point improvement).

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An analysis of the four customer service questions explored the variation in service quality ratings across the three survey modes. For every question, the mean service quality rating was higher for the tablet surveys than for either of the other survey modes, and these differences were statistically significant.

Turning to the socio-demographic characteristics of the people who responded to each survey type, the tablet and paper surveys performed within five percentage points of each other at representing all population groups. In a few cases these differences were statistically significant for population groups particularly important for equity analyses, with the paper survey capturing lower proportions of African-American and low English proficiency (LEP) passengers, but a higher proportion of very low-income and Asian passengers.

Finally, the report compares the cost of the three survey modes in terms of the on-board surveyor and data entry time required to generate each completed survey. The paper surveys required the fewest labor hours per “complete” by all definitions of completeness. The tablet surveys required from 50% to 100% more labor hours, depending on the definition of completeness, and the online surveys required considerably more labor.

IMPLICATIONS FOR PRACTICE

This study suggests several implications for practitioners choosing a survey mode. First, and most importantly, the analysis reinforces the point that there is no single, best survey mode. The choice of mode must depend on an agency’s priorities for what questions most need to be answered, what population groups are most important to represent, and the precise definitions that will be used to define a concept like a “complete” survey or a “usable” address.

The study findings suggest several general recommendations for current survey practice:

1. Online surveys administered via an invitation distributed on the transit vehicle are not a good option.

2. The old-fashioned, low-tech paper survey may still be the best option for many bus passenger surveys.

3. Changes in survey results that accompany changes in survey methods should be interpreted with caution.

4. Using a new survey method, especially one relying on more complex technologies, may create unexpected glitches.

I. INTRODUCTION

This report presents the findings from a research project investigating the relative data quality and administration costs for three different modes of surveying bus passengers that produce results generalizable to the full passenger population. The three modes, all of which used survey methods distributed or administered on board the transit vehicle, were self-complete paper surveys, self-complete online surveys, and interviewer-assisted tablet-based surveys.

Many transit agencies invest substantial financial and time resources into surveying their customers, with costs easily running $500,000 to $1 million for a large agency. For example, the 2006 survey of passenger origins and destinations on Chicago's Metra commuter rail system cost more than $600,000. Agencies are willing to fund these expensive surveys because the data collected are fundamental inputs for a wide range of purposes that include travel modeling, system-wide or route-level planning, improving service design, and communicating with existing customers.[2]

In the fall of 2012, the Federal Transit Administration (FTA) issued a circular that created new surveying requirements for large transit agencies.[3] This circular, "Title VI Requirements and Guidelines for Federal Transit Administration Recipients," provides guidance for compliance with Title VI of the Civil Rights Act, which prohibits discrimination in programs receiving federal funding. The circular directs larger transit agencies to conduct these surveys every five years and ensure participation from minority and low-income populations who have historically under-participated in such efforts. This directive will require many agencies to survey their ridership more frequently than they have in the recent past. Thus, agencies have an even stronger interest than before in identifying which survey methods minimize costs while still gathering high-quality data.

Traditionally, transit agencies designing passenger surveys rarely consider choosing among different survey modes as a key decision that might affect both cost and quality. Because paper-based, self-completed surveys were considered the industry standard, the key considerations were simply how to make the best choices about designing a paper self-complete survey. However, 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 postcards that collect phone 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 the request 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 compared with self-completed paper surveys. However, only two studies have attempted to document the relative response rates, respondent demographics, or survey completion rates of different survey modes for transit passengers.[4] Thus, transit agencies seeking to employ innovative methods to meet their new surveying requirements have little guidance about how to proceed. For example, is it reasonable to save money by switching from traditional paper-based surveys to internet-based ones without compromising data quality? Conversely, do the more costly hybrid surveys actually provide better quality data than paper-based surveys?

The research reported here begins to fill that knowledge gap. 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). All variables of the survey implementation process were kept as similar as possible across the three survey modes, so the one key variation would be the survey mode itself. The three modes used were variations on self-complete paper, self-complete online, and interviewer-assisted tablet surveys.

The next chapters of this report review additional matters related to the challenges of choosing a survey mode for on-board passenger surveys and the existing literature (Chapter II and III), and then describe the study methodology (Chapter IV). Chapter V describes the detailed research findings, and Chapter VI presents summary findings, study limitations, and implications for practice.

II. THE CHALLENGES OF ON-BOARD PASSENGER SURVEYS

To design an appropriate experimental survey for this study, the research team conducted interviews with both transit survey experts and agency staff managing such surveys. The interviews focused on the following topics:

- How the agencies use passenger survey results
- The types of challenges the agencies face with passenger surveys
- The extent to which agencies are considering new passenger survey mode options

Interviews were selected as an appropriate method to complement a review of research because the literature specific to on-board transit passenger surveys is sparse.

A total of 43 interviews were conducted. The researchers began by interviewing seven survey experts who work for firms that transit agencies frequently hire to conduct passenger surveys, and eight other professionals with surveying expertise who work for regional agencies or other government bodies. These experts were asked about the challenges they face in conducting quality surveys, their experience with new survey modes, and their predictions for what survey modes will be most widely used in future. For the next phase of the research, the researchers interviewed staff from 28 agencies, choosing one member at each who manages surveys. The agencies were selected to cover a wide range of transit operator types, from small to large and urban to suburban. Questions were asked about the agencies' history of on-board surveys, changes being made to introduce new technologies into the survey process, and challenges encountered (and overcome) in their survey processes. (See Appendix A for more details on the interview process.)

The following sub-sections discuss the three themes the interviews covered: the uses to which the survey results are put, the challenges specific to surveying bus passengers, and the extent to which agencies are considering or using new survey modes.

THE USES FOR PASSENGER SURVEY DATA

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, marketing, and customer outreach purposes. In addition, the data may be used by other agencies, such as metropolitan planning organizations, which develop travel demand models. Finally, these data are needed to inform applications for capital funding, such as through the Federal Transit Administration (FTA) New Starts program. 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.[5] Some more recent surveys also pursue a fourth type of knowledge: how users might react to proposed policy changes (stated preference).

In 2012, the FTA instituted new civil rights guidelines for transit agencies, which impact passenger surveys.[6] While maintaining a robust surveying program has always been good transit practice, the new guidance now makes such practice a legal requirement for transit

providers operating 50 or more fixed-route vehicles in peak service and located in an urbanized area with a population of 200,000 or more. Further, the circular imposes rules requiring surveys be conducted more frequency than some agencies did in the past, as well as rules requiring that surveys collect certain types of data that were not always a focus for all agencies in the past. These providers are required to collect and report survey data regarding customer demographics, travel patterns, and fare type usage at least once every five years as an explicit component of their Title VI Program.

To meet these new requirements, many transit agencies must undertake surveys in the near future. Further, these agencies must make good-faith efforts to ensure participation from minority and low-income passengers who have historically under-participated in such efforts. Finally, extra concern must be given to reaching low English proficiency (LEP) populations, which adds staffing and logistical challenges.

CORE TRANSIT AGENCY CONCERNS

Cost Concerns

Transit agencies operate in a difficult budget environment in which passenger and other revenues fall substantially short of actual expenditures. Because the difference is made up through public subsidy, transit budgets face a high level of scrutiny – particularly for the cost of activities that do not directly serve passengers. Transit boards anxious to balance budgets are often quite receptive to reducing costly data collection efforts, such as on-board surveys.

The FTA Title VI Circular[7] raises demands on transit agencies to survey their riders, which in turn raises the specter of increased costs. As noted above, survey costs can be quite substantial – exceeding $1 million for a large agency. Historically, agencies suffering budget challenges might postpone, curtail, or avoid surveying efforts. The new guidance, by requiring surveying on a periodic basis and specifying new types of questions that must be included on those surveys, limits these options for managing costs and thus increases agency interest in less expensive survey modes.

Data Quality Concerns

Transit agencies generally recognize the value of on-board surveying as a critical tool for understanding ridership and improving transit service. Given the cost concerns noted above, transit agencies are concerned that expenditures on surveying pay off in terms of gathering useful data. While the statistical sophistication of transit agencies varies widely, transit agencies do want to collect high-quality data. Such collection requires three elements: achieving high response rates, achieving high survey completion rates (especially difficult for certain question types), and obtaining responses from people representing all rider demographics.

The FTA Title VI Circular has also raised the attention level that agencies must give to data quality, as a poor data collection effort might leave an agency susceptible to legal challenges. A staff member from one large transit agency interviewed for this project noted

that the agency was modifying past survey efforts to collect new data required to meet the Title VI requirements:

> On the 2014 survey we're asking even more questions. We've met … with the Title VI folks from the federal government, and we've talked with them about what they would want us to ask on these surveys, what they would need to see in order for them to say our agency's OK as far as Title VI is concerned.

The transit environment poses many special challenges that are not all typical of other survey types. This section summarizes some of the key challenges of surveying bus passengers that could impact data quality.

The Bus Environment Makes Survey Completion Difficult for Passengers

The first challenge is often the physical environment on a bus, which does not make it easy for passengers asked to complete a survey. Surveys are typically conducted on moving vehicles, under crowded, noisy conditions with many people standing. These conditions do not lend themselves well to personal interviews, as privacy is limited. As for surveys, there is usually no convenient place for passengers to fill out the survey instrument. The problem is especially acute for standing passengers, so they are especially unlikely to return a completed survey.

Bus Environments Makes Survey Distribution Difficult for Surveyors

A second and related challenge is survey distribution and collection in crowded vehicles. Crowding not only makes it difficult for passengers to complete a survey, it makes it difficult for a surveyor to distribute and collect surveys. Because surveys are more easily accomplished during off-peak periods and the shoulders of the peak, a perennial concern is that surveys are over-representing off-peak passengers and under-representing peak passengers, and thus not truly reflecting the riding population.

"Short Trippers" are Difficult to Survey

A third challenge with surveying passengers on buses, especially in urban areas, is that many of them may be 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. As one interviewee from a large agency explained:

> ... if you are trying to get people on the bus to fill out [a survey], you get about half of them incomplete, and the biggest reason is because people just don't have time to fill it out.

And another interviewee, from a smaller agency in a university town in the South, discussed the same challenge in even stronger terms:

> There are a lot of times [riders] are only on the bus for a short time, so when we pick the surveyors we have to make sure we have energetic bubbly-type people that could hold those folks' attention … 'cause if you take too long, if a survey run[s] past a minute, they [are] gone.

Non-English Speaking and Illiterate Passengers are Hard to Survey

A fourth challenge is that many agencies must survey passengers who do not speak, read, and write in English. Some passengers may not be literate in any language, and many agencies serve non-English-speaking passengers who come from numerous language traditions. These passengers form a population group that is explicitly protected under the FTA's interpretation of the 1964 Civil Rights Act, making their responses critical, as well as difficult to obtain.

Two experts mentioned that non-English speaking people may also have very low literacy rates. An interviewee at a large transit agency in the South commented:

> At least a quarter of [the surveys] were obviously unusable for reasons of illiteracy … we'd get cards where, for instance, someone had checked every box believing that the people around them wouldn't realize that they were illiterate.

Issues of language and literacy complicate the representativeness of a survey. Surveyors can assist illiterate patrons in completing the survey, but that engagement may be socially difficult and may come at the expense of other surveying responsibilities, such as distributing surveys. Non-English speakers can be served by survey materials printed in another language (assuming literacy) or by foreign language surveyors. Both accommodations add costs to a survey. Also, while these can be good solutions in regions with only one non-English speaking community, many transit agencies operate in regions with many non-English communities, where serving all relevant groups could prohibitively drive up costs. A related concern is that non-English speakers may be more likely to be undocumented and wary of completing a survey sponsored by a government agency.

Respondents Often Skip Questions

A fifth challenge is obtaining responses to all the survey questions. Respondents often pick and choose the questions to answer. Therefore, key questions may go unanswered. A perennial challenge is having respondents reveal personal information, particularly income, but also age and race/ethnicity – sensitive information that is directly and legally relevant to discrimination concerns. Transit on-board surveys also have trouble acquiring accurate travel information from passengers. A common area of passenger confusion arises with the definition of key transit planning concepts that are hard to communicate in surveys, such as a "trip" or a "transfer." Similarly, many patrons have trouble accurately reporting their off-vehicle origin and destination information. This is often incorrectly reported as the boarding and alighting stop locations, or else the information is recorded in a way that is not easily converted into a geocodable location. For example, people may write "home" as a trip end, rather than providing their home address. Further, even people who understand the question may not be able to recall the address or location of a given trip end, or they may not have a destination more precise than a general neighborhood, such as someone going "downtown."

INTEREST IN AND EXPERIENCE WITH NEW SURVEY METHODS

Given the challenges noted above, the current research explores transit agency staff interest in alternative surveying modes. Here, interest varied. Many of the agency staff interviewed expressed a desire for caution and said that they planned to continue to use traditional surveying modes, primarily paper self-completes, because they were familiar with the method, and the upfront costs are low. However, a handful of interviewees did express a strong interest in alternative surveying modes, from postcards to gathering telephone numbers for a subsequent computer-assisted telephone interview (CATI) survey, to an on-board computer-assisted personal interview (CAPI) on a tablet computer.

The surveying experts interviewed reported that the interest in alternatives to the paper self-completes is relatively new (within the last four years). The attributed motivations for this interest varied. Some agencies felt that their patrons expected them to embrace the same technologies that were widely penetrating their ridership. Others see new approaches as overcoming perennial surveying challenges, such as obtaining location data. There was also interest in approaches that automated data collection. One example of a technology that has been used is asking passengers to take a card when they board and return it when they alight. This card has a barcode that can be scanned on boarding and alighting, thus documenting the bus trip origin and destination. Another technology of interest uses wireless sniffers to identify where people carrying wireless devices get on and off vehicles.

Several interviewees talked about their experiences distributing postcards on-board the vehicle to request a phone number, and then following with a CATI survey. Advantages mentioned included that this method may capture more non-English speakers. A key disadvantage mentioned more than once was that people may not remember the specific details of their trip accurately even a day later. This method is also much more expensive than paper self-completes.

Interviewer-assisted tablet surveys are another new mode that some agencies have tried, hoping to collect higher-quality data. Potential advantages are the ability to capture responses from illiterate passengers and the option to geocode location information during the survey process. However, a number of interviewees expressed concerns about the tablet approach. The use of tablet computers was generally considered problematic by staff at agencies where non-English-speaking immigrants might be wary of anybody collecting data about their activities. Another interviewee observed that, while technophiles might like the idea of using tablets to record data, the same is not true of passengers of all generations:

> For [students], if somebody came up to you with a tablet to start the survey, you wouldn't have second thoughts of it at all. You would just answer the questions. You come up to me and [people] in my generation ... I am very skittish of what you are doing because I have no idea what you are putting into that tablet and what you are going to do with it. Thank you very much, but I am not going to take the survey.

Some transit agency staff described how their desire to move toward survey methods that used more technology was coupled with concern about staff time to manage the technologies. These interviewees saw paper surveys as familiar and easy to administer. (Several agency staff interviewed described the costs of administering their surveys as

“just printing.”) Introducing new technologies, by comparison, was perceived as bringing risks of extra work for which no particular staff member would be responsible. Comments of this nature were particularly frequent amongst small transit agencies where staff members have multiple responsibilities, but interviewees from some of the largest agencies also made the same the point. One interviewee at a large agency noted that no single individual has responsibility for system-wide on-board surveys because they are required only once in every three years.

Finally, some interviewees mentioned interest in moving transit passenger surveying onto the web. A few small agencies reported doing this. They would simply advertise to their passengers an on-line survey. Another approach that a couple of agencies are using is to develop panels of passengers who are emailed directly with a request to complete an on-line survey. One survey expert interviewed thinks internet-only surveys may be the wave of the future because most people do now have at least some web access.

III. LITERATURE REVIEW: NEW SURVEY MODES

In the last two decades, surveying practices across all industries have been evolving significantly in response to cultural and technological developments.[8] Traditional approaches such as random-digit-dialing telephone surveys and mail-back surveys are becoming less reliable, with falling response rates.[9] 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 US.[10] 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 because some groups, such as elderly or low-income passengers, are less likely to have internet access.[11]

While there is a great deal of research comparing new and traditional survey modes in general,[12] almost none of it has focused on the unique needs of transit surveys, a gap that this study contributes to filling. Specific to transit, the research team 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.[13] In addition, the research team found only two studies that compare data quality across two survey modes. Work done by NuStats for Los Angeles County examined the data quality for demographic and trip questions that were tested with two modes: mail-back surveys and another approach in which passengers completed a postcard on-board and returned it to the surveyor when exiting the bus.[14] To document the origin and destination for that trip, the surveyor recorded the stop at which each postcard was distributed and collected. More recently, Cummins, et al. compared customer satisfaction question responses from paper surveys distributed on-board and surveys emailed out to a list of agency passengers.[15] 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.

IV. SURVEY METHODOLOGY

The research was set up with an experimental design, so the same survey was distributed via three different survey modes. All factors about the survey and distribution process were kept identical to the extent feasible, so the only variation would be the survey mode itself.

SURVEY MODES

The three different survey modes, all administered to passengers on a bus, were:

- Paper: Self-administered paper surveys with a mail-back option.
- Online: Self-administered online surveys, with the invitation on a postcard printed with a URL and QR code. To ensure that responses were associated with a specific bus route and time of day, respondents were asked to enter into the survey a “run identifier” code that was written on their postcard.
- Tablet: Interviewer-administered surveys recorded on tablet computers, with a paper mail-back option for respondents making short trips and for non-English-speaking Spanish speakers.

The paper method was selected because it is the current industry standard. The tablet method was chosen because there is currently considerable interest in the industry to see whether these interviewer-assisted surveys might generate higher-quality data. Finally, the online option was included because it is perceived to offer potential cost-savings by removing data-entry costs, yet the method still ensures that a random sample of current passengers receive the survey invitation.

SURVEY QUESTIONNAIRE

The same survey questionnaire was used for all three modes, with the only variation across them being design differences required to accommodate the different survey modes (e.g., instructions were spoken for the tablet surveys but written for the paper and online surveys). The paper survey, postcard, and online survey were all available in both English- and Spanish-language versions. (For the tablet survey, non-English-speaking Spanish speakers were offered a paper survey.)

The questionnaire was designed to include a variety of the types of questions asked of transit passengers, yet not to be longer than is typically used for passenger surveys (and not so long as to deter respondents from completing the survey). In addition, the questionnaire was designed to collect the information FTA Circular VI required transit agencies to collect by survey for equity analyses.

The survey asked 20 numbered questions, a few of which had multiple parts (Figure 1). Additionally, there was an opportunity for people to write comments at the end of the paper and online surveys. (For the tablet survey, people were not asked if they had additional comments, but the interviewers recorded any volunteered comments.) One section

of the survey asked seven questions about the trip the respondent was making when s/he received the survey invitation. In addition to asking about the type of trip and the fare payment used, the questionnaire asked respondents to provide the address or nearest intersection where they started the trip. (To minimize the survey length, and because the complete trip information was not necessary for this research project, the destination was not asked.) In addition to trip-specific information, two travel behavior questions asked about frequency of using SFMTA and personal vehicle availability. Another section asked respondents their opinions about the quality of SFMTA service and if they would support a proposed change to the route structure. The survey also gathered home zip codes, plus socio-demographic information about age, race, and ethnicity, languages spoken at home, and household income and size..

Most questions used a standard multiple-choice format, but four questions used a multiple-choice matrix and three others asked for free-format responses. The variety of question formats was chosen both for survey readability and also to test different question types across the survey modes.

SURVEY IMPLEMENTATION

As noted above, the surveys were distributed to the extent possible in identical fashion across all three modes to minimize as much as possible any administration differences other than the survey mode itself.

All surveys were distributed on the same five bus routes operated by the San Francisco Municipal Transportation (SFMTA). The SFMTA serves a diverse community, with passengers of widely different incomes, races, and ethnicities, as well as many passengers who do not speak English. Passengers also use SFMTA buses for both commute and other trip types. The routes – the 5, 5L, 24, 33, and 48 – were chosen to represent a heterogeneous set of SFMTA passengers. For example, the routes passed through neighborhoods with different residential demographics, and some routes were short and others relatively long. Some routes were selected to ensure that the surveyors would face the practical challenge of crowded buses, although the most crowded lines were avoided. The surveying was conducted on Mondays through Thursdays, April 14 to May 1, 2014, from 6 a.m. to 10 p.m.

The firm of Corey, Canapary & Galanis Research (CC&G) administered the survey. CC&G used seven surveyors, all of whom had experience with prior transit surveys. All surveyors were trained for this project at the same time, and all worked across the three survey modes. Three or more different surveyors worked on each bus route.

The surveyor assignments were carefully scheduled so the surveys were distributed by each mode at similar times of day, days of the week, etc. For example, on a particular route, surveyors might administer paper surveys on the 7 a.m. bus run, online surveys on the following bus run, and tablet surveys on the run after that. In addition, the project was designed so roughly the same amount of interviewer time was spent distributing the paper and postcard surveys. In anticipation of the greater surveyor time commitment required to obtain each completed tablet survey, a larger proportion of surveyor time was assigned for those surveys.

V. SURVEY FINDINGS

This section discusses the study results, comparing the three survey modes in terms of overall survey response and completion modes, the response rate for individual questions and types of questions, and respondent socio-demographics. The section ends with a brief discussion of the relative costs by survey mode.

Some further analysis of the 238 online survey responses was performed and is detailed in Appendix B. In addition to other information, metadata from the online survey included the type of device used and time at which the survey was started. These were cross-referenced with data provided in the survey itself.

OVERALL SURVEY RESPONSE AND COMPLETION RATES, BY SURVEY MODE

A primary study goal was to compare among survey modes the proportion of eligible passengers who were *offered* the survey and who also *returned* a survey, either partially or fully completed. High response rates reduce the likelihood of non-response bias, namely that people not answering the survey are statistically distinct from those who do answer. Response rates therefore are crucial for increasing the confidence that the data collected from the sample reflects the actual population. For this reason, a high response *rate* is typically seen as more important to transit agencies than a high *number* of responses.

Table 1 presents the numbers of passengers who received a survey, who refused to participate in the survey process, who returned a survey, and the return and refusal rates for each mode. Passengers returned a total of 3,364 usable surveys: 238 online, 777 by tablet, and 2,349 on paper.

Table 1 also compares the rates at which passengers agreed to participate in the survey project, defining the return rate in two ways. Return Rate A compares the number of returned surveys with any usable information at all with the total number of surveys distributed. Return Rate B instead looks at returned surveys as a proportion of the number of passengers approached by surveyors. (This is the sum of the people to whom a survey was distributed, plus people who declined to participate.)

Table 1. Numbers of Passengers Who Received, Refused, and Returned Surveys, and Return and Refusal Rates, by Survey Mode

	Paper	Online	Tablet
NUMBERS OF PASSENGERS WHO RECEIVED, REFUSED, AND RETURNED SURVEYS			
Passengers[a] who received a survey (a)	2,595	2,721	869[b]
Passengers who refused a survey due to language barrier (b)	196	195	206
Passengers who refused a survey for a reason other than language barrier (c)	1,183	778	908
Total number of passengers approached (a) + (b) + (c) = (d)	3,974	3,694	1,983
Total number of passengers who returned a survey (e)	2,349	238	777[c]
RETURN AND REFUSAL *RATES*			
Return Rate A: Passengers returning a survey (e) / Passengers receiving a survey (a)	91%	9%	89%
Return Rate B: Passengers returning a survey (e) / Total number of passengers approached (d)	59%	6%	39%
Refusal Rate: Passengers refusing a survey (b) + (c) / Total number of passengers approached (d)	35%	26%	56%

[a] Passengers were adults 18 years or older who had not previously participated in the survey and did not work for the transit agency. The survey excluded minors in order to comply with San José State University's Institutional Review Board requirements. Only passengers directly approached by the surveyor are included in this analysis.

[b] Passengers unable to complete the tablet survey on-board were offered a paper survey to complete and mail back. A total of 92 passengers received a paper version of the survey.

[c] A total of three passengers who were approached returned a survey by mail.

The online survey performed by far the worst: fewer than 10% of passengers returned the online survey by either return rate definition. By contrast, both the tablet and paper surveys had much higher return rates. For Return Rate A, the paper and tablet modes performed almost identically, with around 90% of surveys returned. However, because fewer riders refused to participate in the paper survey, that mode performed considerably better for Return Rate B, which looked at returned surveys as a proportion of all passengers who were approached (59% vs. 39%).

Table 2 examines the percentages of surveys that can be deemed "complete" because most consumers of bus passenger survey data use only the data from surveys deemed complete. Because different data users have different needs from a survey, this analysis uses many different possible definitions of a "completed survey," categorized into four groups. A major challenge of on-board surveys is gathering sufficient information to accurately identify trip origins and destinations. For this reason, this analysis of completeness includes the requirement that the data provided by a respondent can be reasonably geocoded, i.e., attributed to a specific latitude and longitude coordinate. Groups I and II differ from Groups III and IV in terms of whether or not location questions are considered "complete" if the address given could not be geocoded. (See section below on "Usability of Address Data" for a discussion of how the authors determined whether location data was geocodable.)

Each group looks at a set of five definitions that vary by the required minimum number of questions answered and whether or not the trip origin question or most of the demographic questions were answered. The trip origin address question is considered because it is important for modeling, while the demographic questions are considered because this information is critical for the equity analyses required by the FTA's Title VI Circular.

Table 2. Survey Completeness[a] Statistics, by Survey Mode, for Different Definitions of "Completeness"

	Paper	Online	Tablet
ANSWERS TO LOCATION QUESTIONS CONSIDERED "COMPLETE" EVEN IF THE RESPONSE CANNOT BE GEOCODED[b]			
Group I: Completeness rates calculated as a percentage of returned surveys			
C-Rate A) All questions complete	62%	76%	67%
C-Rate B) No more than one question skipped	63%	91%	86%
C-Rate C) At least ten questions complete, including the trip origin address and five demographic questions	88%	88%	87%
C-Rate D) At least ten questions complete, including trip origin address	92%	91%	88%
C-Rate E) At least ten questions complete	98%	99%	99%
Group II: Completeness calculated as a percentage of passengers approached			
C-Rate F) All 21 questions complete	37%	5%	26%
C-Rate G) All except one question complete	49%	6%	34%
C-Rate H) At least ten questions complete, including the trip origin address and five demographic questions	52%	6%	34%
C-Rate I) At least ten questions complete, including trip origin address	54%	6%	34%
C-Rate J) At least ten questions complete	58%	6%	39%
ANSWER TO LOCATION QUESTIONS CONSIDERED "MISSING" IF THE RESPONSE CANNOT BE GEO-CODED[b]			
Group III: Completeness rates calculated as a percentage of returned surveys			
C-Rate K) All 21 questions complete	48%	63%	51%
C-Rate L) All except one question complete	77%	85%	79%
C-Rate M) At least ten questions complete, including the trip origin address and five demographic questions	70%	76%	66%
C-Rate N) At least ten questions complete, including trip origin address	73%	80%	67%
C-Rate O) At least ten questions complete	98%	99%	99%
Group IV: Completeness calculated as a percentage of passengers approached			
C-Rate P) All 21 questions complete	29%	4%	20%
C-Rate Q) All except one question complete	45%	5%	31%
C-Rate R) At least ten questions complete, including the trip origin address and five demographic questions	41%	5%	26%
C-Rate S) At least ten questions complete, including trip origin address	43%	5%	26%
C-Rate T) At least ten questions complete	58%	6%	39%

[a] The analysis of completed surveys considered all questions except for one question not asked of all participants (3A) and the open-ended comment section. For question 8, which asked respondents to rate SFMTA in four ways, only respondents who answered all four parts of the question were considered to have completed that question.

[b] For explanation of what address data was considered geocodable, see section below on "Usability of Address Data."

Groups I and II differ by whether completeness is calculated as a percentage of the number of *returned surveys* or as a percentage of the *total number of passengers approached* (the people offered a survey to complete). For Groups I and II, which treated location questions as complete regardless of geocodability, the online survey performed well for almost all the Group I definitions of "complete," but extremely poorly for all Group II definitions of "complete." Comparing paper and tablet, the paper survey performed better than the tablet for all definitions of "complete" calculated as a proportion of the number of passengers approached (Group II). If, however, "complete" is defined only in comparison with the

number of surveys returned (Group I), then the tablet performed about the same as the paper survey for all but one definition. For C-Rate B, the tablet performed considerably better than paper.

For Groups III and IV, location data that cannot be geocoded is considered missing. The findings mirror those from comparing Groups I and II. The on-line survey performs well if "completeness" is defined as a percentage of surveys returned (Group III) but very poorly if "completeness" is defined as a percentage of passengers approached (Group IV). Further, comparing the paper and tablet modes, they perform roughly the same for Group III, but the paper performs much better for Group IV.

It is important to note that for about 10% of the tablet surveys returned, a malfunction occurred that deleted the response to the location questions, so it is impossible to know how many of these respondents actually did answer the question. Had the tablets not malfunctioned, the completeness statistics for the tablet computers undoubtedly would have been modestly higher.

RESPONSE TO EACH SURVEY QUESTION, BY MODE

This section of the paper explores whether the percentage of respondents skipping or providing unusable information for any particular question or question type varied by survey mode.

Analysis of Skipped Questions

Table 3 presents the share of eligible surveys returned that skipped each question. (The analysis excludes only Q3, which not all respondents were asked to complete.) To identify differences by survey mode that are statistically significant ($p \leq 0.5$), the researchers conducted a contingency table analysis using standard chi-square tests to identify the presence of a statistically significant relationship within the table. Next, the researchers ran individual one-way analysis-of-variance models and post-hoc pairwise comparison tests for each question using the Bonferroni method to identify the exact statistically significant differences between each pair of modes.

Table 3. Percent of Eligible Returned Surveys Missing Each Question[a] Answer, by Mode

Survey question	Paper		Online		Tablet	
	% not answering	Stat sig diff[b]	% not answering	Stat sig diff[b]	% not answering	Stat sig diff[b]
Q1A: Trip origin place or activity	1		0		0	
Q1B: Address or nearest intersection to trip origin						
ALT1: All returned, eligible surveys	6	T	8		11	P
ALT2: Returned, eligible surveys (excluding malfunctioning tablets)[c]	6	T	8	T	2	P, O
Q1C: City of trip origin						
ALT1: All returned, eligible surveys	1	T	0	T	11	P, O
ALT2: Returned, eligible surveys (excluding malfunctioning tablets)[b]	1	T	0		2	P
Q2: How did you get to this Muni vehicle?	4	O, T	0	P	1	P
Q4: How did you pay your fare?	4	O, T	0	P	1	P
Q5: What type of fare did you pay for this trip?	4	T	2		1	P
Q6: Trip destination	3	O, T	0	P	1	P
Q7: How long will you ride this bus today?	3	O, T	0	P	1	P
Q8A: Rate Muni's frequency of service	7	O, T	2	P	1	P
Q8B: Rate Muni's on-time performance	10	O, T	2	P	1	P
Q8C: Rate Muni's Total trip time	10	O, T	3	P	1	P
Q8D: Rate Muni's overall experience	11	O, T	5	P	1	P
Q9: How often do you typically ride Muni?	4	O, T	1	P	1	P
Q10: Gender	7	O, T	2	P	1	P
Q11: Race/ethnicity	8	T	4		2	P
Q12: Age	5	T	3		1	P
Q13: Annual household income	12	T	7	T	18	P, O
Q14: Household size	7	T	4		1	P
Q15: Ability to speak English	5	T	2		1	P
Q16: Language(s) spoken at home	8	T	6		2	P
Q17: Frequency of Internet access	5	O, T	2	P	1	P
Q18: Own/access a vehicle	6	T	3		1	P
Q19: Willingness to walk an extra block to Muni to reduce trip time by 5 minutes	7	O, T	3	P	1	P
Q20: Zip code[d]	11	O, T	6	P	4	P
Optional comments	71	O, T	47	P, T	81	P, O

[a] The analysis excludes Q3 because not all respondents were eligible to answer it.

[b] Indicates a statistically significant difference by mode ($p \leq 0.05$) based on results of a one-way analysis-of-variance model followed by post-hoc pairwise comparison tests using the Bonferroni method. "T" indicates a statistically significant difference between the frequency of responses for tablet surveys and the mode noted in the column heading. "O" indicates a statistically significant difference between the frequency of responses for the online surveys and the mode noted in the column heading. "P" indicates a statistically significant difference between the frequency

of responses for the paper surveys and the mode noted in the column heading.

[c] Due to a malfunctioning tablet, 77 surveys were missing the information for Q1B and Q1C. The researchers excluded these observations from this analysis.

[d] Entries that were inaccurate or for non-U.S. locations are not coded as missing.

For all questions except the optional comment question, the percent missing ranges from 0% to 18%, with the value at 5% or less for about three-quarters of questions. (This analysis uses the Alt2 options for Q1B and Q1C, as shown in Table 2.) Turning to the open-ended and optional comments, the tablet mode had the highest rate of people recording comments (81%), and the online survey had the lowest (47%).

Comparing how each pair of survey modes performs, the clearest finding is that the tablet and online surveys performed better than the paper survey for almost all questions, with the notable and important exception that the paper outperformed the tablet on the income question by six percentage points. Comparing just tablet and online modes, the tablet slightly outperformed the online survey for all questions except for a few. The only such question with a large difference by mode was the income question: the online survey has 11 percentage points fewer missing answers.

In thinking about the *importance* of the differences in percent missing for any question, one needs to consider the magnitude of the differences. Excluding the optional comment question, the differences range from one to ten percentage points, with most quite small. In three-quarters of cases, the differences are five percentage points or fewer. Even comparing paper and tablet, the modes that vary the most, the difference is five percentage points or fewer for more than half the questions.

Usability of Address Data

A key concern of travel surveys is the quality of the location data returned: can it be geocoded? Therefore, an additional analysis tested how well each survey mode performed at generating a reasonable and geocodable address for the trip origin street address or the nearest cross streets (Q1B) and city (Q1C). The researchers used the ggmap package in the R statistical environment to query Google Maps with both questions.[16]

For each respondent's trip origin address information, the geocoding process returned latitude-longitude coordinates, an approximate address, and the type of location (e.g., street address, intersection, airport, library, hospital, zip code centroid, or municipal centroid). The location type data were used to identify trip origin addresses that were considered geocodable. This research counted as geocodable any location type smaller than a city block, such as a street address or a library. Location types that referred to larger geographic units, such as a zip code or municipality, were not considered geocodable.

Three-quarters of returned eligible surveys included geocodable location information. There was little difference between the survey modes, with 80%, 75%, and 75% geocodable locations for online, paper, and tablet surveys, respectively. There was no statistically significant difference ($p \leq 0.05$) between modes. It should be noted, however, that this analysis excludes data from 77 malfunctioning tablets that deleted all information from

Q1B and Q1C. (For these 77 surveys, it is impossible to know if respondents answered the question at all, as well as whether or not the addresses recorded were geocodable.) However, if the analysis includes those 77 additional observations, only 67% of the address locations from the tablet surveys were geocodable. This result is statistically different from the results from both the paper and online surveys.

A separate analysis investigated how the survey modes compared at collecting usable data on respondents' home zip codes (Q20), recoding each Q20 entry as either usable, missing, or unusable (e.g., 4-digit responses). Online and tablet surveys both had rates of 94% usable zip codes. Paper surveys had a slightly lower rate (89%) of usable zip codes (a statistically significant difference).

SURVEY RESPONSE BY QUESTION FORMAT AND SUBJECT MATTER, BY MODE

In addition to identifying what percentage of respondents skipped specific survey questions by mode, the researchers also analyzed how the different survey modes fared by question type (multiple choice, free-format, or matrix) or subject matter (trip data, fare details, demographics, or customer satisfaction). Table 4 presents two separate analyses of the average percentage of missing data per question-by-question format (Analysis A) and question subject matter (Analysis B).

Table 4. Average Percent Missing Data, by Survey Question Format and Subject Matter, by Survey Mode

Question	Paper	Online	Tablet
Analysis A: By Question Format[a]			
Multiple choice (Q1A, Q2, Q4-7, Q9-12, Q14-19)	5	2	1
Likert scale (Q8A-D)	10	3	1
Free-format text (Q1B-C, Q20)	6	5	3
Analysis B: By Question Subject Matter[b]			
Trip data (Q1A-C, Q2, Q6-7)	3	1	1
Fare details (Q4-5)	4	1	1
Customer satisfaction (Q8A-D)	10	3	1
Demographics (Q10-18, Q20)	7	4	3

[a] Analysis A excludes Q3 (not asked of all respondents), Q13 (household income), and optional comments by respondents.

[b] Analysis B excludes Q3 (not asked of all respondents), Q9 (frequency of Muni travel), Q19 (willingness to walk an extra block for reduction travel time), and optional comments.

Analysis A: Question Format

The researchers identified three major question formats used in the survey – multiple choice, matrix, and free-format text – and sorted the survey questions by type. Household income (Q13) was excluded because its outlier values are thought to relate more to subject matter than question format. Optional comments were excluded from the analysis because they had outlier values, and Q3 was excluded because it was not asked of all respondents.

Next, the researchers calculated the average percentage of respondents skipping questions for each category of questions, by survey mode. The Likert scale questions on the paper surveys had the highest average percentage of skipped responses (10%), approximately twice the average percentage for both multiple choice and free-format text questions. (It is unclear if this result is explained by the question format or the subject matter because the questions in these two categories are identical.) Tablet surveys had the lowest average percentage of skipped questions for all three question types, although free-format text questions had more than twice as many skipped questions as the other two question formats. For online surveys, the highest average percentage of skipped questions occurred with the free-format text questions.

Analysis B: Question Subject Matter

For this analysis, the researchers were interested in knowing how the survey modes performed depending on the question subject matter. For example, did the percentage of skipped questions by mode vary depending on whether the question focused on customer satisfaction, demographics, or trip data? Four subject matter categories were used: trip data, fare details, customer satisfaction, and demographics. (Analysis B skipped Q3 and optional comments, as in Analysis A, plus Q9 and Q19, because they did not fit into the subject matter categories chosen.) Paper surveys had the highest average percentage of skipped responses for the customer satisfaction questions at 10%. (It is unclear if this result is explained by the question format or the question subject matter because the questions in these two categories are identical.) The lowest average percentage of skipped questions across all three modes occurs for the trip data questions. For online surveys, demographic questions have the highest average percentage of skipped questions.

SURVEY RESPONSE BY SOCIO-DEMOGRAPHIC CHARACTERISTICS, BY MODE

This section of the paper compares the socio-demographic characteristics of the people who responded to each survey type (Table 5) because an essential criterion for assessing the quality of a transit passenger survey is how well it represents all types of passengers – and particularly people with the characteristics required for equity analyses. Statistical significance was tested with the same approach used for Table 3.

Table 5. Respondent Socio-Demographics, by Survey Mode

Socio-demographic category	Paper		Online		Tablet	
	% of respondents	Stat sig diff[a]	% of respondents	Stat sig diff[a]	% of respondents	Stat sig diff[a]
Gender						
Male	45		52	T	44	
Female	55	O	46	P, T	56	O
Other	0	O	2	P, T	0	O
Race/ethnicity						
African-American	8	T	6	T	11	P, O
Asian	17	O, T	9	P	13	P
Hispanic/Latino	16	O	7	P	13	
White	49	O	64	P, T	53	O
Other	3		4		2	
Multiple race/ethnicities	7		10		7	
Age						
18-24	21	O	14	P	20	
25-34	32		31		30	
35-44	16		17		18	
45-54	13	O	21	P, T	13	O
55-64	10		10		11	
65+	9		7		8	
Household income						
Under $5K	12	O, T	5	P	9	P
$5K-$14,999	11	O	5	P	8	
$15K-$24,999	10	T	9		14	P
$25K-34,999	11		9		10	
$35K-$49,999	13		12		14	
$50K-$99,999	22		27		25	
$100K-$149,999	12		17		14	
$150K+	9	O, T	17	P, T	6	P, O
Household size						
1 person	26		33		25	
2 persons	32	O	41	P	37	
3 persons	18		16		18	
4 persons	15	O	8	P	13	
5 or more persons	9	O	1	P, T	7	O
Ability to speak English						
Very well	84	O	95	P, T	85	O
Well	10	O	3	P, T	12	O
Not well/not at all	6	O, T	1	P	3	P

Note: Missing data is excluded from this analysis.

[a] Indicates a statistically significant difference ($p \leq 0.5$) by mode based on results of a one-way analysis-of-variance model followed by post-hoc pairwise comparison tests using the Bonferroni method. “T” indicates a statistically significant difference between the frequency of responses for tablet surveys and the mode noted in the column heading. “O” indicates a statistically significant difference between the frequency of responses for the online surveys and the mode noted in the column heading. “P” indicates a statistically significant difference between the frequency of responses for the paper surveys and the mode noted in the column heading.

Comparing the paper and tablet surveys, the differences were of relatively small magnitude – five percentage points or fewer – for every response category (i.e., any row of data in Table 5). However, some of the differences were statistically significant for passengers important for equity analyses. The data show that the paper survey compared with the tablet infers a:

- Lower rate of African-American passengers
- Higher rate of Asian passengers
- Higher rate of very low income passengers
- Higher rate of Low-English Proficiency (LEP) passengers

The differences in passenger demographics between the online survey and either of the other two modes were considerably greater, up to 15 percentage points.

SURVEY RESPONSE BY TRAVEL BEHAVIOR, BY MODE

Another area for analysis was whether responses varied by mode depending on passenger travel behavior, specifically length of the current bus ride and how frequently the respondent used Muni. As shown in Table 6, the percent of online responses for short-trippers (i.e., a current bus ride of five minutes or less) is significantly higher than the percent of respondents completing on-board paper surveys. This is not unexpected because online surveys could be completed at any time after receiving the postcard invitation. There were no statistically significant differences based on how frequently the respondent rode Muni.

Table 6. Respondent Travel Behavior, by Survey Mode

	Paper		Online		Tablet	
Travel behavior category	**% of respondents**	**Stat sig diff[a]**	**% of respondents**	**Stat sig diff[a]**	**% of respondents**	**Stat sig diff[a]**
Length of the current bus ride						
5 min or less	6	O	12	P	8	
more than 5 min	94	O	88	P	92	
Frequency of Muni usage						
5+ days/week	66		69		66	
3-4 days/week	19		20		21	
1-2 day/week	7		8		8	
1-3x/month	4		2		2	
< once/month	4		2		3	

Note: Missing data excluded from this analysis.

[a] Indicates a statistically significant difference ($p \leq 0.5$) by mode based on results of a one-way analysis-of-variance model followed by post-hoc pairwise comparison tests using the Bonferroni method. “T” indicates a statistically significant difference between the frequency of responses for tablet surveys and the mode noted in the column heading. “O” indicates a statistically significant difference between the frequency of responses for the online surveys and the mode noted in the column heading. “P” indicates a statistically significant difference between the frequency of responses for the paper surveys and the mode noted in the column heading.

RATING SCORES FOR CUSTOMER SATISFACTION QUESTIONS, BY MODE

Transit service providers often conduct surveys to better understand their customers' levels of satisfaction with the service. Table 7 shows the mean value of respondents' ratings of Muni services on a five-point scale overall and by each survey mode. There was a statistically significant difference across all service characteristics for the tablet compared with the paper and online survey modes. In all cases, respondents on the tablets gave a higher rating of Muni services. A possible explanation for this finding is that respondents working directly with a surveyor, as in the case with the tablets, are less comfortable providing a lower rating.

Table 7. Respondents' Ratings of Muni Services, by Survey Mode

		Paper		Online		Tablet	
Customer satisfaction questions/ Rating of Muni services[a]	**Overall Mean**	**Mean**	**Stat sig diff[b]**	**Mean**	**Stat sig diff[b]**	**Mean**	**Stat sig diff[b]**
Frequency of service	3.65	3.62	T	3.54	T	3.77	P, O
On-time performance	3.54	3.50	T	3.38	T	3.68	P, O
Total trip time	3.63	3.57	T	3.47	T	3.85	P, O
Overall experience	3.63	3.59	T	3.50	T	3.76	P, O

Note: Missing data excluded from this analysis.

[a] Respondents were asked to rate various Muni services on a 5-point scale, for which 5 = Excellent and 1 = Poor.

[b] Indicates a statistically significant difference ($p \leq 0.5$) by mode based on results of a one-way analysis-of-variance model followed by post-hoc pairwise comparison tests using the Bonferroni method. "T" indicates a statistically significant difference between the frequency of responses for tablet surveys and the mode noted in the column heading.

COST PER COMPLETE, BY MODE

An assessment of relative benefits of different on-board survey modes requires a consideration of their respective costs. Broadly speaking, these costs consist of survey materials and labor hours.

Survey materials that may need to be purchased include paper, printing services, postage, envelopes, pencils, clipboards, backpacks, tablet devices, subscription to online surveying software, and clothing items to demarcate surveyors. Since many of these costs can be amortized across many survey efforts, they are quite difficult to attribute to a single survey effort. For example, a survey consultant who purchases tablet computers and associated software to coordinate data collection across the devices is likely to use these resources for many efforts without charging a single client the full cost of these services. Other costs, such as printing and postage, are directly tied to a single survey effort. Given the complications of untangling the costs of project-specific and non-specific materials, and the reality that the majority of the total survey costs are tied to labor, this research focuses only on labor costs.

There are three main labor costs to conducting a transit on-board survey: design, field administration, and data processing/entry. Design costs are unlikely to vary substantially between the modes because the inherent tasks of selecting the questions and their layout

are largely the same. One might see higher design costs as surveyor managers first embrace new technologies, but these should drop rapidly and be amortized over time. Given the focus of the current research on designing a single survey and then delivering it across three modes, it was not possible to breakdown the design costs tied to the separate modes in any case.

Instead, this research focuses its cost comparison on the second and third labor costs, which are also the main sources of on-board survey cost variability: the labor hours necessary to administer the survey in the field and to process and enter data collected on paper responses. Because labor rates differ considerably by location (and over time), this research measures costs in labor hours, not in wages paid.

Table 8 presents the cost per completed survey in labor hours using the five different definitions of "complete."

Table 8. Labor Hours per Complete Survey, by Survey Mode

Definition of complete	Paper	Online	Tablet
All 21 questions completed	0.19	0.75	0.36
No more than one question skipped	0.19	0.63	0.28
At least ten questions complete, including trip origin address and five demographics	0.14	0.65	0.28
At least ten questions complete, including trip origin address	0.13	0.63	0.27
At least ten questions complete	0.12	0.58	0.24

Note: Total labor hours were 144 surveyor hours and 139 data entry/processing hours for paper, 136 surveyor hours and 0 data entry/processing hours for online, and 184 surveyor hours and 4 data entry/processing hours for tablet.

For the paper mode, labor hours were roughly evenly split between surveyor and data entry/processing time, while the other survey modes had no or very little data entry/processing time. The online mode required no data entry/processing costs. The tablet mode, however, did require some data entry/processing time to accommodate those surveys sent in by short trippers who were not on the vehicle long enough to complete the interview. (It was expected that the tablet mode would also result in paper surveys for Spanish speaking riders, but no such surveys were mailed in.) The data entry/processing surveys for the mailed-back paper complements to a table survey were higher than for the paper surveys. This may be due to efforts to match partially completed tablet surveys to the paper responses – or it may reflect generally higher costs for handling mail-backs as they drift in.

Per complete, paper surveys proved the least expensive mode, followed by tablet interviews, with online surveying by far the most expensive mode. Depending on the definition of "complete" used, each complete tablet interview required 50% to 100% more labor than a complete paper survey, and each complete online survey required roughly three to five times more labor hours than a complete paper survey.

VI. CONCLUSION

SUMMARY OF KEY FINDINGS

In terms of the return and completion rates, the survey modes' relative performance depends a great deal on whether one is interested in response rates or completion rates, as well as how one defines completion and return rates.

The online survey is perhaps the simplest case. It generated by far the lowest return rates for all definitions, as well as very low completion rates.

Comparing the paper and tablet modes, the paper survey had a much better return rate – 18 percentage points better – if the return rate is calculated as the percentage of passengers approached by a surveyor who returned a survey. This performance difference between the modes reflects the fact that many more passengers who were approached by surveyors refused to take the tablet survey than refused to take the paper survey. These relative refusal and return rates suggest that the paper survey was the mode that better reflected the underlying bus passenger population. Similarly, looking at *complete* surveys, paper performed at least 11 percentage points better than the tablet mode by all five definitions of completeness tested as a percentage of passengers approached. Both tablet and paper performed well in terms of complete responses as a percentage of returned surveys, with tablets marginally better at obtaining responses to all questions, or no more than one question skipped.

Next, the report analyzed the relative performance of the survey modes in terms of how often respondents answered particular questions or types of questions. Key findings are that:

- The tablet and online surveys performed better than paper for almost all questions, with the notable and important exception that the paper outperformed the tablet on the income question by 6 percentage points. However, the *magnitude* of the differences was minimal for most questions, with no difference greater than 11 percentage points and 5 percentage points or fewer in three-quarters of the comparisons across modes for any question.

- When questions were grouped into types, by either format or subject matter, the most striking finding was that the questions rating Muni service, which also uniquely appeared in a matrix format on the paper and online surveys, had the highest missing rates.

- An analysis of the usability of the geographic data that respondents provided found that all three survey modes generated similar percentages of geocodable trip origin address data (Q1B), but the online and tablet surveys generated modestly more usable home zip codes (a 5 percentage point improvement).

One survey question asked respondents to estimate their time on the travel vehicle. The online survey obtained a higher proportion of responses from short-trippers than did the paper surveys. (There was no statistically significant difference between the proportion of short-trippers from the tablet mode and either of the other two survey modes.)

An analysis of the four stated preference questions explored the variation in service quality ratings across the three survey modes. For every question, the mean service quality rating was higher for the tablet surveys than for either of the other survey modes, and these differences were statistically significant.

Turning to the socio-demographic characteristics of the people who responded to each survey type, the tablet and paper surveys performed within five percentage points of each other at representing all population groups. In a few cases these differences were statistically significant for population groups particularly important for equity analyses, with the paper survey capturing lower proportions of African-American and LEP passengers, but a higher proportion of very low-income and Asian passengers.

Finally, the report compares the cost of the three survey modes in terms of the on-board surveyor and data entry time required to generate each completed survey. The paper surveys required the fewest labor hours per “complete” by all definitions of completeness. The tablet surveys required from 50% to 100% more labor hours, depending on the definition of completeness, and the online surveys required considerably more labor.

LIMITATIONS OF THE RESEARCH DESIGN

As with any single research study, the results of this project should be generalized with caution for many reasons. This section lays out three key limitations to the study design.

First, it is possible that the types of people approached for each survey mode were not identical, even though the survey administration process was designed to make this as likely as possible. For example, the surveying for each mode did not cover exactly the same proportion of bus runs by route and time frame, even though the proportions were close.

Second, the analysis of passengers approached and surveys distributed relies on data recorded by very busy surveyors who were juggling many tasks at once, all while in the difficult environment of a moving (and often crowded) bus. The surveyors likely made some small errors in recording the numbers of people they approached, to whom they gave the paper and postcard surveys, and who refused to participate.

Third, any survey design requires making hundreds of small choices about everything from questionnaire font size, to the number of languages included as options, to the protocol that surveyors follow when distributing surveys. Any one of these decisions can potentially affect one survey mode more than another. This section identifies several choices made for this study that may have impacted the results for one mode more than others:

1. The study was conducted only on local bus routes in a large city with many LEP riders. For express bus, commuter rail, or other transit services that have passengers making longer trips and/or fewer LEP passengers, the survey modes might well perform differently.

2. The survey instrument was an amalgam of different types of questions typically asked in transit on-board surveys and thus does not precisely reflect a survey wholly focused

on travel behavior or customer satisfaction. It is possible that a survey would perform differently across the three modes if the questionnaire were of a different length, or if the survey focused on just one type of question, such as stated preference questions or origin-destination trip questions.

3. No rewards were offered for participation in the survey in order to comply with policies from the study's funder and SFMTA concerns about offering a reward. It is likely that adding an incentive might have increased response rates for some survey modes more than others.

4. Advanced mapping features used in some online and tablet surveys were not used for this study. This choice was made in part to provide consistency with the paper surveys, and also because of cost constraints and concerns about reliable wireless access on the buses. Including advanced mapping features in the online and tablet modes might have improved the quality of the address data they collected.

RECOMMENDATIONS FOR FUTURE RESEARCH

It is recommended that future research be conducted that repeats the general experimental design of this study – comparing the data collected when the same survey questionnaire is implemented using different modes – but in ways that help fill in the gaps left by this study, as described above. For example, a similar research design could be conducted in different transit environments, using different questionnaire types, with participation incentives, and/or using tablets equipped with advanced mapping features.

IMPLICATIONS FOR PRACTICE

This study suggests several implications for practitioners choosing a survey mode. First, and most importantly, the analysis reinforces the point that there is no single, best survey mode. The choice of mode must depend on an agency's priorities for what questions most need to be answered, what population groups are most important to represent, and the precise definitions that will be used to define a concept like a "complete" survey or a "usable" address.

Having laid out that important caveat, however, the study findings suggest several general recommendations for current survey practice:

1. Online surveys administered via an invitation distributed on the transit vehicle are not a good option. Across most of the metrics assessed, the online survey was both the most expensive mode, and it performed either no better than or relatively poorly compared with paper and tablet surveys.

2. The old-fashioned, low-tech paper survey may still be the best option for many bus passenger surveys. Not only did the paper mode require unquestionably the fewest labor hours per complete, but for many of the metrics discussed, it also generated data that was as good as – or better than – the tablet survey.

3. Changes in survey results that accompany changes in survey methods should be interpreted with caution. Any change in survey mode will likely elicit a slightly different set of responses. If an agency switches from a paper survey one year to a tablet survey the next year, for example, it is important to realize that changes in response rates or patterns may reflect a change in survey method rather than changes in the underlying rider demographics, travel habits, or opinions. The customer satisfaction questions illustrate this point well; respondents gave more positive ratings to an interviewer than when recording ratings on paper or online. Agencies requiring accurate data on trends over time may want to retain the same survey mode.

4. Using a new survey method, especially one relying on more complex technologies, may create unexpected glitches. The on-board bus environment is a highly challenging location for surveying work, so agencies planning to use new survey modes should be prepared for the possibility of unexpected technical difficulties, even with experienced survey administrators. For example, in this study, 77 (or 10%) of the 777 tablet survey responses were missing trip origin data, apparently because of a problem with tablet operating system updates. One strategy for reducing the likelihood of administrative problems with a new survey methodology is to expand the pilot-testing phase.

APPENDIX A: TRANSIT AGENCY AND CONSULTANT INTERVIEWS

Expert interviews were conducted to develop a deeper understanding of how bus operators conduct passenger surveys, the uses to which they put the data, the challenges faced in doing surveys, and the extent to which agencies are considering using new survey modes to reduce costs or improve data quality.

An initial set of interviews was conducted with eight people working at consulting firms that conduct many on-board transit surveys (Table 9). The goal of the interviews was to help the research team identify the most useful survey methods to test out in the experimental survey, as well as to understand more fully the challenges that agencies face in completing surveys. In these semi-structured interviews, the experts shared their views on the strengths and weakness of different survey methods, as well as the directions where they think the field is headed in the near future.

Table 9. Survey Consultants Interviewed

Name	Affiliation	Title
Margaret Campbell	Resource Systems Group, Inc	Senior Consultant
Brad Carlson	NuStats	Project Manager
Carol Anne Carroll	Corey, Canapary & Galanis	Principal/Research Director
Jesse Cassas	Westat	Senior Research Associate
Fred G'Sell	ETC Institute	Project Manager
Ryan McCutchan	NuStats	Project Manager
Chris Tatham	ETC Institute	Executive Vice President
Kevin Tierney	Bird's Hill Research	Independent Consultant

Another set of seven interviews targeted people involved with transit surveys from a variety of professional positions, including metropolitan planning organizations and the Federal Transit Administration (Table 10). The questions discussed with each person varied according to his or her experience with passenger surveys. As with the consultant interviews, these were designed to help the research team identify the most useful survey methods to test out in the experimental survey, as well as to understand more fully the challenges that agencies face in completing surveys.

Table 10. Other Experts Interviewed

Name	Affiliation	Title
Rebekah Anderson	Ohio Department of Transportation, Office of Statewide Planning & Research	Transportation Engineer
Ken Cervenka	Federal Transit Administration, Office of Planning & Environment	Community Planner
Shimon Israel	Metropolitan Transportation Commission, Planning Division	Associate Transportation Planner/ Analyst
Brian Lane	San Diego Association of Governments	Senior Transit Planner
Darlanne Hoctor Mulmat	San Diego Association of Governments	Senior Research Analyst
David Ory	Metropolitan Transportation Commission, Division, Planning Division	Principal
Yoram Shiftan	Technion - Israel Institute of Technology	Associate Professor of Civil and Environmental Engineering

A third, more extensive set of 28 interviews was conducted with transit operator staff members who manage the survey process for their organizations. These interviews explored the agencies' recent survey efforts, including their surveying budgets, the survey methodologies used, challenges and successes encountered, and the interviewees' conclusions about the effectiveness of the survey method for reaching protected populations as defined by Title VI. A semi-structured interview script was used to ensure consistency across all agency interviews. Students in a transportation planning class at San José State University conducted the interviews in the spring of 2014.

The method for selecting agencies for interview was designed to ensure that the interviews reflected the experience of a diverse set of operators. Data from the National Transit Database (NTD) were used to select for interviews a stratified sample of large and small transit agencies that operate buses.

The first group of interviews came from the 50 largest agencies in the US, defined as those that reported more than 25 million boardings in 2012. Of these largest 50 agencies, 34 agencies were identified as urban transit operators running bus service, thus suitable for interviewing. Interviews were completed with staff at 11 of these agencies, with their selection out of the 34 primarily but not entirely random.

Another set of interviews was carried out with staff at smaller transit agencies, those reporting fewer than 25 million boardings in 2012. Only agencies operating buses in urban and semi-urban environments were considered suitable for the purposes of this research. Among the 429 agencies that fit these criteria, a staff member from each of 17 agencies was interviewed. The agencies these interviewees represented ran the gamut from independent agencies providing the transit for medium-sized cities, to university transportation services, to small-town welfare services. As with the larger agencies, most but not quite all of the agencies were randomly selected from among the set of candidates.

Table 11 lists the 28 agencies from which staff members were interviewed. Interviewee names are not included because agency staff members were encouraged to speak frankly on topics that could be seen as politically sensitive.

Table 11. Transit Agency Staff Interviewed

Agency name & state	Size classification	Census region	Modes operated
Alameda-Contra Costa Transit District, California	Large	West	Bus
Charlotte Area Transportation System, North Carolina	Large	South	Bus, rail
Chicago Transit Agency	Large	Midwest	Bus, rail
Los Angeles County Metro	Large	West	Bus, rail
King County Metro Transit, Washington	Large	West	Bus, rail
Metro-North Railroad (NY MTA)	Large	Northeast	Rail, ferry, bus
Metropolitan Atlanta Rapid Transit Authority	Large	South	Bus, rail
Miami-Dade Transit, Florida	Large	South	Bus, rail
Montgomery County DoT, Maryland	Large	South	Bus
New York City Transit (MTA)	Large	Northeast	Bus, rail
Orange County Transportation, California	Large	West	Bus
Athens Transit System, Georgia	Not large	South	Bus
City of Bowling Green Transit, Kentucky	Not large	South	Bus
Connecticut Department of Transportation	Not large	Northeast	Bus, rail
Denton County Transportation Authority, Texas	Not large	South	Bus, rail
Fort Wayne Citilink, Indiana	Not large	Midwest	Bus
Fresno Area Express, California	Not large	West	Bus
The Rapid, Michigan	Not large	Midwest	Bus
Rio Metro Regional Transit District, New Mexico	Not large	West	Bus, rail
Transit Authority of Lexington (Lextran), Kentucky	Not large	South	Bus
North Dakota State University	Not large	Midwest	Bus
Capitol Area Rural Transportation System, Texas	Not large	South	Bus, rail
PACE Suburban Bus Division, Illinois	Not large	Midwest	Bus
Petersburg Area Transit, Virginia	Not large	South	Bus
Phoenix City Express, Alabama	Not large	South	Bus
City of Port Arthur Transit Department, Texas	Not large	South	Bus
Portage Area Regional Transportation Authority, Ohio	Not large	Midwest	Bus
Roseville Transit, California	Not large	West	Bus

APPENDIX B: ONLINE SURVEY RESPONSES, BY DEVICE TYPE

Responses to the online survey included metadata that allowed analysis of the devices used. Table 12 shows the distribution of devices used by the 238 respondents who completed the online survey. About one-half of respondents used a computer, a bit more than one-third used a smart phone, and only a few used a tablet.

Table 12. Breakdown of Device Type Used to Respond to Online Survey, by Count and Percent

Device Type	Count	Percentage
Desktop/laptop		
Apple operating system	52	22%
Windows operating system	81	34%
Other operating system	4	2%
Total desktop/laptop	137	57%
Phone		
Apple iPhone	57	24%
Android operating system	32	13%
Windows operating system	1	0%
Total phone	90	38%
Tablet		
Apple iPad	11	5%
Android operating system	0	0%
Other	0	0%
Total tablet	11	5%

Device Type Used, by Respondent's Age

Table 13 details the percentage breakdown of device type used to respond to the online survey by respondent age. The percent of respondents accessing the online survey by computer, compared with phone, increases noticeably by age.

Table 13. Percentage Breakdown of Device Type Used for Online Survey, by Age

	Age Group							
Device Type	18-24	25-34	45-54	55-64	55-64	65 and older	Missing	Total
Computer	39%	51%	62%	63%	78%	81%	33%	58%
Phone	55%	48%	33%	27%	17%	19%	67%	38%
Tablet	6%	1%	5%	10%	4%	0%	0%	5%
Sample size	*33*	*73*	*39*	*48*	*23*	*16*	*6*	*238*

Device Type Used, by Gender

Table 14 details the percentage breakdown of device type used to respond to the online survey, by gender. Women were more likely to respond to the survey using a computer (and correspondingly less likely to respond using a cell phone) than men.

Table 14. Percentage Breakdown of Device Type Used for Online Survey, by Gender

	Gender				
Device Type	**Male**	**Female**	**Other**	**Missing**	**Total**
Computer	51%	64%	100%	25%	58%
Phone	45%	30%	0%	75%	38%
Tablet	4%	6%	0%	0%	5%
Sample size	*122*	*107*	*5*	*4*	*238*

APPENDIX C: ON-BOARD PAPER SURVEY (ENGLISH)

SFMTA
Municipal Transportation Agency

Muni Onboard Survey 2014

Muni would like your input. Please take a few moments to complete this survey. Thank you!

About *This* Trip on Muni

Please provide as much information as possible. It will be used to improve access to Muni.

1. **Starting Point.** Where did you **BEGIN** this trip?

a. Place or Activity
- ☐ Home
- ☐ Work
- ☐ School
- ☐ Shopping location
- ☐ Social/recreation/entertainment
- ☐ Personal errand
- ☐ Medical appointment
- ☐ Other (specify)_____

b. Address or Nearest Intersection (of starting place or activity)

_____

c. City: ☐ San Francisco ☐ Other (specify)_____

Run ID:_____

2. How did you **get to *this* Muni vehicle?**
- ☐ Walked all the way
- ☐ Biked
- ☐ BART
- ☐ Caltrain
- ☐ Transferred from another Muni route
- ☐ Drove alone and parked
- ☐ Carpooled *(including dropped off)*
- ☐ Other (specify) _____

(If transferred from another Muni route)

3. Which Muni route did you **transfer from?**

Route transferred from_____

4. **Payment. *How*** did you pay your fare?

By Clipper®
- ☐ Cash value on Clipper®
- ☐ Monthly Pass on Clipper®
- ☐ Other Clipper®

_____

By cash or paper
- ☐ Cash
- ☐ Paper transfer
- ☐ Single fare or round-trip ticket
- ☐ Passport or CityPASS
- ☐ Other cash or paper_____

5. **Fare Category.** What **type of fare** did you pay for this trip?
- ☐ Adult
- ☐ Youth
- ☐ Senior
- ☐ Student
- ☐ Disabled/Medicare Card Holder (RTC)
- ☐ Other_____

6. **Destination.** Where are you going on this trip?
- ☐ Home
- ☐ Work
- ☐ School
- ☐ Shopping location
- ☐ Social/recreation/entertainment
- ☐ Personal errand
- ☐ Medical appointment
- ☐ Other_____

7. **How Long.** About how long will you ride **this** bus today?
- ☐ 5 minutes or less
- ☐ 6 – 10 minutes
- ☐ 11 – 15 minutes
- ☐ 16 – 20 minutes
- ☐ 21 – 25 minutes
- ☐ 26 – 30 minutes
- ☐ 31 – 45 minutes
- ☐ More than 45 minutes

Your Opinion of Muni

8. Please **rate the following features of Muni** services on a 5-point scale. (5=Excellent is the highest rating; 1=Poor is the lowest rating.)

	Excellent				Poor
a. Frequency of service	5	4	3	2	1
b. On-time performance	5	4	3	2	1
c. Total trip time	5	4	3	2	1
d. Overall Experience	**5**	**4**	**3**	**2**	**1**

About *You*

9. **How often** do you **typically** ride Muni?
- ☐ 5+ days/week
- ☐ 3-4 days/week
- ☐ 1-2 days/week
- ☐ 1-3 times/**month**
- ☐ Less than once a month

10. **Gender** ☐ Male ☐ Female ☐ Other_____

11. **Race/Ethnicity** *(Check all that apply)*
- ☐ African American
- ☐ Asian
- ☐ Hispanic/Latino
- ☐ White
- ☐ American Indian or Alaska Native
- ☐ Native Hawaiian or Pacific Islander
- ☐ Other_____

12. **Age**
- ☐ Under 18
- ☐ 18 - 24
- ☐ 25 - 34
- ☐ 35 - 44
- ☐ 45 - 54
- ☐ 55 - 64
- ☐ 65 and older

13. **Annual Household Income**
- ☐ Under $5,000
- ☐ $5,000 - $14,999
- ☐ $15,000 - $24,999
- ☐ $25,000 - $34,999
- ☐ $35,000 - $49,999
- ☐ $50,000 - $99,999
- ☐ $100,000 - $149,999
- ☐ $150,000 and above

14. How many people currently live **in your household**?
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6+

About *You* (continued)

15. How well do you **speak English?**
- ☐ Very well
- ☐ Well
- ☐ Not well
- ☐ Not at all

16. **Language(s).** What languages do you speak in the home?
(check all that apply)
- ☐ English
- ☐ Mandarin
- ☐ Cantonese
- ☐ Spanish
- ☐ Tagalog
- ☐ Other (specify)_____

17. How often do you typically access **the internet**?
- ☐ Daily
- ☐ Several times a week
- ☐ Less than once a week
- ☐ Never

18. **Do you own or have access to a vehicle?**
- ☐ No
- ☐ Yes → ☐ Own/Lease ☐ Shared (e.g. Zipcar) ☐ Other_____

19. For this trip…Would you be willing to walk an extra block to your Muni stop if you knew it would **reduce your time on this bus by 5 minutes**?
- ☐ Yes
- ☐ No
- ☐ Do not walk to my stop
- ☐ Don't know

20. What is your **home ZIP Code**? _____
☐ Outside USA

Comments

_____

_____

_____

Thank you for your responses! You can complete this survey by:
- **Returning it to the surveyor on the bus;** OR
- **Mailing it to** SFMTA Survey, c/o Corey, Canapary & Galanis, 447 Sutter Street, Penthouse North, San Francisco, CA 94108.

APPENDIX D: ON-BOARD PAPER SURVEY (SPANISH)

ACERCA DE *USTED* (CONTINUACIÓN)

15. ¿Qué tan bien **habla usted inglés?**
- ☐ Muy bien
- ☐ Bien
- ☐ No muy bien
- ☐ En absoluto

16. **Idioma(s).** ¿Qué idiomas habla usted en el hogar?
(marque todos los que correspondan)
- ☐ Inglés ☐ Español
- ☐ Mandarín ☐ Tagalog
- ☐ Cantonés ☐ Otro (especificar)_____

17. ¿Con cuánta frecuencia típicamente accede a **internet**?
- ☐ Todos los días
- ☐ Varias veces por semana
- ☐ Menos de una vez por semana
- ☐ Nunca

18. ¿**Tiene usted acceso a un vehículo?**
- ☐ No
- ☐ Sí → ☐ de su propiedad/leasing ☐ compartido (ej, Zipcar) ☐ otro____

19. Para este desplazamiento... ¿estaría usted dispuesto a caminar una cuadra más para llegar a su parada de Muni si supiera que esto **reduciría su tiempo en el bus por 5 minutos**?
- ☐ Sí ☐ No camino hasta mi parada
- ☐ No ☐ No se

20. ¿Cuál es el **código postal** de su hogar? _____
☐ Fuera de los EE.UU.

COMENTARIOS

_____

_____

_____

¡Gracias por sus respuestas! Usted puede completar esta encuesta:
- **Devolviéndosela al encargado de la encuesta en este bus;** O
- **Enviándolo a** Encuesta SFMTA, c/o Corey, Canapary & Galanis, 447 Sutter Street, Penthouse North, San Francisco, CA 94108.

Muni Encuesta de a bordo 2014

SFMTA
Municipal Transportation Agency

Muni desea recibir sus comentarios. Por favor, tome unos momentos para completar esta encuesta. ¡Gracias!

ACERCA DE *ESTE DESPLAZAMIENTO* EN MUNI

Por favor, proporcione tanta información como sea posible. Esta será utilizada para mejorar el acceso a Muni.

1. **Punto de partida.** ¿Dónde **INICIO** usted este desplazamiento?

a. Lugar o Actividad
- ☐ Casa ☐ Social/recreo/entretenimiento
- ☐ Trabajo ☐ Mandado personal
- ☐ Escuela ☐ Cita médica
- ☐ Lugar de compras ☐ Otro (especificar)_____

b. Dirección o cruce más cercano (del lugar o actividad de partida)

_____

c. Ciudad: ☐ San Francisco ☐ Otra (especificar)_____

_____

Run ID:_____

2. ¿Cómo llegó **usted a *este* vehículo de Muni?**
- ☐ Hice todo el camino a pie ☐ Transbordo de otra ruta Muni
- ☐ En bicicleta ☐ Manejé solo y estacioné
- ☐ BART ☐ Viaje compartido en auto *(incluyendo aventón)*
- ☐ Caltrain ☐ Otra forma (especificar) _____

(Si realizó un transbordo de otra ruta Muni)
3. ¿**De qué ruta** Muni realizó su transbordo?

Ruta de la que se realizó el transbordo_____

4. **Pago. ¿Cómo** pagó usted su tarifa?

Con tarjeta Clipper®
- ☐ Clipper® valor en efectivo
- ☐ Pase mensual en Clipper®
- ☐ Otra tarjeta Clipper®
_____

En efectivo o con papel
- ☐ En efectivo
- ☐ Con boleto de transbordo
- ☐ Boleto de ida o de ida y vuelta
- ☐ Pasaporte o CityPASS
- ☐ Otro tipo de efectivo o papel _____

5. **Categoría de tarifa.** ¿Qué **tipo de tarifa** pagó usted por este desplazamiento?
- ☐ Adulto
- ☐ Joven
- ☐ Persona mayor
- ☐ Estudiante
- ☐ Discapacitado/Usuario de tarjeta Medicare (RTC)
- ☐ Otra_____

6. **Destino.** ¿A dónde se dirige usted en este desplazamiento?
- ☐ A casa ☐ Social/recreo/entretenimiento
- ☐ Al trabajo ☐ A un mandado personal
- ☐ A la escuela ☐ A una cita médica
- ☐ A realizar compras ☐ A otro sitio_____

7. **Cuanto tiempo.** ¿Aproximadamente cuánto tiempo durará su viaje en **este** bus hoy?
- ☐ 5 minutos o menos ☐ De 21 – 25 minutos
- ☐ De 6 – 10 minutos ☐ De 26 – 30 minutos
- ☐ De 11 – 15 minutos ☐ De 31 – 45 minutos
- ☐ De 16 – 20 minutos ☐ Más de 45 minutos

SU OPINIÓN SOBRE MUNI

8. Por favor **califique las siguientes características de los servicios de Muni** en una escala de 5 puntos. (5=Excelente es la nota más alta; 1=Pobre es la peor nota.)

	Excelente				Pobre
a. Frecuencia del servicio	5	4	3	2	1
b. Puntualidad	5	4	3	2	1
c. Duración del viaje	5	4	3	2	1
d. Experiencia general	**5**	**4**	**3**	**2**	**1**

ACERCA DE *USTED*

9. **¿Con cuánta frecuencia** usa usted Muni **típicamente**?
- ☐ 5+ días/semana ☐ 1-3 veces/**mes**
- ☐ 3-4 días /semana ☐ Menos de una vez al mes
- ☐ 1-2 días /semana

10. **Sexo** ☐ Hombre ☐ Mujer ☐ Otro_____

11. **Raza/Etnicidad** *(Marque todas las que correspondan)*
- ☐ Africano Americano ☐ Indio Americano o Nativo de Alaska
- ☐ Asiático ☐ Nativo Hawaiiano o de las Islas del Pacífico
- ☐ Hispano/Latino ☐ Otra_____
- ☐ Blanco

12. **Edad** ☐ Menor de 18 ☐ 45 - 54
☐ 18 - 24 ☐ 55 - 64
☐ 25 - 34 ☐ 65 o más mayor
☐ 35 - 44

13. **Ingresos Anuales Familiares**
- ☐ Menos de $5,000 ☐ $35,000 - $49,999
- ☐ $5,000 - $14,999 ☐ $50,000 - $99,999
- ☐ $15,000 - $24,999 ☐ $100,000 - $149,999
- ☐ $25,000 - $34,999 ☐ $150,000 o más

14. ¿Cuántas personas viven **en su hogar** en la actualidad?
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6+

APPENDIX E: POSTCARD SURVEY INVITATION (ENGLISH AND SPANISH)

SFMTA
Municipal Transportation Agency

MUNI SURVEY

SFMTA is conducting a passenger survey to determine how well Muni meets your needs.

To participate, visit:

www.sfmta.com/munisurvey
(Reference Run ID#_____)

We value your feedback and encourage you to participate in this survey within the next few days.

SFMTA
Municipal Transportation Agency

MUNI SURVEY

SFMTA está llevando a cabo una encuesta de pasajeros para determinar en qué medida Muni satisface sus necesidades.

Para participar, visite:

www.sfmta.com/munisurvey
(Núm. de Referencia Run ID _____)

Valoramos sus comentarios y le animamos a participar en esta encuesta durante los próximos días.

APPENDIX F: ONLINE SURVEY (ENGLISH AND SPANISH)

Start

Click the arrow to begin.
Pulse aquí para comenzar.
按这里开始

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Lang

Lang=1 I would like to take this survey in English.

Lang=2 Me gustaría completar esta encuesta en español.

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Runid

Is there a numeric code on the survey invitation card you received ?

Runid=1 No

Runid=2 Yes

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Runo

Please type in the number:

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

date

On what day did you receive the invitation for this survey?

- date=1 Monday, April 14
- date=2 Tuesday, April 15
- date=3 Wednesday, April 16
- date=4 Thursday, April 17
- date=5 Friday, April 18
- date=6 Saturday, April 19
- date=7 Sunday, April 20
- date=8 Monday, April 21
- date=9 Tuesday, April 22
- date=10 Wednesday, April 23
- date=11 Thursday, April 24
- date=12 Friday, April 25
- date=13 Saturday, April 26
- date=14 Sunday, April 27
- date=15 Monday, April 28
- date=16 Tuesday, April 29
- date=17 Wednesday, April 30
- date=18 Thursday, May 1
- date=19 Friday, May 2
- date=20 Saturday, May 3
- date=21 Sunday, May 4

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

route

On which Muni route were you riding when you received the survey invitation?

- route=1 1 California
- route=2 1AX/1BX California Express
- route=3 2 Clement
- route=4 3 Jackson
- route=5 5 Fulton
- route=6 5L Fulton Limited
- route=7 6 Parnassus
- route=8 8X/8AX/8BX Bayshore Express
- route=9 9 San Bruno
- route=10 9L San Bruno Limited
- route=11 10 Townsend
- route=12 12 Folsom
- route=13 14 Mission
- route=14 14L Mission Limited
- route=15 14X Mission Express
- route=16 16X Noriega Express
- route=17 17 Parkmerced
- route=18 18 46th Avenue
- route=19 19 Polk
- route=20 21 Hayes
- route=21 22 Fillmore
- route=22 23 Monterey
- route=23 24 Divisadero
- route=24 27 Bryant
- route=25 28 19th Avenue
- route=26 28L 19th Avenue Limited
- route=27 29 Sunset
- route=28 30 Stockton
- route=30 31 Balboa or 31AX/31BX Balboa Express
- route=31 33 Stanyan
- route=32 35 Eureka
- route=33 36 Teresita
- route=34 37 Corbett
- route=35 38 Geary
- route=36 38L Geary Limited
- route=37 38AX/38BX Geary Express
- route=38 39 Coit
- route=39 41 Union
- route=40 43 Masonic
- route=41 44 O'Shaughnessy
- route=42 45 Union/Stockton
- route=43 47 Van Ness
- route=44 48 Quintara/24th Street
- route=45 49 Van Ness/Mission
- route=46 52 Excelsior
- route=47 54 Felton
- route=48 56 Rutland
- route=49 66 Quintara
- route=50 67 Bernal Heights
- route=51 71/71L Haight/Noriega
- route=52 80X/81X/82X Caltrain Express
- route=53 83X Mid-Market Express
- route=54 88 BART Shuttle
- route=55 90 Owl
- route=56 91 Owl
- route=57 108 Treasure Island

route=29 30X Marina Express

route=58 route_58_other Light Rail/Cable Car/Other (specify)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

time

About what time did you receive the survey invitation? (Use your best estimate if you do not recall specifically.)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Trip

These initial questions relate to the trip you took on Muni where you received an invitation to participate in this survey. Think carefully about that trip when answering the following questions.

Q1a

Starting Point. Where did you **BEGIN** that trip?

Place or Activity

- Q1a=1 Home
- Q1a=2 Work
- Q1a=3 School
- Q1a=4 Shopping location
- Q1a=5 Social/recreation/entertainment
- Q1a=6 Personal errand
- Q1a=7 Medical appointment
- Q1a=8 Q1a_8_other Other (specify)

Q1b

Address or Nearest Intersection (of starting place or activity)

Q1c

City

- Q1c=1 San Francisco
- Q1c=2 Q1c_2_other Other (specify)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Q2

Getting to Muni.

How did you **get to the Muni vehicle** [on which you were offered a survey]?

- Q2_1 Walked all the way
- Q2_2 Biked
- Q2_3 BART
- Q2_4 Caltrain
- Q2_5 Transferred from another Muni route
- Q2_6 Drove alone and parked
- Q2_7 Carpooled (including dropped off)
- Q2_8 Q2_8_other Other (specify)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Q3

Which Muni route did you **transfer from**?

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Q4

Payment.

How did you pay your fare?

- Q4=1 By cash or paper
- Q4=2 By using Clipper
- Q4=3 Q4_3_other Some other method (specify)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Q4Clipper

What kind of Clipper® fare did you pay?

Q4Clipper=1 Cash value on Clipper®

Q4Clipper=2 Monthly Pass on Clipper®

Q4Clipper=3 Q4Clipper_3_other
Other Clipper® (specify)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Q4Cash

What type of cash fare did you pay?

Q4Cash=1 Cash

Q4Cash=2 Paper transfer

Q4Cash=3 Single fare or round-trip ticket

Q4Cash=4 Passport or CityPASS

Q4Cash=5 Q4Cash_5_other
Other cash or paper (specify)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Q5

Fare Category.

What **type of fare** did you pay for this trip?

Q5=1 Adult

Q5=2 Youth

Q5=3 Senior

Q5=4 Student

Q5=5 Disabled/Medicare Cardholder (RTC)

Q5=6 Q5_6_other
Other (specify)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Q6

Destination.

Where did you go on this trip?

Q6_1 Home

Q6_2 Work

Q6_3 School

Q6_4 Shopping location

Q6_5 Social/recreation/entertainment

Q6_6 Personal errand

Q6_7 Medical appointment

Q6_8 Q6_8_other
Other (specify)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Q7

How Long.

About how long did you ride the bus (where you received the survey invitation)?

- Q7=1 5 minutes or less
- Q7=2 6 to 10 minutes
- Q7=3 11 to 15 minutes
- Q7=4 16 to 20 minutes
- Q7=5 21 to 25 minutes
- Q7=6 26 to 30 minutes
- Q7=7 31 to 45 minutes
- Q7=8 More than 45 minutes

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Q8

Your Opinion of Muni

Please **rate the following features of Muni** services on a 5-point scale. (5=Excellent is the highest rating; 1=Poor is the lowest rating.)

	5 (Excellent)	4	3	2	1 (Poor)
Frequency of service	Q8_r1=1	Q8_r1=2	Q8_r1=3	Q8_r1=4	Q8_r1=5
On-time performance	Q8_r2=1	Q8_r2=2	Q8_r2=3	Q8_r2=4	Q8_r2=5
Total trip time	Q8_r3=1	Q8_r3=2	Q8_r3=3	Q8_r3=4	Q8_r3=5
Overall experience	Q8_r4=1	Q8_r4=2	Q8_r4=3	Q8_r4=4	Q8_r4=5

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Q9

How often do you **typically** ride Muni?

- Q9=1 5+ days/week
- Q9=2 3-4 days/week
- Q9=3 1-2 days/week
- Q9=4 1-3 times/**month**
- Q9=5 Less than once a month

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Gender

Gender

- Gender=1 Male
- Gender=2 Female
- Gender=3 Gender_3_other Other

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Race

Race/Ethnicity *(Check all that apply)*

- Race_1 African American
- Race_2 Asian
- Race_3 Hispanic/Latino
- Race_4 White
- Race_5 American Indian or Alaska Native
- Race_6 Native Hawaiian or Pacific Islander
- Race_7 Race_7_other Other

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Age

Age

- Age=1 Under 18
- Age=2 18 to 24
- Age=3 25 to 34
- Age=4 35 to 44
- Age=5 45 to 54
- Age=6 55 to 64
- Age=7 65 and older

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Income

Annual Household Income

- Income=1 Under $5,000
- Income=2 $5,000 to $14,999
- Income=3 $15,000 to $24,999
- Income=4 $25,000 to $34,999
- Income=5 $35,000 to $49,999
- Income=6 $50,000 to $99,999
- Income=7 $100,000 to $149,999
- Income=8 $150,000 and above

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Household

How many people currently live **in your household**?

- Household=1 1
- Household=2 2
- Household=3 3
- Household=4 4
- Household=5 5
- Household=6 6+

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

EPF

How well do you **speak English?**

EPF=1 Very well

EPF=2 Well

EPF=3 Not well

EPF=4 Not at all

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

EPFlang

Language(s).

What languages do you speak in the home? *(Check all that apply.)*

EPFlang_1 English

EPFlang_2 Mandarin

EPFlang_3 Cantonese

EPFlang_4 Spanish

EPFlang_5 Tagalog

EPFlang_6 EPFlang_6_other Other (specify)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Internet

How often do you typically access **the internet?**

Internet=1 Daily

Internet=2 Several times a week

Internet=3 Less than once a week

Internet=4 Never

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Vehicle

Do you own or have access to a vehicle?

Vehicle=1 No

Vehicle=2 Yes

Vtype

(If Yes above) Is it . . .

Vtype=1 Own/Lease

Vtype=2 Shared (e.g. Zipcar)

Vtype=3 Vtype_3_other Other (specify)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

Walkextra

Think again about the trip you were taking when you received the survey invitation . . .

For that trip, would you be willing to walk an extra block to your Muni stop if you knew it would **reduce your time on the bus by 5 minutes?**

- Walkextra=1 Yes
- Walkextra=2 No
- Walkextra=3 Do not walk to my stop
- Walkextra=4 Don't know

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

zip

What is your **home ZIP Code**?

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

com

Comments

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sRunid

¿Hay un número de código en la esquina inferior derecha de su encuesta?

- sRunid=1 No
- sRunid=2 Si

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sRuno

Si es así, por favor escriba el código. _____

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sdate

¿En qué fecha fue invitado a completar la encuesta?

- sdate=1 lunes, abril 14
- sdate=2 martes, abril 15
- sdate=3 miércoles, abril 16
- sdate=4 jueves, abril 17
- sdate=5 viernes, abril 18
- sdate=6 sábado, abril 19
- sdate=7 domingo, abril 20
- sdate=8 lunes, abril 21
- sdate=9 martes, abril 22
- sdate=10 miércoles, abril 23
- sdate=11 jueves, abril 24
- sdate=12 viernes, abril 25
- sdate=13 sábado, abril 26
- sdate=14 domingo, abril 27
- sdate=15 lunes, abril 28
- sdate=16 martes, abril 29
- sdate=17 miércoles, abril 30
- sdate=18 jueves, mayo 1
- sdate=19 viernes, mayo 2
- sdate=20 sábado, mayo 3
- sdate=21 domingo, mayo 4

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sroute

¿En qué ruta Muni fue invitado a participar en esta encuesta?

- sroute=1 1 California
- sroute=2 1AX/1BX California Express
- sroute=3 2 Clement
- sroute=4 3 Jackson
- sroute=5 5 Fulton
- sroute=6 5L Fulton Limited
- sroute=7 6 Parnassus
- sroute=8 8X/8AX/8BX Bayshore Express
- sroute=9 9 San Bruno
- sroute=10 9L San Bruno Limited
- sroute=11 10 Townsend
- sroute=12 12 Folsom
- sroute=13 14 Mission
- sroute=14 14L Mission Limited
- sroute=15 14X Mission Express
- sroute=16 16X Noriega Express
- sroute=17 17 Parkmerced
- sroute=18 18 46th Avenue
- sroute=19 19 Polk
- sroute=20 21 Hayes
- sroute=21 22 Fillmore
- sroute=22 23 Monterey
- sroute=23 24 Divisadero
- sroute=24 27 Bryant
- sroute=25 28 19th Avenue
- sroute=26 28L 19th Avenue Limited
- sroute=27 29 Sunset
- sroute=28 30 Stockton
- sroute=29 30X Marina Express
- sroute=30 31 Balboa or 31AX/31BX Balboa Express
- sroute=31 33 Stanyan
- sroute=32 35 Eureka
- sroute=33 36 Teresita
- sroute=34 37 Corbett
- sroute=35 38 Geary
- sroute=36 38L Geary Limited
- sroute=37 38AX/38BX Geary Express
- sroute=38 39 Coit
- sroute=39 41 Union
- sroute=40 43 Masonic
- sroute=41 44 O'Shaughnessy
- sroute=42 45 Union/Stockton
- sroute=43 47 Van Ness
- sroute=44 48 Quintara/24th Street
- sroute=45 49 Van Ness/Mission
- sroute=46 52 Excelsior
- sroute=47 54 Felton
- sroute=48 56 Rutland
- sroute=49 66 Quintara
- sroute=50 67 Bernal Heights
- sroute=51 71/71L Haight/Noriega
- sroute=52 80X/81X/82X Caltrain Expr
- sroute=53 83X Mid-Market Express
- sroute=54 88 BART Shuttle
- sroute=55 90 Owl
- sroute=56 91 Owl
- sroute=57 108 Treasure Island
- sroute=58 sroute_58_other Light Rail/Cable Car/Other (specify)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

stime

¿Aproximadamente a qué hora del día estaba usted en el bus cuando le pidieron que completara la encuesta?

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sTrip

Estas preguntas iniciales se refieren al viaje que usted realizó hoy día en Muni, en el que recibió la invitación para participar en esta encuesta. Piense detenidamente en ese viaje mientras responde a las siguientes preguntas.

sQ1a

Punto de partida. ¿Dónde **INICIO** usted este desplazamiento?

Lugar o Actividad

- sQ1a=1 Casa
- sQ1a=2 Trabajo
- sQ1a=3 Escuela
- sQ1a=4 Lugar de compras
- sQ1a=5 Social/recreo/entretenimiento
- sQ1a=6 Mandado personal
- sQ1a=7 Cita médica
- sQ1a=8 sQ1a_8_other Otro (especificar)

sQ1b

Dirección o cruce más cercano (del lugar o actividad de partida)

sQ1c

Ciudad:

- sQ1c=1 San Francisco
- sQ1c=2 sQ1c_2_other Otra (especificar)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sQ2

¿Cómo llegó **usted a este vehiculo de Muni**? [en el que se le ofreciera una encuesta]

- sQ2_1 ☐ Hice todo el camino a pie
- sQ2_2 ☐ En bicicleta
- sQ2_3 ☐ BART
- sQ2_4 ☐ Caltrain
- sQ2_5 ☐ Transbordo de otra ruta Muni
- sQ2_6 ☐ Manejé solo y estacioné
- sQ2_7 ☐ Viaje compartido en auto (incluyendo aventón)
- sQ2_8 ☐ sQ2_8_other Otra forma (especificar) _____

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sQ3

¿De qué ruta Muni **realizó su transbordo**? _____

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sQ4

Pago.

¿Cómo pagó usted su tarifa?

- sQ4=1 ○ Con tarjeta Clipper®
- sQ4=2 ○ En efectivo o con papel
- sQ4=3 ○ sQ4_3_other Otro _____

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sQ4Clipper

Qué tipo de tarifa Clipper?

sQ4Clipper=1 Clipper® valor en efectivo

sQ4Clipper=2 Pase mensual en Clipper®

sQ4Clipper=3 sQ4Clipper_3_other Otra tarjeta Clipper®

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sQ4Cash

Qué tipo de dinero en efectivo o papel de tarifas?

sQ4Cash=1 En efectivo

sQ4Cash=2 Con boleto de transbordo

sQ4Cash=3 Boleto de ida o de ida y vuelta

sQ4Cash=4 Pasaporte o CityPASS

sQ4Cash=5 sQ4Cash_5_other Otro tipo de efectivo o papel

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sQ5

Categoría de tarifa.

¿Qué **tipo de tarifa** pagó usted por este desplazamiento?

- sQ5=1 Adulto
- sQ5=2 Joven
- sQ5=3 Persona mayor
- sQ5=4 Estudiante
- sQ5=5 Discapacitado/Usuario de tarjeta Medicare (RTC)
- sQ5=6 sQ5_6_other Otra

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sQ6

Destino.

¿A dónde se dirige usted en este desplazamiento?

- sQ6_1 A casa
- sQ6_2 Al trabajo
- sQ6_3 A la escuela
- sQ6_4 A realizar compras
- sQ6_5 Social/recreo/entretenimiento
- sQ6_6 A un mandado personal
- sQ6_7 A una cita médica
- sQ6_8 sQ6_8_other A otro sitio

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sQ7

Cuanto tiempo.

¿Aproximadamente cuánto tiempo durará su viaje en **este** bus hoy?

- sQ7=1 5 minutos o menos
- sQ7=2 De 6 – 10 minutos
- sQ7=3 De 11 – 15 minutos
- sQ7=4 De 16 – 20 minutos
- sQ7=5 De 21 – 25 minutos
- sQ7=6 De 26 – 30 minutos
- sQ7=7 De 31 – 45 minutos
- sQ7=8 Más de 45 minutos

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sQ8

SU OPINIÓN SOBRE MUNI

Por favor **califique las siguientes características de los servicios de Muni** en una escala de 5 puntos. (5=Excelente es la nota más alta; 1=Pobre es la peor nota.)

	5 (Excelente)	**4**	**3**	**2**	**1 (Pobre)**
Frecuencia del servicio	sQ8_r1=1	sQ8_r1=2	sQ8_r1=3	sQ8_r1=4	sQ8_r1=5
Puntualidad	sQ8_r2=1	sQ8_r2=2	sQ8_r2=3	sQ8_r2=4	sQ8_r2=5
Duración del viaje	sQ8_r3=1	sQ8_r3=2	sQ8_r3=3	sQ8_r3=4	sQ8_r3=5
Experiencia general	sQ8_r4=1	sQ8_r4=2	sQ8_r4=3	sQ8_r4=4	sQ8_r4=5

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sQ9

¿Con cuánta frecuencia usa usted Muni **típicamente**?

sQ9=1 5+ días/semana

sQ9=2 3-4 días /semana

sQ9=3 1-2 días /semana

sQ9=4 1-3 veces/**mes**

sQ9=5 Menos de una vez al mes

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sGender

Sexo

sGender=1 Hombre

sGender=2 Mujer

sGender=3 sGender_3_other Otro

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sRace

Raza / Etnicidad *(Marque todas las que correspondan)*

- sRace_1 Africano Americano
- sRace_2 Asiático
- sRace_3 Hispano/Latino
- sRace_4 Blanco
- sRace_5 Indio Americano o Nativo de Alaska
- sRace_6 Nativo Hawaiiano o de las Islas del Pacifico
- sRace_7 sRace_7_other Otra

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sAge

Edad

- sAge=1 Menor de 18
- sAge=2 18 - 24
- sAge=3 25 - 34
- sAge=4 35 - 44
- sAge=5 45 - 54
- sAge=6 55 - 64
- sAge=7 65 o más mayor

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sIncome

Ingresos Anuales Familiares

- sIncome=1 Menos de $5,000
- sIncome=2 $5,000 - $14,999
- sIncome=3 $15,000 - $24,999
- sIncome=4 $25,000 - $34,999
- sIncome=5 $35,000 - $49,999
- sIncome=6 $50,000 - $99,999
- sIncome=7 $100,000 - $149,999
- sIncome=8 $150,000 o más

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sHousehold

¿Cuántas personas viven **en su hogar** en la actualidad?

- sHousehold=1 1
- sHousehold=2 2
- sHousehold=3 3
- sHousehold=4 4
- sHousehold=5 5
- sHousehold=6 6+

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sEPF

¿Qué tan bien **habla usted inglés?**

- sEPF=1 Muy bien
- sEPF=2 Bien
- sEPF=3 No muy bien
- sEPF=4 En absoluto

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sEPFlang

Idioma(s).

¿Qué idiomas habla usted en el hogar? *(marque todos los que correspondan)*

- sEPFlang_1 Inglés
- sEPFlang_2 Mandarín
- sEPFlang_3 Cantonés
- sEPFlang_4 Español
- sEPFlang_5 Tagalog
- sEPFlang_6 sEPFlang_6_other Otro (especificar)

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sInternet

¿Con cuánta frecuencia típicamente accede **a internet?**

- sInternet=1 Todos los días
- sInternet=2 Varias veces por semana
- sInternet=3 Menos de una vez por semana
- sInternet=4 Nunca

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sVehicle

¿Tiene usted acceso a un vehiculo?

- sVehicle=1 No
- sVehicle=2 Si

sVtype

En caso de SI, es ella. . .

- sVtype=1 de su propiedad/leasing
- sVtype=2 compartido (ej, Zipcar
- sVtype=3 sVtype_3_other otro

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sWalkextra

Estas preguntas se refieren al viaje que usted realizó hoy día en Muni, en el que recibió la invitación para participar en esta encuesta. Piense detenidamente en ese viaje mientras responde a las siguientes preguntas. . . .

Para este desplazamiento… ¿estaría usted dispuesto a caminar una cuadra más para llegar a su parada de Muni si supiera que esto **reduciría su tiempo en el bus por 5 minutos?**

- sWalkextra=1 Si
- sWalkextra=2 No
- sWalkextra=3 No camino hasta mi parada
- sWalkextra=4 No se

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sZip

¿Cuál es el **código postal** de su hogar?

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

sCom

COMENTARIOS

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

thank

Thank you for your answers in this survey! You may now close your browser.

Gracias por sus respuestas en esta encuesta! Ahora puede cerrar el navegador.

谢谢你的答案在本次调查！现在，您可以关闭浏览器。

0% 100%

If you experience any problems with this survey or have questions, please contact Corey, Canapary & Galanis at 415-397-1203 or carolc@ccgresearch.com.

APPENDIX G: SURVEY QUESTIONNAIRE AND RESULTS

This appendix presents the topline survey results by survey mode and total combined responses. Note that in the tables below, some categories do not sum to 100% due to rounding.

1. Starting Point. Where did you begin this trip?

a. Place or Activity

	Paper (%)	Online (%)	Tablet (%)	All (%)
Home	39	52	45	41
Work	28	23	20	26
School	8	3	6	7
Shopping location	4	4	4	4
Social/recreation/entertainment	11	6	6	9
Personal errand	4	7	6	5
Medical appointment	3	3	3	3
Other	3	2	1	3
Refused/missing	1	0	10[a]	3

[a] A total of 77 malfunctioning tablets did not record information for this question.

b. Address or nearest intersection

	Paper (%)	Online (%)	Tablet (%)	All (%)
Provided a response	94	92	89	93
Refused/missing	6	8	11[a]	7

[a] A total of 77 malfunctioning tablets did not record information for this question.

c. City

	Paper (%)	Online (%)	Tablet (%)	All (%)
Provided a response	99	100	89	97
Refused/missing	1	0	11[a]	3

[a] A total of 77 malfunctioning tablets did not record information for this question.

2. How did you get to this Muni vehicle?

	Paper (%)	Online (%)	Tablet (%)	All (%)
Walked all the way	70	80	78	73
Biked	1	2	1	1
BART	5	3	3	4
Caltrain	0	0	1	0
Transferred from another Muni route	17	14	13	16
Drove alone and parked	1	0	0	1
Carpooled (including dropped off)	1	0	1	1
Other	1	1	2	1
Refused/missing	4	0	1	3

3. (If transferred from another Muni route) Which Muni route did you transfer from?

	Paper (%)	Online (%)	Tablet (%)	All (%)
Transferred from another route	16	14	13	15
Did not transfer/missing	84	86	87	85

4. Payment. How did you pay your fare?

	Paper (%)	Online (%)	Tablet (%)	All (%)
By Clipper®	62	75	60	63
By cash or paper	34	24	37	34
Other	1	1	2	1
Refused/missing	4	0	1	3

5. Fare Category. What type of fare did you pay for this trip?

	Paper (%)	Online (%)	Tablet (%)	All (%)
Adult	77	80	80	78
Youth	1	0	1	1
Senior	8	8	7	8
Student	6	4	6	6
Disabled/Medicare	4	7	4	4
Other	1	0	0	0
Refused/missing	4	2	1	3

6. Destination. Where are you going on this trip?

	Paper (%)	Online (%)	Tablet (%)	All (%)
Home	40	31	42	40
Work	21	32	21	22
School	6	6	7	6
Shopping location	4	5	5	4
Social/recreation/entertainment	13	10	13	12
Personal errand	6	9	8	7
Medical appointment	4	4	2	3
Other	3	3	1	3
Refused/missing	3	0	1	2

7. How Long. About how long will you ride this bus today?

	Paper (%)	Online (%)	Tablet (%)	All (%)
5 min. or less	6	12	7	7
6 to 10 min.	16	16	17	16
11 to 15 min.	17	17	19	17
16 to 20 min.	15	12	20	16
21 to 25 min.	14	14	12	14
26 to 30 min.	12	11	12	12
31 to 45 min.	13	15	8	12
More than 45 min.	5	3	3	4
Refused/missing	3	0	1	2

8. Please rate the following features of Muni services on a 5-point scale. (5 = excellent is the highest rating; 1 = poor is the lowest rating.)

a. Frequency of service

	Paper (%)	Online (%)	Tablet (%)	All (%)
1 (Poor)	3	5	1	3
2	9	8	5	8
3	25	29	27	26
4	37	39	45	39
5 (Excellent)	18	16	20	18
Refused/missing	7	2	1	5

b. On-time performance

	Paper (%)	Online (%)	Tablet (%)	All (%)
1 (Poor)	4	7	3	4
2	11	14	7	10
3	26	29	27	27
4	34	33	41	36
5 (Excellent)	15	16	20	16
Refused/missing	10	2	1	7

c. Total trip time

	Paper (%)	Online (%)	Tablet (%)	All (%)
1 (Poor)	3	7	1	3
2	10	10	7	9
3	25	29	22	25
4	35	33	44	37
5 (Excellent)	17	18	25	19
Refused/missing	10	3	1	7

d. Overall experience

	Paper (%)	Online (%)	Tablet (%)	All (%)
1 (Poor)	3	3	1	2
2	8	9	6	7
3	28	34	29	29
4	37	36	44	38
5 (Excellent)	14	13	19	15
Refused/missing	11	5	1	8

9. How often do you typically ride Muni?

	Paper (%)	Online (%)	Tablet (%)	All (%)
5+ days/week	63	68	65	64
3-4 days/week	18	19	21	19
1-2 days/week	7	8	7	7
1-3 times/month	4	2	2	3
Less than once a month	4	2	3	4
Refused/missing	4	1	1	3

10. Gender

	Paper (%)	Online (%)	Tablet (%)	All (%)
Male	42	51	43	43
Female	51	45	56	52
Other	0	2	0	0
Refused/missing	7	2	1	5

11. Race/Ethnicity

	Paper (%)	Online (%)	Tablet (%)	All (%)
African-American	8	5	11	8
Asian	16	9	13	14
Hispanic/Latino	15	7	13	14
White	45	61	52	48
Other	2	4	2	2
Multiple race/ethnicities	6	10	7	7
Refused/missing	8	4	2	6

12. Age

	Paper (%)	Online (%)	Tablet (%)	All (%)
18 to 24 years	20	14	20	19
25 to 34 years	30	31	30	30
35 to 44 years	16	16	18	16
45 to 54 years	12	20	13	13
55 to 64 years	9	10	11	10
65 years and older	8	7	8	8
Refused/missing	5	3	1	4

13. Annual Household Income

	Paper (%)	Online (%)	Tablet (%)	All (%)
Under $5,000	11	5	7	9
$5,000 to $14,999	10	5	7	9
$15,000 to $24,999	9	8	12	10
$25,000 to $34,999	10	8	8	9
$35,000 to $49,999	11	11	11	11
$50,000 to $99,999	19	25	21	20
$100,000 to $149,999	10	16	11	11
$150,000 and above	8	16	5	8
Refused/missing	12	7	18	13

14. How many people currently live in your household?

	Paper (%)	Online (%)	Tablet (%)	All (%)
1	24	32	25	25
2	30	39	36	32
3	17	16	18	17
4	14	8	13	13
5 or more	8	1	6	7
Refused/missing	7	4	1	6

15. How well do you speak English?

	Paper (%)	Online (%)	Tablet (%)	All (%)
Very well	80	93	84	82
Well	9	3	12	10
Not well/Not at all	6	1	3	5
Refused/missing	5	2	1	4

16. Language(s). What languages do you speak in the home?

	Paper (%)	Online (%)	Tablet (%)	All (%)
English only	60	76	66	63
Mandarin only	1	0	0	1
Cantonese only	1	0	1	1
Spanish only	8	4	5	7
Tagalog only	1	1	1	1
Other language only	4	2	5	4
Multiple languages spoken	18	11	20	18
Refused/missing	8	6	2	6

17. How often do you typically access the internet?

	Paper (%)	Online (%)	Tablet (%)	All (%)
Daily	82	91	85	83
Several times a week	6	5	6	6
Less than once a week	3	0	4	3
Never	4	1	5	4
Refused/missing	5	2	1	4

18. Do you own or have access to a vehicle

	Paper (%)	Online (%)	Tablet (%)	All (%)
No	49	38	51	49
Yes	45	59	48	47
Refused/missing	6	3	1	4

19. For this trip…Would you be willing to walk an extra block to your Muni stop if you knew if would reduce your time on this bus by 5 minutes?

	Paper (%)	Online (%)	Tablet (%)	All (%)
Yes	66	63	76	68
No	17	24	18	18
Do not walk to my stop	1	1	1	1
Don't know	9	9	3	8
Refused/missing	7	3	1	5

20. What is your home zip code?

	Paper (%)	Online (%)	Tablet (%)	All (%)
Listed a zip code[a]	88	94	95	90
Outside U.S.	1	0	1	1
Refused/missing	11	6	4	9

[a] Does not consider the accuracy of the information, only whether the respondents provided a response to this question.

ABBREVIATIONS AND ACRONYMS

CAPI	Computer-Assisted Personal Interview
CATI	Computer-Assisted Telephone Interview
CC&G	Corey, Canapary & Galanis Research
FTA	Federal Transit Administration
LEP	Low English Proficiency
NTD	National Transit Database
SFMTA	San Francisco Municipal Transportation Agency

ENDNOTES

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15. Ben Cummins, Greg Spitz, Tara P. O’Malley, and Margaret Campbell, “How Close is Close Enough? Statistical Equivalence of Onboard versus Online Surveys of Transit Customers,” Paper presented at the 92nd Annual Meeting of the Transportation Research Board, Washington, DC, Transportation Research Board, 2013.

16. Because most respondents answered Q1B with two cross streets rather than a street address, a “find and replace” process was used to convert common symbols for separating the two streets (&, /, -, and _) to the word “and.”

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